Cape Peninsula University of Technology

STAKEHOLDER MANAGEMENT IN SELECTED IT FOURTH INDUSTRIAL REVOLUTION PROJECTS IN SOUTH AFRICA

By

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ABSTRACT

This study aimed to explore stakeholders' role in the success or failure of IT projects, identify the complexities of stakeholder management in IT development projects, and develop a robust stakeholder management process specifically tailored to the context of developing economies. This study offers valuable insights and practical recommendations for optimising stakeholder management processes and enhancing overall IT project performance in this ever-evolving business landscape. This was conducted within South Africa to help bridge the gap between stakeholder management and project performance. In a technologically changing world, the roles and expectations of stakeholders are continuously evolving. It behoves project practitioners to understand and appreciate the dynamics of stakeholder management in this new world order. The study was scoped within South Africa to investigate the factors influencing stakeholder management and project performance. A quantitative approach was used, and inferential factor analysis statistics were applied to analyse responses from a questionnaire distributed online using the Lime Survey platform. Statistical analyses were done using SPSS® Amos® Version 29. The research aimed to identify factors that influenced IT project stakeholder management in the fourth industrial revolution (4IR) in South Africa and develop a project stakeholder framework. "Communication and engagement practices", which focus on strategies and tools that facilitate effective stakeholder communication and involvement, and secondly ", data-driven stakeholder engagement", which emphasises the use of data and application of technology to enhance stakeholder engagement, were identified as significant factors impacting stakeholder management. The model demonstrates a good fit with the data, supported by strong fit indices and robust path coefficients. This suggests that the model was well-constructed and effectively captures the relationships between the variables. The model emphasises that ethical practices, stakeholder communication, proactive engagement, and effective risk management are key to project success. Projects should be adaptable, transparent, and inclusive while focusing on achieving meaningful outcomes for stakeholders.

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DEDICATION

I want to dedicate this to my wife Ellen,

daughters Sharon-Lily Makanaka, Carmel Anesu, and Grace Makatendeka

(The Fore Sisters!)

PUBLICATIONS

The following journal articles emanating from the study:

Journal Articles

1. **Fore, S**., Mugobo, V. (2024). Strategies for Effectively Managing Stakeholders in 4IR Information Technology (IT) Projects. International Journal of Applied Research in Business and Management. ISSN:2700-8983. Volume 5, Issue 2. https://doi.org/10.51137/wrp.ijarbm.2024.sfsa.45625 (Published).
2. **Fore, S**. (2024). Stakeholder management challenges encountered in IT projects. International Journal of Scientific Research and Engineering Development (IJSRED). ISSN 2581-7175.doi :10.5281/zenodo.14677530. (Published)
3. **Fore, S.** (2025). Critical Success Factors for IT Projects in South Africa. International Journal of Applied Research in Business and Management, 6(1). https://doi.org/10.51137/wrp.ijarbm.2025.sfci.45772

Conference Papers

The following articles were presented at peer-reviewed conferences and emanated from the study:

1. **Fore, S.,** Desai, I. 2024. Factors influencing effective Management of stakeholders in IT 4IR projects in South Africa. 6th ICOPEV – International Conference on Production Economics and Project Evaluation .14-15 November 2024. Guimarães, Portugal. https://icopev2024.dps.uminho.pt/
2. **Fore, S.,** Mugobo, V. 2024. Stakeholder management challenges encountered in IT projects. International Conference on Interdisciplinary Studies in Education Research & Technology 2024 (ISERT - 2024). 20 – 23 December 2024.Dubai, UAE.

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ABBREVIATIONS AND ACRONYMS

CFI	Comparative Fit Index
GFI	Goodness of Fit Index
IFI	Incremental Fit Index
NFI	Normal Fit Index
NNFI	Non-Normed Fit Index
RFI	Relative Fit Index
RMSEA	Root Mean Square Error of Approximation
SEM	Structural Equation Modelling
SPSS	Statistical Package for the Social Sciences
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
AI	Artificial Intelligence
IT	Information Technology
CHAT	Cultural-Historical Activity Theory
SOPs	Standard Operating Procedures
IS	Information Systems
TLI	Tucker-Lewis Index

GLOSSARY

Artificial Intelligence (AI): AI refers to the simulation of human intelligence processes by machines, especially computer systems. This includes learning, reasoning, problem-solving, perception, and language understanding (Mhlanga, 2022).

Axiology: Axiology centres on the researcher's values and how these values may impact the research process and outcomes. It encompasses questions about the researcher's ethical stance and the potential influence of their values on research findings (Saunders and Townsend, 2016).

Cultural Historical Activity Theory: Cultural-Historical Activity Theory (CHAT) is a framework used in various fields, including education and psychology, to understand human activities within their cultural and historical contexts. It explores the relationships between individuals, tools, and the socio-cultural environment in which they operate (Engestrom, 2008).

Epistemology: Epistemological philosophy deals with the nature of knowledge and how it is acquired. It explores questions related to how we come to know things and the validity of different sources of knowledge (Easterby-Smith et. al., 2012).

Fourth Industrial Revolution (4IR): The Fourth Industrial Revolution is characterised by the integration of physical, digital, and biological technologies. It is marked by rapid advancements in areas like automation, artificial intelligence, and biotechnology. (Schwab, 2019).

Information Communication and Technology (ICT): ICT encompasses various aspects of information technology, including the internet, wireless networks, cell phones, and other forms of communication (Agerdal-Hjermind, 2012).

Information Systems projects: Wiener,Mähring,Remus,and Saunders (2016 citing (Kirsch 1996; Mähring and Keil 2008) define IS projects as complex, nonroutine, and dynamic temporary organizations, which entail considerable ambiguity and uncertainty .

Information Technology (IT): IT involves the study, use, and management of systems, especially computers and telecommunications, for storing, retrieving, and transmitting information. It encompasses various technologies and tools for processing and managing data (Maaroufi and Asad, 2017).

IT Projects: IT projects are specific initiatives or undertakings focused on the development, implementation, or improvement of information technology systems, software applications, or digital solutions. These projects often have defined objectives, timelines, and resource requirements (Marnewick & Marnewick, 2021).

Ontology: Ontological philosophy focuses on the nature and study of reality. A central question in ontology is whether social realities should be viewed as social constructions that emerge from the perspective and actions of social actors or as objective entities. This can be further divided into objectivism, constructionism, or subjectivism (Bryman et al., 2016).

Project Management: Project management is the process of planning, executing, and controlling a temporary endeavour undertaken to create a unique product or service. It involves managing resources, time, and costs to achieve project objectives (PMBOK, 2021).

Project Performance: Performance measurement should involve processes for assessing progress against predetermined objectives (Bourne, 2003)

Project Stakeholder: A project stakeholder, according to Burke (2023) and Oosthuizen and Venter (2018), can be a group or individual who may impact the project's outcome and upon whom the project manager relies for the project's success.

Project Success: Project success encompasses delivering the anticipated output, accomplishing the intended objectives, and fulfilling stakeholder requirements (Miller, 2022).

Project Success: Project success is defined as the completion of a project within the allocated time and cost, meeting the specified performance criteria, with minimal scope changes, and delivering a product or service that is accepted and usable by the customer or end-user (Kerzner, 2022).

Project: According to the PMBOK Guide, a project is a series of tasks and activities with a specific objective to be completed within defined specifications. It has clear start and end dates, resource limitations, and often spans across multiple functional areas (PMI, 2020).

Stakeholder Engagement: Stakeholder engagement is the process of actively involving and communicating with stakeholders who have an interest or influence in a project, organisation, or initiative. It aims to build positive relationships, gather input, and address their concerns and expectations (Steyn, 2016).

Stakeholder Management: Stakeholder management is the systematic approach to identifying, analysing, and prioritising stakeholders, understanding their interests and needs, and developing strategies to effectively engage and communicate with them throughout a project's lifecycle (Schwab, 2019).

Stakeholder Theory: Stakeholder theory is a framework that suggests that organisations should consider the interests of all stakeholders, not just shareholders, in their decision-making processes. It emphasises the importance of creating value for a broader range of stakeholders, including employees, customers, suppliers, and the community (Steyn, 2016).

Stakeholder: In the context of project management (PMBOK, 2017), a stakeholder is an individual, group, or organisation that may be affected by, affect, or perceive itself as affected by a decision, activity, or outcome of the project.

Successful Execution: Successful execution refers to the effective and efficient completion of a project or initiative while meeting its defined objectives, staying within budget and timeline constraints, and delivering value to stakeholders. It involves the planning, coordination, and monitoring of project activities to achieve desired outcomes (PMI, 2021).

Web Development: Web development involves the design and creation of software applications for websites. It encompasses a wide range of tasks associated with building and maintaining websites (Vodnik & Gosselin, 2014).

CHAPTER 1

INTRODUCTION AND BACKGROUND TO STUDY

1.1 Background

Satisfaction of stakeholders plays a pivotal yet often overlooked role in influencing project success. Failure to address stakeholders' needs may lead to substantial setbacks such as increased expenses, failure to meet project outcomes and delivery delays, and unsuccessful project results (Herz and Krezdorn, 2021). Improvement in stakeholder management subsequently enhances the chances of project success. However, this crucial element has received insufficient attention and fragmented research over the past few years (Bulğan & Tas, 2023).

Information technology is encountered in different aspects of life. For instance, IT is utilised when booking a flight, banking, registering for a program at a college, applying for jobs online, shopping or requesting a concierge service. Since its emergence in the 1980s, IT research information has gradually grown (Marnerwick et al., 2022). Information Technology (IT) is defined as the use of computers, various storage systems, network components, and many other tangible devices, together with the accompanying requisite infrastructure and standard operating procedures (SOPS), to create, process, store, secure, and convey different electronic data types (Castagna, 2020). Despite the increasing investments in IT, concerns regarding information system (IS) project failures persist (Herz and Krezdorn, 2021). Assessing IT and IS investments versus the productivity returns they yield remains a continuously pressing need for businesses.

The nature of the IT industry has become pivotal in this high-tech communication and information age. The IT industry has been growing in leaps and bounds due to more businesses moving into e-commerce to sell products and services and the need to relate to various stakeholders. This is evidence that we live in an information age where services are obtained by manipulating an information system. Sabry and AlShawi (2009) posit that information systems are "inter-disciplinary systems that can be described as interrelated information and knowledge components with identifiable boundary, working together for some purpose". The interactions of the different facets many times gives rises to new stakeholders that may not have been percieved at the inception of the project. Thus, investigating the mediating role of effective stakeholder management is of utmost importance in IT projects. This includes interrogating elements such as well-defined project objectives, adaptability to change, and efficient communication in the association between stakeholder characteristics and perceived success (Nguyen et al., 2021).

Robust collaboration among various stakeholders in projects is imperative. This is due to the diverse nature and frequently conflicting interests they bring into the project. The needful collaboration involves the sharing of resources as well as the aligning of activities (Einhorn et al., 2019). This can be a challenging endeavour since stakeholders often bring their unique methodologies, work practices, and beliefs acquired, directly or indirectly, from their respective organisational cultures (Project Management Institute, 2020). Thus, a framework is needed to manage the stakeholders for projects conducted in the IT space.

In the contemporary business environment, software development projects have assumed significant importance (Castagna, 2020). They enable organisations to harness technology to improve project execution efficiency, enhance client experience and boost innovation. The IT project industry's dynamic nature, characterised by continuously changing technologies and shifting customer demands, introduces complexity to the projects (Jones et al., 2021).

The latest PMBOK version 7 has adopted a systems approach to the management of projects which has been a drastic shift from the traditional ten knowledge areas (PMI, 2021). The shift represents the necessity to consistently assess and revise project management methods in dynamic environments where change is the only consistent factor.

IT projects operate within broader systems; their outcomes become integral parts or components of larger systems. For example, projects typically form a part of a program, and programs, in turn, are usually components of a portfolio. These interconnected arrangements are referred to as a 'system of systems' (Cordeiro et al., 2020). IT projects always have subsystems that must be integrated effectively to deliver the intended goals. For instance, when various teams develop different aspects of a project, in the outcome, all the components should seamlessly integrate to form one whole (Singh, Pathak & Patra, 2023). This calls for teams to interact and align subsystems regularly.

Project Stakeholder Management is a critical success factor for all types of projects (Nguyen et al., 2018). Projects with inadequate stakeholder management approaches tend to perform poorly, experience delays, operate above budget, and sometimes fail altogether (Sperry et al., 2019).

Managing IT project stakeholders in the 21st century still lacks a singular framework or methodology, although there is an emergence of compilations of guidelines and best practices (Bourne, 2016). This can be attributed to the dynamic nature of the industry.

Challenges are often encountered when identifying and analysing complexity due to vague definitions, unclear terminologies, and confusion between aspects such as stakeholder needs. These challenges impact theoretical research and influence project performance within the IT industry (Kerzner, 2021).

1.2 Statement of the Problem

Maaroufi and Asad (2017) posit that IT project teams operate in dynamic environments characterised by evolving customer needs and requirements. They say this often necessitates the delivery of spontaneous and immediate innovative solutions. This highlights the pivotal role that the human element plays in achieving successful project outcomes and gaining greater control over projects. Eyiah-Botwe et al. (2016) elucidate that stakeholder management has not been formally embraced as a project management skill to improve project delivery for socio-economic growth in developing countries. Therefore, there is a need to develop robust stakeholder management approaches for IT projects within the context of developing economies.

Project failure is typically characterised by the inability to complete a project within the premises of the triple constraints, i.e., scheduled timeline, with the desired quality, and within the allocated budget (Joslin and Müller, 2015). The examination of historical data on the failure rate of IT projects shows that IT projects continue to experience failures despite having over 50 years of history and numerous methodologies, advice, and publications dedicated to them (Moore, 2015). Gartner (2016) pegged the failure rate for big data projects at 60%. However, the actual failure rate was even higher at 85% . Furthermore, a survey in the Harvard Business Review (Flyybjerg and Budzier, 2022) says that the average cost overrun for IT projects was 27% at that time. In addition, the review alludes to the fact that one in six projects can be considered a “black swan”, with cost overruns averaging 200% and schedule overruns of nearly 70%. Based on the Standish Group Report CHAOS report, only 31% of IT projects were successful, 50% were challenged, and 19 % failed (Portman, 2021). A survey conducted by Bain and Company revealed that a mere 5% of companies undertaking digital transformation initiatives reported project success (that is, they either met or surpassed their expectation) (Baculard et al., 2017). Imam and Zaheer (2021) state that neglecting humans' role in project management contributes to project failure. They further add that there is a “paucity” of research in this regard despite holding strategic importance in projects. Even though there is a wealth of literature on stakeholder management, there is a noticeable research gap in the context of IT stakeholder management in projects in the 4IR in South Africa (Ke Yu, 2022). This study aims to address this gap by examining the stakeholder factors that affect the outcomes of IT projects and their subsequent impact on project success. One of the common situations that derail global projects in general and African projects is poor stakeholder management. In most projects, it is possible and easy to forget the importance and role played by stakeholders in project success as project managers deviate from the project scope and end up using resources inefficiently (Siavhundu, 2019).

The existing literature extensively discusses the impact of AI on IT project management. However, there is a noticeable absence of an equally robust discussion regarding the influence of AI projects, specifically on stakeholders (Miller, 2021). This is even more pronounced in the South African context.

Additionally, the growing literature on AI within computer science, data science, business ethics, and law domains has not thoroughly examined the viewpoint of project management (OECD, 2019; Wieringa, 2020).

This study aimed to explore stakeholders' role in the success or failure of IT projects, identify the complexities of stakeholder management in IT development projects, and develop a robust stakeholder management process specifically tailored to the context of developing economies. This study offers valuable insights and practical recommendations for optimising stakeholder management processes and enhancing overall IT project performance in this ever-evolving business landscape. This is conducted within the South African context to help bridge the gap between stakeholder management and project performance.

1.3 Research Question and Sub-questions

1.3.1 Main Question

How can the stakeholders be managed sustainably for the successful execution of IT projects in the fourth industrial revolution in SA?

1.3.1.1 Sub-Questions

Sub-Research Question 1: What are the stakeholder management challenges encountered in information technology projects within the context of the Fourth Industrial Revolution?

Sub-Research Question 2: What strategies can be developed to effectively manage stakeholders in information technology projects in the era of the Fourth Industrial Revolution and the proliferation of AI?

Sub-Research Question 3: What is the relationship between stakeholder satisfaction and 4IR IT project success.

Sub-Research Question 4: What are the critical success factors for stakeholder engagement and satisfaction in IT projects, considering the influence of AI and the evolving landscape of the Fourth Industrial Revolution?

1.4 Purpose and Objectives of the Research Study

1.4.1 Main Objective

The main objective of this research was to develop a 4IR-relevant stakeholder management framework to enhance project success in the IT project industry in South Africa.

1.4.1.1 Secondary Objectives

The following sub-objectives should be achieved by the end of the research:

Sub-Objective 1: Identify the stakeholder management challenges encountered in information technology projects in the Fourth Industrial Revolution.

Sub-Objective 2: Identify strategies that can be used to effectively manage stakeholders in information technology projects in the era of the Fourth Industrial Revolution and the proliferation of AI.

Sub-Objective 3: Determine the relationship between stakeholder satisfaction and 4IR IT project success.

Sub-Objective 4: Identify the critical success factors for stakeholder engagement and satisfaction in IT projects, considering the influence of AI and the evolving landscape of the Fourth Industrial Revolution.

1.5 Hypotheses

Hypothesis 1: The Fourth Industrial Revolution introduced unique stakeholder management challenges organisations must address for successful information technology (IT) projects.

Hypothesis 2: Adopting effective stakeholder management strategies is essential for successful information technology projects.

Hypothesis 3: There is a relationship between Stakeholder satisfaction and 4IR IT project success.

Hypothesis 4: There is a relationship between critical success factors and IT project performance in the 4th Industrial Revolution.

These hypotheses are elaborated on in Section 3.13 of Chapter 3.

Table 1: Linking Research Questions to Hypotheses and Objectives

Main Objective: How can the stakeholders be managed and engaged sustainably for the successful execution of IT projects in the fourth industrial revolution?				
Sub-objectives	*Sub-Objective 1:* Identify the stakeholder management challenges encountered in information technology projects in the Fourth Industrial Revolution	*Sub-Objective 2:* Identify strategies that can be used to effectively manage stakeholders in information technology projects in the era of the Fourth Industrial Revolution and the proliferation of AI.	*Sub-Objective 3:* Determine the relationship between stakeholder satisfaction and 4IR IT project success.	*Sub-Objective 4:* Identify the critical success factors for stakeholder engagement and satisfaction in IT projects, considering the influence of AI and the evolving landscape of the Fourth Industrial Revolution.
Hypotheses	***Hypothesis 1****:* The Fourth Industrial Revolution introduced unique stakeholder management challenges organisations must address for successful information technology (IT) projects.	***Hypothesis 2****:* Adopting effective stakeholder management strategies is essential for successful information technology projects.	***Hypothesis 3****:* There is a relationship between Stakeholder satisfaction and 4IR IT project success.	**Hypothesis 4**: There is a relationship between critical success factors and IT project performance in the 4th Industrial Revolution

	Sub-Research Question 1: What are the stakeholder management challenges encountered in information technology projects within the context of the Fourth Industrial Revolution?	*Sub-Research Question 2:* What strategies can be developed to effectively manage stakeholders in information technology projects in the era of the Fourth Industrial Revolution and the proliferation of AI? .	*Sub-Research Question 3*: What is the relationship between stakeholder satisfaction and 4IR IT project success	*Sub-Research Question 4*: What are the critical success factors for stakeholder engagement and satisfaction in IT projects, considering the influence of AI and the evolving landscape of the Fourth Industrial Revolution?

1.6 The Significance of the Study

The rapid pace of technological advancements causes a disparity between the current skill sets project employees possess and the changing demands of stakeholder management roles (Whysall et al., 2019). The research will identify challenges faced in IT project stakeholder management and recommend possible solutions. A stakeholder management framework for the IT projects industry within a developing country like South Africa will be designed. This framework will contribute towards the effective management of stakeholders in a developing economy context.

The 4th Industrial Revolution is changing how stakeholders in the IT projects sector interact and inherently impact how they are being managed (Mhlanga, 2020). There is a need to develop a framework for managing stakeholders that incorporates change brought about by the proliferation of new technology. Such a framework is necessary to enhance project success. The research will also assist project managers better manage stakeholders and mitigate occurrences of conflicting stakeholder expectations prevalent in IT projects and further complicated by new technology.

The study provides invaluable information and insights that are geared at improving stakeholder management procedures, which will, in turn, enhance and improve the performance of IT projects in a dynamic 21st-century environment. The goal of the study was to narrow down the gap between stakeholder management and project performance.

Burke (2023) says the challenge currently as we enter the fourth industrial revolution is for academic institutions or business schools to integrate artificial intelligence into their project management courses to enable students to be leaders in the transformation process. The research will also help by suggesting aspects around stakeholder management such as stakeholder identification and engangement. These can then be incorporated in developing learning material for training industry-relevant project managers. Many academic institutions in South Africa offer Project Management as a qualification at various levels. Updating the training material to incorporate new stakeholder frameworks will contribute towards curriculum renewal discourse.

Continued research is imperative for developing methodologies and tools that effectively measure and manage complex IT projects. This ongoing exploration must maintain a close link and direct relevance to the industry, ensuring practical and impactful applications in real-world project management scenarios (Kerzner, 2021).

1.7 Preliminary Literature Study

A review of leading academic databases such as Web of Science and ScienceDirect using the keywords shows that research in this area is still developing. The graph below attests to the foregone statement. Figure1.1 below illustrates a search on ScienceDirect using the keywords: Stakeholder Management; Fourth Industrial Revolution; IT Projects:

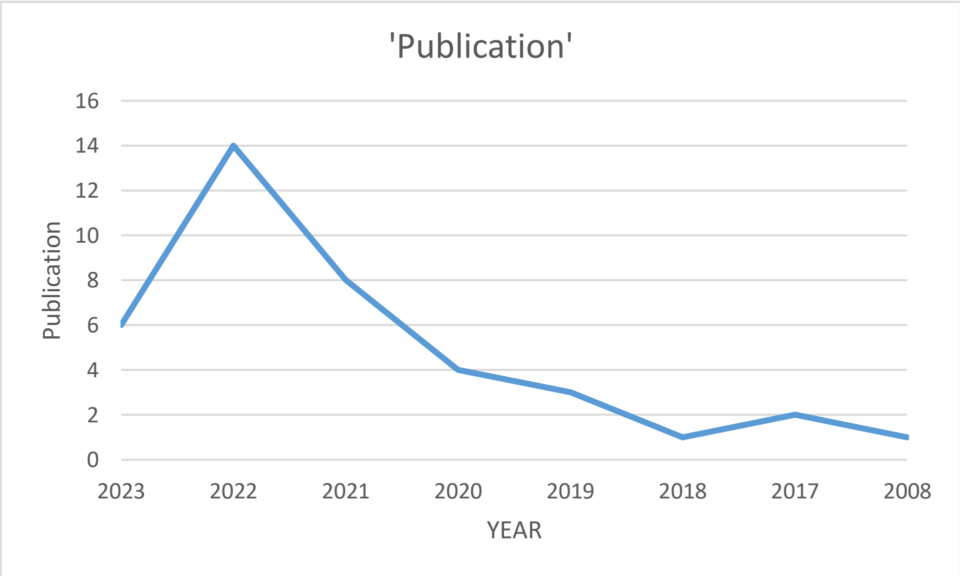

Figure 1.1: Search on ScienceDirect using keywords

(Author)

Of the publications that have been published from 2020 to the present, there is no specific study focussing on stakeholder management in IT projects in South Africa within the ambit of the fourth industrial revolution. Upon adding “South Africa” to the search, only two 2022 publications are yielded, and these are not on IT projects in the fourth industrial revolution in SA.

1.8 Project Management

Project management is a discipline that has a set of tools and techniques to be adhered to when executing a project (Larson and Grey, 2020). Venter and Oosthuizen (2018) find project management to be another form of management that is recognised globally. Lester (2014) states that project management is about achieving the project objectives within the agreed criteria of time, cost and performance through the planning, monitoring, and control of all project features and the motivation of all those involved in it. In order to complete a project and to make things happen a team or a group of people will work together.

Over recent times, businesses have gradually shifted from operations and product-based to project-orientation (Simion et al., 2018). Schwalbe et. al (2020) echoes the foregone statement when he says that project management principles can be applied in any organisation and, as such, are not limited to a particular project. Mantel (2019) argues that over the past decades, project management principles have been rapidly used as a strategy by which organisations achieve their objectives. Kerzner (2022) defined project management as the art of planning, controlling and properly orchestrating projects and company resources to achieve the specific goals and objectives of the project.

Murphy and Ledwith (2007) explored the utilisation of project management practices in small, high-technology firms. They noticed that the factors that contribute to the successful completion of a project include the existence of a project manager and considerable planning prior to the execution thereof.

As can be seen from the above definitions, projects, one way to perceive a project is as an entity that functions within a fluctuating or dynamic environment, displaying characteristics akin to a system (Siriram 2017). These characteristics have to be recognised and managed for the project to be successfully completed.

1.9 Project Stakeholder Management

According to Burke (2020) and Oosthuizen and Venter (2018), a project stakeholder may compromise any internal or external group to the project who might affect the project's outcome and whom the project manager relies on to complete the project. It can also be anyone whose interests are negatively or positively impacted by the project being executed. For instance, suppliers may have an interest in the project as a strategy and their relationship needs to be well maintained (Siavhundu, 2019). It is, however, clear that stakeholders within projects must be identified and their influence ascertained so as to mitigate the impact on web project delivery. Ahmed (2016) states that highly structured project management methods are required in software product development for large software products. He also adds that project management is a necessity for managing large sized teams involved in software development projects. A project manager must be able to identify project stakeholders and know how to manage them as resources, as this is important for the success of the project. According to Eyiah-Botwe (2016), stakeholders should be ascertained and classified to enable project managers to rank stakeholder interests, roles and influence and establish the basis for stakeholder engagement.

In any given project or company, there are always stakeholders to be satisfied. Steyn (2016) asserted that in any organisation, whether part of the project or not, there are people with an interest in the organisation that make up the stakeholders.

Standoff (2015) admitted that there may be good plans or architectural diagrams, but there is more to that before a project is successful. Many projects change drastically due to scope creep emanating from lack of decisiveness of the stakeholders or sponsors. Even though Standoff (2015) admitted to the challenges due to the indecisiveness of stakeholders, he also believes there are ways to commit them. However, committing to timelines and budget may lead to an unusable but successful project regarding timeline and budget. Hence, this research study seeks to uncover the fundamental challenges to the management of stakeholders.

Failure is, to a greater extent, related to stakeholder's perception of the value of the project and their relationship with the project team (Herz and Krezdorn, 2021). Different stakeholders have different perceptions and have different definitions of success. If a project fails to meet stakeholder expectations and the perceived value, it will be regarded as a failure. Stakeholders will always have an impact on projects, and their understanding of the scope may not always be the same (Nguyen et al., 2023).

1.10 Outline of Chapters

This study was divided further divided into five other chapters:

Chapter Two: Literature Review on Stakeholder Management in IT Projects & 4IR. This chapter explores the literature on stakeholder management in projects, presents the theoretical framework of the study. The impact of 4IR on project stakeholder management and how success is measured in projects is discussed.

Chapter Three: Literature Review on Existing Stakeholder Models & Theories.As a build-up to Chapter 2. This chapter specifically zeroes in on various stakeholder models and theories. Some models discussed include the Power/Interest Grid developed by Henrik von Scheel. Another model discussed is the Stakeholder Management Strategy Matrix, which was propagated by John Kotter and Leonard Schlesinger.Yet another model discussed is the Stakeholder Salience Model designed by Freeman and Wicks (Kujala et al.,2019).

Chapter Four: The Research Methodology and Design Chapter presents the research paradigm underpinning the study and methodology utilised. This chapter focuses on the research methodology and research plan employed in the study to achieve the objectives. It outlines research topics, demographics, sampling methodologies, data collection and analysis methods, and ethical considerations integral to the study. The study employed a mono-method quantitative research methodology, gathering data through self-administered online surveys using the Lime Survey platform

Chapter Five: Data Analysis, Findings and Discussions: - This Chapter presents the quantitative findings from the questionnaires and qualitative findings from open-ended questions. This chapter presents the data and discussion of the findings. Structural Equation Modelling was used for data analysis. The SEM has two parts; the first part is a confirmatory factor analysis of the measurement model, which measures how well the variables fit reality (Ramlall, 2017). The next part is the structural model representing the interrelationship of variables between constructs (Hair et al., 2018). This study used SPSS® AMOS® Version 29 to analyse the data. Generative AI (Microsoft Copilot, 2024) was also used to assist in interpreting the output from SPSS

Chapter Six: Conclusions & Recommendations: this chapter will present the conclusions and recommendations of the research considering the findings and envisaged framework. A variable was developed or generated using the factor analysis regression process. The analysis was iterated several times until the model was relevant. The main aim of the research was to develop a stakeholder management framework for the successful execution of the 4IR projects. The evaluation of project success is a surprisingly open question, with few authors using consistent definitions and measures (Ika and Pinto ,2022).

1.11 Summary

This chapter presented the following aspects of the research: background to the study, statement of the problem, research question and sub-questions, main objective, hypotheses, the significance of the study, preliminary literature study and the outline of chapters in the Thesis. Neglecting the needs and contributions of stakeholders might negatively impact project success and, hence, the need for effective management. Due to recent technological changes as a result of the fourth industrial revolution, there is a need to research stakeholder management more, especially in IT projects, as these have been significantly impacted.

This study focuses on understanding the role of stakeholders in IT project success in the context of a developing economy such as South Africa. The aim was to develop a stakeholder management framework relevant to the Fourth Industrial Revolution (4IR) and to find sustainable ways to engage stakeholders for successful IT projects. The research seeks to address the gap between current skills and the evolving demands of stakeholder management due to rapid technological changes. The next chapter presents the literature review on IT project management.

CHAPTER 2

LITERATURE REVIEW-PROJECT STAKEHOLDER MANAGEMENT OF 4IR PROJECTS

2.1 Introduction

The previous chapter presented an overview of the research and gave an outline of the chapter outlines and what they entail. Changes in software and related technology have rapidly grown with the advent of the fourth industrial revolution. The field of IT project management continues to evolve due to artificial intelligence (AI) (Mhlanga, 2022). A detailed analysis of the stakeholders from the beginning of a project is crucial and goes a long way in mitigating potential future conflicts and project failures (Mhlanga, 2020). There have been calls for robust stakeholder management frameworks in the dynamic environment due to the fourth industrial revolution (4IR) in recent years (Schwabe, 2020). This chapter explores the literature on stakeholder management in projects, presents the theoretical framework of the study, discusses the impact of 4IR on project stakeholder management and how success is measured in projects.

2.2 Background

Stakeholder management has been identified by the Project Management Institute (PMI) as one of the project management domains for performance, alongside teams, development cycle, lifecycle planning, project work, delivery, measurement and uncertainty (PMI,2022). Business has significantly evolved over the years. Nonetheless, projects still play a significant role as business process drivers (PMBOK® Guide, 2021). To continue generating revenue and being relevant, companies must continuously design and re-design ways of executing projects. Information Technology (IT) teams are made up of several project team members working together to build software from scratch or utilising templates. Stakeholder identification, analysis, and proactive engagement from project initiation to closure help to increase the chances of project success (PMBOK® Guide, 2021).

Research has shown the importance of interaction between project stakeholders for project success (Niebecker, Eager, & Kubitza, 2008; Freeman et al., 2010) (Hatamleh, 2021). Vital project key performance indicators (KPIs) must be identified from the onset and communicated to the project team; such communication and collaboration aid project success. Gemünden and Schoper (2015) highlight that transnationalism represents a social phenomenon that entails increasing interconnectedness among individuals, groups, and institutions in an emerging global context. Project managers must perpetually update their skills in response to an ever-changing environment (Whysall et al., 2019). They must evolve alongside the organisation and take the lead in executing technology-related projects (Marnewick and Marnewick, 2021). The present skills suite and competencies according to the Project Management Institute (PMI, 2017) and the International Project Management Association (IPMA, 2015), does not encompass the vital and essential progression in skills and competencies. Managing stakeholders is one of the crucial roles that influence the performance of complex and mega projects (Beringer et al., 2018).

In information systems projects, stakeholders bring different perspectives and views. As a result, it is quite difficult to realise universal satisfaction. The perspective of the stakeholders is arguably one of the most important factors that influence IS project success (Marnewick, C., Erasmus, W. & Joseph, N., 2017). This suggests a growing complexity in managing stakeholder expectations and achieving overall project success. A trend in contemporary literature reflects the foregone sentiments as stakeholder management is considered key in both Agile Methodologies and traditional waterfall method (Joseph & Marnewick 2014; Todorovic´ et al., 2015; Williams 2016).

The fourth Industrial revolution in developing economies, particularly in South Africa, is still relatively in its infancy. The momentum in the fourth industrial revolution is certainly gathering pace (Mlanga, 2023). Over the years, IT projects, both locally and in the international arena, have experienced high failure rates (CHAOS Report, 2020). 'Business IT' projects are projects in the business sector that involve an information technology element. Traditionally, these projects encounter various challenges in meeting clients' demands, resulting in 36% of project failures, according to a global survey by PMI (2017). The success rate of these projects has been deemed unsatisfactory. This has led to billions of dollars in wasteful expenditure each year (Einhorn et al., 2019). The identification, analysis, and proactive engagement of stakeholders from the initial stages to closure enables project success (PMBOK, 2022). The effective management of stakeholders is key to achieving success in project management and process management (Marnewick et al., 2017). Efficiently managing stakeholders is very important for the success of any project, regardless of what type of project it is (Nguyen et al., 2018). There is not much research about the future of IT project stakeholder management (Aliu et al., 2023). Yohannes and Mauritsius (2022) adopted a predominantly waterfall approach to IT system implementation in project management in their research. They suggested that exploring the impact of agile project management methodologies in future research is necessary. This would, in turn, help further improve the identification of critical success factors for IT project success and provide valuable insights into the evolving landscape of IT project management practices.

Thus, the main objective of this research study was to develop a stakeholder management framework in the IT industry in South Africa at the advent of the fourth industrial revolution.

2.3 Theoretical Framework

The evolution of activity theory can be divided into four distinct generations of theoretical development and investigation. Each generation introduced its own primary analytical framework. The first generation, influenced by Vygotsky's work, did not specifically propose or define "activity" as the fundamental unit of analysis, despite Vygotsky's occasional references to "systems of activity" (Vygotsky,1997). Zinchenko (1985) observed that Vygotsky's main unit of analysis was culturally mediated action. Scribner's (1997) studies in work research are prominent examples from this era.

The second generation, represented by Leont'ev (1978), introduced the concept of "activity" as the core unit of analysis. Activity refers to a relatively stable system where different goal-oriented actions are divided and combined to serve a collective objective. This objective, known as the "object," defines the direction and identity of the activity. The object is enduring, continuously evolving, and shapes the possibilities for actions within the activity. It is distinct from conscious goals and is often challenging for participants to define precisely.

In third-generation studies, lateral interactions across the boundaries between participating activity systems become central (Engeström & Sannino, 2021). This sideways dimension of expansive learning involves the construction of new social relations by means of debate, negotiation and shared experimentation. .In a recent paper, Spinuzzi (2019) argues that as work and organizations are increasingly operating in unstable, fluid and poorly bounded arrangements, an interventionist approach of third-generation activity theory may struggle to unite different stakeholders or even to identify and stabilize one set of stakeholders. The possibility of a fourth generation of CHAT was tentatively put forward in 2009 (Engeström, 2009; Sannino et al., 2009)

In this study, project practitioners might agree that project success is the objective of their work activity, and each might give slightly varied characterisations based on personal history and their role in the project.

An activity system extends beyond the mere sum of its components, creating its dynamic context. In activity theory, these contexts are the activity systems themselves. The subsystem related to the subject-mediator-object relationship exists in relation to the other elements within the system. This holistic view emphasises the relational nature of context. The collection of studies found in Putting Activity Theory to Work (Engeström et al., 2005) predominantly represents the second generation. These studies typically analyse a single, reasonably well-defined activity system and its evolutions.

The study will draw its basis on the Cultural Historical Activity Theory (CHAT) to identify and delineate the constructs around IT project stakeholders. While CHAT has been widely used (and still is) in educational, psychological and cultural research, its main tenets and principles can also be extended to other domains, such as stakeholder management in IT projects (Igira & Gregory, 2009). After the identification and subsequent delineation, CHAT is then used to assess the dynamics of the stakeholder interactions. The theory argues that an activity system represents how subjects' actions towards a certain object to realise tools govern outcomes (these may be either physical or symbolic or both), rules (these may be formal and informal), communities (participants and stakeholders) and a division of labour (Engestrom, 1987). The CHAT aids in the identification of bottlenecks in the system so that they can be analysed, adjusted and brought under subjection. The activity system triangle below depicts an activity system, showing various nodes:

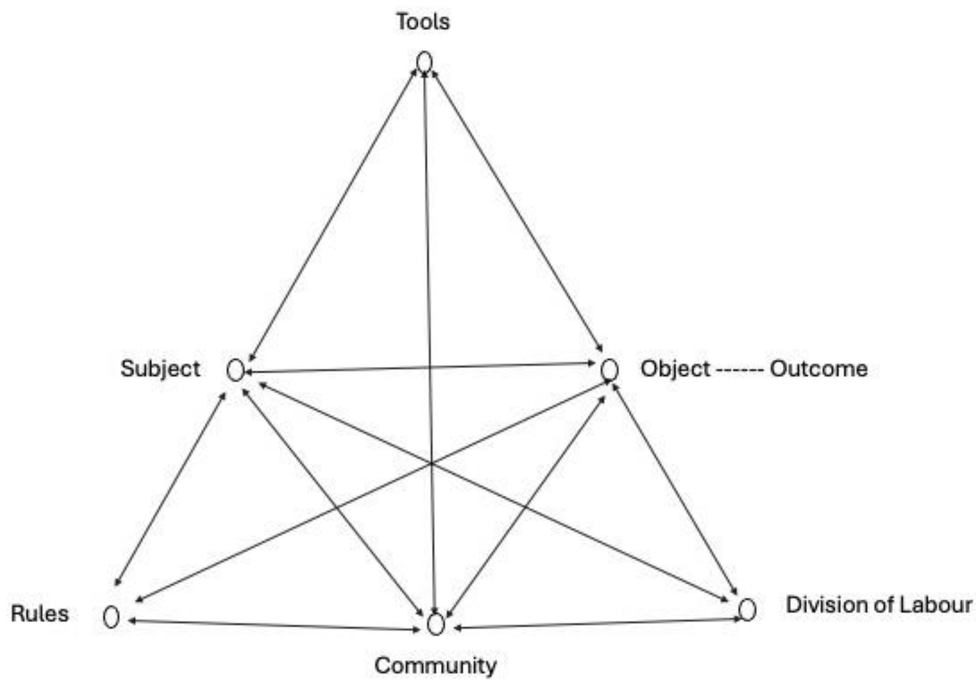

Figure 2.1: Activity System Triangle (Engestrom, 1987)

Based on the above theoretical framework, the conceptual framework was derived as presented in Section 3.12 of Chapter 3 on page 69.

2.4 Project Management (PM)

Project management is a discipline that has a set of tools and techniques to be adhered to when executing a project (Murphy and Ledwith, 2007). Venter and Oosthuizen (2011) find project management to be another form of management that is recognised globally. Over recent times, there has been a gradual shift in businesses from operations and product-based to project-orientation. Schwalbe (2011) echoes the previous statement when she says that project management principles can be applied in any organisation and, as such, are not limited to a particular project. Mantel (2012) says that over the past decades, there has been a rapid usage of project management principles as a strategy by which organisations achieve their objectives. Kerzner (2022) defined project management as the art of planning, controlling and properly orchestrating projects and company resources to achieve the project's specific goals and objectives.

Murphy and Ledwith (2007) explored the utilisation of project management practices in small high-technology firms. They noticed that the factors that contribute to the successful completion of a project include the existence of a project manager and considerable planning prior to the execution thereof. Web development, or web programming, refers to designing software applications for a website (Vodnik & Gosselin, 2014).

Lester (2014) states that project management is about achieving the project objectives within the agreed criteria of time, cost and performance through the planning, monitoring, and controlling of all project features and the motivation of all those involved. In order to complete a project and make things happen, a team or a group of people must work together. Research has shown the importance of interaction between project stakeholders for project success (Niebecker, Eager, & Kubitza, 2008). Vital project KPIs (key performance indicators) must be identified from the onset and communicated to the project team; such communication and collaboration aid project success.

2.4.1 The nature of IT project management

The nature of the Information Technology (IT) industry has become pivotal in this high-tech communication and information age. The IT industry has been growing in leaps and bounds due to more businesses moving into e-commerce to sell products and services and the need to relate to various stakeholders. ERP systems are being used more than before to link organisations virtually in real-time.

Since its emergence in the 1980s, IT research information has gradually grown. Every day, we encounter information technology in different aspects of our lives. We experience IT, for instance, when booking a flight, when we do banking, when registering for a program at a college, when applying for jobs online, when shopping, or when requesting a concierge service. As Moses (2014) puts it, this shows that we live in an information age where services are obtained by manipulating an IS. Sabry & AlShawi, (2009:164) posit that “Inter-disciplinary systems can be described as interrelated information and knowledge components with identifiable boundary, working together for some purpose”.

Information systems improve the proficiency and functioning of organisations. Piccoli (2012) highlights that an information system has four components: "technology, process, structure and people”. This research focuses on the people aspect, namely stakeholders and their impact on project success. We recognise that people need to work together with the other components to realise success. The role of information systems advances is to allow management to gain information that assists them in decision-making for IS processes across the organisation (Iriarte and Bayona, 2020). Wognum in Jern (2009) notes that the purpose of information technology is to provide support to companies in their information needs. An example of such an information system examined is an Enterprise Resource Planning system. Dudas, in Moses (2014), notes that information systems form a fundamental component of an organisation's system by creating value. The graphical presentation below of a conceptual information system processing flow allows one to understand the activities involved in processing information.

IT project management constantly changes, and new technologies and frameworks are emerging rapidly. These evolutions invariably impact stakeholder management and necessitate updated frameworks (Lee et al., 2018). These frameworks must consider challenges and opportunities linked to emerging technologies such as cloud computing, artificial intelligence, and blockchain. On another note, continuous improvement (CI) or the notion of a learning organisation, entails learning from past IT projects, leading to new ideas, insights and lessons from the best-in-class (Marnewick & Marnewick, 2021).

Moreover, different industries have varying statutory and legal requirements that significantly impact stakeholders. The development of IT industry-specific frameworks can aid in the effective management of stakeholders and thereby bolster the chances of success (Adzmi and Hassan, 2018).

Burke (2023) states that there is a growing application of AI techniques for project planning and control. He says that Project Management will become more and more organised around the Hierarchy of Artificial Intelligence, spanning from cyber-physical systems (such as industrial robots, drones, and 3D printing) to Internet of Things (IoT) connectivity, Digital Twin modelling, Augmented Reality (AR), Expert Systems for problem-solving, and Machine Learning for creating learning organisations.

As the world embarks on the initial phases of the industry 4.0 economy, AI planning and control techniques are anticipated to grow in effectiveness and deliver increasing benefits (Burke, 2023).

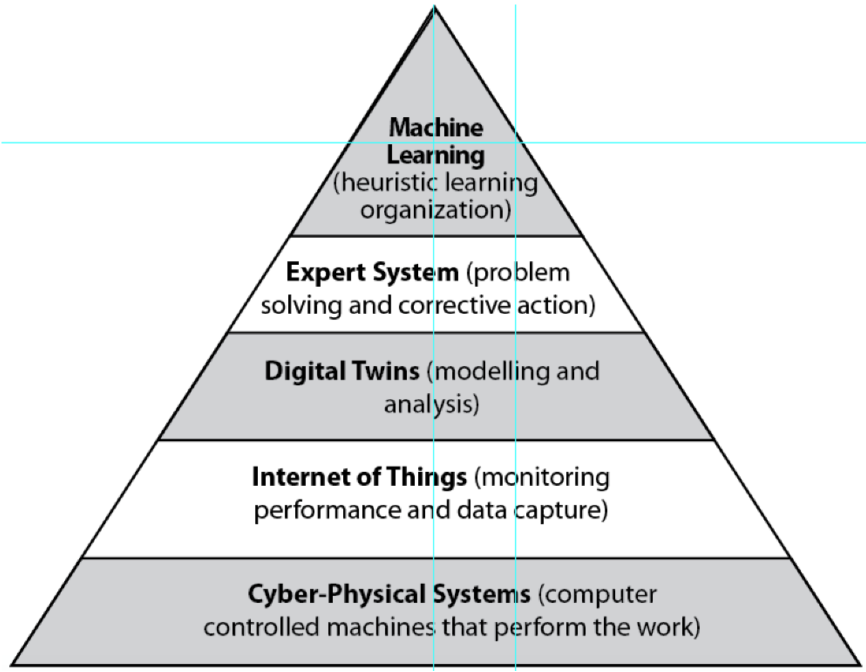

Figure 2.2: Hierarchy of Artificial Intelligence (Burke, 2023)

Simion et al. (2018) examined the attributes of project management in the digital age. They focussed on the distinct influences stemming from the fourth industrial revolution. These influences encompassed the “projectification of society, virtualisation, managing complexity, transnationalisation, and professionalisation”. Simion et al. (2018) posit that these factors, unique to the digital era and the fourth industrial revolution, ushering in a new phase in the development of project management, which they termed "Project Management 4.0”.

Figure 2.3 and Table 2.1 below show the evolution of project management (PM) from its initial era, marked by the First Industrial Revolution. In this phase, PM was based mostly on intuition and experience in contrast to the systematic application of scientific methods (Marnewick & Marnewick, 2020). The second era of PM emerged during the Industrial

Revolution, characterised by a significant shift towards the utilisation of systematic approaches in project execution (Aliu et al., 2023).

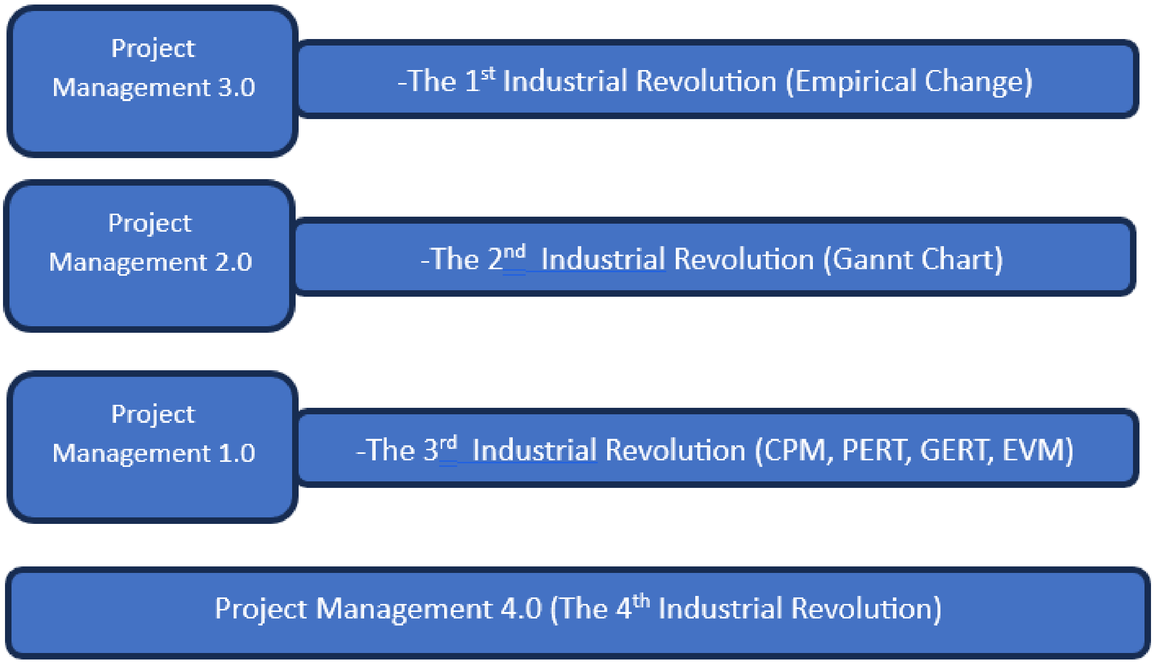

Figure 2.3: Evolution of project management (PM) from its initial era

(Aliu et al., 2022)

Until the 1980s, project management was predominantly applied within fields like engineering and information technology. However, starting in the 1980s, project management began to garner wider acceptance across various management and other disciplines (Turner et al., 2013). The four industrial revolutions have been propelled by significant technological advancements, which, in turn, have had a profound influence on the realm of project management (Aliu et al., 2022).

Revolution	Period	Technical achievements (Prisecaru, 2016; Campa, 2020)	Modern project management (Seymour and Hussein, 2014; Kwak et al., 2003; Morris et al., 2011)
1st	1765–1850	Steam engine, mechanization	
2nd	1870–1950	Internal combustion engine	• Project management started as an administrative function of scheduling and coordinating to shorten delivery times by parallel planning.
3rd	1969–2000	Computer, robots, automation, laser, internet, mobile phones	• Advances in technology increased the utilization of tools in project management (PERT, WBS). • Management sciences were introduced as projects grew in complexity. However, the focus was still on administrative function of scheduling and coordinating and excluded functions such as project definition, quality assurances and success criteria. • Enterprise-wide project management developed as technology advanced and were integrated across the enterprise. Professional bodies, competency frameworks, standards and methodologies emerged.
4th	2000 and beyond	Internet of Things, cyber systems, smart industry, advance robotics, artificial intelligence	• Project management developed into a complex discipline requiring project managers that can manage complexity, coordinate social interaction among people, create value for business, operated across disciplines and continuously learn and reflect.

Table 2.1: Impact of Industrial Revolutions on PM

(Marnewick and Marnewick, 2021)

Lee et al., (2018), the "AI + 12tech" model for the Fourth Industrial Revolution in technology. This model comprises six digital and six analogue transformation technologies, all integrated with AI, as illustrated in Figure 2.4 below.

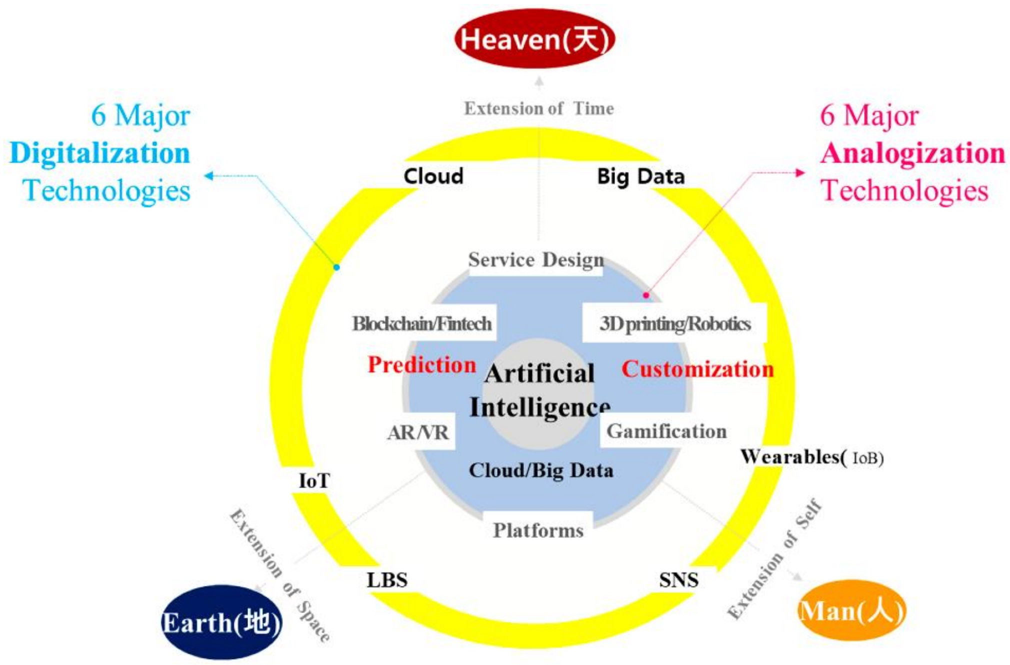

Figure 2.4: Six digital transformation and six analogue transformation technology models

(Lee et al., 2018)

The Fourth Industrial Revolution entails eradicating barriers in digital, biological, and physical sciences and building upon the foundations of the Third Industrial Revolution. In the 2017 Global Risks Report by the Davos Forum, 12 high-potential technologies were identified, with AI and robotics as the most significant (WEF, 2020). Many experts envisage that the top five technologies will include IoT, robotics, 3D printing, Big Data, and AI. Typically, developments across ICT-related technologies, physics, and biology give rise to new demands (Kibe et al., 2023). This leads to the creation of innovative products and services like smart factories or autonomous driverless cars equipped with intelligent guidance systems. Project managers must equip themselves with skills in online communication and collaboration, as emphasised by Waizenegger et al. (2020).

One of the major challenges is identifying stakeholders during the briefing meetings, capturing their various and often conflicting needs, and addressing them during the project lifecycle. The dynamic nature of IT projects exacerbates these often-conflicting needs, hence the need to create a way of capturing, mapping and managing them (Burke, 2023).

Managing the needs of different stakeholders in a dynamic environment is a challenge on its own. By definition, project management deals with a unique endeavour in a changing environment and bringing in the complexities of variable stakeholder requirements further complicates the successful management of such projects (Kerzner, 2022). There are no formal or standardised stakeholder management processes in the IT industry. Many organisations fail to deliver envisaged targets due to challenges in stakeholder management. The need for more complex IT applications is growing daily. In contrast, application managers and developers face huge challenges when they need to approximate development time, effort, and cost aspects based on client requirements (Čeke & Milašinović, 2018).

2.5 Stakeholder Management

The latest PMI Guide (2022) cites eight performance domains critical to project success. Stakeholder management is one of the domains. In the previous PMBOK 6th edition, Stakeholder management was one of the ten knowledge areas. Continuous engagements between project teams and other stakeholders underpin successful outcomes (PMI, 2022).

2.5.1 Definition of Stakeholders

Freeman's (1984:16) definition of a stakeholder entails "any group or individual who has the potential to influence or is influenced by the organisation's goal accomplishment." According to Burke (2023:96) and Oosthuizen and Venter (2018:44), a project stakeholder may compromise a group or individual who might have an impact on the project’s outcome and whom the project manager depends on for the success of a project. Shafique and Gabriel (2022:3) define a stakeholder as an entity, human or non-human, that can affect and is being affected by the decisions of other stakeholders and their resultant actions or non-actions. This definition is adopted in this study as it captures the tenets of the research topic and problem.

2.5.2 Impact of 4IR on Stakeholder Management in PM

Many organisations have adopted agile practices to execute information systems (IS) projects and add value to their businesses. However, the adoption of these practices has not been without challenges. Mkoba and Marnerwick (2022) cite several organisational cultural attributes that influence adopting agile practices. These include management control, team collaboration, market and creativity. Mayo et al. (2024), cited by Odejide (2024), say the realm of project management is experiencing a significant transformation with the integration of Artificial Intelligence (AI).

In the conventional information age, information technology served as a bridge connecting various disciplines and technologies. Nevertheless, with the advent of artificial intelligence, the world has witnessed a transformation where intelligence and recognition were no longer separate, and the boundary between virtual and physical spaces blurred (Lee et al., 2018). The 1st and 2nd Industrial Revolutions established a centralised network. At the same time, the 3rd Industrial Revolution introduced a decentralised network with dispersed powerful hubs. Conversely, the 4th Industrial Revolution represents a “distributed network” where all convergent nodes possess “equal power”, as illustrated in the illustration below (Lee et al., 2018).

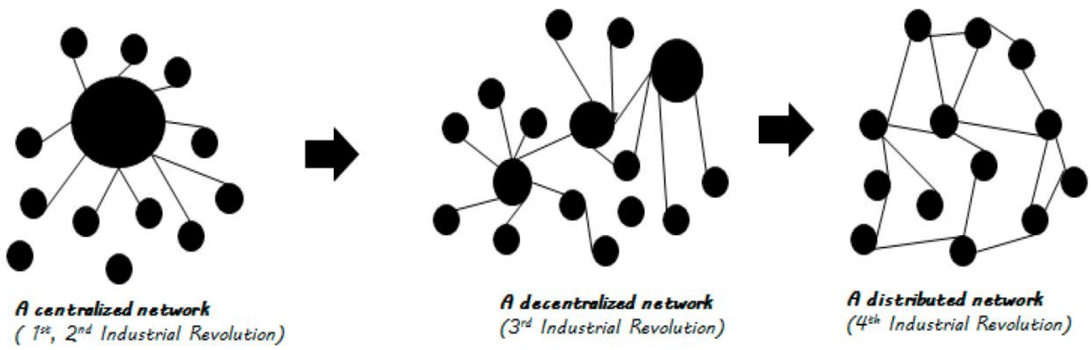

Figure 2.5: Industrial Revolutions and Network Relationships

(Lee et al., 2018)

According to the Davos World Economic Forum (2020), the 4th Industrial Revolution has been in motion since the early twenty-first century. It is a radical shift in how things are done. It is characterised by widespread mobile internet access and affordable, compact, robust sensors coupled with machine learning (Schwab, 2018). This concept encompasses the radical transformation driven by a range of recent technologies.

As stated by Schwabe (2016)

> "We are witnessing profound shifts across all industries, marked by the emergence of new business models, the disruption of incumbents and the reshaping of production, consumption, transportation and delivery systems. Governments and institutions are being reshaped. Artificial intelligence is all around us, from self-driving cars and drones to virtual assistants and translation software."

IT projects have not been spared.

The fourth industrial revolution (4IR) is distinguished by the convergence of physical, digital, and biological technologies, and this convergence has a direct influence on how stakeholders are managed in IT projects (Alexander, 2021).

One of the notable aspects of the Fourth Industrial Revolution (4IR) era is the development of hybrid project teams. These hybrid teams are composed of members that will include virtual assistants, such as software and applications with learning and expressive capabilities. In contrast, others will be physical team members (Aliu et al., 2023). This revolutionary wave of digitalisation underscores the importance of innovation in projects. Project teams are anticipated to become more and more compact and oriented toward specific goals (Schwab, 2016).

Kibe et al. (2023) retrieved 914 research publications on 4IR and sustainable development in Africa. The study discovered that 4IR technologies support various industrial sectors such as education, health services, tourism, e-commerce, and project management. This emerging form of intelligence demands fresh skill sets, but there remains some uncertainty about the specific competencies needed, particularly in the context of project management (Marnewick & Marnewick, 2021).

2.6 Project Management Methods

Some project management approaches specific to IT projects have been developed over the years. These can be linked directly to the growth of software development projects. Some of the methodologies adopted for IT projects include, amongst others, Agile Project Management, Software Development Lifecycle (SDLC), Lean Project Management and DevOps (Patel, 2022).

The waterfall method gave birth to the SDLC, and there is a parallel between the two approaches in that both follow a systematic sequential approach in which a phase is closed off before the next one (Serrador & Pinto, 2015). The phases involve issues such as defining requirements and agreements, designing the system and software, and coding testing and integration (Alshamrani & Bahattab, 2020). In order to counter the shortcomings of the waterfall method, Agile Project Management has been developed. The most common or popular agile approaches are Scrum and Extreme programming (XP); in essence, the iterative aspect is key to both, though they have different lifecycles (Dingsoyr et al., 2012; Misra et al., 2009; Van Waardenburg &Van Vliet, 2013). Though Scrum and XP are two distinct methods, they can be used simultaneously or as a hybrid (Serrador & Pinto, 2015). Rosenberger and Struzl (2017) showed that many so-called performance indicators are not suitable for Agile project management with respect to IT projects and hence the need for new solutions and redefining KPIs.

Normally, there is a disjoint between development and deployment in IT projects and DevOps was designed to bridge this gap and to help corporates develop capital and complex ICT solutions and focus on four main tenants, namely Culture, Automation, Measurement and Sharing (Fitzgerald & Stol, 2017).

Lean project management is founded on five major tenets, namely value, value stream, flow, pull and perfection ((Fisser & Browaeys, 2012; Wang et al., 2012; Womack & Jones, 2013). On the other hand, the shortcoming of the waterfall method is that it does not adapt to real-time changes, which is the norm in IT projects. The cost implications of accommodating late changes are very high.

It can thus be seen from the foregone that there is a vast difference between traditional (I.e.waterfall approach) and lean project management approaches. These differences arise in the objectives and execution of the phases as well as in the link between participants and phases. Furthermore, lean project management contrasts with traditional project management not only in goals pursued but also in the structure of its phases as well as in the relationship between phases and the participants in the phases (Bhamu & Sangwan, 2014).

Reusch and Reusch (2013), as cited by Joseph (2017), assert that in addition to the above five tenets, the following principles should be added: increase learning, making timely decisions, empowering the project team whilst establishing integrity, and finally having a holistic view.

2.7 Challenges in IT Projects

One of the challenges during the initiation of IT projects is to identify key stakeholders and capture their various and often conflicting needs and how to address them during the project lifecycle (Lalic et al., 2022). These often-conflicting needs are exacerbated by the dynamic nature of IT projects, hence the need to create a way of capturing, mapping and managing these stakeholders (Zhang et al., 2023). Besides a plethora of stakeholder theories, there are still challenges in stakeholder management in IT projects, as evidenced by scope creep and high IT project failures.

Managing the needs of different stakeholders in a dynamic environment is a challenge on its own. By definition, project management deals with a unique endeavour in a changing environment and bringing in the complexities of variable stakeholder requirements further complicates the successful management of such projects (PMI,2021). As stakeholders take on digitisation technologies, it creates pressure on the organisation to address their needs as well. (Yi et al., 2024). Many organisations fail to deliver envisaged targets due to challenges in stakeholder management. The need for more complex IT applications is growing daily. In contrast, application managers and developers face huge challenges when they need to approximate development time, effort, and cost aspects based on client requirements (Čeke & Milašinović, 2015).

Academics and practitioners have extensively studied the success of information system projects over the past few decades. The urgency behind this considerable research stems from compelling evidence suggesting that information system projects continue to experience alarming rates of failure (Marnewick, Erasmus and Joseph 2017). Globally, research on information system project success is conducted by the Standish Group, generating the Chaos Chronicles. The Standish Group Report (2021) revealed that merely 16.2% of projects reach completion within the allocated budget and timeframe. Alarmingly, around 31% of projects end up getting abandoned, and a significant majority experience issues with cost and time overruns. This data highlights the prevalent challenges and shortcomings faced by projects in meeting their intended goals within the stipulated resources and schedules. In South Africa, the Prosperus Reports, as identified by Labuschagne and Marnewick (2009), Marnewick (2013), and Sonnekus & Labuschagne (2003), contribute to the understanding of IS project success rates. Figure 2.6 illustrates the results derived from international research (Marnewick, Erasmus, and Joseph, 2017).

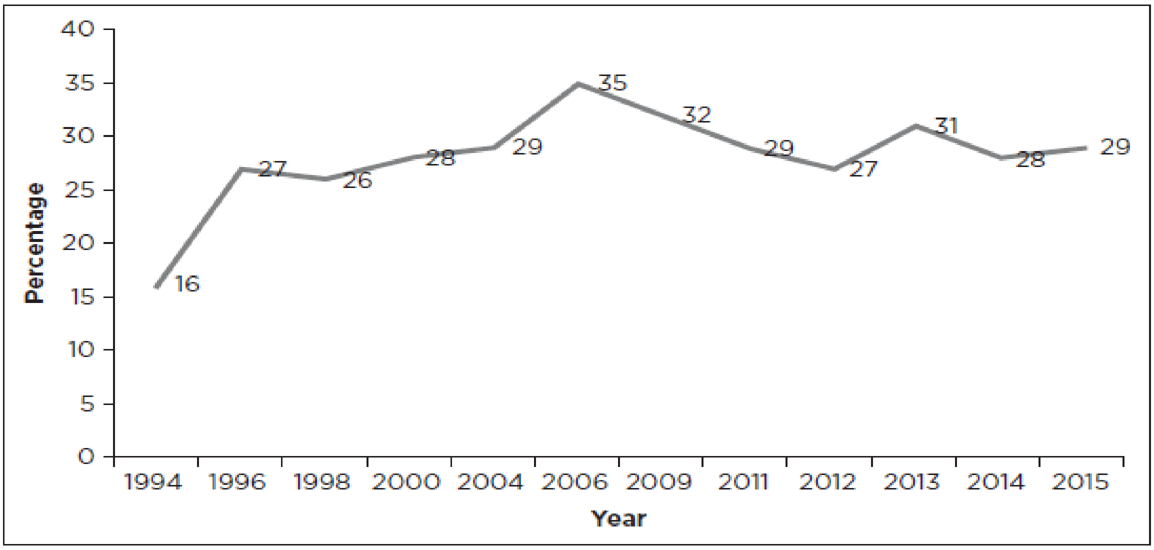

Figure 2.6: International Information Systems Project success rates

(Marnewick, Erasmus, and Joseph, 2017).

The South African success rates depicted in Figure 2.7 look better than the international success rates shown in Figure 2.6; South African companies are in a similar predicament as international companies, in the sense that both illustrations show that an average of one-third of IS projects are considered as successful (Marnewick, Erasmus, and Joseph, 2017). The foregone analysis indicates a dire need to address IS project success.

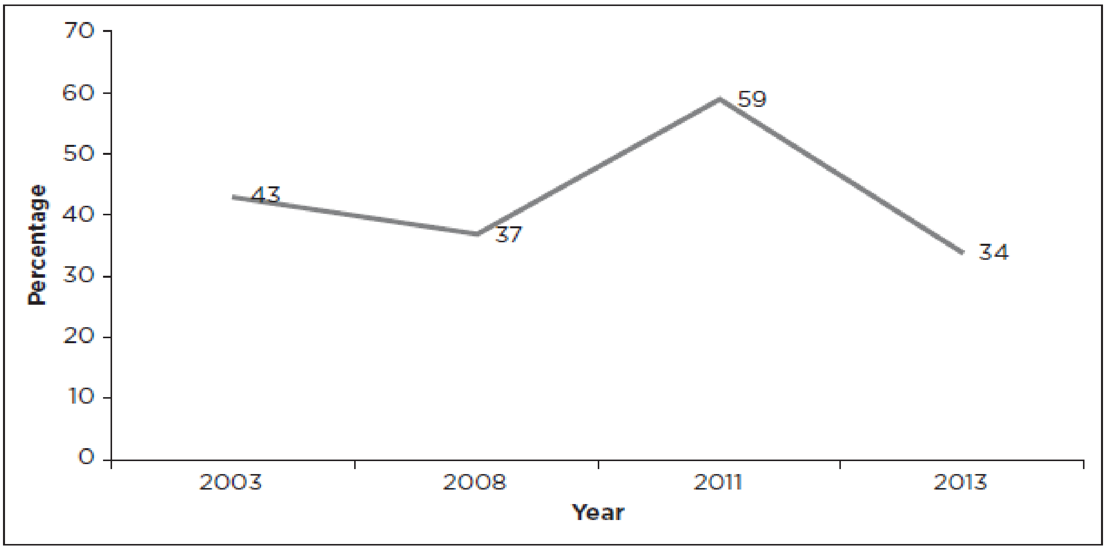

Figure 2.7: South African Information System project success rate

(Marnewick, Erasmus, and Joseph, 2017)

Spending on IT services and projects is on an upward trajectory, as illustrated in Table 2.2:

Table 2.2: Information Technology Spending World

Spending (Billions of dollars)	Years						
	2014	2015	2016	2017	2018	2019	2020
Data centre systems	166	171	170	175	176	178	181
Enterprise software	310	314	333	355	380	407	436
Devices	649	646	588	589	589	593	593
IT services	897	866	900	938	981	1029	1081
Communications services	1541	1399	1384	1408	1426	1441	1462
Total	**3564**	**3395**	**3375**	**3464**	**3553**	**3648**	**3752**

(Lovelock et al. 2017)

The figures in Table 2.2 from Lovelock (2017) above clearly demonstrate substantial expenditures by companies and governments on IT-related services. The projected figures show an annual growth rate of 2.7%, underscoring the ongoing nature of investments in information technology. This persistent commitment to IT investment is observable in a South African context, with projections indicating an expenditure of $10.5 billion in 2017. This represents 0.3% of the global expenditure on IT. Research findings further reveal that South African companies allocate significant amounts, running into billions of rands, towards IT services, as depicted in Figure 2.8 cited by (Marnewick, Erasmus, and Joseph, 2017).

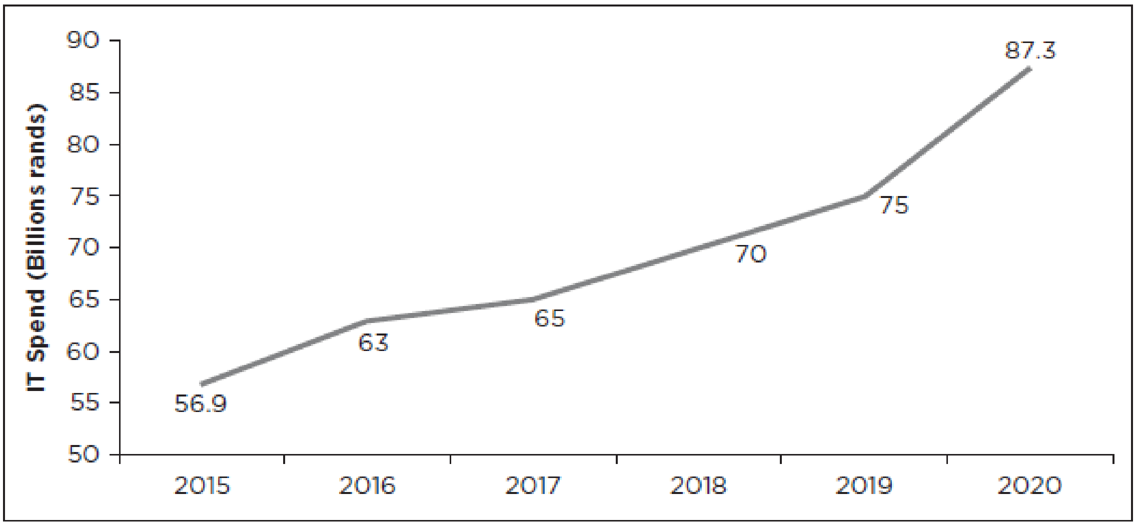

Figure 2.8: Information system spending

(Lovelock, 2017)

Studies have associated project failures with poor stakeholders' performance, Eyiah-Botwe et al. (2016). Developers face several challenges. These include a lack of control over document presentation and entry points to the site (Joseph, 2017). The other challenge is that potential users come from diverse backgrounds, embracing a wide range of cultures and languages, amongst other things.

Usman (2017) classifies IT project constraints into two types: business constraints and technical constraints. The former relates to constraints resulting from organisational management issues that include financial challenges and operational matters present on the client's side; the latter looks at organisational resources challenges.

Stakeholders with conflicting interests often bring about high complexity, which, in turn, can result in both time and cost overruns. There are notable cases that vividly demonstrate this problematic aspect (Prebanić and Vukomanović, 2023). Engaging project stakeholders represents a complex and multifaceted process. Prebanić and Vukomanović (2023) explored the context and intricacies surrounding the stakeholder engagement process, and they acknowledge that it is pivotal in the achievement of a sustainable management approach. They recommend that it should be recognised as a standard project management practice.

2.7.1 IT projects failures

IT project failures have been widely documented despite many organisations investing money and time into software development (Ramos & Mota, 2014). For Bannerman (2008), IT projects tend to be susceptible to failure as they are challenging undertakings. Multistakeholder engagement is critical in IT projects worldwide, as alluded to in a report by Gartne Inc., 2015 (Kyte & Ziiden, 2015). This was also highlighted (Suliyistani and Tyas, 2022) positing that stakeholder engagement is paramount for the successful management of IT projects.

Varajão et al. (2022) introduce a novel concept called "success management" in their paper. This approach aims to enhance the understanding of project success drivers by identifying, leveraging, and securing success through a thorough awareness of stakeholder values and managing the project in alignment with those values. Given the socio-political complexities inherent in projects, stakeholders often have varying perspectives and definitions of success at different stages of the project lifecycle. Consequently, project success is an intersubjectively constructed phenomenon, particularly in an era where sustainability is increasingly important (Pinto et al., 2022).

Some studies have associated project failures with poor stakeholders' performance (Eyiah-Botwe et al. 2016). Many studies have concluded that the issue of IT project success is multi-dimensional and deserves more than just a casual treatment (Neves at al., 2016). Williams (2017:32) says "stakeholder management is an integral part of the project management process". The other challenge is that potential users come from diverse backgrounds, embracing a wide range of cultures and languages, amongst other things. As such, there is a general lack of a clear model of user behaviour. PMI (2013) posits that meeting all stakeholders' needs and satisfaction is an important project success criterion. Stakeholder management theory asserts that project success hinges upon considering and addressing the needs and requirements and also the interaction between the Project Team and the various stakeholders as discussed in section 2.8.

2.8 Project Team Versus Stakeholders

A project manager should be capable of recognising project stakeholders, knowing how to handle them, and considering them just as important as other project resources for the project to come out successful (Young, 2006). According to Dobson, 2004, he defines stakeholders as those individuals and organisations who have an interest in the project tasks or even the final project outcome. Important stakeholders are entities that can affect the scope, schedule, or budget (Tam et al., 2020). Clients and project managers should conduct periodic performance reviews with key stakeholders to discuss the measurement results and any implications that may arise from the results. Project managers should encourage feedback and seek input into appropriate courses of action to expedite or enhance the progress being made (Farkas, 2009). There is a need to monitor changing stakeholder needs proactively throughout the stakeholder management process (Pascale et al., 2020).

2.9 Measuring Project Success

There is no established method widely recognised in project management literature to measure project success, sparking ongoing discussions about what defines success in a project.

Pinto et al. (2022), citing Lundin et al. (2015), say the need to reassess the nature of project success periodically is a recognition that projects and the project society are constantly evolving and reconfiguring.

2.9.1 No universal definition for project success

A concrete, universally accepted definition of project success is notably absent (Yohannes and Mauritsius, 2022). The success of IT projects is evaluated differently by various stakeholder groups. Project success seems to be contingent on the individual perspectives of each stakeholder.

Empirical studies commonly utilise varied definitions of project success, leading to comparison challenges. Within the literature, project success can denote completion "on time, within budget, to specification," the success of the resulting product, or achieving the project's business objectives. Chipulu et al. (2019) found that stakeholders tend to emphasise project effectiveness when evaluating the project's successes. Conversely, when evaluating project ‘failure’, they focus more on efficiency. For project managers, it is vitally important to understand how stakeholders assess and prioritise project outcomes. This helps them gain a clearer insight into the individual interests of various stakeholders. These measures are frequently debated, making it challenging to identify if a problem exists (Sauer et al., 2007). Adding to the complexity is the subjective nature of success, similar to quality, which varies based on stakeholders' perspectives and changes over time following project completion. Despite these complexities, resolving the issue of defining project success is crucial for advancing project management research and expanding the knowledge within this emerging field (Bannerman, 2008). Varajão et al. (2020) point out that there have been major strides in PM processes, but this has not impacted project success rates as stakeholder expectations are constantly not being met and continue to be disappointed by their results.

2.9.2 Project success: beyond the technical tools

Historically, evaluation tools for gauging project success have primarily revolved around technical aspects, with a narrow focus on critical factors like time, cost, and adherence to quality standards (Yohannes and Mauritsius, 2022). Nevertheless, contemporary literature suggests that assessing project success should extend beyond these technical parameters (Adzmi, 2022). For instance, certain projects may meet their time and budget constraints but still fall short because they have neglected the requirements of the customer or the intended beneficiaries, which underscores that project management success can be determined at the end of the project. The success depends on how the base organisation utilises the potential of the deliverables. As such, there is a general lack of a clear model of user behaviour. PMI (2022:51) posits that meeting all stakeholders' needs and satisfaction is an important project success criterion. Stakeholder management is key to project success throughout the project lifecycle (Eyiah-Botwe, 2016). It has been recommended to incorporate stakeholder satisfaction as an evaluation criterion for project success alongside the conventional measures of time, cost, and quality (Yohannes and Mauritsius, 2022).

2.9.3 Project success and IT projects

From the perspective of software developers, a successful IT project is one that is implemented within the budget and on schedule, meeting all the specified functionalities (Yohannes and Mauritsius, 2019). For end-users, a project is considered successful if it provides them with satisfaction and the ability efficiently perform tasks. Organisations define successful projects based on the contribution to profit margins and the project's ability to establish a competitive advantage in the marketplace (Urbach et al., 2009).

Accomplishing project success involves various dimensions and formulating a framework to visually represent this idea (Bannerman, 2008; Bannerman & Thorogood, 2012). This framework is illustrated in Figure 2.9 below:

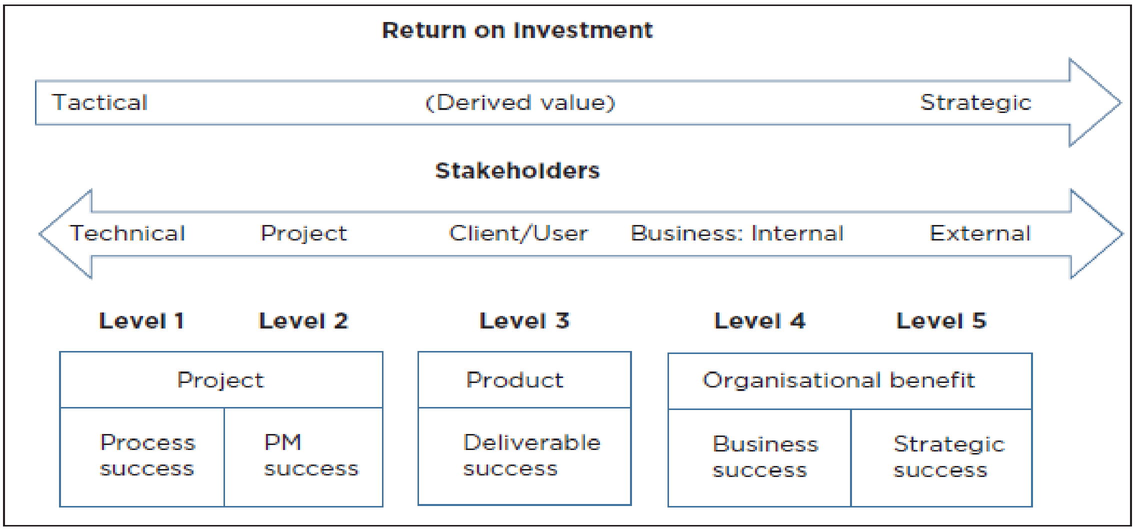

Figure 2.9: Project success framework

(Bannerman, 2008).

In the first tier, Level 1, project success heavily depends upon the effective implementation of project management tools and techniques. Evaluation at this stage centres mainly on the careful choice of tools and how much they can be adapted to different scenarios and produce desired results.

In Level 2, success is measured by the project's adherence to the traditional triple constraint, i.e. time, cost, and scope. Failure to meet these technical constraints leads to overall project failure at Level 1 and Level 2. Users and customers are primarily concerned with the deliverables produced by the project. Factors such as 'fit for use' or usability gain prominence at Level 3 (Marnewick, Erasmus and Joseph, 2017).

At Level 3, success is contingent on meeting customer specifications, and achieving project success here implies product success. Notably, there are instances where a project's product aligns with customer needs but fails to meet criteria at Levels 1 and 2 (Marnewick, 2016; Serra and Kunc, 2015).

Level 4 project success is determined by the realisation of benefits post-project completion. True success is attained if the benefits outlined in the initial business case materialise as a direct outcome of the completed project. However, these benefits may not become immediately apparent upon project completion (Marnewick, 2013b). Ultimately, Level 4 success is predicated on whether or not business goals are achieved through the project's successful culmination.

At Level 5, project success extends beyond internal considerations and becomes externally focused. Strategic success is anticipated to stem from the effective delivery of projects. The emphasis here is on evaluating whether the organisation's standing improves in terms of investors, competition, and the overall market. Attributing this level of success to a specific project may prove exceptionally challenging (Marnewick, Erasmus and Joseph, 2017).

Due to its increasing significance within organisations and the escalating complexity of projects, the definition of project success has gone beyond the conventional focus of the triple budget, time, and quality constraints. It has evolved over time into a complex assessment encompassing the various benefits received by stakeholders involved in the project (Castro et al., 2021).

2.10 The Different Needs and Interests of the Various Stakeholders

As varied as the stakeholders involved in software projects are, their diverse needs and interests contribute to various criteria used to measure project success. Consequently, defining project success has become a challenging and shifting target, influenced by these distinct measurement criteria aligned with stakeholder groups' needs. However, despite this complexity, the assessment and attainment of project success remain pivotal in project management, particularly for satisfying stakeholders, including software project teams (SPTs) (Hans and Marebane, 2023).

Many research studies have looked at project success or failure from various stakeholder perspectives, and this has been collaborated with research that indicates that crucial stakeholders tend to be sidelined or overlooked during projects. Hans and Marebane (2023) conducted a systematic literature review (SLR) investigating whether empirical studies on evaluation software projects' success from stakeholders' perspectives have been done over recent years. According to the authors, limited research has been conducted to explore this aspect.

Table 2.3: Summary of critical success factors

Critical Success Factors	Global									Australian	
	Chan et al. (2010a)	Dulaimi et al. (2010)	Yuan et al. (2009b)	Yuan et al. (2011)	Yuan et al. (2009a)	Chen & Doloi (2008)	Nisar (2013)	Yuan et al. (2012)	Liu & Wilkinson (2014)	Liu et al. (2015)	Tang et al. (2013)
Related to economics and finance											
Stable macro-economic conditions	x	x	x	x	x	x			x		
Sound economic policy	x							x			
Sound financial analysis	x		x	x	x			x		x	
Related to planning and initiation											
Sound feasibility analysis	x		x	x	x					x	x
Multi-benefit objectives	x								x		x
Flexible PPP contracts			x	x	x					x	
Favourable legal agenda	x	x	x	x	x			x			x
Effective risk management	x	x	x	x	x		x	x		x	x
Sound business case									x		
Transparent & effective VFM assessment										x	
Effective evaluation of PPP stages										x	
Related to procurement											
Clear and precise tender documents										x	x
Competitive procurement	x		x	x	x					x	
Investment in research		x	x	x	x	x					
Related to contract management											
Effective safety management			x	x	x					x	
High quality control			x	x	x					x	
Effective time management			x	x	x					x	x
Good facility management			x	x	x					x	
Effective conflict management			x	x	x					x	
Technical management and skill			x	x	x					x	x
Effective interface management			x	x	x					x	
Effective cost management			x	x	x					x	
Environmental protection			x	x	x						
Perfect price adjustment mechanism			x	x	x						
Resource utilization			x	x	x					x	
Technology innovation									x		
Reliable service delivery									x		
Related to stakeholder management											
Honesty											x
Open and effective communication											x
Good relationships within project teams			x	x	x					x	x
Shared authority between public and private sectors	x							x			x
Strong private consortium	x	x	x	x	x			x	x		x
Well-organized and committed public agency	x							x			
Political support	x	x	x	x	x		x	x			
Good governance	x		x	x	x					x	
Employee training			x	x	x			x			
Public client's satisfaction	x		x	x	x						
Effective final negotiation										x	x
Trust											
Extensive stakeholder engagement									x		x

(Jayasuriya, 2017)

Joseph (2017) highlights that many definitions and views of project success are discussed in various literature. Traditionally, project success has been measured based on the triple constraint model, namely, time, cost and quality (Sulistiyani and Tyas, 2022; ;Todorovic et al., 2015). This approach has been under scrutiny for some time now and has its shortcomings as other aspects, such as stakeholder views, have to be included as well, together with the benefits realisation (Lech, 2013; Chih and Zwkael, 2015).

Table 2.4: Five commonly and widely used project standards methods

PMBOK	PRINCE2	ASAP	OUM	Sure Step
Initiating	Starting up a project	Project preparation	Inception	Diagnostic
Planning	Initiating a project	Business blueprint	Elaboration	Analysis Design
Execution				
Monitoring & Controlling	Directing a project Managing a stage boundary Controlling a stage	Realisation	Construction	Development
Closure	Managing product delivery Closing a project	Final preparation Go-live support	Transition	Deployment
N/A	N/A	Operate	Production	Operation

(Joseph, 2017)

Joseph (2017) compares five commonly and widely used project standards and methods. He argues that these commonly used standards and methods are the same thing once mapped. Other seemingly different methodologies specially designed for IT projects, such as ASAP and OUM, still have their roots in the standard methods like PMBOK and the Unified Software Development process. As such, Joseph (2017) further argues that all PM standards and methodologies make use of the same principles and fail to obtain improved ICT project performance. More so, projects are being executed in a complex environment, influencing the abovementioned methodologies. Project Success can be viewed from different angles (Davis, 2014; Varajao et al., 2022).

For instance, project stakeholders such as the project manager, top management of the organisation, customer-client organisation, and team members generally view project success differently (Yohannes, 2022). Scheepers et al., (2023) argue that even within the same organisation, success will be seen in different ways by different people. The measure of success can be diverse for clients and project teams. Success has a different meaning from the project team's perception and from the client's or end-user's end, which may lead to miscommunication and misunderstanding. Pinto et al., (2022), however, believes that a project can only be considered to have failed if it fails to deliver the required level of satisfaction to the client.

Albert et al. (2017) says that triple constraint, normally referred to as the Iron Triangle, namely time, cost, and quality, was one of the initial ways to ascertain project success. However, the need to integrate other criteria, such as stakeholder satisfaction, has become stronger over the years. Matthias et al. (2017) say the distinction between 'criteria for success' and 'success factors' must be made, though they are intricately related. Merhi (2023) is also of the same sentiments when he posits that success factors (i.e., those factors that help the Project Manager boost the chances of successful project competition) are not readily available and well-defined tools that he can simply use during project execution. In order to cross-check the success of a project, success criteria are used (Sulistiyan and Tyas, 2022), whilst Kim and Ahn (2023) and Muller and Jugdey (2012) define success factors as those aspects that increase the chances of successful project completion, but they are not exclusively available as they are intertwined with other aspects.

Koppel and Pentrack (2021) says that project management success can be determined at the end of the project. The success depends on how the base organisation utilises the potential of the deliverables. Traditionally, project assessment instruments for success have often been technically driven by narrowly focusing on key factors such as time, cost and quality standards. However, the emerging literature argues that measuring project success should transcend technical confinement (Pinto et al.,2022). For instance, some projects are completed within a specified time and budget but fail because they have compromised the needs of the customer or intended project beneficiaries.

One of the objectives of many e-projects, especially internet and extranet projects, is to achieve global reach to access customers or suppliers in broader, more diverse market segments (Goel, 2007). The table below summarises the main phases of a typical project life cycle (in this case, a Web Design Project), as discussed by Farkas (2019).

Table 2.5 below shows the transition in research conclusions around commonly accepted success dimensions over different eras, namely (1960s-1980s; 1980s-2000s; and 21st century) according to Pinto and Ika (2022). The first era (1960s–1980s) the triple triangle was considered as the predominant measure for project success. The next era of (1980s–2000s) zeroed more on empirical studies. Most success models entailed in the success criteria aspects such as cost, perceived quality as well as client satisfaction. There was a gradual shift during that period form project plan success to business case success (Pinto and Ika, 2022). The current trend defining the third era has shifted from just focussing on business cases success to a multi-success criteria encompassing multiple and diverse stakeholder environmental , and societal implications, also including return on investment and competitive advantage for the sponsor or owner organisation (Zwikael & Meredith, 2021).

Table 2.5: Measuring success across time.

	Period 1 1960s-1980s	Period 1980s-2000s	Period 3 21st century
Success criteria	Iron triangle (time, cost, quality)	Iron triangle Business case benefits Benefits to key internal stakeholders (client/ funder, owner, end-users, project team, organizational employees)	Iron triangle Business case benefits Value of the investment for the funding/owner, the delivery and supply (or other partnering) organizations Benefits to internal stakeholders Benefits to external stakeholders Symbolic and rhetoric evaluations and attributions of success by diverse stakeholders Community, environmental, societal impacts or sustainability
Results chain	Outputs	Outcomes	Impacts
Time horizon	Short-term	Medium-term	Long-term
Emphasis	Project plan success	Business case success	Green efficacy

(Adapted from Ika, 2009, cited in Pinto and Ika, 2022)

Stakeholder management is thus key to project success throughout the project lifecycle (Eyiah-Botwe, 2016). This has to be incorporated in the above project phases. Giachetti and Truex (2010) observe the following as critical success factors of ERP implementation:

- "Commitment from top management";
- "Empowered teams with the ability to make decisions";

- “Strong project management leadership and project management skills”;
- “Adaptable organisation that can respond to challenges”;
- “Defined business direction-know the goals of the project”; and
- “Best people = best results”

2.11 African Versus Western Philosophy of PM

The UN World Economic Situation Prospectus (WESP, 2022) classifies all countries in the world into three classes, namely:

- Developing economies;
- Economies in transition;
- Developed Economies.

Due to the different economic and cultural conditions, the execution of project management in developed countries differs across the three categories. There has been an assumption that the techniques are global and thus transferrable, but this is not the case. There has been a gradual shift in the last ten years towards a more ‘African’ thought trend whereby home-grown practices have been incorporated more and more into Project Management as Project Management proponents are advocating more for approaches more suitable to the African environment. These, according to Marnewick and Joseph (2018), are still relatively few and far between, thereby sparking a huge academic interest concerning the role of African Management Philosophy (AMP) in the African project management space as opposed to Western Management Philosophy (WMP). This debate is very important and cannot be ignored, considering the diverse cultural differences between the different settings globally.

Unfortunately, there is a lack of recorded research focusing on AMP's role in shaping the project management landscape in Africa. However, it allows further exploration, and the stakeholder model this research develops will invariably consider this aspect seriously.

Several authors have compared and contrasted AMP and WMP (Hunter, 2012; Karsten & Illa, 2005). The outstanding major distinction that differentiates the two schools, highlighted by the various research, is that WMP is individual-centred whilst AMP leans more towards groups yet takes the individual’s role into consideration. Nzelibe (1986) agrees when he says the underlying difference between these apparently contradictory schools of thought is that WMP is based on individualism, whereas AMP leans more towards the group but does not discard the individual factor. Nzelibe (1986) further clarifies the distinction between the two: “Western management thought advocates Eurocentricism, individualism, and modernity, [whereas] African management thought emphasises ethnocentrism, traditionalism, communalism, and cooperative teamwork.”

In South Africa and indeed in Africa at large, the cultural value of Ubuntu (humanness) is widely acknowledged as vital in African Society. This is aptly put by Karsten and Illa (2005) when they posit that Ubuntu is the “pervasive spirit of caring and community, harmony and hospitality, respect, and responsiveness that individuals and groups display one for another.

Manerwick and Joseph (2018), echo similar sentiments and depicted below. They highlight that Capitalism is at the core of the WMP, whilst Ubuntu is at the core of AMP.

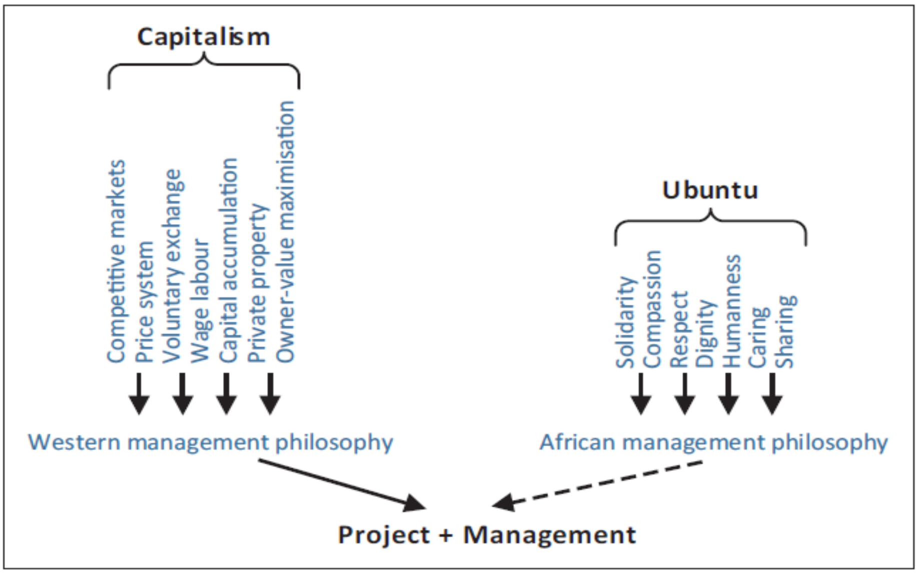

Figure 2.10: Infusing African management philosophy into PM

(Marnewick & Joseph, 2018).

Project management is the process of leading a team to achieve specific goals and objectives within a defined time frame. However, the philosophy of project management can vary depending on cultural and societal influences. In this essay, we will examine the differences between African and Western philosophies of project management.

African philosophy of project management is often rooted in the concept of Ubuntu, which is a Bantu term meaning "humanity" or "humanness." Ubuntu emphasises the interconnectedness and interdependence of individuals within a community. This philosophy is reflected in the way African project managers lead their teams, as they often prioritise collaboration, communication, and the well-being of team members over individual success (Tshimanga, 2017).

In contrast, the Western philosophy of project management tends to focus on efficiency and individual achievement. Western project managers often prioritise meeting deadlines and achieving specific goals over the well-being of team members (Tshimanga, 2017). This approach is reflected in the widespread use of methodologies such as Agile and Scrum in Western project management, which prioritise speed and flexibility over long-term planning and collaboration (Kerzner, 2022).

One of the main differences between African and Western philosophies of project management is the approach to risk management. African project managers tend to view risk management as a collective responsibility, and they often involve the entire team in identifying and mitigating risks (Tshimanga, 2017). In contrast, Western project managers tend to view risk management as the project manager's responsibility, and they often rely on formalised risk management processes and tools (Kerzner, 2022).

Another difference is that African project managers tend to use a more holistic approach to project management, considering not only the project itself but also its impact on the community and the environment (Tshimanga, 2017). Western project managers, on the other hand, tend to focus on the project's success within the constraints of budget and time (Kerzner, 2022).

In conclusion, African and Western philosophies of project management differ in several key ways. African project management emphasises collaboration, communication, and the well-being of team members, while Western project management prioritises efficiency and individual achievement. African project managers also approach risk management as a collective responsibility and use a more holistic approach to project management, while Western project managers rely on formalised risk management processes and tools and focus on the project's success within budget and time constraints. When project management performance is assessed, they may be biased observations depending on the lenses one is wearing.

2.12 South Africa's Performance in a Global Digital Capability Assessment

The different management philosophies may lead to certain percieved percetions of stakeholder management in South Africa and the subsequent readiness to adopt new technologies. In 2015, a research team from the Fletcher School at Tufts University reported their first assessment of the global digital economy in the Harvard Business Review (Chakravorti, Tunnard and Chaturvedi, 2015). This was followed by an expanded version of their instrument, the Digital Evolution Index, in 2017 (Chakravorti and Chaturvedi, 2017). The index intended to assess how countries compare in readiness for the digital economy.

The Digital Evolution Index is a data-driven, holistic evaluation of the progress of the digital economy across 60 countries, combining more than 100 indicators across four key drivers: Supply conditions, Demand conditions, Institutional environment, and Innovation and change.

The resulting framework captures both the state and the rate of digital evolution and identifies implications for policy, investment and innovation.10 The index classifies countries into four segments:

Stand-out countries are both highly digitally advanced and exhibit high momentum,

1. Stall-out countries enjoy a high rate of digital advancement while exhibiting slowing momentum,

2. Break-out countries are low-scoring in their current states of digitalisation but are evolving rapidly and

3. Watch-out countries face significant challenges with their low state of digitalisation and low momentum, and in some cases, these countries are even moving backwards.

The big picture of the 2017 Digital Evolution Index is illustrated in Figure 2.11 below.

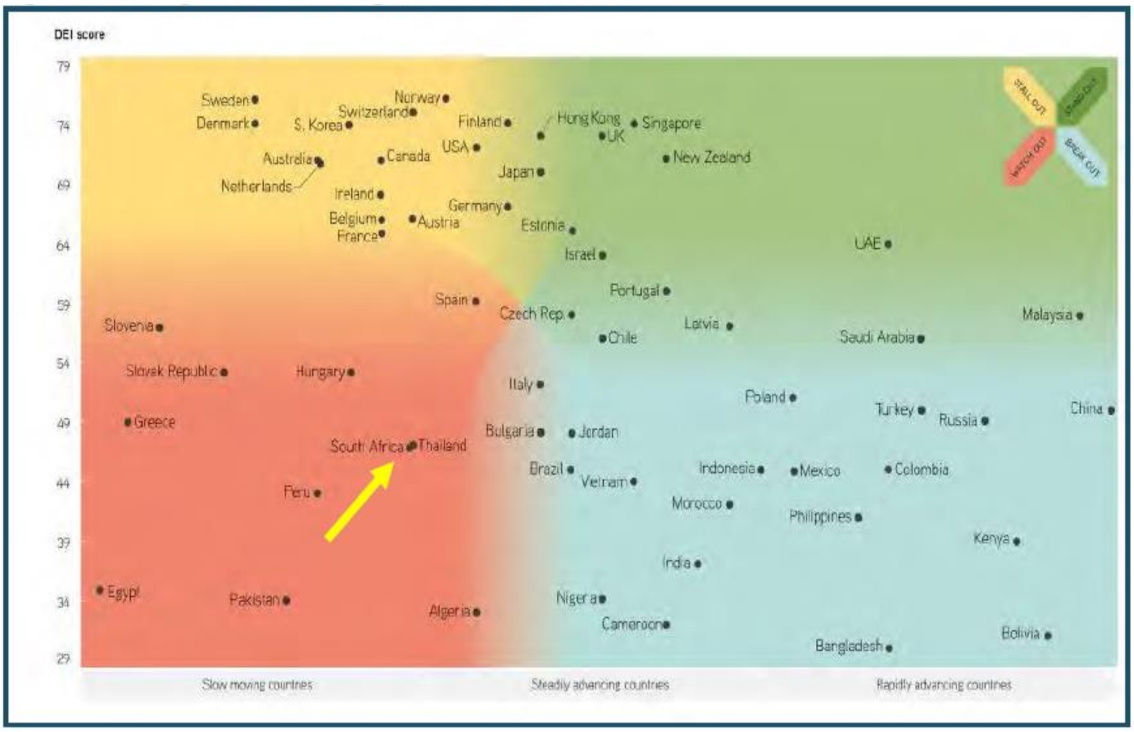

Figure 2.11: The Digital Evolution Index, 2017

(Chakravorti and Chaturvedi, 2017)

Figure 2.11 above illustrates three countries classified in the top-right category. These are denoted as "Stand-Out", namely Singapore, New Zealand, and UAE. The countries mentioned above display policy-driven digital strategies and approaches that can be well emulated by other countries. Other countries such as Germany and the US are categorised in both the Stand-Out and Stall-Out segments, and they showcase their commitment and emphasis on Industry 4.0 as well as digitalisation strategies. South Africa’s BRICS counterparts are all placed in the Break-Out segment. China exhibits the most significant momentum in this category, followed by Russia and India. Nigeria also falls within the Break-Out segment and displays quicker momentum than South Africa; however, it starts from a lower developmental base. South Africa is categorised under the Watch Out segment, lagging behind its peers. The study also focuses on the Digital Trust Economy. The study omitted South Africa from the 42-country survey due to the lack of data for a comprehensive country profile. This absence challenges South Africa's integration into global supply networks, demanding high data security, network integration, and privacy laws.

2.13 Summary

This chapter explored several key areas relevant to IT project management. The theoretical framework, utilising Cultural Historical Activity Theory (CHAT) to understand IT project stakeholders, was presented and illustrated how it was adapted for the study. The principles of the CHAT were applied to stakeholder management in IT projects as presented.

Project management is a globally recognised discipline that has specific tools and techniques. The application of some of the traditional tools encounters limitations, especially when confronted by a highly dynamic environment such as the 4IR. The Fourth Industrial Revolution (4IR) is thus discussed, focusing on its impact on the operations of many organisations. According to the latest PMI Guide, stakeholder management is identified as one of the eight critical performance domains pertinent to project success. The chapter also highlights the nature of IT project stakeholder management, emphasising its importance in the modern communication and information age. The chapter also addresses challenges in IT projects, such as capturing and managing diverse stakeholder needs, which can lead to project failures if not handled properly. Measuring project success remains a debated topic in project management literature, with no universally accepted method. Some of the widely accepted definitions were presented and discussed. Finally, the chapter reviewed South Africa’s performance in a global digital capability assessment, highlighting the country’s position in the global digital economy. Different stakeholder management strategies specific to IT projects have evolved, particularly in software development, as discussed in the chapter. Further to this, the next chapter discusses some of the frameworks used for stakeholder management for various projects. The conceptual framework that informed the study is also discussed in the next chapter.

CHAPTER 3
STAKEHOLDER MANAGEMENT MODELS & CONCEPTUAL FRAMEWORK

3.1 Introduction

This previous chapter explored the literature on stakeholder management in projects and presented the study's theoretical framework. The impact of 4IR on project stakeholder management and how success is measured in projects was discussed from a theoretical standpoint. This chapter looks at the different stakeholder models and frameworks. The stakeholder theory is presented, and various project success models, such as the four-dimensional model, are discussed. The conceptual framework is also presented, and the development of hypotheses is comprehensively discussed.

3.2 Models for Project Stakeholder Management

Many models, tools, and techniques have been put forth in the literature on project stakeholder management. The Stakeholder Circle Model, developed by R. Edward Freeman, is a visual representation of the various stakeholders involved in a project and their level of interest and influence (Bourne and Walker, 2006). This model helps project managers to prioritise and engage with stakeholders based on their level of importance to the project. This chapter discusses some stakeholder models and culminates in a proposed model that was then tested using Structural Equation Modelling (SEM). Some models discussed include the Power/Interest Grid (Sarungu, 2024). This model has been used to classify stakeholders based on the level of power and interest in the project and is useful in assisting PMs with the identification of key stakeholders and in developing strategies for engagement. Another model discussed is the Stakeholder Management Strategy Matrix, which was propagated by John Kotter and Leonard Schlesinger. It is mainly useful in identifying stakeholders and assessing their level of support (negative or positive) for the project. This matrix helps project managers develop strategies for managing stakeholders based on their level of support or opposition. However, another model discussed is the Stakeholder Salience Model designed by Freeman and Wicks (Kujala et al.,2019). The focus of this model is to aid project managers in understanding how different stakeholders are most likely to perceive the project and how their perceptions could be dealt with during project execution.

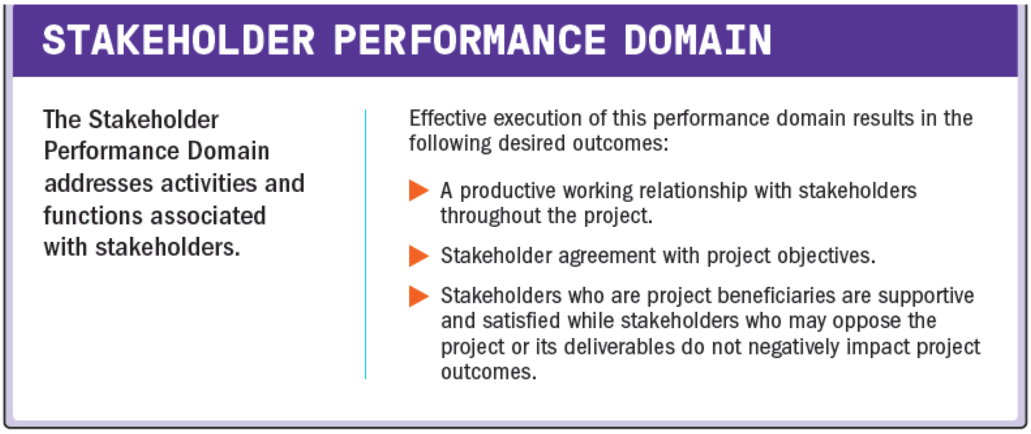

Figure 3.1: Stakeholder Performance Domain

(PMI, 2021)

Projects are executed by people, and such cannot be separated from them. It is, therefore, important that there is collaboration with stakeholders to ensure that there is alignment and also to cultivate relationships that lead to satisfaction. Figure 3.2 depicts stakeholders as individuals, groups, and organisations (PMI, 2021). In addition, the influence, power, or interest of stakeholders may, and often do, evolve throughout the project lifecycle.

Figure 3.2: Examples of Project Stakeholders

3.3 Stakeholder Theory

The Stakeholder Theory was introduced by R. Edward Freeman in 1984. The theory emphasises the moral and ethical considerations that are fundamental to business operations. In corporate governance and projects, the many stakeholders potentially gain from enhanced good governance practices. According to Freeman, an organisation's primary allegiance or obligation is owed to the stakeholders. (Stakeholders Theory, n.d.). The theory gives a view on capitalism that underscores the interconnections between the organisation and its stakeholders, including consumers, suppliers, employees, investors, and communities (Davila, 2024; Aggarwal and Manasawi, 2021).

3.4 Current Stakeholder Theories and Shortcomings in 4IR

Figures 3.3 to 3.5 below illustrate some current stakeholder frameworks used in IT projects.

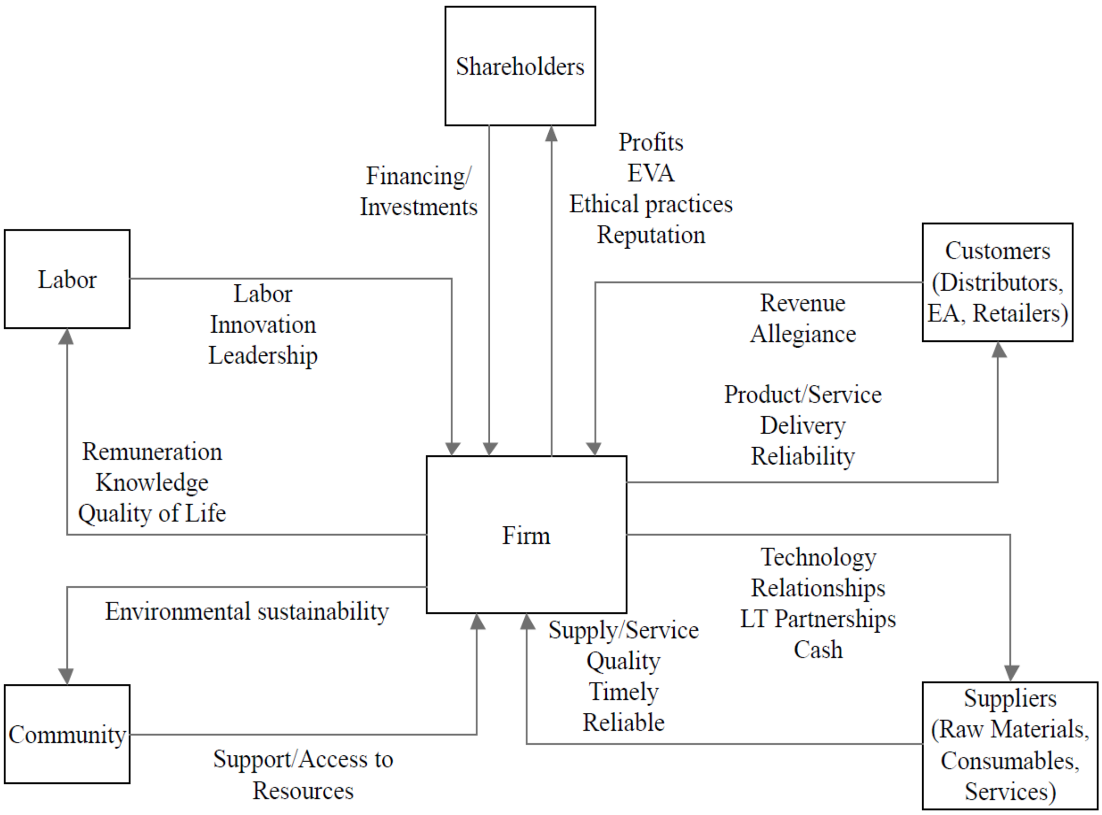

Figure 3.3: Stakeholder engagement process

(Walker, 2003).

Walker's (2003) work on stakeholder engagement (Figure 3.3) emphasises a deliberate structure approach to managing and engaging stakeholders in projects. This involves initially recognising the potential stakeholders that are able to influence the project. The next step would be to ascertain the interests and influences as well as the expectations of the stakeholders. Appropriate tools, such as the Stakeholder Circle (Figure 3.5), are then used to map them. The Stakeholder Cycle is a visual tool designed to assist PMs in identifying, prioritising and engaging stakeholders. The power, proximity, and urgency of each stakeholder are assessed. After that, strategies are developed to engage stakeholders, making sure that their needs are addressed during the project roll-out, from initiation to closure. The identified strategies are then implemented, and while doing so, constant monitoring and review are performed. This process aims to ensure that the project is afforded a higher probability of success by maximising positive stakeholder impacts and minimising potential negative impacts.

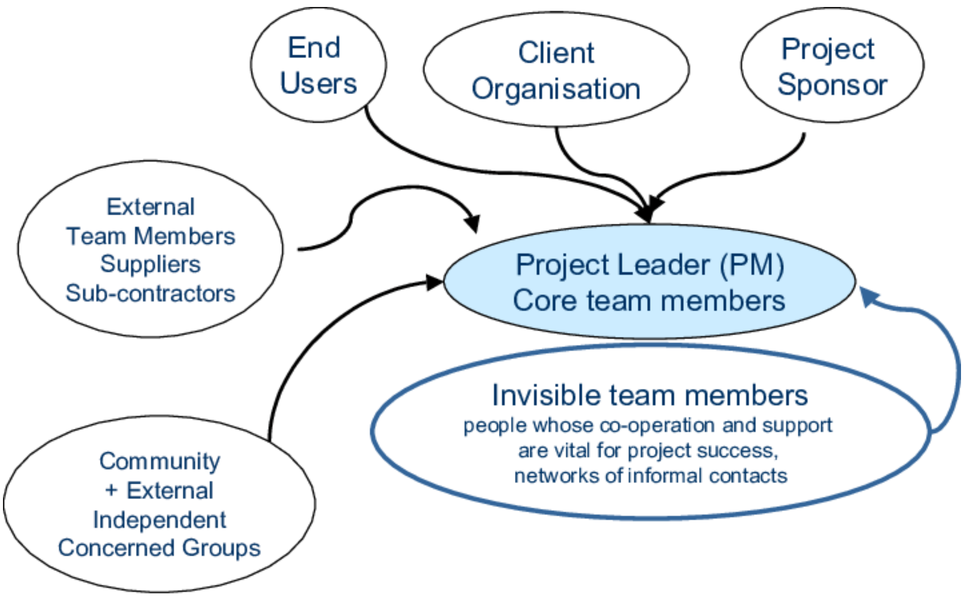

Figure 3.4: Stakeholder Model (Walker, 2003).

The figure shows a stakeholder model for a project. The client organisation can be seen to be the most obvious stakeholder. Team members from the supply chain hold a stake in project success. The core project team members also have a visible stake in the project (Walker, 2003).

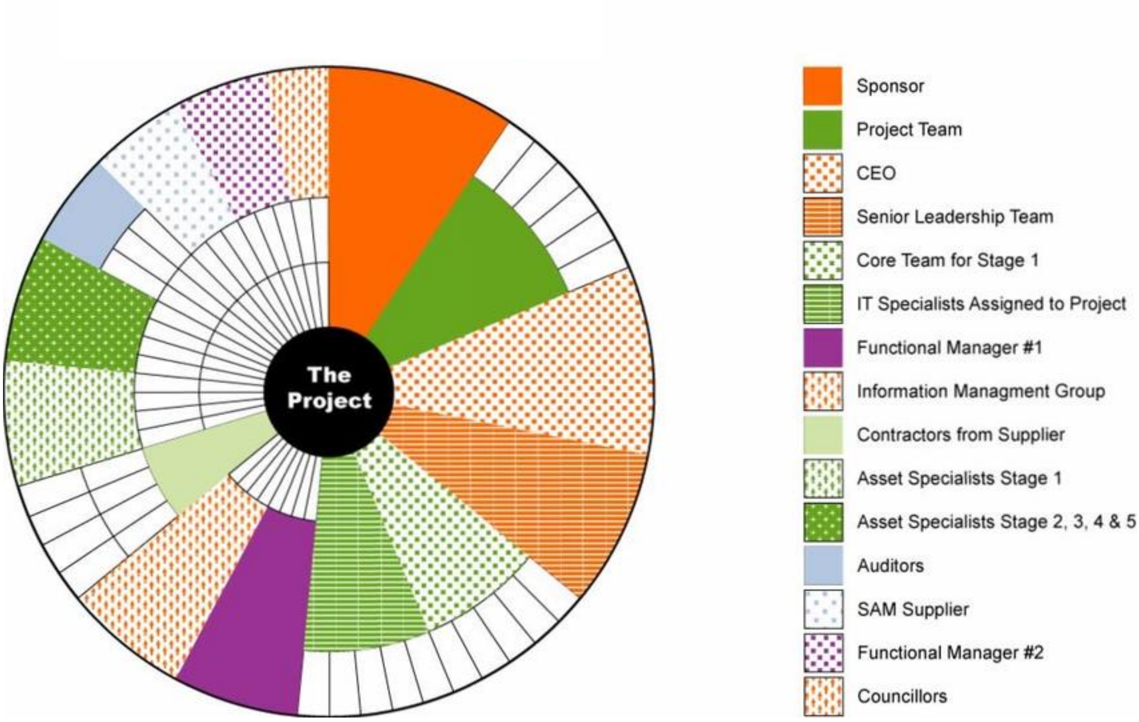

Figure 3.5: The Stakeholder Circle^{TM} tool

(Bourne & Walker, 2016)

The stakeholder circle is developed because the successful initiation and subsequent execution of a project can only be successful when backed up by the relevant stakeholder community. Besides a plethora of stakeholder theories, there are yet still challenges in stakeholder management in IT Projects, as evidenced by scope creep and high IT project failures (Mhlanga, 2020). According to Schwab (2019), for companies to uphold the tenets of stakeholder capitalism, they must adopt new metrics that encompass a fresh gauge of shared value generation. These metrics should encompass environmental, social, and governance (ESG) objectives alongside traditional financial metrics as a complementary measurement.

The concept of the stakeholder circle is based on the premise that a project's successful initiation and execution relies a lot on the involvement and support of the relevant stakeholder community. Bourne & Walker (2008) further say that this approach, well supported by the Stakeholder Circle tool, gives an effective mechanism to assess stakeholders' relative influence. It also helps in the comprehension of their expectations and in establishing suitable stakeholder engagement procedures. These procedures aim to influence key stakeholders' expectations and perceptions for the project's benefit.

Fundamental aspects of the stakeholder circle include the following: Firstly, the area signifies the scope and magnitude of influence. Secondly, the depth indicates the level of impact. Lastly, the concentric circles portray stakeholders' proximity to the project or its delivery entity (Bourne, 2005; Bourne & Walker, 2005).

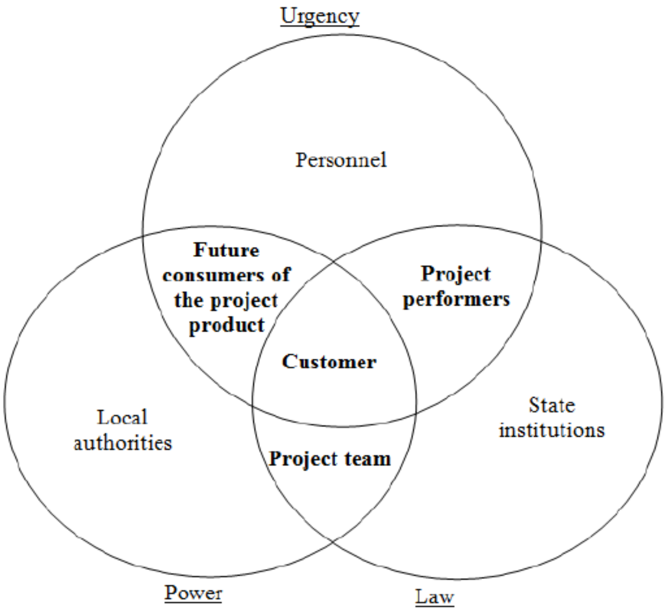

Figure 3.6: The Mitchell Model

(Skachkov and Skachkova, 2018)

The Mitchel model is typically used to differentiate stakeholder importance via an assessment of three special and distinct attributes: power, legitimacy, and urgency, as depicted in Figure 3.6 above. Power refers to the ability to achieve desired outcomes through various means, such as using force, authority, or even emotional resources. However, the above model faces challenges in a dynamic environment brought about by AI in 4IR. Mhlanga (2020) examines the existing voids within stakeholder theory in the context of the Fourth Industrial Revolution (4IR). His review is not a critique of stakeholder theory; it highlights unresolved queries stemming from the theory's foundational principles and assumptions. Therefore, stakeholder theory needs to be integrated into the 4IR paradigm to facilitate the achievement of sustainable development goals on a global scale.

Table 3.1: Five project stakeholder management standards and methods

PMBOK	PRINCE2	ASAP	OUM	Sure Step
Initiating	Starting up a project	Project preparation	Inception	Diagnostic
Planning	Initiating a project	Business blueprint	Elaboration	Analysis Design
Execution	Directing a project Managing a stage boundary Controlling a stage	Realisation	Construction	Development
Monitoring & Controlling				
Closure	Managing product delivery Closing a project	Final preparation Go-live support	Transition	Deployment
N/A	N/A	Operate	Production	Operation

(Joseph, 2017)

Table 3.1 above in Joseph's (2017) study highlights five frequently utilised project stakeholder management standards and methods. In his analysis, Joseph contends that these commonly employed standards and methods converge when examined in-depth. Furthermore, even seemingly distinct methodologies tailored for IT projects, such as Accelerated SAP (ASAP) and Oracle Unified Method (OUM), can be traced back to foundational methods like PMBOK and the Unified Software Development (USD) process. Joseph goes on to assert that all project management standards and methodologies operate based on a shared set of principles and fall short of delivering substantial improvements in the performance of IT (Information Technology) projects. Additionally, he notes that projects unfold within a complex environment that significantly influences the methodologies mentioned above.

A more recent approach to stakeholder management in IT projects is embedded in the Agile Project approach to project management. Artificial intelligence (AI), data analytics and 4IR have challenged existing systems and necessitated agility (Sharma et al. 2022).

Ruharjo & Purwandari (2020) did a systematic study on Agile Project management execution and pointed out that the biggest challenge arises from stakeholder management, and this related to agile adaptation, transition, and transformation. According to Bohmer et al. (2017), the Agile approach to project management is "no silver bullet". The agile approach has many practices, and some tend to give conflicting outcomes (Hidalgo, 2019). This further supports the need for new frameworks for IT Project Management.

3.5 Project Success Model

Pinto et al. (2022:831) say that:

> *"Our understanding of projects and the key levers that can affect their success (factors) has expanded and become more sophisticated, and this knowledge has signalled a concomitant need to regularly reappraise how projects are deemed successful (criteria and dimensions)."*

Another way to define project success is to consider a framework that assesses success at different milestones after the project closure. The assessment must be done from diverse stakeholder viewpoints (see Figure 3.7 below). These milestones, depending on the nature and size of the project, may span different aspects. These aspects may include the following: the project itself (with regards to the processes and their efficiency in meeting major design constraints), the resulting product or main deliverable (i.e., how it is aligned with specifications and purpose, acceptance, and usage). The other aspect is the organisational benefits derived from the investment (i.e., attainment of business objectives and strategic value generation). These milestones establish five levels for formally or informally evaluating project-related performance. Levels 2 to 4 align with criteria commonly discussed in the literature. Level 5, implicit in some research, is explicitly defined in this framework. Meanwhile, Level 1 integrates a measure of technical performance from specialised domains to facilitate learning and advancement at the operational level during project design and execution (Bannerman, 2008).

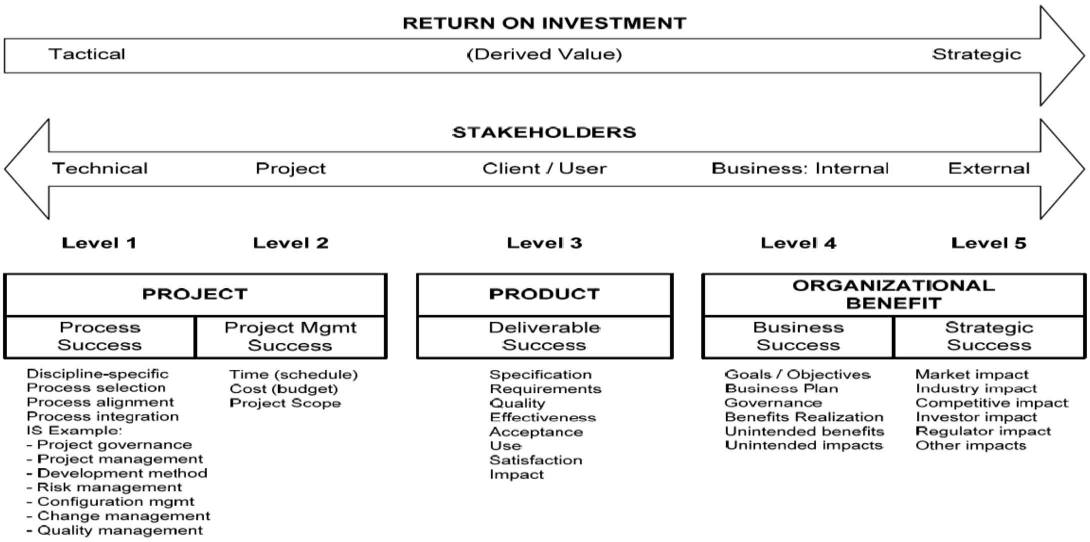

Figure 3.7: Five levels of Project Success

(Bannerman, 2008).

This approach or methodology facilitates continuous re-assessment as the project benefits grow. Stakeholders are afforded the opportunity to consistently assess and align perceived project success with project benefits as they grow. According to this framework, the highest level of benefit during project evaluation determines the project's success. This approach permits the possibility for a project to fail at a lower assessment level while still achieving success at a higher level of perceived project return, making it less contentious.

Each level is briefly outlined below and further detailed in Table 3.2 below:

Table 3.2: A Multilevel Framework of Project Success (Bannerman, 2008)

Level	Success Criterion	Description	Empirical Indicators
1	Process	Discipline-specific technical and managerial processes, methods, tools, and techniques employed to achieve the project objectives.	Technical and managerial processes were: • Appropriately chosen for the purpose • Aligned with the project objectives • Integrated with each other (as appropriate) • Effectively implemented
2	Project Management	The project design parameters or objectives. Here "scope" refers to the intended scope of the project (e.g., to specify, build, test, and implement a new system), not the scope of specifications of the main project deliverable.	• Schedule met • Budget not exceeded • Project scope achieved
3	Product	The main deliverable(s) from the project. The nature of the deliverable(s) will be discipline-specific. For example, it might be a product, system, building, bridge, airplane, rocket, or a service of some kind.	• Specifications met • Requirements met • Client/user expectations met • Client/user acceptance • Product/system used • Client/user satisfied • Client/user benefits realized
4	Business	The business objectives that motivated the investment. That is, what the business wanted to achieve from the investment.	• Objectives met • Business case validated • Business benefits realized
5	Strategic	Business expansion or other strategic advantage gained from the project investment, either sought or emergent.	• Business development enabled • External stakeholder/competitor recognition • Competitive response generated

Following this rationale to amass insights into project success, this study suggests a standardised gauge of project success using a radar chart. This chart could be utilised to compare projects across diverse contexts. Clear project assessments on the same scale can be carried out, facilitating a basis for comparison purposes Castro et al. (2019).

Project success indicators differ from project to project depending on the project's type, size, and complexity. Castro proposes a generic success metric that covers the unique features of each project and, as a result, facilitates a customised analysis that considers each project's unique nature. This flexible approach enables organisations to prioritise dimensions and modify their assessments accordingly Castro et al. (2019).

They concluded that project success is multifaceted and has multiple dimensions beyond the traditional time, cost, and specifications. Since projects can have negative and positive effects on various organisational dimensions, a deeper or more comprehensive evaluation of project success must be carried out. Specific features can be utilised to measure success based on project specifics and measures postulated in the study by Castro et al. (2019).

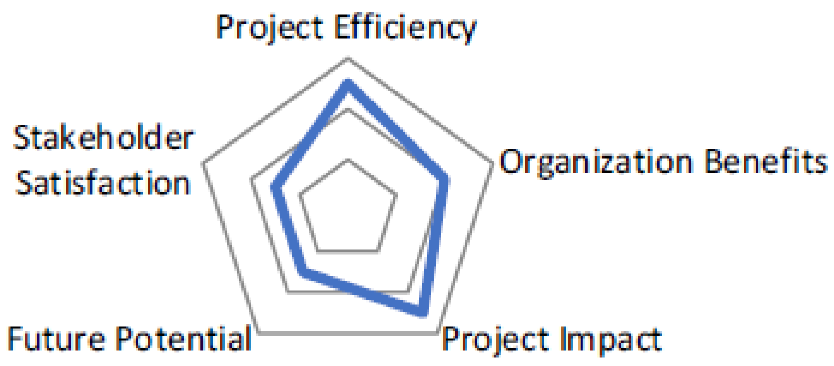

Figure 3.8: Stakeholders' ongoing interest

(Castro et al. 2019)

3.6 A four-dimensional Model of Success

Although the assessment of project success may not always capture its multidimensional nature, it is a complex phenomenon that changes over time based on the project type, stakeholders involved, and the broader context (Ika & Pinto, 2022). Their four-dimensional model of project success is presented in Figure 3.9 below.

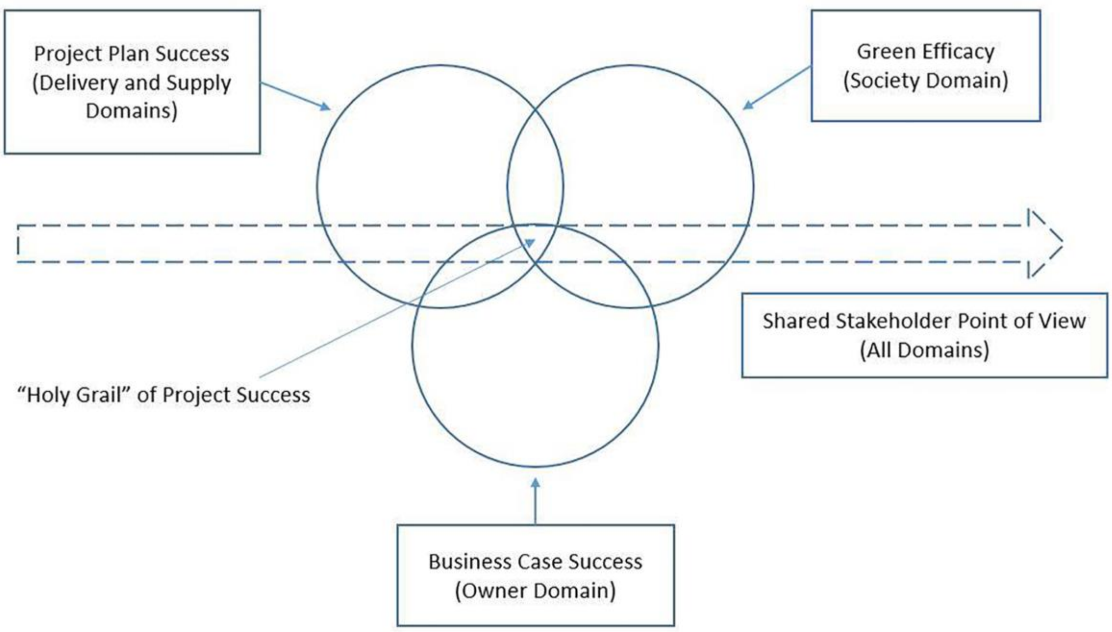

Figure 3.9: A four-dimensional Model of Project Success

(Ika and Pinto, 2022)

1) First, there are projects that are considered all-around successes, “the holy grail” aspired by policy-makers, funders and managers: they come in on time and budget or close, deliver benefits at least as expected and meet sustainability targets; they are altogether project plan, business case, and green successes (Ika and Pinto, 2022)

2) Second, there are projects that are outright failures not only in terms of project plan, business case, and sustainability: they experience cost and/or time overruns, fail to deliver benefits to expectations, and yield negative sustainability impacts.

3) Third, there are projects that are both project plan and business case successes but green failures in that they cause harms in terms of sustainability (Ika and Pinto, 2022).

4) Fourth, there are projects that are both project plan and business case failures but green successes; that is, they hold a net positive effect sustainability-wise (Ika and Pinto, 2022).

3.7 Project Team Versus Stakeholders

Yohannes (2022) says that the ability of a project manager to identify project stakeholders and to engage with them effectively is crucial for project success. According to Dobson (2024), stakeholders are individuals and organisations with a vested interest in the project tasks or the final outcome. Note that these key stakeholders can hold power and influence the project's scope, schedule, or budget (Farkas, 2009). He goes on to recommend that regular assessments of project performance by involving key stakeholders and project managers are essential to review measurements to address potential implications. This stakeholder acceptance was revealed by several researchers as one of the dimensions of project success (Sulistiyani and Tyas, 2022). Project Managers should openly encourage feedback to streamline progress and enhance the chances of positive project outcomes.

3.8 Project Stakeholder Management

Ahmed (2016) asserts the need for a highly structured project management approach, especially in large-scale software product development. He also emphasises the importance of project management in overseeing large project teams involved in software development projects. According to Young (2006), a project manager's ability to recognise and effectively manage stakeholders as valuable resources is integral to project success. Stakeholders are groups or individuals that have vested interests that impact an organisation or project outcomes. (Steyn 2016, Burke 2021; Oosthuizen and Venter, 2011).

Eyiah-Botwe (2016) focuses on the importance of stakeholder identification and classification, which helps project managers assess stakeholders' interests, roles, and influences while establishing a baseline for engaging stakeholders.

The complexity of stakeholder dynamics is well noted and acknowledged by Standoff (2015). They point out that project success goes beyond just plans or diagrams. The challenges of scope creep stemming from stakeholders' indecisiveness suggest that finding ways to engage them effectively is necessary, even though strict adherence to timelines and budgets might yield a project that meets those criteria but falls short in usability or success.Project failures are often linked to stakeholders' perceptions of a project's value and their relationship with the project team, and, as Scheepers et al. (2022) mentioned, stakeholders' local interests that serve to subjectively identify project value can create tensions that influence project performance.

Project success is in the eyes of the beholder (Ika and Pinto,2022). Various stakeholders define project success differently, and it is important that their expectations are addressed; otherwise, the project will be rendered a failure. In addition, stakeholders' diverse perspectives and influence contribute to their complex impact on projects, which often leads to varied understandings of the project scope.

3.8.1 A proposed framework for stakeholder participation

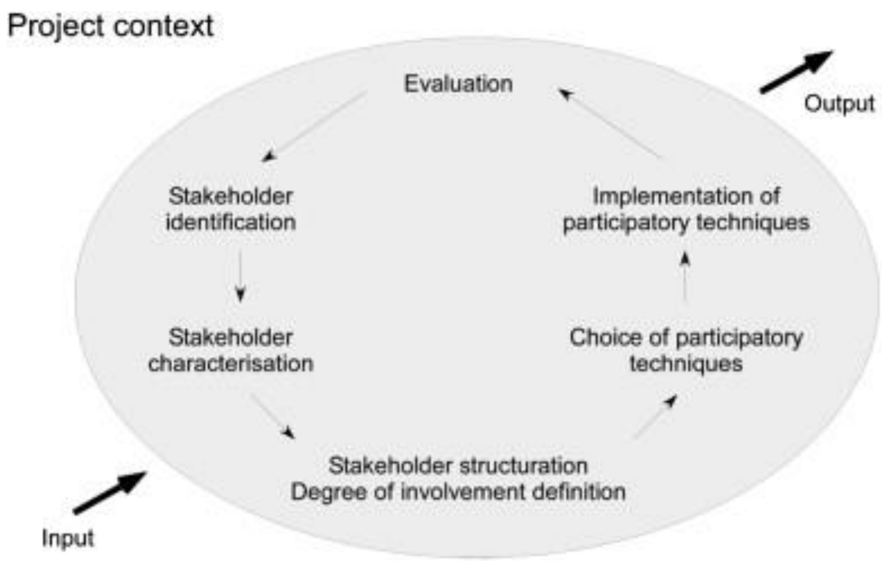

Figure 3.10: A proposed framework for stakeholder participation (Luyet et al. 2012).

In Figure 3.10 of the proposed framework for stakeholder participation by Luyet et al., (2012), he starts with the identification phase, which focuses on recognising stakeholders using one or more established techniques. Factors such as economic interests, values, principles, and legitimacy are considered. Subsequently, in the characterisation step, the balance of stakeholder power and interest is analysed by employing mapping techniques whilst ensuring objectivity. Stakeholder structuring involves determining the degree of involvement in grouping the stakeholders and, at the same time, assessing their level of engagement in the project. The following step emphasises how stakeholders engage since they are influenced by factors such as project culture, environmental aspects, and historical considerations. Once the manner of participation has been determined, the final step involves implementing the techniques that have been identified. Proper implementation is important because failure may lead to frustration, loss of confidence, and project failure.

Failing to identify critical stakeholders at the onset of the projects can have significant downstream effects on subsequent activities. In other terms, inadequate identification can result in the exclusion of some stakeholders. These stakeholders may emerge later in the project, which might pose some challenges and concerns when they want to integrate their perspectives. Such oversight can have detrimental effects on project progress and execution, as highlighted (Luyet, 2012).

3.8.2 The Organisation and Stakeholder relationships of influence

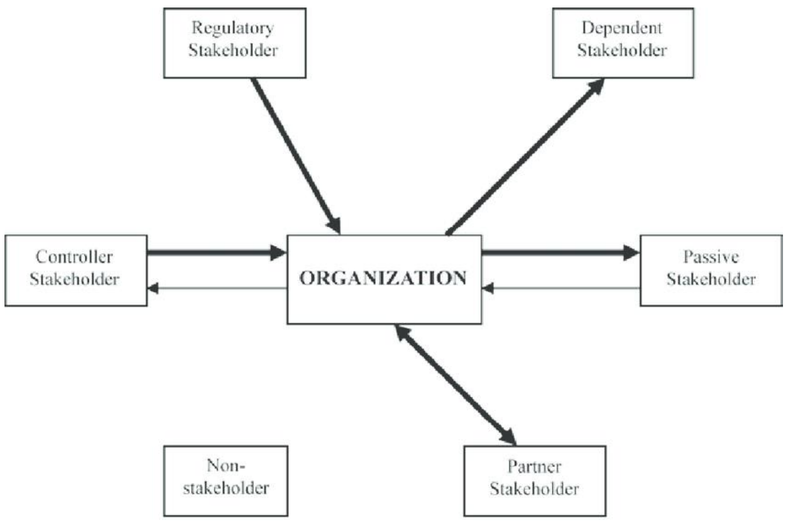

Figure 3.11: The Organisation and Stakeholder relationships of influence

(Mainardes et al. 2012)

Stakeholder mapping plays an important part in determining how much influence and power stakeholders hold over the project. Mainardes et al. (2012) propose a threefold management approach. The approach includes stakeholder identification and the development of processes to address stakeholder needs and interests. Thirdly, he details the establishment of relationships aligned with the organisation's strategy. Figure 4 below illustrates this approach.

3.8.3 Stakeholder Engagement Process

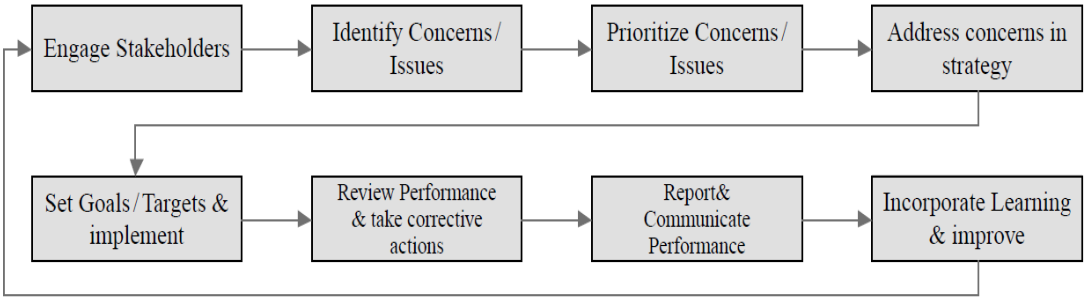

Figure 3.12: Stakeholder engagement process

[Tata Steel Corporate Sustainability Report. (Joseph, 2008), available at www.globlreporting.org]

The thickness of the arrows represents the strength of those relationships. Partridle et al. (2005), in a study on Tata Steel (TS), alludes that it is an organisation that considers 'stakeholder engagement' not just as a peripheral aspect but as central to the future success of the company. This holds true for the IT industry as well. It can be seen, thus, that stakeholder engagement is a deliberate exercise requiring careful planning and, subsequently, careful management to improve the probability of positive outcomes.

A lack of effective stakeholder engagement throughout the project lifecycle, particularly during the early stages of planning and implementation, often leads to suboptimal project performance (Bahadorestani et al., 2020).

Engaging beneficiaries in projects helps address their needs, build trust, and cultivate positive stakeholder relationships, which are essential for success throughout the project lifecycle (Bandé et al., 2024).

3.9 Stakeholder Identification Skills

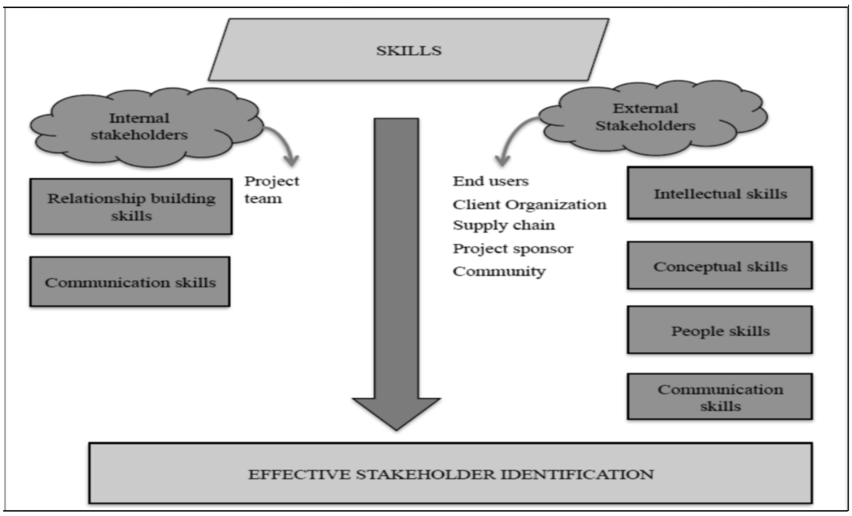

Figure 3.13: Effective Stakeholder Identification

(Model, 2017)

Figure 3.13 illustrates the essential skills required for assembling a team and identifies key skills for engaging with external stakeholders. It is essential to note that this does not imply that external stakeholders do not necessarily require relationship-building skills from the team.

3.9.1 The Mitchell Model

Table 3.3: Project Stakeholders, according to the Mitchell Model (1997)

A stakeholder group	A stakeholder name
Determining group	Customer
Dominating group	Project team
Dependent group	Project performers (a repair and construction company, a designing agency, a recruiting agency
Dangerous group	Future consumers of the product
Inactive group	Local authorities
Controlling group	State institutions
Demanding group	Personnel

Table 3.3 illustrates the model, highlighting four crucial stakeholder groups based on the Mitchell model: customers, the project team, project performers, and future consumers

of the project's product. The Accountability Scorecard (ASC), which focuses on connections between benefits, incentives, and stakeholder interests, is used to analyse the Stakeholders' interests further. The conclusion is that stakeholders' ongoing interest in projects directly depends on the perceived gains and values they derive, especially when these perceived values exceed or compensate for their expectations. The project manager's first task involves creating a comprehensive list of all stakeholders involved in a project. This list draws data from several documents such as project charters, project plans, reports from similar projects done in the past, the work breakdown structure (WBS), and any other relevant sources containing important information. The stakeholders are then classified into seven clear groups after the above compilation. These seven groups are as follows: inactive, dominating, controlling, depending, demanding, dangerous, and determining (Skachkov and Skachkov, 2018).

3.10 Agile Project Management

Capital projects involving the churning out of new products and software bring together various stakeholders with varying interests and processes, bringing a dynamic dimension to PM that is exacerbated by other technical issues. As such, the traditional approaches developed in the past year have come under intense scrutiny in the light of this dynamism. Artificial Intelligence has experienced remarkable growth and widespread adoption across various industries, transforming how tasks are executed, and problems are solved (Josh, 2024).

3.10.1 Volatile multi-stakeholder environment

Numerous stakeholders with diverse interests partake in new product development and new service systems (e.g., new software). These processes and dynamic technical aspects in an unstable environment lead to high uncertainty and complexity. Making use of the old methods of Project Management that are based on stage-gate approaches developed in the thirties in the USA (PMI, 2017) in the current volatile multi-stakeholder, multi-project environment with lots of uncertainty has come under heavy criticism from academia and project practitioners (Gustavsson & Hallin, 2019). Having plans cast in concrete that are strictly based on detailed plans negates value as they do not consider the variability inherent in projects and thus side-lining the integration of various stakeholders' keys to the project.

As such, these fixed and control–oriented project plans kill innovation and adaptability as they do not consider the unpredictability that is part and parcel of all projects, resulting in the failure to integrate the different stakeholders and their expectations. Therefore, there is a need for more adaptable, flexible and collaborative approaches in project execution processes that continuously engage, embrace and harness changes in value creation (Miller, 2022; Howell et al., 2010).

3.10.2 The Agile Alternative

Agile project Management methodologies within ICT have become popular in recent years. They are very useful for bringing together different stakeholders within the IT project value web and thus address uncertainty and dynamism inherent in ICT projects. These new approaches in PM have been introduced to optimise productivity and project output by inculcating real-time, ongoing collaboration between project stakeholders in a multi-project environment (Zuzek et al., 2020).

These approaches link the project owner to the project, bringing to the fore the importance of quality delivery to the end-user whilst highlighting the importance of identifying and managing multi-stakeholders very early into the project by fostering constant face-to-face communication and the pro-active use of digital communication methods, aided by flexible multi-party contract models (Ika and Pinto, 2022). The agile methods concept came into being in 2001 after 17 practitioners of different software came together in the United States of America in a bid to tackle challenges arising in software development projects. This gave birth to the Agile Manifesto.

3.10.3 Different Agile Approaches

Several agile approaches, such as scrum for agile software development, are now in place. These methods are built on the foundations of collaboration and liaison of the various stakeholders and, at the same time, the client or end-user being heavily involved in iterative loops aimed at infinitesimal team-based developments as opposed to the traditional PM role (Howell et al., 2010).

There are 12 principles and four values that make up the Manifest. The values focus on individual people and relationships instead of processes and tools. The values also focus on functioning software rather than documentation and emphasise interaction in contrast to contract negotiation and adjustments to alter instead of dogmatically following a plan (Zwikael et al., 2023). There is a clear distinction between Agile Methods and Traditional approaches. Traditional approaches are based on the premise of fully pre-determinable goals via meticulous plans, while Agile approaches look at small iterative teams, focusing on real-time design updates and improvements that are informed by feedback and testing (Nerur and Balijepally, 2019).

The biggest hindrance in executing agile projects is striking a balance in the integration of the traditional PM approach and the iterative team empowerment while at the same time keeping in control effective agile iterations as well as retaining the ability to monitor all projects or programs (Zuzek et al., 2020). According to Cooper (2016), Agile teams empower teams with flexibility and self-management with respect to roles, whereas the traditional approach promotes individual specialisation. Control and management focus more on processes, while agile approaches emphasise people and leadership (Cooper, 2016).

Overall, agile organisational culture would be termed as organic (i.e. flexible, cooperative and participative), a big contrast to the traditional approach that tends to be bureaucratic and favour formalisation (Gustavsson & Hallin, 2014).

3.10.4 IT Projects performance

IT systems are vital in today's world for increased competitiveness and profitability. The failure rate in IT projects is still quite high despite the recent propagation of theories, methodologies and frameworks. Khanfar et al. (2018) say that the main factors impacting IT project performance are project team performance and planning, and the critical failure factors (CFFs) are unstable organisational environment and reporting between project stakeholders. These factors lead to project failures.

Bhutani (2016) concurs and posits that IT projects have an important contribution to economic growth. Most of the huge investments world over are in IT technology and thus failure is not an option as these projects tend to take long durations and hence proper feasibility study is necessary. Fuzzy Cognitive Maps have been widely used to identify and evaluate project success factors in IT projects.

Silva de Araújo (2015) posits PM leadership competencies as key to project success and people management as one of the key factors. A study by Bin (2014) analysed the reason behind the failure and concluded that new PM for IT projects have to be designed. Joseph and Marnewick (2018) argue that PM certification has not helped the cause for successful project execution, and these certifications' influences need to be verified. They argue that certification does not impact project delivery or performance in the South African environment.

Chiang and Manuel (2013) also bring another dimension: IT project portfolio management. Challenges arise due to the complexities related to the size of the investments. Thus, there is a need to develop a model for optimising stakeholder management in IT project portfolios.

3.10.5 Stakeholders and Project Goal Alignment

Project Management is made more efficient when there is an alignment between stakeholders and project goals (Gilchrist et al. 2018). The lead time to a decision is shortened due to smoothing friction between stakeholders. The challenge is ascertaining stakeholders' social dynamics in a complex IT project portfolio. Iden and Bygstad's (2018) research show that social alignment or misalignment evolves through 8 stages, namely separation, disrespect, lack of cross-discipline participation, social misalignment learning; respect and cross-discipline participation; social misalignment, respect and cross-discipline participation and ultimately social alignment.

Hidding and Nicholas (2017) state that despite efforts to improve IT projects, the failure rates remain high. They argue that efforts have centred around variations of the traditional approaches as enshrined in PMBOK. They propagate a new philosophy called Value-Driven Change Leadership (VDCL). Traditional approaches and new thinking are necessary to enhance IT projects' success. The management of stakeholders, as well as time and scope management as promoted by the traditional approaches, needs to be 'married' with practices such as value addition and end-product architecture. Thus, further research must be carried out to bridge this gap.

Ko and Kirsch (2017) say that there is an increased pressure on Project Managers to resolve what they term 'paradoxical tensions' that have arisen due to the clear distinction between business and IT due to short-term efficiency versus longer-term flexibility and success. Thus, there is a need for PMs to address these tensions by becoming 'hybrid', i.e., having business astute as well as IT project prowess in order for them to deal with various diversities and paradoxes arising due to contradictory demands linked with business and technical uncertainties. This change in the focus of business knowledge on PMs increases the chances of project success.

3.10.6 Good practices pertaining to IT projects

Zhu and Kindarto's (2016) research looked at the Government IT projects and the challenges they face in Indonesia. They suggest a way of leadership managing IT projects from within the decision structures as these influence an IT project's success or failure. The leadership style was found to have a downstream impact on the decision structure, which impacted the IT project structure.

This view is echoed by a South African study on the public sector by Javani and Rwelamila (2016), who suggest that the relationship between project teams and project clients in IT projects in the public sector can be made better through knowledge sharing and continuous communication throughout the project lifecycle.

Osei-Kyei and Chan (2015) say that public sector projects involve multiple stakeholders and present great challenges. This has resulted in many projects performing poorly. Research has shown that managing large-scale projects calls for coordination and collaboration that can be achieved by established processes and procedures that bring stakeholders together. Furthermore, it can be added that having processes in place is one thing and implementing the process is another.

Piroozfar (2019) concluded that the common problems pertain to issues around system design, implementation, project management and governance as well as contract management.

The need for effective communication is further echoed by Nuijten et al. (2016) when they apply the deaf effect to the project environment. They took a leaf from the stewardship theory and conjectured that if messengers carrying warnings are seen as collaborative partners, their message will likely be heard. On the other hand, if the messengers are seen as opponents, the deaf effect will be exhibited. Thus, it is crucial to manage project stakeholders carefully, as this invariably impacts project output.

Jackie et al. (2019) focus on the effect of requests for changes from the client and how this negatively impacts the contractor's performance. He uses a multi-attribute system to show that conflict arises due to the quality of information in the request for change.

Every slice, no matter how thin, has two sides. Berkay (2018) concurs with the foregone statement and applies it to stakeholder management when he postulates that each stakeholder is a pressure source that can be detrimental to the project. They can also create opportunities.

In their research, Liu et al. (2015) assessed how effective project teams are in securing and retaining top management buy-in. By employing the Organisational Influence Theory, they concluded that cognitive participation and emotional involvement heavily influence the extent to which management support is gained. They further found that cognitive involvement had a lesser influence than emotional involvement.

Polak and Wójcik (2016) say the IT sector is very demanding due to its dynamic nature as projects are becoming increasingly complex. Due to the complexities and sheer size, more stakeholders are involved, such as subcontractors or outsourcing, coupled with partners within the same organisation. Stakeholders from various origins, including different geographical locations and cultures, are involved in the project, and their interests must be considered and managed appropriately. There is thus a need to look at the interaction between stakeholders at different stages of the IT project and model how consensus can be achieved for effective project management.

The aim of the research by Kurzydłowska (2015) was to identify good practices pertaining to IT projects in different sectors of the economy. The COVID-19 pandemic resulted in the widespread adoption of remote work in most organisations, which invariably included remote project management (Ferreira et al., 2022). Managing project teams that are located in different geographical locations made it necessary for virtual collaboration tools and platforms to be used (Wu, 2022). Post-pandemic, most organisations have shifted to a hybrid project management approach. These tend to blend traditional waterfall and agile methodologies (Ciric et al., 2022; Hussein et al., 2023). By so doing, companies can now leverage the structure and predictability of traditional methods while embracing the adaptability and collaboration offered by agile practices (Ciric et al., 2022; Guo & Zhang, 2022).

On the other hand, according to (Reiff & Schlegel, 2022), the emergence of different hybrid methodologies in recent times has made it quite difficult to differentiate between these approaches and made it challenging to grasp the overall advantages and drawbacks of adopting a hybrid approach.

3.10.7 Information System (IS) Success Model

IS has resulted in the development of new business models and paradigms for business and industry. It has also influenced communication mechanisms and altered how business transactions are executed (Van der Westhuizen, 2022). IS systems are evolving continuously.Keen (1980) pointed out that there was a lack of scientific tools to ascertain success. He argued that variables like user satisfaction and person-hours could not be relied on as success measures. Subsequently, other researchers have latched on to the challenge and proposed different success models. DeLone and McLean developed one such significant model after a comprehensive literature review in 1992. This led them to develop a baseline tool, the Done and McLean success tool. This model gives a detailed taxonomy and was built based on earlier models, such as the Shannon Model (1948). Looking at the literature review from 1981 to 1988, they identified six interrelated and interdependent categories: System, Quality Information, Quality Service, Quality User Satisfaction and Net Benefits. These are illustrated in Figure 3.14 below:

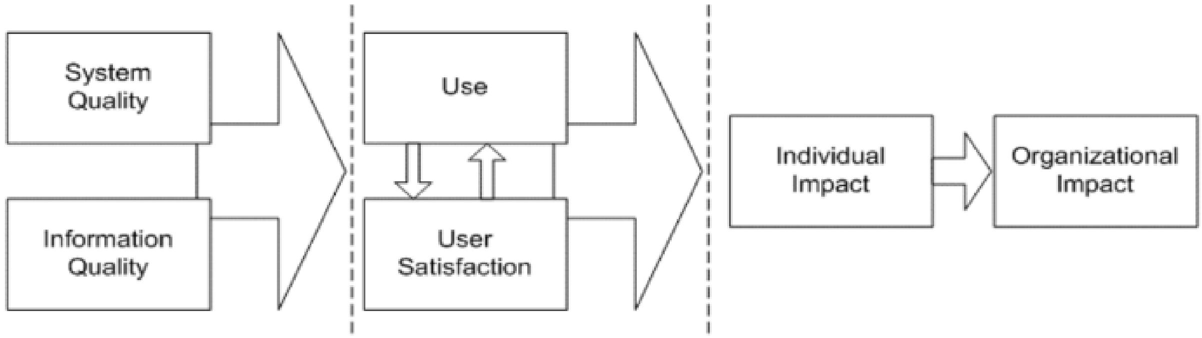

Figure 3.14: DeLone and McLean IS Success Model

(DeLone and McLean, 1992)

System Quality: This measures the performance of the IS itself, including its reliability, ease of use, and functionality.

Information Quality: Assesses the quality of the information produced by the IS, such as its accuracy, relevance, and timeliness.

Service Quality: Evaluates the support provided by the IS, including the responsiveness and competence of the support team.

Use: Looks at the extent and manner in which the IS is used by its intended users.

User Satisfaction: Gauges the satisfaction of users with the IS, reflecting their overall experience and contentment.

Net Benefits: Considers the overall impact of the IS on individuals and organisations, including improvements in efficiency, decision-making, and competitive advantage.

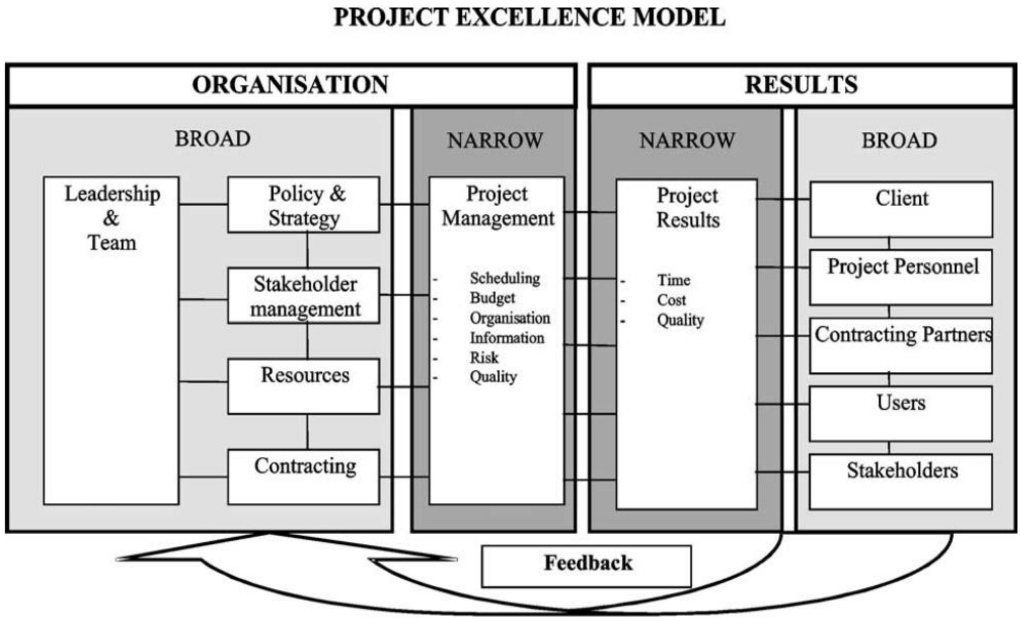

Figure 3.15: Project Excellence Model

Westerveld (2003)

3.11 Systems View of Project Management

Kezner (2021) propagate the adoption of a systems-thinking approach in project management. This would entail the recognition of the interconnection between various dimensions, such as project complexity, product and process intricacies, and organisational complexities. They point out that admitting and subsequently embracing the significance of complexity in daily organisational operations, whether natural or artificial, can lead to advancements in IT project management.

A general systems approach will be used since a project stakeholder network can be regarded as a system of interlinking components (PMI, 2020). An IT project encompasses creating and implementing an information technology system within an organisation. Thus, an IT system can be conceptualised as a system composed of various technological components that must be orchestrated to function seamlessly together to fulfil the overarching objectives of the entire system (Flyvbjerg et al., 2022). Stakeholder power and influence are dynamic during the lifecycle of the project. Montouri (2000) notes that systems thinking provides a basis for identifying relationships between factors in this dynamic environment rather than limiting oneself to individual factors or circumstances. Stakeholder management factors arise from these intricate relationships of variables within the IT project lifecycle (Menon, 2023). Identified factors will be used to develop the conceptual framework, which will be validated through a questionnaire involving key stakeholders.

Numerous researchers have delved into the incorporation of systems thinking into project management (Siriram, 2017). It is worth noting, however, that there are still gaps in this emerging area of study.

The new addition of the PMBOK Guide advocates for a systems view of Project Management. This approach is a significant shift from the knowledge areas in the preceding additions and come up with eight performance domains (PMI, 2021). The performance domains can be seen as an intertwined family of activities that are key to the success of projects. Stakeholder management is one of the performance domains (PMI, 2021).

A system represents several components that interact and are dependent on one another, thus operating as one unit (Menon, 2023). A project, thus, can be viewed as an entity that operates within variable or dynamic circumstances, demonstrating system-like qualities (Siriram 2017). Therefore, project personnel must appreciate this holistic view of projects, seeing them as systems with their own functional components (Hitchcock, Grobbelaar & Vermeulen, 2022).

As an example, most deliverables in IT projects are released incrementally. As such, each increment must consider changes in the present environment and the capabilities of previous versions (Einhorn et al., 2019). This is because as projects are being executed, both internal and external conditions continuously change, and one change can have several ripple effects. For example, according to PMI, 2021:38:

> *"On a large construction project, a change in requirements can cause contractual changes with the primary contractor, subcontractors, suppliers, or others. In turn, those changes can create an impact on project cost, schedule, scope, and performance. Subsequently, these changes could invoke a change control protocol for obtaining approvals from entities in external systems, such as the service providers, regulators, financiers, and government authorities."*

It is possible that some changes can be predicted ahead of time. However, most changes emerge in real-time during project execution. Adopting a systems thinking approach assists the project team in constantly monitoring internal and external conditions, thus navigating a wide range of changes and keeping the project in agreement with relevant stakeholders (Menon, 2023). The project system often consists of a diverse project team working together to achieve a common outcome. Systems thinking also encompasses how the project team perceives itself and its interactions with the broader project system (PMI, 2021). While diversity can bring value to the project, it is essential to effectively leverage these differences to promote cohesion (Singh et al., 2023).

As an illustration, consider Private-Public Partnerships (PPPs) aimed at developing new technology, where the development team may comprise members from both private and public sectors (Osei-Kyei and Chan, 2018). This situation represents an interaction between two distinct cultures within the project team. Team members bring with them their cultural biases shaped by their respective home organisations, whether those are private companies or public entities. To enhance the likelihood of project success, it becomes necessary to synthesise a unified team culture, establishing a common approach and standardised toolsets.

3.12 Conceptual Framework

A conceptual framework is an analytical tool with several variations and contexts. It is used to make conceptual distinctions and organise ideas. Strong conceptual frameworks capture something real and do this in a way that is easy to remember and apply. Conceptual frameworks tend to illustrate the current state of the subjects under study and their interrelations. Planning based on research questions and the conceptual framework offers the advantage of explicitly delineating various levels of abstraction within research (Frick, Bitzer, Rule and Albertyn, 2014).

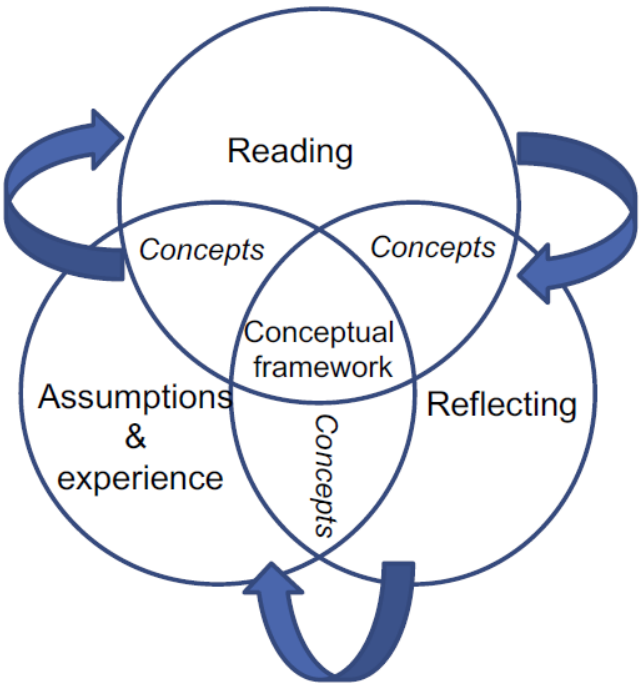

Figure 3.16: A conceptual framework development

Frick et. al., (2014)

As illustrated in Figure 3.16, a conceptual framework is developed based on the researcher's literature review, assumptions and experiences, and personal reflections. Based on the theoretical framework in Section 2.1 and the above-mentioned process, the following conceptual framework in Figure 3.17 was designed.

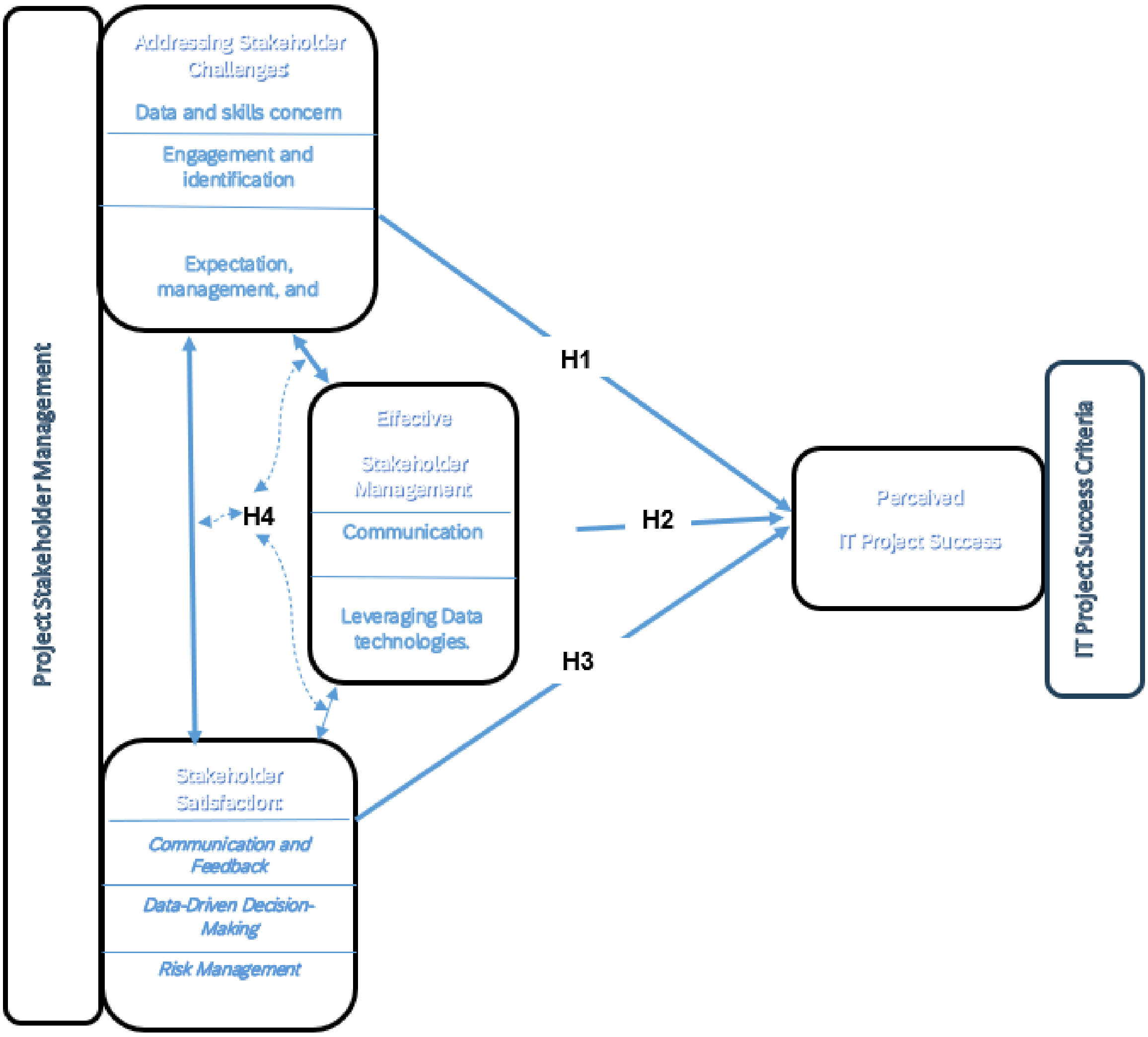

Figure 3.17: Conceptual Framework

(Author)

3.13 Hypothesis Development

Many technological advances have occurred due to the rise of the fourth industrial revolution. These technological advancements have grown in leaps and bounds over the past few years, as explained in sections 2.4 to 2.9. These rapid, monumental changes have affected all industries in many ways, and the field of IT project management has not been an exception.

The huge paradigm shift brought about by the revolution has brought with it new challenges in the management of stakeholders (Mhlanga, 2022). These changes are in many different areas and require that project managers balance diverse stakeholder expectations whilst at the same time ensuring ethical implications are smoothed out, as well as security issues that come with new technologies (Schwab, 2016; Xu, David and Kim, 2018; Mhlanga, 2022; Turner, 2021).

3.13.1 Hypothesis 1 (H1)

Due to these challenges, organisations must develop dynamic and innovative approaches to stakeholder management to ensure the success of IT projects in this era (Makazhe and Maramura, 2023). The information age has ushered in new changes in the dynamics of stakeholder power. These new changes have been largely attributed to the availability of much information and vast amounts of data in contrast to when data was not as readily available (Kibe et al., 2023:244). The coming of new technologies has brought with it a lot of new tools that can be used for project collaboration. This, in turn, has made it easier to undertake stakeholder engagement (Marnewick and Marnewick, 2021:8). The rise of 4IR and AI has given rise to new stakeholders in the IT projects arena. This means an increased stakeholder diversity. This new diversity of stakeholders implies a need for new ways to manage them, which makes way for their expectations to be better addressed. Also, it makes way for effective collaboration, which enhances the chances of successful project delivery (Sharma et al. 2022:5). These tools must be leveraged to gain better communication and facilitate collaboration. Subsequently, based on the above discussion, the following hypothesis was developed:

Hypothesis 1 (H1): The Fourth Industrial Revolution introduces unique stakeholder management challenges organisations must address for successful information technology (IT) projects.

3.13.2 Hypothesis 2 (H2):

Project-based organisations must be able to manage stakeholders' variable needs proactively throughout the project life cycle. Stakeholder management must be an ongoing exercise from the onset of the project right up to project closure for successful project outcomes. There are different strategies at the project manager's disposal to achieve the desired goals and outcomes. These strategies include stakeholder mapping, regular communication, and proactive engagement, which are pivotal to project success (Freeman, 1984; Bourne, 2016; Lockhart, 2024; Leanwisdom, 2023). When properly implemented, the strategies mentioned earlier go a long way in ensuring that stakeholder expectations and overall project goals and objectives are aligned. Subsequently, based on the above discussion, the following hypothesis was developed:

Hypothesis 2 (H2): Adopting effective stakeholder management strategies is essential for successful information technology projects.

3.13.3 Hypothesis 3 (H3)

The maintenance of high levels of stakeholder satisfaction also has a direct bearing on the perception of the success of IT projects in the 4IR (Nadzri et al., 2023). Rapid technological advancement compels organisations to track evolving stakeholder expectations in real-time during the project lifecycle. Therefore, there is a need to understand and incorporate these evolving expectations to satisfy the stakeholders. Stakeholder satisfaction is an important determinant of project success, especially in 4IR IT projects. Satisfied stakeholders support the project by providing necessary resources and becoming strong advocates for success (Nadzri et al., 2023). Research has shown that stakeholder satisfaction is also related or linked to other variables such as resource optimisation, stakeholder level of involvement, effective communication, project due date performance, and the delivery of expected outcomes (Mhlanga, 2022).

The following hypothesis was then developed from the above:

Hypothesis 3 (H3): There is a correlation between Stakeholder satisfaction and 4IR IT project success.

3.13.4 Hypothesis 4 (H4)

The emergence of new technologies in this modern world that are heavily influenced by AI has made it necessary to redefine factors that define the outcome of IT projects. These are called Critical Success Factors (CSFs), and they include technological competence, effective project management, and stakeholder engagement (Makazhe and Maramura, 2023; Parmentola and Tutore, 2023). These factors must be thoroughly considered to facilitate the navigation of various complexities that have come into existence by developing new PM technologies. The successful integration of the afore-mentioned grossly improves and promotes project performance by helping address the unique challenges presented by the 4IR environment (Turner, 2015). Understanding and leveraging the critical success factors significantly increases the chances of positive IT project outcomes (Zwikael and Smyrk, 2012; Makazhe and Maramura, 2023). Ethical concerns arise as a result of AI and other technologies like blockchain and the Internet of Things (IoT), amongst other technologies. The concern centres around security and privacy, amongst others (Mhlanga, 2022:6). These issues must be considered proactively to ensure the stakeholders' values and interests are taken aboard during the project lifecycle.

The following hypothesis was developed based on the above.

Hypothesis 4 (H4): There is a relationship between critical success factors and IT project performance in the 4th Industrial Revolution.

3.14 Summary

This chapter looks at different stakeholder models used over the years in various industries to help manage stakeholders effectively. The stakeholder theory was initially introduced, and the commonalities between the Models were discussed. The conceptual framework based on literature was presented after assessing existing models and theories proposed by various researchers. The systems view of Project Management was also discussed. This framework was subjected to structural equation modelling based on the responses given by participants in the survey. The next Chapter looks at the Research Methodology adopted in the study.

CHAPTER 4
RESEARCH METHODOLOGY AND DESIGN

4.1 Introduction

The preceding chapter established the theoretical foundation for investigating stakeholder management in IT projects in the fourth Industrial Revolution. The stakeholder theory was presented, and various project success models were discussed. The conceptual framework was also presented, and the development of hypotheses was comprehensively discussed. The study's primary objectives were presented using relevant literature to substantiate existing beliefs. This chapter focuses on the research methodology and research plan employed in the study to achieve the objectives. It outlines research topics, demographics, sampling methodologies, data collection and analysis methods, and ethical considerations integral to the study. The study employed a mono-method quantitative research methodology, gathering data through self-administered online surveys using the Lime Survey platform. These surveys were distributed based on snowball sampling due to the challenges in locating practitioners in the AI industry.

4.2 Statement of the Problem

Maaroufi and Asad (2017) posit that IT project teams operate in dynamic environments characterised by ever-changing customer requirements and needs. This often makes it imperative to deliver spontaneous and immediate innovative solutions at short notice. This further brings into the limelight the central role that the human element still plays in achieving successful project outcomes and gaining greater control over projects. Eyiah-Botwe et al. (2016) elucidate that stakeholder management has not been formally embraced as a project management skill to improve project delivery for socio-economic growth in developing countries. There is a need to develop robust stakeholder management approaches for IT projects within the context of developing economies. In addition, it is evident, based on historical data on the failure rate of IT projects, that IT projects continue to experience failures. However, over 50 years of history and countless methodologies, advice, and publications have been dedicated to them (Moore, 2015). Gartner (2016) estimated the failure rate for big data projects at 60%, though the actual failure rate was even higher, reaching 85%. Project failure is typically characterised by not being able to complete a project within the scheduled timeline, within the desired quality, and the allocated budget. (Flyybjerg and Budzier, 2022), in a survey reported in the Harvard Business Review, noted that the average cost overrun for IT projects is 27%. They also noted that one in six projects can be considered a "black swan", with cost overruns averaging 200% and schedule overruns averaging nearly 70%. Based on the CHAOS report, only 31% of IT projects were successful; 50% were challenged, and 19 % failed, Standish Group Report 2021(Portman, 2021). A survey conducted by Bain and Company revealed that a mere 5% of companies undertaking digital transformation initiatives reported project success (that is, they either met or surpassed their expectation) (Baculard et al.; 2017). Imam and Zaheer (2021) state that neglecting the part that humans play in project management contributes towards project failure. They further add that there is a "paucity" of research despite its strategic importance in projects. There is a plethora of existing literature on stakeholder management. However, there is a noticeable research gap in the context of IT stakeholder management in projects in the 4IR in South Africa (Ke Yu, 2022). This study aims to address this gap through interrogation of stakeholder factors that have a bearing on the outcomes of IT projects and the subsequent impact on project success. Poor stakeholder management is a common factor known to derail global projects; African projects are no exception. It is quite easy to forget the crucial role played by stakeholders in ensuring project success as project practitioners move away from the scope of the project and resources are inefficiently used (Siavhundu, 2019)

This study offers valuable insights and practical recommendations for optimising stakeholder management processes and enhancing overall IT project performance in this ever-evolving business landscape. This is conducted within South Africa to help bridge the gap between stakeholder management and project performance.

4.3 Research Constructs

4.3.1 Relationship between Variables

Scale reliability was assessed using Cronbach's alpha test, a measure of the consistency of responses in latent and known variables (Saunders et al. 2009). Indicators with a Cronbach value of above 0.7 confirm the internal consistency and reliability of data (Taber, 2018). A pilot study was run to test the reliability of the data collection instrument. The study investigated the relationship between project success and various stakeholder influences.

4.3.2 Research Methodology and Design

To create a cohesive structure and direction for this study, the researcher employed the research process onion model by Saunders et al. (2019). Figure 4.1 below shows the research process onion model underscoring the diverse choices, philosophical foundations, strategies, and methodologies applied during a typical systematic research journey. Consequently, the subsequent sections in this Thesis are organised following the layers of the research onion, beginning with an examination of the chosen research philosophy, approach, strategy, decision-making, timeframe, data collection methods, and data analysis techniques.

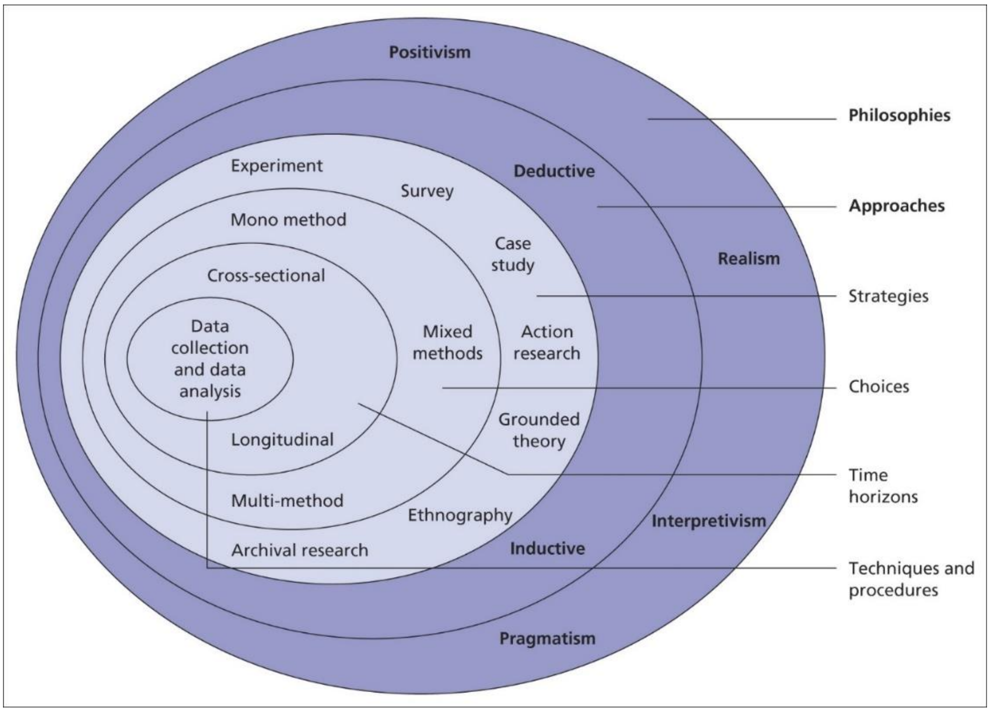

Figure 4.1: The research process onion

(Saunders et al., 2019)

The 'Research Onion' stages applied to the research study are outlined below, beginning with the Research Philosophy.

4.4 Research Design and Plan

Babbie (2010) explains that research design is a blueprint on which the researcher aims to conduct the research, whereas research methodology concentrates on the research processes, tools, and procedures to be applied throughout the study. Fellows and Liu (2008) posit that the research methodology is the heart of research as it dictates the research direction or path and how it will be conducted. This research will follow a quantitative approach, drawing leaves from similar studies that effectively used a quantitative study to infer models using SEM. Similarly, O'Leary (2017) suggests that a sample size of at least 30 is necessary for generalising findings to a broader population. A thorough literature review on IT project stakeholder management will be executed using a filtering approach of various journal databases and a combination of different keywords to identify the constructs. The study is cross-sectional, i.e., it studies a particular phenomenon at a particular time (Majeed et al., 2020). Due to the dynamic nature of the industry, a longitudinal study would not be appropriate (Saunders et al., 2019).

Table 4.1: Research Questions

Main Objective: How can the stakeholders be managed and engaged sustainably for the successful execution of IT projects in the fourth industrial revolution?				
Sub-objectives	*Sub-Objective 1:* Identify the stakeholder management challenges encountered in information technology projects in the Fourth Industrial Revolution.	*Sub-Objective 2:* Identify strategies that can be used to effectively manage stakeholders in information technology projects in the era of the Fourth Industrial Revolution and the proliferation of AI.	*Sub-Objective 3:* Determine the relationship between stakeholder satisfaction and 4IR IT project success.	*Sub-Objective 4:* Identify the critical success factors for stakeholder engagement and satisfaction in IT projects, considering the influence of AI and the evolving landscape of the Fourth Industrial Revolution.
Hypotheses	***Hypothesis 1****:* The Fourth Industrial Revolution introduced unique stakeholder management challenges organisations must address for successful information technology (IT) projects.	***Hypothesis 2****:* Adopting effective stakeholder management strategies is essential for successful information technology projects.	***Hypothesis 3****:* There is a relationship between Stakeholder satisfaction and 4IR IT project success.	**Hypothesis 4**: There is a relationship between critical success factors and IT project performance in the 4th Industrial Revolution.
Sub-objectives	*Sub-Research Question 1*: What are the stakeholder management challenges encountered in information technology projects within the context of the Fourth Industrial Revolution?	*Sub-Research Question 2:* What strategies can be developed to effectively manage stakeholders in information technology projects in the era of the Fourth Industrial Revolution and the proliferation of AI?	*Sub-Research Question 3*: What is the relationship between stakeholder satisfaction and 4IR IT project success	*Sub-Research Question 4*: What are the critical success factors for stakeholder engagement and satisfaction in IT projects, considering the influence of AI and the evolving landscape of the Fourth Industrial Revolution?

(Author)

The hypotheses (see section 3.13) were developed based on the conceptual framework presented in Section 3.12 and built based on the envisaged linkages.

4.5 Research Philosophy

When undertaking a research study, researchers can choose from various research philosophies. In this study, given the epistemological considerations, a positivist research philosophy has been embraced, and a mono-method research methodology has been applied, as alluded to by Bryman (2012). This approach aligns with similar studies conducted by Machiels et al. (2023) and Nguyen et al. (2023). The aforementioned studies adopted a positivist approach.

Saunders et al. (2019) emphasise that research philosophy pertains to the development of knowledge as well as the nature of knowledge itself. Understanding research philosophy assists researchers in clarifying the research design and determining what is feasible and what is not (Easterby-Smith et al., 2012). The researcher's philosophical standpoint reflects their worldview, which is closely linked to the research questions (Saunders et al., 2019). There are three primary types of research philosophies: epistemology, ontology, and axiology. Epistemological philosophy looks at the nature of knowledge and assesses how it is acquired. It explores questions related to how we come to know things and how valid the different sources of knowledge are inclined to be. (Easterby-Smith et al., 2012). The ontological philosophy focuses on the nature and study of reality. A key question interrogated in the ontology is whether social realities should be considered as social constructions that emerge from the perspective and actions of social actors or should be viewed as objective entities.

The ontological philosophy can be further classified into objectivism, constructionism, or subjectivism (Bryman et al., 2014). On the other hand, axiology has more to do with the researcher's values and how these values may impact the research process and outcomes. It includes questions about the researcher's ethical stance and the associated potential influence of their values on the research findings (Saunders et al., 2016:128). The choice of research philosophy goes a long way in influencing the overall research approach and methodology that a researcher may adopt. This is unconsciously or consciously done by shaping the researcher's perspective and guiding their decisions throughout the research process, starting right from the formulation of research questions to data collection and the subsequent data analysis. The researcher's worldview and values can also impact the research outcomes and conclusions.

4.6 Epistemology

Epistemology is divided into Positivism and Interpretivism (Saunders et al., 2019). The research approach can be interpretivism, positivism and pragmatism (Raddon, 2010) and (Kumar, 2011).

This research adopts a positivist approach using deductive reasoning, driven by the nature of the research question, the problem being investigated, the desired outcome, and the IT stakeholder management framework. Mashali et al. (2023) used a similar approach in an empirical study on stakeholder engagement in mega projects. They posit that all respondents are given an identical distribution, which allows for a systematic and statistical revelation of patterns within their perceptions. Nguyen et al. (2023) strongly advocated the use of quantitative approaches, such as structural equation modelling or partial least squares, to assess the relational propositions in stakeholder studies. Research methodology is directly impacted by research philosophies or paradigms and various approaches within these paradigms (Creswell, 2007). Positivism posits that there is a single objective reality surrounding a particular research phenomenon, and this objective view requires scientific methodology to bring it out (Kumar, 2010) (Saunders, Phillip and Thornhill, 2009). Bahari (2010) concurs and states, "Positivism assumes that there are social facts with an objective reality apart from the beliefs of individuals".

Interpretivism is the view that reality takes many, often subjective forms (Kumar, 2011), and pragmatism attempts to reconcile the differences between interpretivism and positivism (Kumar, 2011; Punch, 2013). Positivism is based on quantitative research designs and emphasises objective reality through scientific, highly reliable and controlled data collection, analysis, and interpretation methods. At the same time, interpretivism yields more readily to a qualitative research design (Saunders et al., 2009).

This research adopts a positivist approach whereby data is gathered from the research objects and quantitatively analysed. Positivism, which has a strong focus on practicality and problem-solving, aligns very well with deductive research (Alzoubi, 2022). The positivist approach empowers researchers to rely more on statistics and generalisation, fostering the creation of universal laws and discoveries (Alharahsheh and Pius, 2020).

A deductive approach is used to collect data to explore a phenomenon and identify themes and patterns. (Saunders et al. 2012). This data is consolidated to develop a conceptual framework for managing stakeholders in IT projects in South Africa by identifying patterns in IT project execution.

Table 4.2: Distinctive features of the research approaches

	DEDUCTION	**INDUCTION**	**ABDUCTION**
Logic	*Deductive reasoning is based on the principle of logical validity, ensuring that the conclusion logically follows from the given premises, provided those premises are accurate*	*In inductive inference, known premises or observations are used to generate conclusions that are generalisations or predictions. Unlike deductive reasoning, inductive reasoning does not guarantee that the conclusions are true; instead, it suggests that the conclusions are likely to be true based on the available evidence.*	*In abductive reasoning, known premises are used to generate the most plausible explanations or hypotheses for observations or evidence. These conclusions are formulated to be testable and open to verification through additional investigation or the collection of further evidence.*
Generalisa bility	*Making deductions from the general to the specific.*	*Drawing conclusions from specific instances to form general principles*	*Generalising from the interactions between specific and general elements.*
Use of data	*Data is used to assess propositions or hypotheses that are linked to an established theory.*	*Data collection explores a phenomenon, recognises themes and patterns, and establishes a conceptual framework.*	*Data collection serves the purpose of investigating a phenomenon, recognising its themes and patterns, situating these within a conceptual framework, and validating these findings through successive rounds of data collection.*
Theory	*The process involves either refuting or confirming a theory.*	*The process involves generalising existing theories and constructing new ones.*	*The process involves generalising or adapting existing theories, incorporating them where relevant, constructing new theories or modifying existing ones.*

(Saunders et al. 2019)

4.7 Quantitative Approach

The quantitative approach was adopted to identify causal relationships between dependent and independent variables. The dependent variable was Project Success, and the independent variables were Stakeholder Management Challenges, Effective Management of Stakeholders, and Stakeholder Satisfaction. A quantitative approach involves collecting and analysing data to derive insights from relationships that emerge among the variables using descriptive and inferential statistics (Soiferman, 2010). Quantitative research uses deductive methods to analyse theories to get numerical evidence to either validate or contradict a hypothesis (Creswell & Plano Clark, 2007).

While some researchers advocate for the potential benefits of adopting multiple or mixed strategy approaches, others remain inclined toward mono methods for different reasons. An article by (Aguirre and Robles, 2020) delves into a descriptive study that examines the research strategies employed by top-ranked researchers by reviewing publications over the 2018-2019 period in the International Journal of Project Management, which serves as the premier journal in the field of project management and organisational studies. As depicted in Figure 3, out of the 127 articles reviewed, 96 were found to have adopted a mono-strategy approach, whilst 19 utilised a multi-strategy, and 12 adopted a mixed-strategy (Aguirre, and Robles, 2020). The mono-strategy approach stands out as the most commonly utilised method among the reviewed articles.

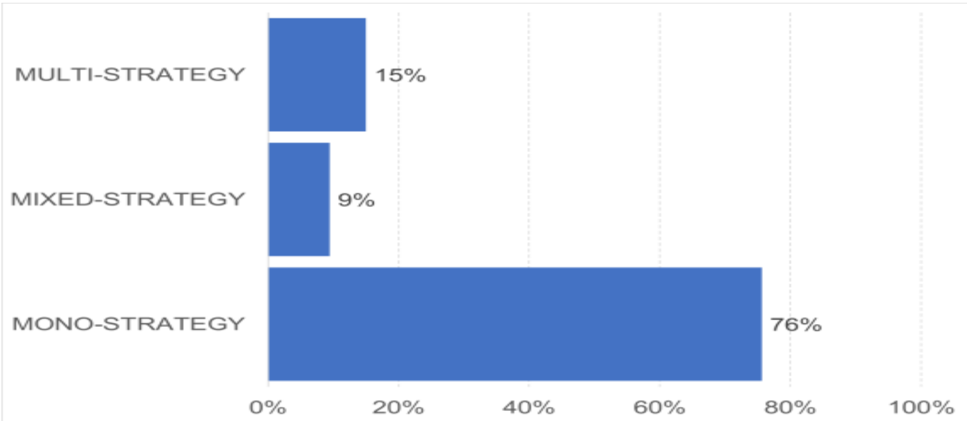

Figure 4.2: Distribution of the articles depending on the combination of strategies

(Aguirre and Robles, 2020).

A quantitative, mono-method research methodology that aligns with the positivist epistemological perspective was adopted in the study. A single data collection technique and a corresponding data analysis procedure were used. Saunders et al. (2019) define the mono-method as a research approach that uses only one data collection technique and an associated data analysis method.

4.8 Time-Horizon

Research studies can be categorised into either longitudinal or cross-sectional research based on the nature and the scope of the study. The time horizon chosen for this study was a cross-sectional approach, which is a suitable choice, particularly when undertaking surveys (Saunders et al., 2019).

4.9 Population

According to Welman et al. (2008), the term "population" pertains to objects with specific characteristics and constitutes the complete assembly of individuals under examination in an ongoing study. Conversely, Powers, as cited in De Vos, Strydom, Fouche, and Delport (2001:193), views the population as "a set of entities in which all the measurements of interest to the researcher are represented." In the context of this study, the respondents were selected from IT project organisations, and this group included designers, developers, Project managers and administrators, functional and divisional managers, IT-services client liaisons, and IT security specialists. The questionnaire was designed to self-screen using a filter question, as highlighted in Sections 4.10 and 4.12 below.

4.10 Snowball sampling

A sample may be viewed as a subset of a population selected to participate in a study (Sileyew, 2019). Snowball sampling falls under the category of non-probability sampling methods and is employed in the study for gathering data from respondents. Snowball may be used when the population is hidden or hard to reach Welman, Kruger, and Michell (2008). Snowball sampling involves initiating data collection from contacts within the researcher's network, gradually expanding to potential respondents through referrals (Showkat et al., 2017). This method proved fitting for this study due to the unique characteristics required within the targeted population. Snowball is used because since the fourth industrial revolution is gaining momentum in South Africa, identifying organisations applying artificial intelligence might be a challenge.

In the snowball sampling technique, the initial step involves identifying a small number of individuals who meet the specified criteria for the study (Kumar, 2011). Subsequently, they will be requested to suggest additional individuals in their network who meet the same criteria. It is important to note that this approach does not typically yield samples that are fully representative but will be used to access hard-to-reach AI-based organisations (Hair et al., 2028).

In snowball sampling, the researcher relied on friends, colleagues, and family to identify possible participants and propagate the questionnaire within their networks. However, this approach has a limitation in that it may have a potential bias that may be inherently built in when respondents refer to others with similar views, potentially leading to a homogeneous sample (Saunders et al., 2012; Yin, 2017). To mitigate this, companies that were involved in IT projects were approached.

Ghasemi and Zahediasl (2012:486) emphasise that "in large samples (> 30 or 40), the sampling distribution tends to be normal, regardless of the data's shape." Similarly, O'Leary (2017) suggested that a sample size of at least 30 is necessary to generalise findings to a greater population. This study's final sample size of 50 satisfies the requirements for making inferences about a wider population and assuming normality. N = 50 might be sufficient for a randomised trial with repeated measures to detect a large effect size, but N = 50 might be absurdly low for a between-subjects comparison to detect a low effect size (McNeish and Wolf, 2023). Obondi (2022) used a sample size of 50 project managers in the US to investigate the relationship between project risk monitoring and control and project success. Miller (2022), in a study on Stakeholder accountability in AI projects, received 98 usable US responses and 50 German responses, and abandon rates were 8% and 22%, and the margin of error was 10.1% and 14.1% for US and Germany, respectively. A filter question was used to identify the stakeholders that are involved in IT projects as shown in Figure 4.3 below:

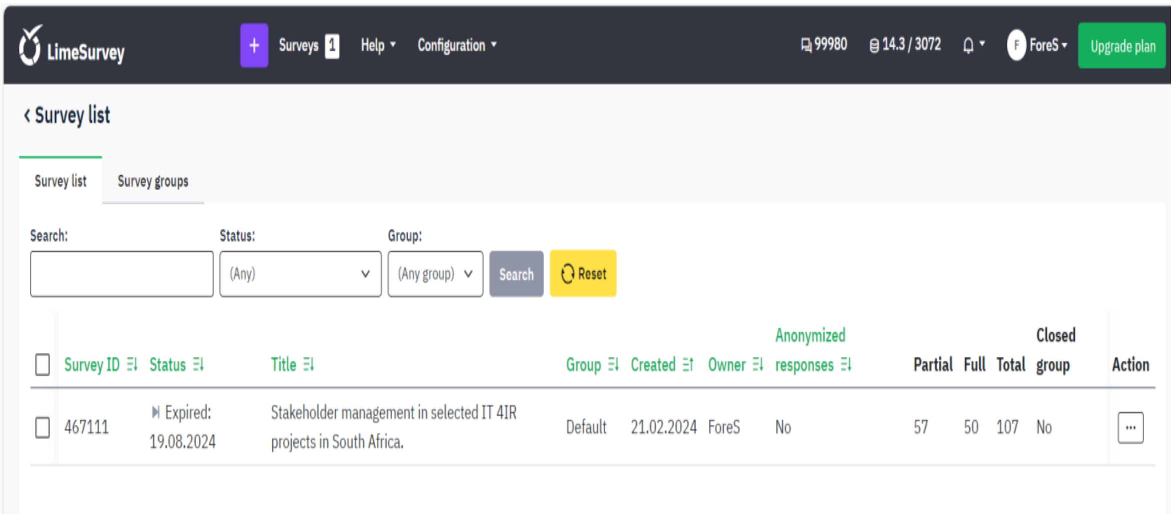

Figure 4.3: Filter question responses

(LimeSurvey, 2024)

4.11 Data Collecting Instruments, Sources and Procedures

Data collection is the systematic process of gathering and analysing data, thus enabling researchers to address their research effectively (Welman et al., 2005). Primary data is the data that is collected for the first time, and secondary data is data that has been gathered and analysed by someone else (Saunders, 2019). The main objective of data collection is to obtain high-quality evidence that can support thorough data analysis, leading to satisfactory answers to research questions (Kabir, 2016). Two primary approaches for gathering information are recognised: primary and secondary approaches (Kumar, 2011).

The configuration of a questionnaire significantly influences response rates and the validity and reliability of the data acquired.

Dillman (2014) underscores the significance of recognising three distinct types of data variables obtained through questionnaires, as this affects the formulation of questionnaire questions:

1. Opinion variables: a record of respondents' sentiments, thoughts, or beliefs regarding a particular subject.

2. Behaviour variables: a gathering of information about individuals' actions in the past, present, or intended future activities.

3. Attribute variables: concentrate more on the characteristics or traits of the respondents.

The data collection in this research aimed to understand IT stakeholders' opinions, experiences, and attitudes toward 4IR platforms, making it a descriptive study. The goal was to utilise gathered data to identify and interrogate variables within the IT stakeholder management area. The researcher designed the questionnaire to align with the research question and study objectives.

One limitation of snowball sampling is the inherent bias, where participants tend to refer others who share similar perspectives, potentially leading to a homogeneous sample (Saunders et al., 2012). Self-selecting sampling was employed, thus empowering potential respondents to decide their participation and reducing the chances of a homogeneous sample (Aga et al.2016). This was a mitigation factor for the shortcomings of the snowball sampling technique. This method involved sharing the study invitation across social media, messaging platforms, and emails, thus offering diverse avenues for participation (Saunders et al., 2012). Responses were gleaned from individuals with varied experiences and viewpoints, using these multiple platforms and reducing the risk of acquiring a homogeneous sample (Fink, 2015).

The questionnaire was designed to obtain participants' responses by presenting a standardised set of questions. It serves as an efficient means to collect responses from a large sample for quantitative analysis purposes (Fink, 2015).

The study used a questionnaire as the primary data collection tool. Respondents were required to provide ratings on a provided Likert scale. Secondary Data on IT project success was gleaned from publications related to IT projects. All potential respondents were requested to answer whether their companies have adopted AI tools and whether they were involved in IT projects. If the answer was no, the respondents were directed to stop the survey and not to respond further. This prevented the wrong respondents from completing the survey. Various questions were designed to help obtain as much relevant information as possible.

The study employed a composite measure of project success that brought together different dimensions, relying on stakeholders' perceptions of specific criteria. This methodology is consistent with previous studies that took a similar approach (Suprapto, 2015; McNeish and Wolf, 2023; Obondi, 2022). The project success measure comprises 14 items, encompassing aspects like time, cost, performance, client usage, satisfaction, and effectiveness. Stakeholders evaluated each item using a Likert scale from 1 to 5, indicating their level of agreement ranging from 'strongly disagree' to 'strongly agree' (Aga et al., 2016).

4.12 Data Analysis Procedure

Saunders et al. (2012) suggest that survey-based methods commonly result in response rates that range between 50% and 60%. An acceptable response rate of 50% was achieved in the study. Understanding data types is important in the analysis of the findings. The study adopted a quantitative research approach with a focus on numerical data. The survey gathered categorical data primarily, and two types of categorical data that were analysed in the survey were as follows:

Nominal data: These lack numerical definition and ordering. Nominal data is descriptive and counted based on the frequency of occurrences. A good example of nominal data is gender count (i.e., male/female) or marital status (married/unmarried). Clear categorisation aids unambiguous analysis (Welman et al., 2005).

Ordinal data: This type includes ranked or scale-based questions like a Likert scale for rating variables such as quality or agreement that fall under ordinal data.

Once ethical clearance was obtained (see Appendix B), data collection commenced utilising the LimeSurvey platform. The platform was selected because it is easily accessible and easy to use, and it is not irrelevant to the study. Before the formal survey, a 5-day pilot, utilising five participants, was conducted to evaluate the alignment of the instrument with the study's objectives. Feedback from the pilot study confirmed that the research instrument was suitable. No validity or reliability issues were identified. The survey was made available on the platform for several months (February to August 2024). Regular prompts were sent to increase the probability of more widespread and varied participation.

Moreover, the survey was promoted on social media platforms (WhatsApp, LinkedIn, Instagram, and Twitter) to maximise participation. The local project management professional body, Project Management South Africa, was also contacted to assist with disbursing the questionnaire. The organisation has a database of more than 3000 practising project managers.

The use of the web-based LimeSurvey platform proved to be a cost-effective approach. In addition, the platform enabled broader reach across diverse respondent groups. LimeSurvey also allows data to be stored and provides downloadable features. These features facilitated subsequent analysis by exporting responses to a spreadsheet, which was, in turn, exported to SPSS Amos Version 29 for statistical analysis.

A filter question (refer to Table 4.3) was strategically designed to ensure that only suitable participants completed the survey. Any potential participant who responded negatively to the screening question had the survey automatically closed, preventing further completion. The outcomes of these screening questions and the total count of valid and targeted responses are summarised in Table 4.3.

Table 4.3: Filter Question responses

Screening questions	Number of "Yes" responses	% of "Yes" responses	Number of "No" responses	% of "No" responses
I am a stakeholder in 4IR stakeholder projects.	50	46.7%	57	53.3%

Data was analysed using descriptive statistics and inferential statistics. IBM SPSS AMOS Version 29 was used for quantitative data analysis and presentation. The Statistical Package for Social Sciences (SPSS) serves two primary functions, as outlined by Kulas (2009): (1) it functions as a data analyser, and (2) it acts as a data organiser and manager. In this study, both descriptive and inferential statistics were instituted on the data.

Descriptive statistics included the creation of frequency tables that were visually presented in the form of tables after the coding process. Inferential statistics was also instituted on the data to draw broader conclusions about the entire population under study based on the responses from the sample (Sutanapong and Louangrath, 2015). Regression analysis was employed on the data to explore the relationships between the hypothesised variables. Structural Equation Modelling (SEM) was also utilised to ascertain the independent variables' collective impact on the dependent variable. SEM examined connections between various factors and assisted in identifying potential correlations among them. Marnewick, Erasmus and Joseph, (2017) used SEM in their study on project success factors in a similar study. SEM is discussed in more detail in the next section, 3.14. Project Success was the dependent variable in this study. A deductive approach concerned with theory falsification or verification (Cohen, Manion & Morrison, 2011) was utilised to develop the stakeholder management framework.

4.13 Structural Equation Modelling

Structural Equation Modeling (SEM) is a statistical tool commonly used by social science researchers (West et al., 2023). They use it mainly to test and estimate relationships between observed and latent (unobserved) variables (Hair et al. 2017). SEM is a versatile method employed in social sciences and other fields to analyse complex relationships among variables.

The technique enabled the researcher to examine causal relationships. These relationships may directly or indirectly affect the variables within the theoretical model. It integrates factor analysis and regression analysis (see Sections 4.15 and 4.16), thus enabling the examination of both measurement models (relationships between observed variables and their underlying constructs) and structural models (relationships between the constructs).

The approach used path diagrams to visualise hypothesised relationships between variables, and this facilitated the evaluation of the fit of the models to the observed data (Mali-Swelindawo 2016). SEM helps in assessing and evaluating the validity of theoretical models. Furthermore, it also helps estimate and subsequently test relationships between variables and understand a complex system of interrelated factors (West, 2023). For SEM to be relevant or applicable, certain fit statistics must be tested (Shadfar et al., 2013). West et al. (2023) suggest a group of indices and bunch them into what is known as "practical fit indices".

For this study, the fit statistics are summarised below:

Table 4.4: Fit statistics

Measure	Terrible	Acceptable values	Perfect fit
CMIN/DF $\left(\frac{\chi^2}{df}\right)$	> 5	> 3	> 1
CFI	<.90	.90<CFI<.95	>.95
SRMR	>.10	.08<SRMR<.10	<.08
RMSEA	>.08	.06<RMSEA<.08	<.06
PClose	<.01	.01<PCLOSE<.05	>.05
GFI	<.90	.90<GFI<.95	>.95
TLI	<.90	.90<TLI<.95	>.95
NFI	<.90	.90<NFI<.95	>.95
IFI	<.90	.90<IFI<.95	>.95
AGFI	<.90	.90<AGFI<.95	>.95
RFI	The better the closer to 1		

(Hair et al., 2019 and Hu and Bentler, 1999)

4.14 Factor Analysis

Factor analysis was used to identify underlying relationships between variables by grouping these into relevant factors (Ramlall, 2017). For stakeholder management in IT projects during the 4IR, factor analysis was used to identify key areas of concern. Data was gathered from the stakeholders using a questionnaire. The data was then analysed and sorted into different themes. A correlation matrix was created to ascertain how the variables are linked or correlated. The principal component matrix was then used to extract factors. Each factor represented a group of related factors. The factors were analysed to identify underlying themes. Under the measurement model, the objective is to test the relationship between a latent variable and its corresponding observed variables. Only after the measurement model has been derived does the focus shift towards the structural model estimation, also known as path analysis (Ramlall,2017).

4.15 Regression Analysis

Regression analysis links independent and dependent variables when assessing statistical inter-correlation (Mafini, 2014). Regression aims to explain variables' dependency on one or more independent variables and implies a one-way causal influence on the response variable regardless of whether the impact is greater or indirect.

4.16 Correlation Analysis

Correlation analysis is used to analyse how strongly two variables are associated (West, 2019). Significant correlations imply that the two variables are closely related, and on the other hand, a low correlation coefficient shows that variables are not related or weakly related (Hair et al. 2019). Correlation analysis was used to assess the relationship between project success and the causal elements such as improving stakeholder satisfaction, enhancing effective stakeholder management, strengthening social support, monitoring and adjusting indirect influences, and regular assessments and feedback. The results are shown in Table 6.2, Chapter 6.

4.17 Reliability and Validity of Data

Taber (2017) says validity and reliability are crucial elements to keep in mind when administering or piloting a measuring instrument.

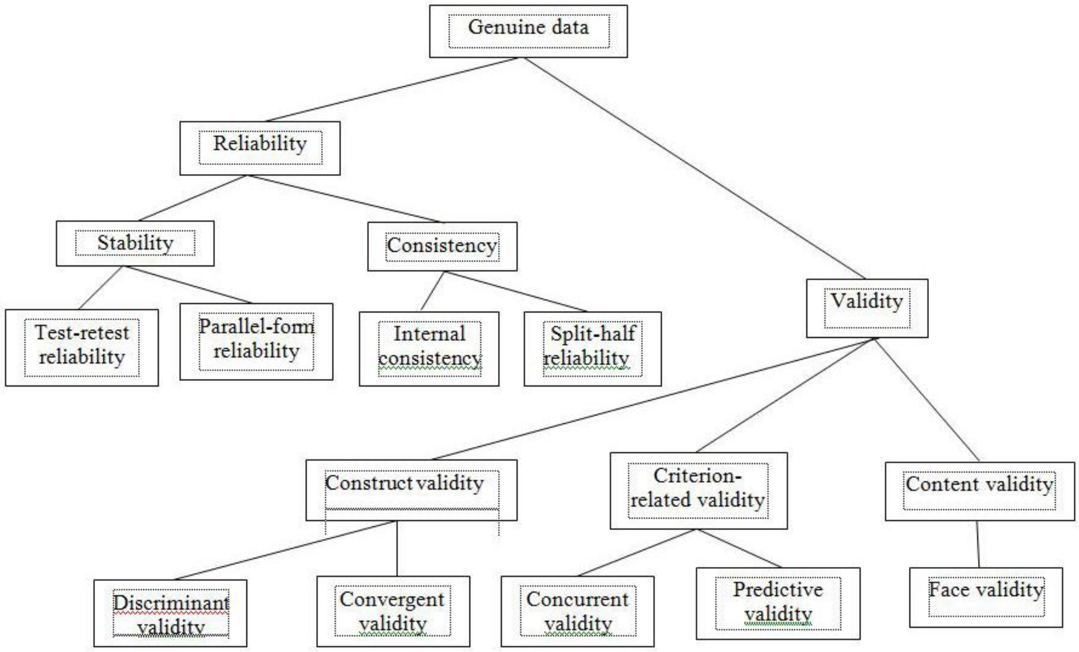

Figure 4.4: Reliability and Validity (Bajpai and Bajpai, 2014)

Before fully deploying the questionnaire on LimeSurvey for data gathering, a pilot test was conducted to refine it and ensure that the questionnaire solicited the right information and that the respondents understood it. This test also helped evaluate the questionnaire's validity and reliability (Saunders et al., 2019). Fink (2015) recommends at least ten responses for pilot testing smaller-scale questionnaires due to potential financial or time constraints. However, it is crucial to include diverse population variations that might impact responses. For this study, a select group of five individuals was given access to the survey for a week during the pilot phase.

By ensuring internal validity, the researcher confirms that the questionnaire measures the intended elements and not something else (McNeish and Wolf, 2023). To achieve this, the questionnaire was tested for measurement validity. As the attributes enabling IT project success were discussed in the literature, the questionnaire's validity relied on the following specific concepts:

4.17.1 Content validity

The questions included in the questionnaire were gleaned based on the literature review to ensure comprehensive coverage of the themes under investigation. The pilot was a further endorsement of the questionnaire's content validity.

4.17.2 Criterion-related validity

This aspect focused on the questionnaire's ability to forecast outcomes or future behaviours (McNeish and Wolf, 2023). The survey period was extended to seven months to increase the sample size and enhance the questionnaire's predictive validity.

4.17.3 Construct validity

This checked if the questionnaire accurately measured the intended constructs. Piloting the survey confirmed the presence of the targeted concepts. Regarding internal consistency validity, Cronbach's alpha (α) for each item within the constructs was utilised. Constructs with $\alpha > 0.7$ will affirm consistency validity (Taber, 2018; Guilford & Lyons, 1942; Hair et al., 2009). Adadan and Savasci (2012) concur when they also suggest that a Cronbach's alpha value of 0.7 or higher is acceptable for reliability. However, other studies, such as that by Griethuijsen et al. (2015), indicate that different interpretations of alpha values are possible, and values ranging between 0.6 and 0.7 can also be considered acceptable.

The reliability of data (i.e., referring to consistency) was further reinforced and assured by a close examination of internal consistency by utilising correlations between questionnaire responses. Careful wording aimed to eliminate ambiguity, and standardising completion conditions using LimeSurvey ensured reliability across respondents and various conditions (Taherdoost, 2016). A statistician also scrutinised the instrument to ensure it was compatible with SPSS software. This approach, encompassing diverse validity checks and reliability measures, established a robust methodology for gathering credible and consistent research data.

Reliability and validity tests for the hypotheses were conducted using constructs. The reliability of results is primarily based on their consistency when reproduced (Taber, 2018). This is often measured through the assessment of correlation coefficients. A significantly positive coefficient indicates dependable results (Mohajan et al., 2017). An adequacy assessment was performed utilising Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling statistics. The KMO test measures the strength of partial correlation between different variables. Constructs with p-values below 0.01 in

Bartlett's test of sphericity and constructs exceeding 0.5 in the KMO measures indicate measurement adequacy and imply it is plausible to carry out factor analysis (Hu and Bentler, 1999). Bartlett's test of sphericity tests the null hypothesis that the correlation matrix is an identity matrix.

4.18 Possible Ethical Issues

It is very important that respondents or participants be provided with sufficient information in order for them to make informed decisions pertaining to their participation in the study (Roberts and Allen, 2015:50). This ensures that individuals have a clear understanding of the research study, and they can make informed choices about their involvement. The principles of informed consent, protection from harm, the right to privacy, and involvement in the research process were adhered to in this study:

4.18.1 Informed Consent and Protection from Harm

This is a significant issue regarding participant involvement in the study (Bell et al., 2019). It is of crucial importance that participants are provided with as much information as possible concerning the research. In this study, participation in responding to the questionnaire was entirely voluntary. Participants had the right to withdraw from the study at any time without any obligation, and the landing page of the survey on LimeSurvey was clear about that. Participants were informed in an appropriate manner using a cover letter. Before responding to the survey, their informed consent was sought through a cover letter providing comprehensive information about the study. Only data necessary to address the research question was collected. Therefore, for this study, no personal or biographical information was gathered, as it is deemed irrelevant to answering the research inquiries (Fleming and Zegwaard, 2018).

4.18.2 Right to Privacy

Privacy is a fundamental ethical concern that is the basis for various ethical principles. These principles include respect for individuals, informed and voluntary consent, and confidentiality (Creswell, 2008). These underline the importance of protecting the respondent's personal information and ensuring that their participation in the research considers their independence and confidentiality. All information collected from participants was treated with confidentiality, and their identities and that of their organisation were kept anonymous. This commitment to privacy is also applicable to any articles or publications emanating from the study unless explicit permission was obtained from individuals to use their names or disclose their identities.

4.18.3 Involvement in the Research

Information provided by participants was used purely for research purposes and nothing else. The research objectives were clearly outlined to participants at the onset, and their consent was subsequently solicited. Respondents were not required to disclose their names, and surveys were conducted in a confidential manner, following the guidelines outlined by Saunders et al. (2016).

The research project pursued ethical clearance in accordance with the requirements set forth by the academic institute's Ethics Committee. The researcher acknowledges the institution's plagiarism policy and is committed to presenting work that is genuinely original and authentic unless specifically noted otherwise. In cases where information was derived from external sources, the researcher provided complete references to the literature sources and acknowledged them accordingly. As articulated by Creswell and Poth (2016), ethical considerations involve securing permission from both the management of the institution under study and the University. As such, the researcher strived to adhere to the University's ethical guidelines for Postgraduate Research Studies and was issued the necessary Ethical Clearance (See Appendix A). The research endeavoured to ensure the well-being of all involved individuals, with a commitment to treating all participants with honesty and respect, and the subsequent data analysis maintained a high standard of integrity. To prevent any emotional or psychological harm to the subjects, the researcher refrained from using disparaging or offensive language in the design of the questionnaire.

To reach our objective of crafting a framework for IT project success in the fourth industrial revolution, a generic stakeholder framework for project success drawing from available literature and interviews with project managers was formulated from literature as shown below in Figure. This stakeholder framework was evaluated through quantitative surveys involving South African IT project stakeholders across diverse industries. As a result, a comprehensive IT project stakeholder framework has been devised to supplement project-specific metrics.

4.19 Summary.

The chapter looked at the research methodology and design adopted in this research. Structural Equation Modelling (SEM) is a statistical tool commonly used by social science researchers, and it was discussed in this chapter, including its major building blocks such as factor, regression analysis, and correlation analysis. The Reliability and Validity of Data of data instruments were also discussed. Possible ethical issues were also detailed. A statement of the problem was presented at the beginning of the chapter, followed by the research methodology and design. The researcher employed the research process onion model to create a cohesive structure and direction for this study. The research questions were also presented. When undertaking a research study, researchers can choose from various research philosophies, and the research philosophy adopted in the study was also explained. The study utilised the quantitative approach, which is detailed in this chapter with the relevant justification for its use. The quantitative approach was adopted to identify causal relationships between dependent and independent variables. The population and sampling approaches are also discussed. Data collection is the systematic process of gathering and analysing the data. The chapter also details the data-collecting instruments, sources, and procedures and highlights the data-analysis procedure. The next Chapter looks at the Findings, Data Analysis and Discussions.

CHAPTER 5

DATA ANALYSIS, FINDINGS AND DISCUSSIONS

5.1 Introduction

The previous chapter focused on the research methodology and research plan employed in the study to achieve the objectives. It outlined research topics, demographics, sampling methodologies, data collection and analysis methods, and ethical considerations integral to the study. The study employed a mono-method quantitative research methodology, gathering data through self-administered online surveys using the Lime Survey platform. These surveys were distributed based on snowball sampling due to the challenges in locating practitioners in the AI industry. This chapter presents the data and discussion of the findings. Structural Equation Modelling was used for data analysis. The SEM has two parts; the first part is a confirmatory factor analysis of the measurement model, which measures how well the variables fit reality (Ramlall, 2017). The next part is the structural model representing the interrelationship of variables between constructs (Hair et al., 2018). This study used SPSS® AMOS® Version 29 to analyse the data. Generative AI (Microsoft Copilot, 2024) was also used to assist in interpreting the output from SPSS. Reliability and validity were considered in the analysis. This research aimed to develop a model for stakeholder management in the IT industry in the fourth industrial revolution.

5.2 Stakeholder Management Challenges

Factor Analysis

Table 5.1: Correlation Matrix[a]

[a]Determinant = .031		
KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.623
Bartlett's Test of Sphericity	Approx. Chi-Square	185.816
	df	28
	Sig.	<.001

(IBM SPSS Amos)

5.2.1 Factor analysis summary

The correlation matrix determinant or value 0.031 is small, suggesting that the correlation matrix might be close to singular or ill-conditioned. This could indicate issues with multicollinearity among the variables, or it might imply that the variables are not sufficiently independent of each other. KMO values range from 0 to 1, with values closer to 1 indicating that factor analysis may be appropriate. Values above 0.6 are generally acceptable; however, values higher than 0.7 are preferred for better sampling adequacy. The KMO value is 0.623 in this instance, which indicates that while factor analysis may be feasible, the sampling adequacy is only marginally acceptable. Bartlett's Test of Sphericity with Approx. Chi-Square = 185.816; df = 28, and Sig. < .001 indicating that the correlations among variables are sufficient to proceed with factor analysis (Hu and Bentler, 1999).

5.2.2 Communalities

Table 5.2: Communalities for Stakeholder Challenges

(IBM SPSS Amos)

	Initial	Extraction
Difficulty in identifying stakeholder	1.000	.756
Stakeholder resistance to change	1.000	.690
Balancing the expectations of multiple stakeholders	1.000	.767
Limited stakeholder involvement.	1.000	.799
Addressing ethical concerns related to AI and automation	1.000	.566
Ensuring data privacy for stakeholders	1.000	.854
Ensuring data security for stakeholders	1.000	.866
Lack of soft skills to achieve deliverables	1.000	.403

Extraction Method: Principal Component Analysis.

Communalities illustrate how much information each variable contributes to the underlying factors. Initial communities represent the proportion of variables in each that are valuable and explained by the original data. Each variable starts with an initial commonality of one because this is the same as itself. Extraction communities represent the proportion of variance in each variable explained by the extracted components, which are the principal components. Extraction communities are typically lower than initial communalities because PCA reduces dimensionality by combining variables. Valuables with higher extraction communities that are closer to 1 contribute more to the extraction components. Variables with lower extraction communalities may not be well represented by the extracted components. For example, ensuring data security for stakeholders has a higher extraction communality of 0.866, indicating that it aligns very well with extracted components. Stakeholder resistance to change is a moderate extraction communality of 0.690. The variables with low community were examined to determine if they should be revised or removed entirely from the analysis. Considerations were made to ascertain whether they were aligned with the factors measured or measured a different concept.

5.2.3 Total Variance

Table 5.3: Total Variance for Stakeholder Challenges

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	3.002	37.522	37.522	3.002	37.522	37.522	2.769
2	1.438	17.979	55.501	1.438	17.979	55.501	1.787
3	1.260	15.752	71.253	1.260	15.752	71.253	1.687
4	.811	10.140	81.393				
5	.611	7.634	89.027				
6	.439	5.484	94.510				
7	.368	4.598	99.109				
8	.071	.891	100.000				

Extraction Method: Principal Component Analysis.

[a]When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

(IBM SPSS Amos)

For Component 1, the initial Eigenvalue: 3.002 and explains 37.522% of the total variance. For **Component 2**, the initial Eigenvalue is 1.438 and explains 17.979% of the total variance. The cumulative variance explains 55.501%. For **Component 3**, the initial Eigenvalue is 1.260 and explains 15.752% of the total variance. The cumulative variance explained: 71.253%. **Components 4 to 8** are not explicitly extracted (Eigenvalues are less than 1). They do not significantly contribute to the variance. When components are correlated, sums of squared loadings cannot be directly added to obtain a total variance (Ramlall, 2017). In summary, the first three components capture most of the variance in the data. The factors extracted were then analysed in order to understand what constructs they represented and how well the variables with high communalities align with these constructs.

5.2.4 Pattern Matrix

Table 5.4: Stakeholder Challenges Pattern Matrix[a]

	Component		
	NEQFact1	NEQFact2	NEQFact3
Ensuring data security for stakeholders	.916		
Ensuring data privacy for stakeholders	.914		
Addressing ethical concerns related to AI and automation	.713		
Lack of soft skills to achieve deliverables	.605		
Limited stakeholder involvement.		.903	
Difficulty in identifying stakeholder		.819	
Balancing the expectations of multiple stakeholders			.873
Stakeholder resistance to change			.821

Extraction Method: Principal Component Analysis.

Rotation Method: Promax with Kaiser Normalization.[a]

[a]Rotation converged in 5 iterations.

(IBM SPSS Amos)

The pattern matrix displays the factor loadings of each variable on the exacted factors, with higher loadings which are close to 1 indicating a strong relationship between the variables and the factor (Awang et al. 2016). The rotation method allows factors to be tested for correlation.

NEQFact1 (Factor 1) indicates high loadings in the following aspects such as ensuring data security for stakeholders with a value of 0.916 as well as ensuring data for stakeholders with a reading of 0.914, addressing ethical concerns related to AI in automation, which is a value of 0.713 lacking skills to achieve deliverables as a lower value of 0.605. Analysing the given aspects and their loadings indicates that this factor constitutes issues related to data security, privacy, ethical concerns, and soft skills. Thus, this factor was interpreted as reflecting **“Stakeholder data and skills concerns.”**

NEQFact2 (Factor 2) indicates high loadings in the following aspects: limited stakeholder involvement, which has a value on the table of 0.903, and difficulty identifying stakeholders on the same Pattern Matrix table, which indicates 0.819. This was identified as **“Stakeholder engagement and identification”.**

NEQFact3 (Factor 3) indicates high loadings for balancing the expectations of multiple stakeholders, which has a value on the pattern matrix of 0.873 and takes all that resistance to change, which on the same pattern matrix is the value of 0.821. This factor was labelled as **“Stakeholder expectation, management and resistance.”** The correlations between the factors were analysed further to understand their relationship and how they interact. This is elaborated on in the Structure Matrix in the next section.

5.2.5 Structure Matrix

Table 5.5: Structure Matrix

	Component		
	1	2	3
Ensuring data security for stakeholders	.920		.303
Ensuring data privacy for stakeholders	.913		
Addressing ethical concerns related to AI and automation	.700	.303	
Lack of soft skills to achieve deliverables	.622		
Limited stakeholder involvement.		.892	
Difficulty in identifying stakeholder	.343	.858	
Balancing the expectations of multiple stakeholders			.868
Stakeholder resistance to change			.829

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

(IBM SPSS Amos)

The structure matrix provides another insight, over and above the pattern matrix, showing the link between variables and factors. This is the understanding of how variables line up with factors.

Analysing the structure matrix metrics shows that Component 1 has high loadings in various aspects. The aspects are as follows: there is a high loading in “ensuring data security for stakeholders” with a value of 0.920; the next high loading is in the aspect of ensuring data privacy for stakeholders with 0.913; addressing ethical concerns related to AI and automation is next in line with the value of 0.700, and finally lack of skills to achieve project deliverables is 0.622. In summary, consistent with the previous interpretation, these aspects can be grouped as “**Stakeholder data and skills concerns**”.

Component 2 reflects high loading in issues around “limited stakeholder involvement”, which is 0.892; “difficulty in identifying stakeholders”, which has a value of 0.858; and “addressing ethical concerns related to AI in automation”, which has a value of 0.303. It can be seen that this is consistent with the previous interpretation that these aspects can be grouped under the banner “**Stakeholder engagement and identification**”.

Component 3 exhibits high loadings in “balancing expectation of multiple stakeholders”, with a value of 0.868, as well as Stakeholder resistance to change (0.829) and addressing ethical concerns related to AI in automation (0.303). Inherent in these high loadings is “**Stakeholder expectation, management and resistance**”.

Some variables load onto more than one factor, as reflected by the structure matrix above. For example, “addressing ethical concerns related to AI and automation” is one of the factors. This implies that the variable has complex roles in different constructs. Practically speaking, project management organisations must consider these factors when planning projects.

5.2.6 Component Correlation Matrix

Table 5.6: Component Correlation Matrix

Component Correlation Matrix

Component	1	2	3
1	1.000	.250	.211
2	.250	1.000	.135
3	.211	.135	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

(IBM SPSS Amos)

The component correlation matrix above displays correlations between the extracted components after the rotation. This matrix helps understand the relationships between the factors.

Component 1 and Component 2 have a correlation of 0.250, implying that there is a moderate positive correlation between them. This suggests that though these components seem distinct, they share some common variance. Component 1 and Component 3 have a Correlation of 0.21, implying a weak positive between the two; thus, it can be inferred that these components are largely independent of each other. Lastly, Component 2 and Component 3 have a very low correlation of 0.135, suggesting that these components are quite distinct from one another. The low to moderate correlations between components indicate that the factors are relatively independent. This is ideal for clear interpretation and use (Hu and Bentler, 1999). Also, given that the components are somewhat independent, the extracted factors were used to represent distinct constructs.

5.3 Effective Management of Stakeholder

Factor Analysis

Table 5.7: Correlation Matrix

Correlation Matrix[a]

[a]Determinant = .006

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.759
Bartlett's Test of Sphericity	Approx. Chi-Square	234.277
	df	36
	Sig.	<.001

5.3.1 Factor Analysis Summary

As alluded to earlier, KMO assesses the adequacy or sufficiency of data for factor analysis. Values close to 1 indicate suitability for factor analysis. The value of 0,759 above indicates, thus, that the data is reasonably appropriate for factor analysis. The value is above the acceptable threshold of 0. 7 (Taber, 2018). In other words, the correlations between variables are adequate for factor analysis to be instituted on that data so as to derive meaningful factors. Bartlett's Test of Sphericity checks whether the correlation matrix significantly differs from an identity matrix (i.e., whether there are meaningful relationships between variables). The chi-square value (approx. 234.277) and the associated significance level (<0.001) indicate that these correlations are not due to chance. Therefore, as indicated by the values, the data was suitable for factor analysis.

5.3.2 Communalities for Effective Stakeholder Management

Table 5.8: Communalities

Communalities

	Initial	Extraction
Regular communication with stakeholders	1.000	.773

Transparent communication with stakeholders	1.000	.653
Engaging stakeholders in the project planning process	1.000	.608
Engaging stakeholders in the decision-making process	1.000	.449
Proactive mitigation of risks related to stakeholder concerns.	1.000	.465
Leveraging data analytics for informed stakeholder engagement	1.000	.841
Leveraging data AI for informed stakeholder engagement	1.000	.910
Agile project management methodologies for flexibility in adapting to changing stakeholder needs	1.000	.471
Collaborative tools for efficient communication	1.000	.656
Extraction Method: Principal Component Analysis.		

(IBM SPSS Amos)

From the above table, “leveraging data AI for informed to stakeholder engagement” has a value of 0.910, followed by “leveraging data analytics for informed stakeholder engagement” with a value of 0.841. These constituted the higher communalities, and the implication was that these factors explained the major portion of their variance. Next in line were the moderate values that implied that the extracted factors were well represented. These included “regular communication with stakeholders” (0.773) and “transparent communication with stakeholders” (0. 653). The variables with lower communities included “engaging stakeholders in the decision-making process” (0.449) and “proactive mitigation of risks related to stakeholder concerns” (0.465). The communalities assisted in comprehending how the variables fit into the factor structure and helped in understanding how any variables might have needed further investigation.

The communalities represent the proportion of variance inherent in each variable or item that is explained by the extracted components. The initial communalities values are all one at the beginning, and this implies that the variables explain 100% of their own variance. The underlying assumption is that the variable is independent. Usually, after performing factor analysis or extraction, the communalities change. Generally, the extraction of communality shows the proportion of variance that is accounted for by the components. For instance, “leveraging AI data for informed stakeholder engagement” has a high extraction communality of 0.910, implying that this factor contributes significantly to one of the extracted components. On the other hand, “engaging stakeholders in the decision-making process” has a low extraction communality of 0.449, meaning it has less contribution to the extracted factors. Practically speaking, variables with higher extraction communalities are more relevant to the components that have been identified, and conversely, variables with lower communalities may not align strongly with any specific factor.

5.3.3 Total Variance

Table 5.9: Total Variance

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	4.376	48.627	48.627	4.376	48.627	48.627	4.251
2	1.450	16.109	64.736	1.450	16.109	64.736	2.259
3	.959	10.653	75.389				
4	.732	8.128	83.517				
5	.436	4.846	88.363				
6	.398	4.421	92.784				
7	.338	3.759	96.544				
8	.172	1.906	98.450				
9	.140	1.550	100.000				

Extraction Method: Principal Component Analysis.

[a]When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

(IBM SPSS Amos)

The eigenvalues show the variance in the data explained by each principal component, whilst the percentage of variance indicates the percentage of total variance explained by each component. The cumulative percentage shows the cumulative variance that is explained by that component (Saied, 2024). Extraction sums of squared loadings account for the variance explained by the components retained after the extraction process. The rotation of data redistributes variance across components and makes them more interpretable. The rotation sums of squared loadings are done to make the interpretation of components easier, and these values represent the variance explained by the rotated components.

Component 1 has an Eigenvalue of 4.376 after the initial extraction. This component explains 48.627% of the overall variance, and after rotation, it still retains a significant amount of variance while being slightly less at 4.251.

Component 2 has an eigenvalue of 1.450 and explains an additional 16.109% of the variance. After rotation, the contribution increases to 2.259, suggesting that rotation made this component more prominent or influential in explaining the variance.

Components 3 through 9: Eigenvalues of less than one means that these components explain less variance in the data compared to those with eigenvalues greater than one. The cumulative variance accounted for by Component 1 and Component 2 is a total of 64.736, which is deemed sufficient for analysis. The percentage means that they captured much of the data. The variance after rotation is still significant, suggesting that they are crucial for understanding the underlying structure of the data. Components with eigenvalues below one are not retained as they contribute much less to the explained variance.

5.3.4 Pattern Matrix

Table 5.10: Pattern Matrix

Pattern Matrix[a]

	Component	
	EMFact1	EMFact2
Regular communication with stakeholders	.919	
Transparent communication with stakeholders	.829	
Engaging stakeholders in the project planning process	.790	
Collaborative tools for efficient communication	.738	
Agile project management methodologies for flexibility in adapting to changing stakeholder needs	.679	
Engaging stakeholders in the decision-making process	.653	
Proactive mitigation of risks related to stakeholder concerns.	.635	
Leveraging data AI for informed stakeholder engagement		.987
Leveraging data analytics for informed stakeholder engagement		.855

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization[a]
[a]Rotation converged in 3 iterations.

(IBM SPSS Amos)

Component Loadings (EMFact1 and EMFact2)

EMFact1 and EMFact2 are the rotated components. The loadings reflect the contribution of each variable to the component, and higher absolute values indicate a stronger relationship.

Component EMFact1 has high loadings in variables such as “regular communication with stakeholders”, which has a value of 0.919; “transparent communication with stakeholders”, with a value of 0.829; and “engaging stakeholders in the project planning process”, which has a loading of 0.790. Thus, to sum it up, EMFact1 appears to represent a factor related to **“stakeholder engagement and communication**”, which focuses on direct human-centred approaches to managing stakeholder relationships.

Component EMFact2 has high loading in variables that entail firstly “leveraging data AI for informed stakeholder engagement” with (0.987), followed by “leveraging data analytics for informed stakeholder engagement” with 0.855. The component focuses on the **“use of data and technology in stakeholder engagement”.**

The variables load clearly and cleanly onto one factor, thus indicating that the two components are different and represent distinct concepts. In summary, the analysis has identified two distinct factors in the data: one that focuses on communication and stakeholder engagement and the other that centres on leveraging data technologies. These components were then used to interpret the structure of the dataset.

5.3.5 Structure Matrix

Table 5.11: Structure Matrix

(IBM SPSS Amos)

	Component	
	1	2
Regular communication with stakeholders	.868	
Transparent communication with stakeholders	.805	
Collaborative tools for efficient communication	.794	.417
Engaging stakeholders in the project planning process	.779	
Agile project management methodologies for flexibility in adapting to changing stakeholder needs	.686	
Proactive mitigation of risks related to stakeholder concerns.	.673	.328
Engaging stakeholders in the decision-making process	.669	
Leveraging data AI for informed stakeholder engagement		.947
Leveraging data analytics for informed stakeholder engagement	.440	.906

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

The structure matrix is an output of factor analysis, especially when using oblique rotation methods such as ProMax. The pattern matrix shows the unique contribution of each variable to a factor, but the structure takes this further and shows the correlations between them. The loadings in the above structure matrix reveal the correlation between each variable and the extracted components, with higher absolute values indicating a stronger correlation with the component.

It can be seen that “regular communication with stakeholders” (0.868) is strongly correlated with Component 1 as well as “transparent communication with stakeholders” (0.805) and “collaborative tools for efficient communication” (0.794) also showed high correlations with the same Component 1, thus inferring that these are closely associated with the first component. Engaging stakeholders in the project planning process (0.779) also loads onto Component 1, thus reinforcing the interpretation that this component reflects “Stakeholder engagement and communication”.

On the other hand, “leveraging data AI for informed stakeholder engagement” (0.947) shows a very strong correlation with Component 2 as well as does “leveraging data analytics for informed stakeholder engagement” (0.906) that has a high loading also on Component 2 and this reinforces the conclusion that this component is focusing on “data-driven decision making”.

However, “collaborative tools for efficient communication” with (0.417) and “proactive mitigation of risk related to stakeholders concerns” (0.328) have a moderate correlation with Component 2. Thus, they have an indirect link and linkage primarily to Component 1. So, collaborative tools for efficient communication have moderate loadings on Component 1 and Component 2, which suggests that they contribute in various measures to both components.

Component 1 is characterised by variables that emphasise regular transparent communication, stakeholder involvement in planning, and other collaborative tools. Their high correlations imply that the aspects are strongly correlated and that they form a cohesive factor, which can be summarised as explaining “traditional engagement-focused aspects of stakeholder management.” Component 2 reflects a more technology-centric approach since it is dominated largely by using AI and data analytics for informed stakeholder engagement. In summary, factor analysis has unveiled two separate components that are related to stakeholder engagement, i.e. “Communication and engagement practices”, which focus on strategies and tools that facilitate effective stakeholder communication and involvement, and secondly “, data-driven stakeholder engagement”, which emphasises on the use of data and application of technology to enhance stakeholder engagement.

5.3.6 Component Correlation Matrix

Table 5.12: Component Correlation Matrix

Component Correlation Matrix

Component	1	2
1	1.000	.338
2	.338	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

(IBM SPSS Amos)

The correlation matrix displayed in the above table shows the relationship between the factors extracted during the execution of the principal component analysis (PCA) using ProMax rotation. The unit values indicated in the component correlation matrix represent the correlation of each component with itself, and this will always be a unit. The correlation between component 1 and component 2 is 0.338, which indicates a moderately strong positive correlation. This value indicates that the two components cannot be viewed as entirely independent while capturing different aspects of the data. Some overlap implies that changes in one component may be related to changes in the other. As such, the moderate correlation is supported by the ProMax oblique rotation method.

It also infers that identified factors such as “stakeholder engagement and communication”, and “data-driven decision-making “may have some influence over each other to a certain extent. For instance, how an organisation approaches traditional stakeholder engagement may be linked to how it uses data-driven tools, even though they are still largely separate strategies. This means that, whilst focusing on improving communication and stakeholder engagement (i.e., Component 1), there may be some inherent impacts on the data-driven data approaches (i.e., component 2) and vice versa.

This is crucial when designing integrated strategies where improvements in a certain area can potentially support or enhance another area. This becomes valuable contextually when both traditional and data-driven approaches to stakeholder management are being concurrently implemented.

5.4 Stakeholder Satisfaction

Factor Analysis

Table 5.13: Correlation Matrix

Correlation Matrix[a]
[a]Determinant = 1.59E-005

(IBM SPSS Amos)

5.4.1 Factor Analysis Summary

When ascertaining the suitability of data for factor extraction, the correlation matrix and its associated determinant are key factors to be considered. The determinant of the correlation matrix (1.59E-005) is very close to zero,0 and this implies that the variables in question are highly correlated. When doing factor analysis, a very low determinant value close to zero indicates multicollinearity amongst the variables, and as such, they are not independent of each other. The low value of the determinant also suggests that the data is ideal for factor analysis, and it means that the variables have sufficient correlation for meaningful components to be extracted. The correlations are strong enough to support the extraction of meaningful factors.

Table 5.14: Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO)

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.785
Bartlett's Test of Sphericity	Approx. Chi-Square	499.098
	df	66
	Sig.	<.001

(IBM SPSS Amos)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) is 0.785, indicating that underlying factors can account for a substantive amount of variance in the data. It shows an adequate sampling adequacy. Bartlett's Test of Sphericity has a Chi-Square value of 499.098 with 66 degrees of freedom (df) and a significance level (Sig.) of < 0.001. As explained earlier, Bartlett's Test of Sphericity verifies whether the correlation matrix is an identity matrix. This would indicate whether the variables are unrelated, making them unsuitable for structure detection. The significance level (Sig.) of < 0.001 indicates the presence of a pattern in the relationship between the variables. This would then render the data suitable for factor analysis.

5.4.2 Communalities

Table 5.15: Communalities

Communalities

	Initial	Extraction
Clear communication with stakeholders	1.000	.847
Regular communication with stakeholders	1.000	.808
Active involvement of stakeholders in decision-making	1.000	.639
Proactive risk management	1.000	.849
Proactive risk resolution	1.000	.827
Utilisation of agile project management methodologies	1.000	.654
Collaborative digital platforms	1.000	.803
Data analytics insights for decision-making	1.000	.833
Data AI-driven insights for decision-making	1.000	.772
Actionable stakeholder feedback	1.000	.817
Timely stakeholder feedback	1.000	.867
Transparent reporting of project progress	1.000	.804

Extraction Method: Principal Component Analysis.

(IBM SPSS Amos)

The communality shown in Table 5.15 after the extraction (using PCA) is generally high for most of the variables and shows that the extracted factors explain quite a substantive portion of the variance in these variables. When the extraction values exceed 0.6, they are considered adequate, and as can be seen from the table, most of these values above exceed the threshold, suggesting that the model is a good fit for the data.

5.4.3 Total Variance

Table 5.16: Total Variance

(IBM SPSS Amos)

Total Variance

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	6.655	55.460	55.460	6.655	55.460	55.460	5.682
2	1.813	15.107	70.567	1.813	15.107	70.567	4.627
3	1.050	8.747	79.314	1.050	8.747	79.314	4.485
4	.600	5.002	84.316				
5	.486	4.047	88.363				
6	.353	2.938	91.301				
7	.289	2.406	93.707				
8	.242	2.013	95.720				
9	.193	1.609	97.329				
10	.172	1.434	98.762				
11	.090	.749	99.511				
12	.059	.489	100.000				

Extraction Method: Principal Component Analysis.

[a]When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

For Component 1, the Initial Eigenvalue is 6.655 %, and the Percentage of Variance Explained is 55.460%. After rotation, the total variance explained by the component 1 is adjusted to 5. For Component 2, the Initial Eigenvalue is 1.813, and the Percentage of Variance Explained is 15.107%. The total cumulative percentage for both Component 1 and Component 2 is 70.567%. For Component 2, the total variance explained is adjusted to 4.627 after rotation. For component 3, the initial Eigenvalue is 1.050, and the

Percentage of Variance Explained is 8.747%, whereas the Cumulative percentage of all the components is 79.314%. The total variance explained by Component 3 is adjusted to 4.485 after rotation.

Components 4 through 12 have eigenvalues below 1, implying that they contribute less variance than a single variant. Thus, they are typically not taken into consideration for returning to PCA analysis under the Kaiser criterion.

On the other hand, the first three components have eigenvalues that are more than 1 and combined; they explained 79.314% of the variance in the data set under analysis. As such, these three components provide a good representation of the underlying structure of the data. Rotation did not change the total sum of variance explained; rather, it just improved interpretability by redistributing the explained variance among the components. The rotation sums of the squared loadings column attest to this deduction, and it can be seen that the variance is spread more evenly across the first three components. In summary, the analysis identified three primary components that captured the majority of the variance in the data, which suggests that the components capture most of the essential information.

5.4.4 Pattern Matrix

Table 5.17: Pattern Matrix

Pattern Matrix[a]

	Component		
	SSFact1	SSFact2	SSFact3
Timely stakeholder feedback	.974		
Clear communication with stakeholders	.936		
Transparent reporting of project progress	.905		
Regular communication with stakeholders	.851		
Actionable stakeholder feedback	.805		
Data analytics insights for decision-making		.944	
Data AI-driven insights for decision-making		.933	
Collaborative digital platforms		.843	
Utilisation of agile project management methodologies		.686	
Proactive risk management			.973
Proactive risk resolution			.887
Active involvement of stakeholders in decision-making			.560

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization[a]
[a]Rotation converged in 5 iterations.

(IBM SPSS Amos)

As explained before, the pattern matrix shows the loadings after the rotation process, and hence, it reveals the unique contribution of each variable relative to the respective component whilst, at the same time, it also accounts for any correlations between the components.

SSFact1 (Stakeholder Communication and Feedback)

"Timely stakeholder feedback" with 0.974 and "clear communication with stakeholder" with 0.936, and "transparent reporting of project process" (0.905) all load significantly onto the "stakeholder communication and feedback" factor. This component, thus, reflects "Stakeholder communication and feedback processes" within the field of project stakeholder management.

SSFact2 (Data-Driven Decision-Making):

"Data analytics insights for decision-making" with 0.944; "Data AI-driven insights for decision making" with 0.933; and "Collaborative digital platform" with 0.843 all load onto the "data-driven decision-making component". This factor focuses on the application and use of data analytics and AI in decision-making processes. It also emphasises the role of technology in stakeholder management.

SSFact3 (Risk Management):

This component is dominated by "proactive risk management "(0.973), as well as "proactive risk resolution" (0.887). It centres on managing and resolving risks. This is one of the key aspects in ensuring project stability and stakeholder satisfaction (Chipulu, 2022).

As can be seen from the pattern matrix, it clearly shows that the variables load cleanly into the above three distinct components, and thus, the interpretation is straightforward. Each individual component is representative of a distinct aspect of stakeholder project management. The cross-loadings from the pattern matrix are minimal, implying that each variable can be strongly associated with only one component. Thus, the factors could be clearly defined.

5.4.5 Structure Matrix

Table 5.18: Structure Matrix

Structure Matrix

	Component		
	1	2	3
Timely stakeholder feedback	.927	.362	.512
Clear communication with stakeholders	.913	.348	.543
Transparent reporting of project progress	.897	.421	.508
Actionable stakeholder feedback	.896	.477	.613
Regular communication with stakeholders	.871	.570	.444
Data analytics insights for decision-making	.357	.908	.441
Collaborative digital platforms	.440	.890	.527
Data AI-driven insights for decision-making	.391	.866	.312
Utilisation of agile project management methodologies	.478	.792	.530
Proactive risk management	.484	.416	.919
Proactive risk resolution	.535	.483	.909
Active involvement of stakeholders in decision-making	.634	.494	.759

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

(IBM SPSS Amos)

After rotation, the Structure Matrix in factor analysis shows the correlations between the variables and the components (factors). This matrix differs from the pattern matrix because it includes direct and indirect relationships between the variables and the factors.

Interpreting the Structure Matrix:

“Timely Stakeholder feedback” with 0.927, followed by “Clear Communication with stakeholders” (0.913) and “Transparent Reporting of project progress” with 0.897; ”Actionable stakeholder feedback” with 0.896; “Regular communication with stakeholders” with 0.871, are highly correlated to Component 1. This confirms that this component represents aspects of “Stakeholder Communication and Feedback”.

“Data Analytics insights for decision-making” with 0.908, “Collaborative Digital platforms” with 0.890 “, Data AI-driven insights for decision-making” with 0.866 and finally “Utilisation of Agile project management methodologies” with 0.792, are all highly correlated to Component 2. This confirms the importance of data-driven decision-making and the use of digital tools in Project Management.

"Proactive Risk Management" with 0.919, followed by "Proactive Risk Resolution", with 0.909, and "Active involvement of stakeholders in decision-making", with 0.759, are all highly correlated to Component 3. This component focuses on managing and resolving risks, involving stakeholders in decision-making, and mitigating potential risks.

"Timely stakeholder feedback" also has 0.512 with Component 3; "Active involvement of stakeholders in decision-making" has 0.634 with Component 1 and 0.494 with Component 2 and 0.759 with Component 3. Thus, these show moderate correlations with several other components. This suggests that these variables are not unique to only one component. The presence of these moderate cross-correlations implies that the components are somewhat distinct. However, there is some interconnectedness with other components. For example, "Proactive risk management" correlates with risk management (Component 3), and yet it also has some relevance to stakeholder communication (Component 1) and data-driven decision-making (Component 2).

5.4.6 Component Correlation Matrix:

Table 5.19: Component Matrix

Component Correlation Matrix

Component	1	2	3
1	1.000	.474	.577
2	.474	1.000	.499
3	.577	.499	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

From the above component correlation matrix, it is evident that Component 1 and Component 2 have a relationship to some extent, although they are still distinct. Component 1 and Component 2 have a correlation of 0.474, as shown in the table above. To a certain extent, the moderate correlation implies a relationship between Stakeholder Communication and Feedback (Component 1) and Data-driven Decision-making (Component 2). This can be interpreted to mean that changes in one may influence the other.

The higher correlation (0.577) between Component 1 and Component 3 (Risk Management) infers a strong relationship between the two aspects. They are not mutually exclusive. The correlation of 0.499 implies a moderate relationship between Data-Driven Decision-Making (i.e., Component 2) and Component 3. There is evident interdependence between the variables. Managing these aspects separately might overlook the mutual benefits of their linkages. This implies that a change in one potentially impacts the other. In that case, an integrated approach may increase the chances of a positive project outcome. Understanding those mentioned above can be pivotal in developing sound project management strategies that take advantage of the inter-dependencies.

5.5 Project Success (Dependent Group)

Factor Analysis

Table 5.20: Correlation Matrix

Correlation Matrix[a]

[a]Determinant = .084

(IBM SPSS Amos)

5.5.1 Factor Analysis Summary

The correlation matrix above showed that the determinant value was not close to 0, and therefore, the data set was deemed appropriate for factor analysis. The determinant value of 0.084 implied that the variables had sufficient variance that allowed for meaningful factor extraction. This also proved the validity of the factor analysis results that we calculated, which included the component matrices, patent matrices and the correlations.

Table 5.21: KMO and Bartlett's Test

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.706
Bartlett's Test of Sphericity	Approx. Chi-Square	114.618
	df	15
	Sig.	<.001

(IBM SPSS Amos)

The KMO value of 0.706 implied that the data set had enough sampling for factor analysis, which meant that the correlations across the variables were strong enough to extract meaningful factors.

The chi-square statistic of **114.618** with **15** degrees of freedom is significant at **$p < 0.001$**. A significant result ($p < 0.05$) indicated that the variables were sufficiently correlated to go ahead with factor analysis. The result ($p < 0.001$) indicates that the correlation matrix is not an identity matrix; thus, there are correlations between variables. This supports the appropriateness of factor analysis because it implied that it would most likely yield meaningful factors.'

5.5.2 Communalities

Table 5.22: Communalities

Communalities

	Initial	Extraction
The outcomes of the project being used by its intended end users	1.000	.760
The project making a visible positive impact on the target beneficiaries	1.000	.792
Project specifications being met by the time of handover to the target beneficiaries	1.000	.712
Project team members being satisfied with the process by which the project was implemented	1.000	.778
The project having minimal start-up problems	1.000	.551
The project directly leading to improved performance for the end users/target beneficiaries	1.000	.791
Extraction Method: Principal Component Analysis.		

(IBM SPSS Amos)

The communality table (Table 2.22) above demonstrate how the variance in each variable is explained by the extracted factors in factor analysis. The tables show most variables have extraction communalities ranging from 0.551 to 0.792, suggesting the factors extracted explained a huge portion of the variance in these variables. The inference is that the extracted factors reflect significant aspects of the original variables. "The project having minimal start-up problems" has the lowest extraction communality of 0.551, suggesting less variance in this variable is accounted for by the extracted factors compared to others.

The communality table gives an insight into how the variances in each variable are explained by the extracted factors in analysis. The table shows most variables have extraction communalities ranging from 0.551 to 0.792, suggesting the factors extracted explained a huge portion of the variance in these variables. In general, high extraction and communalities across variables support the effectiveness of the factor analysis process (O'Leary, 2017). The inference is that the extracted factors reflect significant aspects of the original variables. "The project having minimal start-up problems" has the lowest extraction communality of 0.551, suggesting less variance in this variable is accounted for by the extracted factors compared to others. This variable is either not well represented by the factors or may have a unique variance that is not captured.

5.5.3 Total Variance

Table 5.23: Total Variance

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	2.969	49.476	49.476	2.969	49.476	49.476	2.583
2	1.416	23.597	73.072	1.416	23.597	73.072	2.335
3	.650	10.834	83.906				
4	.401	6.677	90.583				
5	.342	5.695	96.278				
6	.223	3.722	100.000				

Extraction Method: Principal Component Analysis.

[a]When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

(IBM SPSS Amos)

The total variance explained in the table above shows that the first component is responsible for about 49.5% of the total variance in the data, implying that it captures almost half of the variability in the data. The second component accounts for 23.6% of the variance, and Component 1 and Component 2 combined account for almost 73.1% of the overall variance in the data. Component 3 explains 10.8% of the variance, whilst combining Component 1, Component 2, and Component 3 gives a cumulative variance of about 83.9%. Components 4 to 6 combined explain lesser amounts of the variance in the data and hence contribute less significantly than the first three components.

Component 1 and component 2 still capture the same percentage of variance as before extraction. The Extraction Sums of Squared Loadings show this in the table above. Components 3 to 6 are not indicated in the extraction sums, suggesting that only the first two components (that account for 73% of variance before and after rotation) are retained after extraction in the final solution. These are the principal components explaining most of the variance in the data set. Rotation did not fundamentally change the significance of these two components.

5.5.4 Pattern Matrix

Table 5.24: Patten Matrix

Pattern Matrix[a]

	Component	
	PSFact1	PSFact2
The project making a visible positive impact on the target beneficiaries	.919	
The outcomes of the project being used by its intended end users	.871	
The project directly leading to improved performance for the end users/target beneficiaries	.847	
Project team members being satisfied with the process by which the project was implemented		.903
Project specifications being met by the time of handover to the target beneficiaries		.809
The project having minimal start-up problems		.748

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization[a]
[a]Rotation converged in 3 iterations.

(IBM SPSS Amos)

PSFact1

The pattern matrix above in the table shows PSFact1 as having high loadings in the following aspects: “The project making a visible positive impact on the target beneficiaries” (0.919); “The Outcomes of the project being used by its intended end users,” (0.871); “The project directly leading to improved performance for the end users/target beneficiaries,” (0.847). It can be seen from the foregone that PSFact1 is strongly associated with the impact and effectiveness of the project. It captures how well the project achieves its intended outcomes and, thus, benefits the end users.

PSFact2

PS fact 2 is high loadings in the following aspects: “Project team members being satisfied with the process by which the project was implemented” (0.903); “Project specifications being met by the time of handover to the target beneficiaries” (0.809) and “The project having minimal start-up problems,” (0.748). This factor reflects project management and operational efficiency.

5.5.5 Structure Matrix

Table 5.25: Structure Matrix

Structure Matrix

	Component	
	1	2
The project making a visible positive impact on the target beneficiaries	.885	
The project directly leading to improved performance for the end users/target beneficiaries	.884	.401
The outcomes of the project being used by its intended end users	.872	.306
Project team members being satisfied with the process by which the project was implemented		.880
Project specifications being met by the time of handover to the target beneficiaries	.371	.840
The project having minimal start-up problems		.742

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

(IBM. SPSS Amos)

From the above Structure Matrix table, it can be seen that Component 1 has a high positive loading for all the variables linked to the project's effectiveness and impact. It is high loadings in the following: “Project making a visible positive impact on the target beneficiaries” (0.885), “The project directly leading to improved performance for the end users/target beneficiaries” (0.884) and “The outcomes of the project being used by its intended end users,” (0.872).

It is evident that Component 2, as reflected in the Structure Matrix, can be seen to represent project management and operational efficiencies as it has high loadings in the following: “Project team members being satisfied with the process by which the project was implemented,” (0.880); “Project specifications being met by the time of handover to the target beneficiaries,” (0.840) and “The project having minimal start-up problems,” (0.742).

5.5.6 Component Correlation Matrix

Table 5.26: Component Correlation Matrix

Component Correlation Matrix

Component	1	2
1	1.000	.349
2	.349	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

(IBM SPSS Amos)

The positive correlation of 0.349, reflected in the table above, indicates a moderate relationship between the two components. The implication is that Components 1 and 2, whilst different aspects of the data, can be said to overlap. However, the components remain distinct factors despite the moderate correlation mentioned above, in that each captures different dimensions of project performance, namely effectiveness and management.

5.6 Model Variables

Observed, endogenous variables (Outcome Variables): PSFact1; PSFact2

Observed, exogenous variables (Factors/Dependent Variables): EMFact1; SSFact1; SSFact3; NEQFact1; NEQFact2; SSFact2; NEQFact3

Unobserved, exogenous variables (errors, linked): ePOS; ePTS

Descriptives [with new variables created]

Table 5.27: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Project outcomes successful – PSFact1	50	1.33	5.00	4.5067	.67424
Stakeholder Communication & Feedback, - SSFact1	51	1.00	5.00	4.5020	.70583
Effective Project Management – EMFact1	51	1.29	5.00	4.4258	.62824
Proactive Management & Active Stakeholder Involvement – SSFact3	51	1.67	5.00	4.4052	.71589
Data Analytics & AI; Digital Platforms & Agile PM Methods – SSFact2	51	2.00	5.00	4.1275	.81144
Leveraging AI & Data Analytics – EMFact2	51	1.50	5.00	4.1176	.84610
Project Team Satisfaction, targets met & minimal start-up problems – PSFact2	50	2.67	5.00	4.0533	.72644
Stakeholder management – NEQFact3	58	1.50	5.00	3.7414	.87480
Data Security, privacy, & ethical concerns – NEQFact1	58	1.25	5.00	3.5948	.91026
Stakeholder identification – NEQFact2	58	1.00	5.00	3.2931	1.00888
Valid N (listwise)	50				

(IBM SPSS Amos)

The table above of descriptive statistics gives a snapshot of the various project-related factors. It summarises how the respondents perceived the different aspects of the project. Generally, the mean score is above 4.0. This implies that most respondents responded in the affirmative to the different questions. They strongly agree on the project outcome, effective management communication practises and the use of technology.

Those moderate scores below 4 suggest more variability in the respondents' perception of these aspects' importance in measuring project success. These include factors such as stakeholder management, data security, and stakeholder identification. Consideration of the standard deviations, Effective Project Management, EMFact1 with 0.62824), reflect consistency in how the respondents perceive project management effectiveness. Stakeholder Identification (NEQFact2) with 1.00888 indicates significant variability in the responses, implying that the respondents had differing opinions.

Since most factors are rated positively, respondents strongly agreed on project success, communication, and management practices. Lower mean scores (i.e., for Stakeholder management, data security, and stakeholder identification indicate that respondents felt that they did not have a significant bearing on overall project success and stakeholder satisfaction.

5.7 Summary of Reliability Analysis

Table 5.28: Reliability analysis using Cronbach's alpha values

Factor	No Items	Cronbach's	Result
NEQFact1	4	0.809	Very Good
NEQFact2	2	0.691	Good
NEQFact3	2	0.637	Moderate
EMFact1	**7**	**0.872**	**Very Good**
EMFact2	**2**	**0.843**	**Good**
SSFact1	5	0.949	Excellent
SSFact2	4	0.890	Very Good
SSFact3	3	0.862	Very Good
PSFact1	3	0.850	Very Good
PSFact2	3	0.710	Good

(Author)

The above table summarises reliability analysis using Cronbach's alpha values for various factors. The table indicates the internal consistency of the items that make up each factor. Crobach's alpha values show how closely related a set of items are within a group. The values range from 0 to 1, whereby a higher value indicates better reliability.

Some guidelines for interpreting Cronbach's alphas are given below, according to Table 5.29 (2018).

Table 5.29: Cronbach's Alpha

Value Range	**Inference**
≥ 0.9:	Excellent
0.8 – 0.89:	Very Good
0.7 – 0.79:	Good
0.6 – 0.69:	Moderate
< 0.6	Poor

(Taber, 2018)

According to Cronbach's alpha, most factors in the Summary of Reliability Analysis table indicate good internal consistency. This shows the reliability measurement of the constructs they are intended to represent. A few factors, though, search is in NEQFact2 and NEQFact 3 have lower Cronbach's alpha values. PSFact 2 has good internal consistency, though on the lower side of the continuum. Overall, most of the scales exhibit good reliability, especially those with a higher number of items.

5.8 FIT indices for the Main model.

Table 5.30: Main model Fit Indices

FIT Test	**Level of Acceptance**	**Value**	**Interpretation**
RMSEA	<0.08	0.000	excellent fit
NFI	>0.09	0.949	very good fit
CFI	>0.09	1.000	perfect fit.
IFI	>0.09	1.046	excellent fit
RFI	>0.09	0.904	good fit
NNFI/TLI	>0.09	1.096	excellent fit

(Author)

RMSEA value of 0.000 is well below the 0.08 threshold. This indicates an excellent fit of the model to the data. A NFI (Normed Fit Index) of 0.949 is also above the 0.90 threshold, suggesting a very good fit. Thus, this model fits better than a null model. The null model assumes no relationships among the variables. A CFI (Comparative Fit Index) value of 1.000 indicates a perfect fit. This also implies that the model's fit is as good as possible compared to the null model. The IFI (Incremental Fit Index) value of 1.046 is above 0.90. This indicates an excellent fit. Values over 1.0 do occur, especially with very well-fitting models. RFI (Relative Fit Index) value of 0.904 is above the threshold of 0.90. Again, this indicates a good fit. This suggests that the model has good explanatory power compared to a baseline model.

NNFI/TLI (Non-Normed Fit Index/Tucker-Lewis Index) of 1.096 is well above the 0.90 threshold and hence suggests an excellent fit (Values above 1.0 are unusual but can indicate a very well-fitting model)—all the fit indices, in general, provided acceptable levels. The suggestion is that the model demonstrates an excellent fit to the data across multiple measures. This means that the specified model represents the underlying data structure well. As such, inferences based on this dataset are likely to be valid.

5.8.1 CMIN (Chi-square Minimum Fit Function Test)

Table 5.31: CMIN (Chi-square Minimum Fit Function Test)

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	35	10.402	19	.942	.547
Saturated model	54	.000	0		
Independence model	18	204.856	36	.000	5.690

(IBM SPSS Amos)

The P-value of 0.942 from the above CMIN table indicates that the model is not significantly different from the data. Generally, a $p > 0.05$ suggests a good fit (Kline, 2023). The CMIN/DF ratio of 0.547 is well below the commonly accepted threshold of 2 to 3 (Alareeni, 2024). This indicates an excellent fit. A ratio below 2 often suggests a very good model fit (Kline,2023). Thus, the default model is an excellent fit for the data. This is evidenced by the low CMIN/DF ratio and the high p-value. This indicates no significant difference between the model and the observed data (Cherry, 2013).

5.9 AMOS SEM Constructs for Composite model

5.9.1 SEM Quantitative Analyses

The preceding sections discuss the fit statistics around the constructs created for each model's independent variable that originated using the IBM SPSS AMOS Version 29 software.

5.9.2 Individual model constructs

Constructs were identified by factor analysis. They were analysed before they were incorporated into the final model. Fit statics were utilised to assess these individual constructs of the proposed model. The graphical illustrations were obtained from SPSS AMOS Version 29. Evaluations were iterated, and latent variables were updated until a good fit was achieved.

NEQ Factor 1

The model contains the following variables (Group number 1)

Observed, endogenous variables: NEQ8; NEQ7; NEQ6; NEQ9

Unobserved, exogenous variables: eNEQ8; eNEQ7; eNEQ6; eNEQ9; NEQDim1.

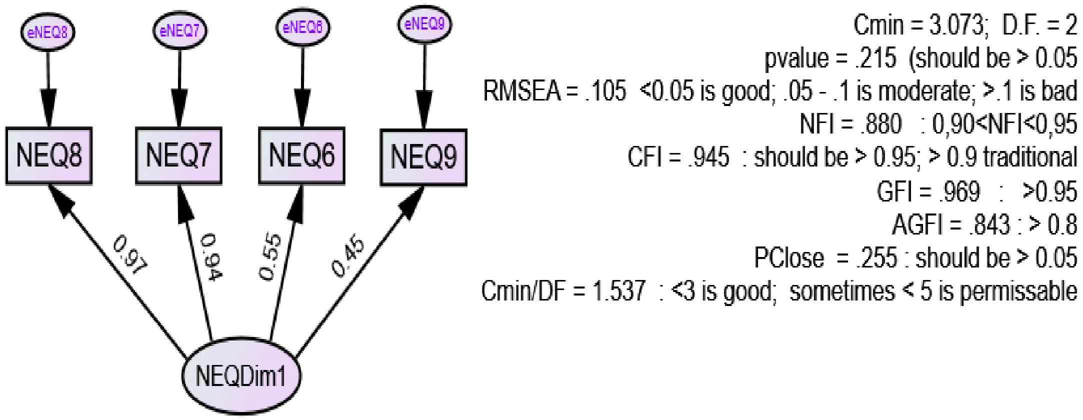

Figure 5.1: NEQ Factor 1

(IBM SPSS AMOS SEM Version 27)

Table 5.32: Latent Variable (NEQDim1)

ITEM	STATEMENT
NEQ6	Addressing ethical concerns related to AI and automation
NEQ7	Ensuring data privacy for stakeholders
NEQ8	Ensuring data security for stakeholders
NEQ9	Lack of soft skills to achieve deliverables

This represents a construct being measured by the observed variables: NEQ8, NEQ7, NEQ6, and NEQ9. The factor loadings indicate how strongly each observed variable is associated with the latent variable (Saied, 2024). Higher loadings imply stronger relationships between latent factors and observed variables (Woldearegay, 2015). Model Fit Indices provide insights into how well the model fits the observed data (Galahitiyawe, 2013). Cmin (Chi-square value): 3.073, DF (degrees of freedom) = 2. A lower value indicates a better fit (Hair et al., 2018). The degrees of freedom help interpret the chi-square result. The p-value is 0.215 (should be > 0.05). A non-significant p-value (>0.05) suggests that the model fits the data well. RMSEA (Root Mean Square Error of Approximation) is 0.105. (<0.05 is considered good; 0.05–0.1 is moderate and >0.1 indicates a poor fit); With RMSEA = 0.105, this falls into the "moderate" range, meaning the model is acceptable. NFI (Normed Fit Index): 0.880 (acceptable range is 0.90–0.95) (Miljko, 2020). NFI compares the model to a null model. A value closer to 1 indicates a better fit, but 0.880 is very close to the desired range and thus acceptable. CFI (Comparative Fit Index) is 0.945 (should be >0.95; >0.9 is traditional) (Hair et al. 2018). CFI compares the model fit with a baseline model. 0.945 is close to the 0.95 threshold. This implies a reasonable fit. GFI (Goodness of Fit Index) is 0.969 >0.95 and is considered good. Thus, this value indicates a good fit for the model. AGFI (Adjusted Goodness of Fit Index) 0.843>0.8 is considered acceptable (Hair et al., 2018) as a reflection of model fit. This value also suggests an acceptable fit. PClose is 0.255 (should be >0.05). RMSEA is significantly different from 0. A value >0.05 indicates a good fit.

Another measure of fit is Cmin/DF, which is 1.537 (should be <3; sometimes <5 is acceptable). The value of 1.537 affirms a good model fit. Overall, the model has a reasonable fit based on most of the fit indices, namely (CFI, GFI, AGFI, PClose, Cmin/DF). However, RMSEA suggests some concerns with the model's approximation error. The NFI is also slightly below the desired threshold. The factor loadings indicate that NEQ8 and NEQ7 are strongly associated with the latent variable, while NEQ6 and NEQ9 show weaker associations (Microsoft Copilot, 2024).

5.9.3 Result for Default Model

Minimum was achieved; Chi-square = 3.073; Degrees of freedom = 2; Probability level = .215

Regression Weights: (Group number 1 - Default model)

Table 5.33: Regression Weights

			Estimate	S.E.	C.R.	P	Label
NEQ8	<---	NEQDim1	1.000				
NEQ7	<---	NEQDim1	.944	.102	9.245	***	
NEQ6	<---	NEQDim1	.483	.118	4.083	***	
NEQ9	<---	NEQDim1	.484	.153	3.166	.002	

(SPSS® AMOS® Version 29)

Path Coefficients and Significance (Microsoft Copilot, 2024):

NEQ8 <— NEQDim1

This path coefficient is fixed to 1.000 to set the scale of the latent variable NEQDim1 as per common practice in SEM to identify the model.

NEQ7 <— NEQDim1

This path coefficient is statistically significant with ($P < 0.001$). This indicated a strong positive relationship between NEQDim1 and NEQ7.

NEQ6 <— NEQDim1

This path coefficient is statistically significant ($P < 0.001$), indicating a moderate positive relationship between NEQDim1 and NEQ6.

NEQ9 <— NEQDim1

This path coefficient is statistically significant ($P < 0.01$), indicating a moderate positive relationship between NEQDim1 and NEQ9.

All the path coefficients are statistically significant, indicating that NEQDim1 has a meaningful positive relationship with NEQ8, NEQ7, NEQ6, and NEQ9. Strength of

Relationships: The strongest relationship is between NEQDim1 and NEQ7 (0.944), while the relationships with NEQ6 (0.483) and NEQ9 (0.484) are moderate.

5.10 NEQ Factor 2 (Different to FA)

Model Variables

Observed, endogenous variables: NEQ3;NEQ4;NEQ1;NEQ5

Unobserved, exogenous variables: eNEQ3;eNEQ4;eNEQ;eNEQ5;NEQDim2

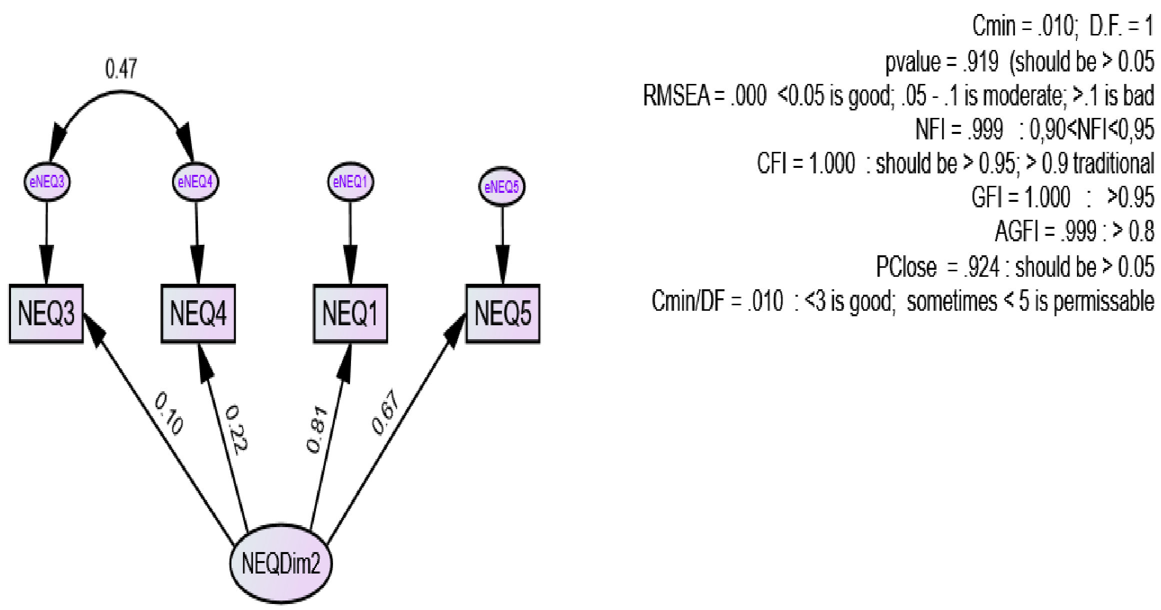

Figure 5.2: NEQDim2

(IBM SPSS AMOS Version 27 SEM)

Table 5.34: NEQDim2

ITEM	STATEMENT
NEQ1	Difficulty in identifying stakeholder
NEQ3	Stakeholder resistance to change
NEQ4	Balancing the expectations of multiple stakeholders
NEQ5	Limited stakeholder involvement

(Author)

5.10.1 Latent Variable (NEQDim2):

NEQDim2 is measured by four observed variables: NEQ3, NEQ4, NEQ1, and NEQ5. The factor loadings (on the arrows) show the strength of association between each observed variable and the latent variable: NEQ3: 0.10 (weak association); NEQ4: 0.22 (weak association); NEQ1: 0.81 (strong association); NEQ5: 0.67 (moderate association). The curved arrow between them also indicates a correlation of 0.47 between NEQ3 and NEQ4. Cmin (Chi-square value): 0.010, DF = 1. This very low value suggests a very good fit for the model. p-value: 0.919 (should be >0.05). A non-significant p-value (>0.05) suggests the model fits the data well. RMSEA (Root Mean Square Error of Approximation): 0.000. With RMSEA = 0.000, the model has a perfect fit, as anything below 0.05 is considered excellent. NFI (Normed Fit Index): 0.999 (acceptable range: 0.90–0.95). A value of 0.999 indicates an excellent fit compared to a null model. CFI (Comparative Fit Index) is 1.000 (should be >0.95; >0.9 traditional). A value of 1.000 indicates a perfect fit. GFI (Goodness of Fit Index): 1.000 (>0.95 is considered good). A perfect GFI suggests an excellent fit. AGFI (Adjusted Goodness of Fit Index): 0.999 (>0.8 is considered acceptable), the value of 0.999 indicates a very strong fit.PClose: 0.924 (should be >0.05); the PClose test also indicates a perfect fit, as the value is well above 0.05. Cmin/DF: 0.010 (should be <3; sometimes <5 is acceptable). A very low Cmin/DF of 0.010 suggests the model fits the data extremely well. To sum it up, the fit indices (RMSEA, CFI, GFI, AGFI, PClose) suggest a nearly perfect model fit with this CFA. All indicators are within excellent ranges. NEQ1 and NEQ5 have stronger associations with the latent factor NEQDim2, while NEQ3 and NEQ4 show weak associations, indicating that these variables may not be as good indicators of the latent factor.

5.10.2 Regression Weights

Table 5.35: Regression Weights

			Estimate	S.E.	C.R.	P	Label
NEQ1	<---	NEQDim2	1.000				
NEQ5	<---	NEQDim2	.668	.577	1.158	.247	
NEQ3	<---	NEQDim2	.114	.197	.578	.563	
NEQ4	<---	NEQDim2	.192	.184	1.042	.298	

(IBM SPSS AMOS SEM Version 27)

The above table breaks down the provided estimates for the relationships between the latent variable NEQDim2 and the observed variables NEQ1, NEQ5, NEQ3, and NEQ4.

5.10.3 Path Coefficients and Significance:

NEQ1 <— NEQDim2:

This path coefficient is fixed to 1.000 to set the scale of the latent variable NEQDim2. This is a common practice in SEM to identify the model (Microsoft Copilot, 2024).

NEQ5 <— NEQDim2:

This path coefficient is not statistically significant ($P > 0.05$). This implies that the relationship between NEQDim2 and NEQ5 is not strong enough to be considered significant.

NEQ3 <— NEQDim2:

This path coefficient is not statistically significant ($P > 0.05$), indicating that the relationship between NEQDim2 and NEQ3 is insignificant.

NEQ4 <— NEQDim2:

This path coefficient is not statistically significant ($P > 0.05$), suggesting that the relationship between NEQDim2 and NEQ4 is insignificant. As seen from the above relationships, none of the path coefficients, except for the fixed one, are statistically significant, indicating that NEQDim2 does not have a strong direct effect on NEQ5, NEQ3, or NEQ4 in this model. The relationships between NEQDim2 and NEQ5, NEQ3, and NEQ4 are weak and not statistically significant.

5.11 EMFact1

Model Variables (Group number 1)

Observed, endogenous variables: EM1; EM2; EM4; EM5; EM9; EM12; EM13

Unobserved, exogenous variables: eEM1; eEM2; eEM4; EMDim1; eEM5; eEM9; eEM12; eEM13

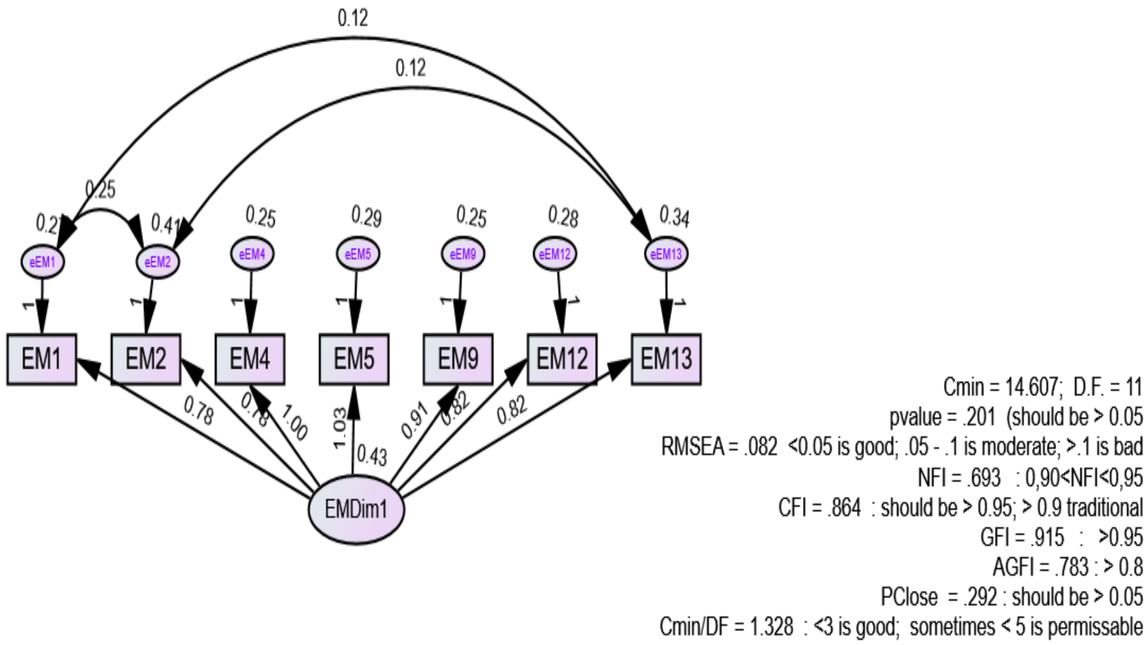

Figure 5.3: EMDim1

(IBM SPSS AMOS Version 27 SEM)

Table 5.36: EMDim1

ITEM	STATEMENT
EM1	Regular communication with stakeholders
EM2	Transparent communication with stakeholders
EM4	Engaging stakeholders in the project planning process
EM5	Engaging stakeholders in the decision-making process
EM9	Pro-active mitigation of risks related to stakeholder concerns
EM12	Agile project management methodologies for flexibility in adapting to changing stakeholder needs
EM13	Collaborative tools for efficient communication

(Author)

This image represents a Confirmatory Factor Analysis (CFA) model for the latent variable "EMDim1," measured by the observed variables EM1, EM2, EM4, EM5, EM9, EM12, and EM13. Breaking down the key elements (Microsoft Copilot, 2024):

5.11.1 Latent Variable (EMDim1):

EMDim1 is measured by seven observed variables: EM1, EM2, EM4, EM5, EM9, EM12, and EM13. **Factor Loadings** (i.e. the numbers on arrows) show the strength of the relationship between each observed variable and the latent variable.

Cmin (Chi-square value): 14.607, DF = 11 is a moderately low value, suggesting an acceptable model fit with a p-value: 0.201 (should be >0.05). A non-significant p-value (>0.05) indicates that the model fits the data well.

RMSEA of 0.082 suggests a moderate model fit, whilst **NFI (Normed Fit Index)** = 0.693, which is low, suggests that the model fit could be improved. A value closer to 1 is ideal. CFI is below the desired threshold of 0.95, indicating a less-than-ideal fit. GFI of 0.915 suggests an acceptable fit, though slightly below the preferred threshold. **AGFI (Adjusted Goodness of Fit Index):** 0.783 (>0.8 is considered acceptable). This is slightly below the threshold of 0.8, suggesting a weaker fit. **PClose:** 0.292 (should be >0.05). PClose >0.05 indicates that the RMSEA is not significantly different from 0, supporting model fit. **Cmin/DF**: 1.328 (should be <3; sometimes <5 is acceptable). This value indicates good model fit, as it falls below the threshold of 3. While some indices suggest the model has a reasonable fit (Cmin/DF, p-value, GFI, PClose), others like NFI, CFI, and RMSEA suggest room for improvement. The model fit is moderate, with some potential areas that could be improved (Microsoft Copilot, 2024).

The variable EM4 has the highest loading (1.00), meaning it is strongly associated with the latent variable EMDim1. EM1, EM2, EM9, EM12, and EM13 also show strong associations, while EM5 has the weakest association with the latent variable. Significant correlations exist between some observed variables (e.g., EM2 and EM4), which may indicate relationships that need further exploration in the model (Microsoft Copilot, 2024).

5.11.2 Regression Weights:

Table 5.37: Regression Weights (IBM SPSS AMOS SEM Version 27)

			Estimate	S.E.	C.R.	P	Label
EM4	<---	EMDim1	1.000				
EM5	<---	EMDim1	1.026	.224	4.572	***	
EM1	<---	EMDim1	.781	.167	4.683	***	
EM2	<---	EMDim1	.775	.182	4.269	***	
EM9	<---	EMDim1	.910	.202	4.511	***	
EM12	<---	EMDim1	.820	.171	4.783	***	
EM13	<---	EMDim1	.816	.174	4.685	***	

Breaking down the provided estimates for the relationships between the latent variable EMDim1 and the observed variables EM4, EM5, EM1, EM2, EM9, EM12, and EM13:

5.11.3 Path Coefficients and Significance:

The following analysis was derived using (Microsoft Copilot, 2024).

EM4 <— EMDim1: This path coefficient is fixed to 1.000 to set the scale of the latent variable EMDim1. This is a common practice in SEM to identify the model.

EM5 <— EMDim1: This path coefficient is statistically significant ($P < 0.001$), indicating a strong positive relationship between EMDim1 and EM5.

EM1 <— EMDim1: This path coefficient is statistically significant ($P < 0.001$), indicating a strong positive relationship between EMDim1 and EM1.

EM2 <— EMDim1: This path coefficient is statistically significant ($P < 0.001$), indicating a strong positive relationship between EMDim1 and EM2.

EM9 <— EMDim1: This path coefficient is statistically significant ($P < 0.001$), indicating a strong positive relationship between EMDim1 and EM9.

EM12 <— EMDim1: This path coefficient is statistically significant ($P < 0.001$), indicating a strong positive relationship between EMDim1 and EM12.

EM13 <— EMDim1: This path coefficient is statistically significant ($P < 0.001$), indicating a strong positive relationship between EMDim1 and EM13.

All the path coefficients are statistically significant, indicating that EMDim1 has a meaningful positive relationship with EM4, EM5, EM1, EM2, EM9, EM12, and EM13.Strength of Relationships: The relationships are strong, with path coefficients ranging from 0.775 to 1.026.

5.12 SS Factor1

The model contains the following variables (Group number 1)

Observed, endogenous variables: SS1;SS2;SS12;SS13;SS14

Unobserved, exogenous variables: eSS1;SSDim1;eSS2;eSS12;eSS13;eSS14

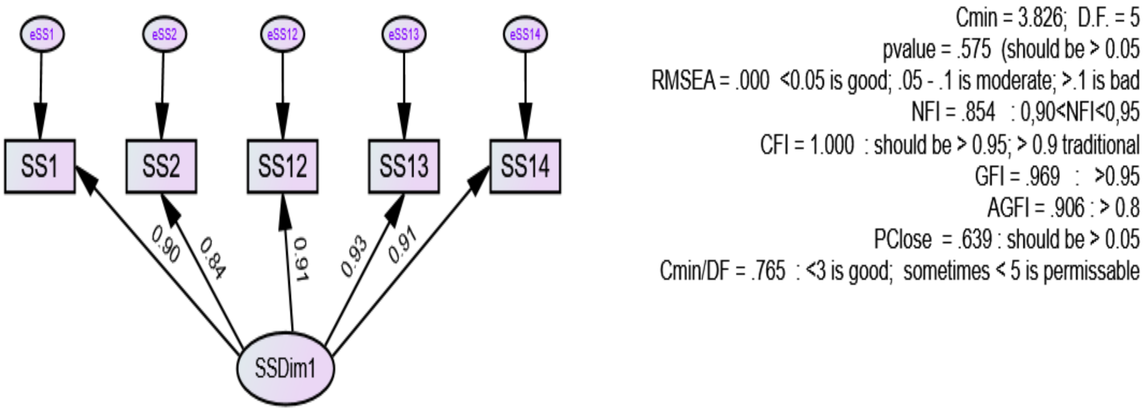

Figure 5.4: SSDim1

(IBM SPSS AMOS Version 27 SEM)

Table 5.38: SSDim1

ITEM	STATEMENT
SS1	Clear communication with stakeholders
SS2	Regular communication with stakeholders
SS12	Actionable stakeholder feedback
SS13	Timely stakeholder feedback
SS14	Transparent reporting of project progress

(Author)

5.12.1 Model Overview:

The image depicts a structural equation model (SEM) with four latent variables (SS1, SS2, SS3, SS4), each connected to three observed indicators (x1 to x12). The relationships between these latent variables are indicated by single-headed arrows, with values showing the strength of these relationships.

The above model fits the data very well, as indicated by the excellent RMSEA, CFI, and GFI values. The p-value and PClose also suggest a good fit. The strong relationships between the latent variables (0.81, 0.84, 0.91) indicate significant connections. Overall, this SEM appears to be well-constructed and provides a good fit to the data.

SS1 <— SSDim1: The estimate is fixed at 1.000 for identification purposes, meaning it serves as a reference point for the other estimates.

SS2 <— SSDim1: This indicates a strong positive relationship between SSDim1 and SS2.

SS12 <— SSDim1: This indicates a strong positive relationship between SSDim1 and SS12.

The p-value is very low, indicating strong statistical significance.

SS13 <— SSDim1: The p-value is very low, indicating strong statistical significance.

SS14 <— SSDim1: This indicates a strong positive relationship between SSDim1 and SS14. The p-value is very low, indicating strong statistical significance.

The estimates indicate strong and statistically significant relationships between SSDim1 and the observed variables (SS1, SS2, SS12, SS13, SS14). These relationships suggest that SSDim1 is a robust latent factor influencing these observed variables.

5.12.2 Regression Weights: (Group number 1 - Default model)

Table 5.39: Regression Weights

			Estimate	S.E.	C.R.	P	Label
SS1	<---	SSDim1	1.000				
SS2	<---	SSDim1	.955	.114	8.365	***	
SS12	<---	SSDim1	1.040	.112	9.284	***	

			Estimate	S.E.	C.R.	P	Label
SS13	<---	SSDim1	1.056	.098	10.789	***	
SS14	<---	SSDim1	1.130	.130	8.719	***	

(IBM SPSS AMOS SEM Version 27)

Interpretation:

5.13 SS Factor 2 (incorporating SS Factor 3)

The model contains the following variables (Group number 1)

Observed, endogenous variables: SS3;SS6;SS7;SS8;SS9;SS10;SS11

Unobserved, exogenous variables: eSS3;SSDim2;eSS6;eSS7;eSS8;eSS10;eSS11

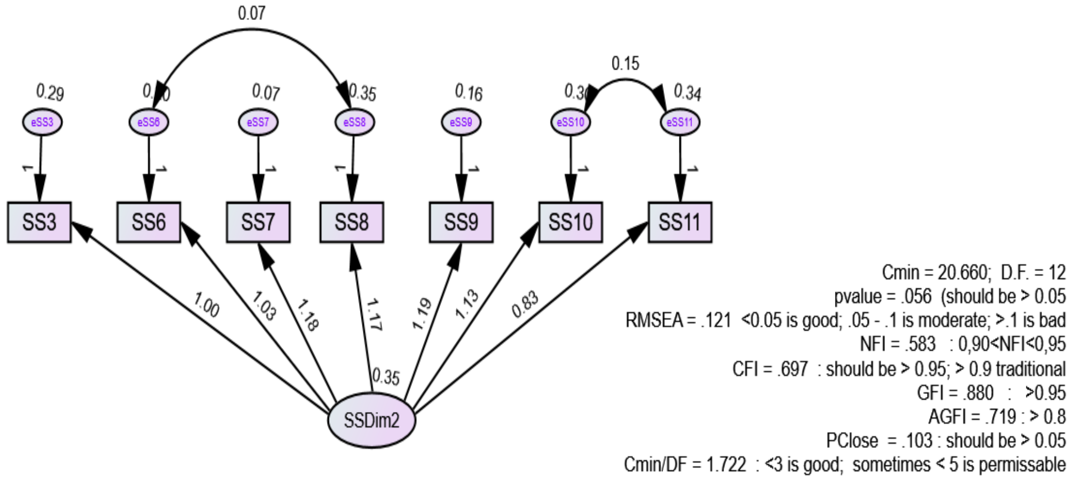

Figure 5.5: SSDim2

(IBM SPSS AMOS Version 27 SEM)

Table 5.40: SSDim2

ITEM	STATEMENT
SS3	Active involvement of stakeholders in decision-making
SS6	Proactive risk management
SS7	Proactive risk resolution
SS8	Utilisation of agile project management methodologies
SS9	Collaborative digital platforms
SS10	Data analytics insights for decision-making
SS11	Data AI-driven insights for decision-making

(Author)

5.13.1 Model Overview:

The image depicts an SEM with eleven observed variables (SS3 to SS11) and two latent variables (Sdom12 and Plocse). The paths between these variables have coefficients indicating the strength of their relationships, ranging from 0.07 to 0.34.

Key Relationships:

As seen above, the strength of relationships between the latent and observed variables ranges from 0.07 to 0.34. Each observed variable has an associated error term, indicating the variance not explained by the latent variables.

Interpretation:

The model does not fit the data well, as indicated by the high RMSEA and Cmin/DF values. The NFI, CFI, GFI, and AGFI values are slightly below the recommended thresholds. The path coefficients suggest moderate to weak relationships between the latent and observed variables. Overall, this SEM indicates a moderate fit to the data.

5.13.2 Regression Weights: (Group number 1 - Default model)

Table 5.41: Regression Weights

			Estimate	S.E.	C.R.	P	Label
SS3	<---	SSDim2	1.000				
SS6	<---	SSDim2	1.034	.192	5.377	***	
SS7	<---	SSDim2	1.183	.194	6.104	***	
SS8	<---	SSDim2	1.170	.252	4.636	***	
SS9	<---	SSDim2	1.187	.247	4.801	***	
SS10	<---	SSDim2	1.131	.265	4.262	***	
SS11	<---	SSDim2	.830	.218	3.805	***	

(Author)

Breaking down the provided estimates for the relationships between the latent variable SSDim2 and the observed variables SS3, SS6, SS7, SS8, SS9, SS10, and SS11:

Path Coefficients and Significance:

SS3 <— SSDim2: This path coefficient is fixed to 1.000 to set the scale of the latent variable SSDim2. This is a common practice in SEM to identify the model.

SS6 <— SSDim2: This path coefficient is statistically significant (P < 0.001)(Sengupta, 2024), indicating a strong positive relationship between SSDim2 and SS6.

SS7 <— SSDim2: This path coefficient is statistically significant (P < 0.001), indicating a strong positive relationship between SSDim2 and SS7.

SS8 <— SSDim2: This path coefficient is statistically significant (P < 0.001), indicating a strong positive relationship between SSDim2 and SS8.

SS9 <— SSDim2: This path coefficient is statistically significant (P < 0.001), indicating a strong positive relationship between SSDim2 and SS9.

SS10 <— SSDim2: This path coefficient is statistically significant (P < 0.001), indicating a strong positive relationship between SSDim2 and SS10.

SS11 <— SSDim2: This path coefficient is statistically significant ($P < 0.001$), indicating a strong positive relationship between SSDim2 and SS11.

All the path coefficients are statistically significant, indicating that SSDim2 has a meaningful positive relationship with SS3, SS6, SS7, SS8, SS9, SS10, and SS11. The strength of the relationships are strong, with path coefficients ranging from 0.830 to 1.187

5.14 PS Factor

The model contains the following variables (Group number 1)

Observed, endogenous variables: PS2; PS3; PS8; PS4; PS5; PS6; PS1; S7

Unobserved, exogenous variables: PS2; PSDim2; ePS3; ePS8; ePS4; ePS5; ePS6; ePS1; ePS7

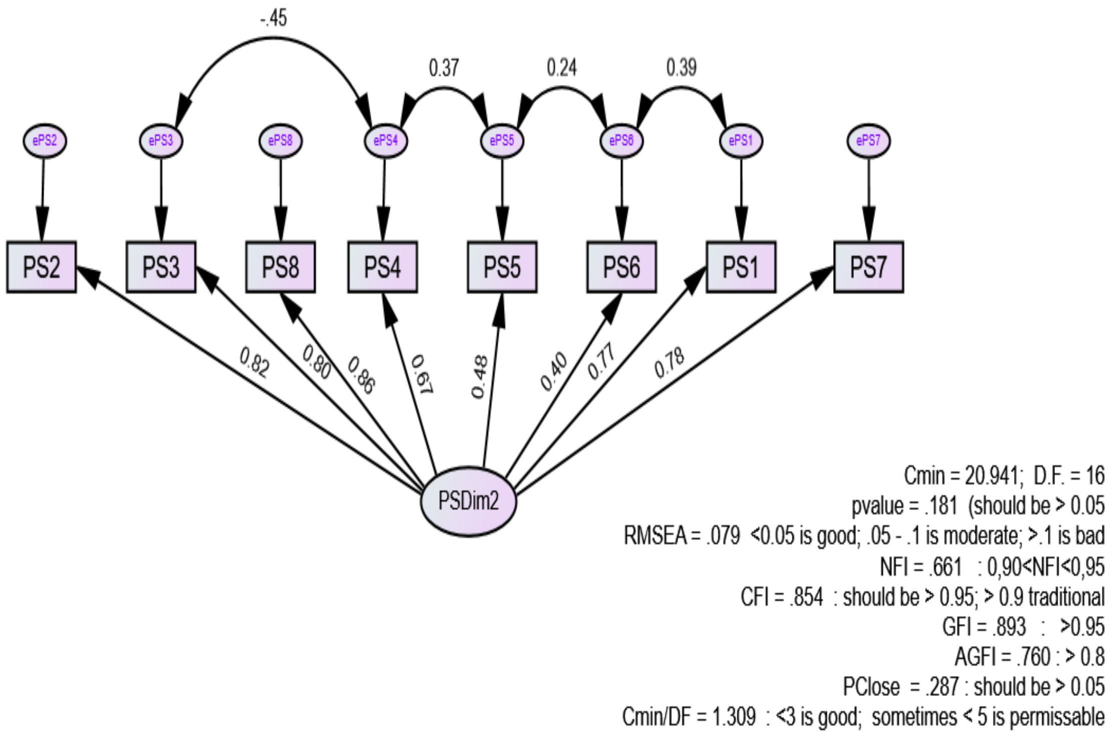

Figure 5.6: PSDim2

(IBM SPSS AMOS Version 27 SEM)

Table 5.42: PSDim2

ITEM	STATEMENT
PS1	The project being completed according to the budget allocated
PS2	The outcomes of the project being used by its intended end users
PS3	The project making a visible positive impact on the target beneficiaries
PS4	Project specifications being met by the time of handover to the target beneficiaries
PS5	Project team members being satisfied with the process by which the project was implemented
PS6	The project having minimal start-up problems
PS7	The principal donors/sponsor being satisfied with the outcomes of the project implementation
PS8	The project directly leading to improved performance for the end users/target beneficiaries

(Author)

The image depicts a structural equation model (SEM) with various paths and relationships between variables. It includes circles representing latent variables, squares for observed variables, and arrows indicating the direction of influence or correlation. Each path has an associated decimal value, presumably representing path coefficients or correlations.

5.14.1 Path Coefficients:

PS2 -> PS3: 0.37; PS3 -> PS4: 0.58; PS4 -> PS5: 0.24; PS5 -> PS6: 0.39;PS6 -> PSI1: 0.78

PSD/inn2 -> PSI1: -0.15; **Correlations:**D2 <-> D3: 0.02;D3 <-> D4: 0.02;D4 <-> D5: 0.02;D5 <-> D6: 0.02;

The model shows a moderate fit to the data. The CFI and GFI values are above the traditional cutoffs, indicating a good fit. However, the RMSEA value suggests a moderate fit, and the NFI is slightly below the recommended threshold. Relationships: The path coefficients indicate varying strengths of relationships between the variables, with some strong (e.g., PS6 -> PSI1: 0.78) and some weak (e.g., PSD/inn2 -> PSI1: -0.15). Overall, this SEM provides a moderate fit to the data, with some areas potentially needing improvement

5.14.2 Regression Weights: (Group number 1 - Default model)

Table 5.43: Regression

			Estimate	S.E.	C.R.	P	Label
PS2	<---	PSDim2	1.000				
PS3	<---	PSDim2	.818	.136	6.009	***	
PS8	<---	PSDim2	1.029	.164	6.293	***	
PS4	<---	PSDim2	.642	.166	3.858	***	
PS5	<---	PSDim2	.511	.187	2.734	.006	
PS6	<---	PSDim2	.712	.288	2.470	.013	
PS1	<---	PSDim2	1.132	.210	5.381	***	
PS7	<---	PSDim2	.895	.215	4.154	***	

(IBM SPSS AMOS SEM Version 27)

Breaking down the provided estimates for the relationships between the latent variable PSDim2 and the observed variables PS2, PS3, PS8, PS4, PS5, PS6, PS1, and PS7

5.14.3 Path Coefficients and Significance:

This path coefficient is fixed to 1.000 to set the scale of the latent variable PSDim2. This is a common practice in SEM to identify the model.

PS3 <— PSDim2: This path coefficient is statistically significant ($P < 0.001$), indicating a strong positive relationship between PSDim2 and PS3.

PS8 <— PSDim2: This path coefficient is statistically significant ($P < 0.001$), indicating a strong positive relationship between PSDim2 and PS8.

PS4 <— PSDim2: This path coefficient is statistically significant ($P < 0.001$), indicating a moderate positive relationship between PSDim2 and PS4.

PS5 <— PSDim2: This path coefficient is statistically significant ($P < 0.01$), indicating a moderate positive relationship between PSDim2 and PS5.

PS6 <— PSDim2: This path coefficient is statistically significant ($P < 0.05$), indicating a moderate positive relationship between PSDim2 and PS6.

PS1 <— PSDim2: This path coefficient is statistically significant ($P < 0.001$), indicating a strong positive relationship between PSDim2 and PS1.

PS7 <— PSDim2: This path coefficient is statistically significant ($P < 0.001$), indicating a strong positive relationship between PSDim2 and PS7.

Significant Relationships: All the path coefficients are statistically significant, indicating that PSDim2 has meaningful positive relationships with PS2, PS3, PS8, PS4, PS5, PS6, PS1, and PS7. The relationships range from moderate to strong, with path coefficients ranging from 0.511 to 1.132.

5.15 Open-ended Responses Analysis

5.15.1 Fear and Resistance to Technology

Some respondents expressed concerns about technology replacing human roles and duties in the future. There were also elements of stakeholders' reluctance to adapt to new technologies and processes that may be interpreted as resistance to change. The following statements reflect these sentiments:

Response 1: *"Fear of technology taking over processes or duties performed by stakeholders."*

Response 2: *"The level of digital literacy is often a problem. The lower the level of digital literacy is, the higher the expectation for the project."*

Response 3: *"People's resistance to change."*

5.15.2 Communication and Collaboration

Clear and effective communication was emphasised as critical for stakeholder management. Thus, an inclusive collaboration that involved key stakeholders and end-users in the project to ensure their needs and perspectives were considered was encouraged. The following responses reflected these.

Response 4: *"Clear and effective communication plays a critical role in the management of stakeholders in IT projects."*

Response 5: *"Inclusive collaboration with key stakeholders ensures valuable insights and perspectives are considered, while active involvement and training of end-users enhance satisfaction and success."*

Response 6: *“Regular engagement sessions, adherence to governance and risk logs.”*

Joshi (2024), in their research on the use of chatbots for communication in projects, said that most participants acknowledged the positive impact of AI-powered chatbots on communication efficiency, emphasising their effectiveness in providing timely and relevant information.

5.15.3 Training and Education

The importance of providing adequate training to stakeholders to ensure they understand and can use new technologies was one of the emerging themes from the respondents. Educating stakeholders about the practical implications and costs associated with new technologies is very important.

Response 7: *“Training is the most important one. You don’t want to implement something that no one knows how to utilise, it will be a disaster.”*

Response 8: *“Stakeholder education - some stakeholders have heard about a product but do not completely understand the practical implications as well as associated costs.”*

Response 8: *“Lack of proper education in projects and management of resources.”*

5.15.4 Project Management and Governance

The respondents highlighted the need to institute adaptive strategies like Agile Project methods in the fast-evolving technology landscape. Additionally, the necessity of ensuring that all stakeholders have a shared understanding of the project’s goals and limitations as well as demonstrating value through measurable outcomes were also sentiments that were reflected in some responses:

Response 9: *“Setting realistic expectations about the capabilities, limitations, and timeline of the project is very helpful.”*

Response 10: *“Agile project management and adaptive strategies are necessary for effective project execution in the ever-changing technology landscape”.*

Response 11: *"Good contract management, project governance, and project management."*

5.15.5 Cultural and Social Considerations

Acknowledging and respecting cultural differences to enhance teamwork and reduce misunderstandings was also highlighted as a CSF by respondents. Another aspect was that of political and cultural awareness. The understanding of the broader social and political context in which the project operates, as reflected in the following sentiments:

Response 12: "It's vital to acknowledge and respect cultural variances and ensure practices are inclusive, catering to various groups."

Response 13: "Political and cultural awareness is crucial for stakeholder management.

Response 14: "Cultural Sensitivity and Inclusion: It is vital to acknowledge and respect cultural variances and ensure practices are inclusive, catering to various groups."

5.15.6 Technical Challenges

Integration with legacy systems: Managing the transition between old and new technologies is essential for project success. Also, ensuring the quality, integrity, and security of data used in AI-driven projects, i.e., Data governance, is crucial, as reflected in the following responses:

Response 15: *"Managing the transition and compatibility between old and new systems can pose significant technical and organisational challenges."*

Response 16: *"In AI-driven IT projects, success is bolstered by robust data governance practices that secure the quality, integrity, and security of data used for training and decision-making."*

Response 17: *"Integration with legacy systems".*

5.15.6 Stakeholder Engagement and Satisfaction

Another common theme emanating from the open-ended question was keeping stakeholders informed about project progress and challenges through regular updates and transparency. This aligns quite well with the need to adopt strategies that help ensure stakeholders are satisfied with the project outcomes, such as involving them in decision-making and setting realistic expectations.

> **Response 18**: *“Providing regular updates on progress and being transparent about any challenges or setbacks encountered.”*

> **Response 19**: *“Projects are more successful when the objectives are clear and documented explicitly from the start of the project to avoid scope creep.”*

> **Response 20**: *“Encouraging stakeholders’ participation and feedback.*

5.15.7 Change Management

Strategies to help stakeholders adapt to new technologies and processes must be implemented to enhance stakeholder management. Continuous learning and improvement by building mechanisms for feedback and iteration to improve the AI solution over time is also essential, as evidenced in the following statements:

> **Response 21**: *“Change management is crucial for overseeing projects, particularly in dynamic and technologically advancing settings such as IT and AI initiatives.”*

> **Response 22**: *“Continuous Learning and Improvement is important. Building mechanisms for feedback, iteration, and improvement of the AI solution over time.”*

> **Response 23***: “Alignment of all project stakeholders with technology and being digitally matured.”*

5.16 Summary

Overall Implications are as follows:

5.16.1 Strong Constructs.

NEQDim1, EMDim1, SSDim1, SSDim2, and PSDim2 have strong, statistically significant relationships with their respective indicators, indicating that these latent variables are well-represented in the model. This implies that the model can reliably explain the constructs these latent variables represent (e.g., emotional dimensions, social support, perceptions).

5.16.2 Weak Constructs

NEQDim2's relationship with its indicators (i.e. NEQ5, NEQ3, NEQ4) is weak. This suggests that this particular construct may not be that reliable. Thus, there might be a need for further refinement of this construct (i.e., NEQDim2) and re-evaluation of associated indicators.

5.16.3 Model Fit and Significance

Based on the significant path coefficients, it can be seen that most constructs indicate that the model has a good fit overall. However, certain specific areas like NEQDim2 may require further improvement to increase the model's overall explanatory power.

To sum it up, the model appears robust in explaining most latent variables, particularly related to the effective management dimension (EMDim1) and stakeholder satisfaction (SSDim1, SSDim2). However, attention should be given to NEQDim2, where relationships with some indicators are not statistically significant. This could affect the precision of the model's predictions in areas related to this specific construct. The open-ended questionnaire responses highlight several key themes in stakeholder management for technology projects. These themes are fear and resistance to technology, communication and collaboration, training and education, project management and governance, cultural and social considerations, technical challenges, stakeholder engagement and satisfaction, and change management. Overall, addressing both technical and human factors is vital for successful project outcomes. The next chapter looks at the Composite model.

CHAPTER 6

FINAL COMPOSITE MODEL, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The previous chapter looked at the constructs of the composite model. This chapter discusses the final composite model. As discussed previously, a composite latent variable has been developed using SEM for individual elements of the model. A variable was developed or generated using the factor analysis regression process. The analysis was iterated several times until the model was relevant. The main aim of the research was to develop a stakeholder management framework for the successful execution of the 4IR projects. The evaluation of project success is a surprisingly open question, with few authors using consistent definitions and measures (Ika and Pinto ,2022). Zwikael and Meredith (2021) say that despite a longstanding interest in practice and decades of deliberation in research, project success remains a complex, ambiguous, and non-consensual concept. The framework was developed using SPSS AMOS Version 29, as presented in the section below.

The model contains the following variables:

Observed, endogenous variables **(Dependent): PSFact**

Observed, exogenous variables **(Independent)**: NeoFact1; EMFact1; SFact1; SSFact2; Unobserved, exogenous variables; ePSFact

6.2 Main Model Presentation

The conceptual framework presented in Chapter 3 and the hypothesis developed were tested using various indices in SEM. The indices are presented in Table 6.2, and the relationships are presented in Figure 6.1 below.

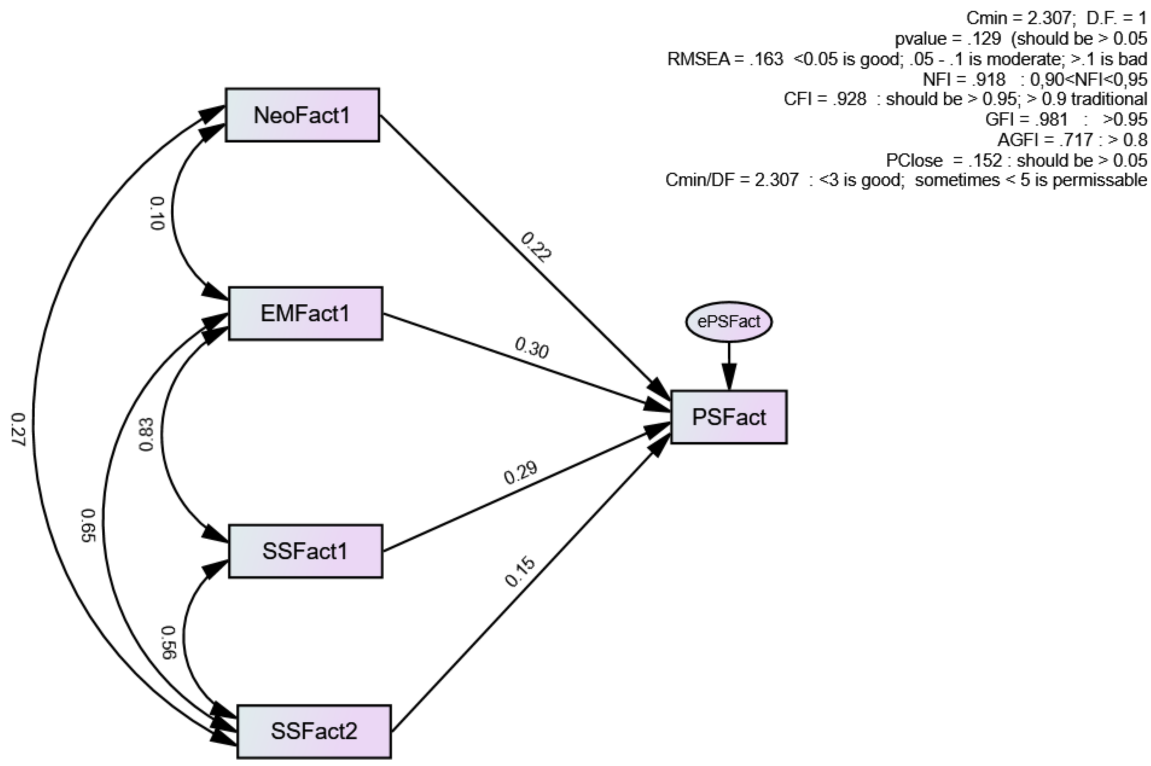

Figure 6.1: Main Model Presentation

(IBM SPSS AMOS Version 27 SEM)

6.2.1 Path Coefficients:

Path coefficients show the direct effects of one variable on another, helping to understand the direct relationships in the model (Garson, 2013). The following are the coefficients as indicated in the model in Figure 6.1 above.

NeoFact1 -> EMFact1: 0.10; EMFact1 -> ePSFact: 0.22; ePSFact -> PSFact: 0.30

PSFact -> SSFact1: 0.27; SSFact1 -> SSFact2: 0.15

6.2.2 Model Overview:

The composite model includes several observed variables (e.g., NeoFact1, EMFact1, SSFact1, SSFact2) and latent constructs (e.g., ePSFact, PSFact). The paths between these variables have coefficients indicating the strength of their relationships. Additionally, there are correlations between some variables. Curved, double-headed arrows between NeoFact1, EMFact1, SSFact1, and SSFact2 show covariances between these latent factors. The covariance values (e.g., 0.83, 0.65, 0.10, 0.27) indicate how much these factors share in variance with each other. Path coefficients are standardised regression weights that indicate the direct effect of one variable on another in the model (Garson, 2013). They are similar to regression coefficients in linear regression. Range typically ranges from -1 to 1 (Loehlin,2004). A positive value indicates a positive relationship, while a negative value indicates a negative relationship (Grapentine, 2000). The absolute value of the path coefficient indicates the strength of the relationship. A positive coefficient means that as one variable increases, the other variable also increases. A negative coefficient means that as one variable increases, the other variable decreases. NeoFact1 to PSFact: 0.22; EMFact1 to PSFact: 0.30; SSFact1 to PSFact: 0.29; SSFact2 to PSFact: 0.15. The paths show that EMFact1 has the most substantial relationship with PSFact, while SSFact2 has the weakest. A path coefficient of 0.30 suggests a moderate relationship, while a coefficient of 0.80 indicates a strong relationship.

6.2.3 Model Fit Indicators:

Cmin/DF: 2.307 (Good, should be < 3). A ratio below 3 is preferred, indicating a good fit. Here, 2.307 meets this criterion; RMSEA: 0.063 (Moderate fit, should be < 0.05). The RMSEA suggests a moderate fit (0.163 is slightly higher than the ideal threshold). P-value = .129 (should be > 0.05 to indicate a good fit).\; since the p-value is above 0.05, it suggests an acceptable model fit.

CFI: 0.928 (Good, should be > 0.90); Ideally, CFI should be greater than 0.95, although values close to this threshold, like 0.928, are traditionally acceptable.

AGFI: 0.717 (Below recommended, should be > 0.80). AGFI should be above 0.80, and this value of 0.717 suggests a somewhat lower fit;

PClose: 0.152 (Good, should be > 0.05). This value should be greater than 0.05 for a good fit, and 0.152 is acceptable.

GFI: 0.905 (Good, should be > 0.90). With values above 0.95 considered ideal, this GFI value indicates a very good fit.

NFI (Normed Fit Index): 0.918. A value between 0.90 and 0.95 is acceptable, and the NFI is within this range, showing a reasonable fit

6.2.4 Interpretation:

The path coefficients indicate varying strengths of relationships between the variables, with some moderate (e.g., ePSFact -> PSFact: 0.30) and some weaker (e.g., NeoFact1

-> EMFact1: 0.10). Considering the path coefficient from PS6 to PSI1, which is 0.78: This is a strong positive relationship, indicating that changes in PS6 have a significant direct effect on PSI1. Since the coefficient is positive, it means that as PS6 increases, PSI1 also increases. The model generally demonstrates a good fit, with some minor deviations (such as the AGFI and RMSEA) that suggest areas for potential improvement. The paths indicate that EMFact1 is the most significant predictor of PSFact, while SSFact2 has the most negligible impact. The covariances between factors show significant shared variance, particularly between EMFact1 and SSFact1. The model is acceptable based on these indicators, though refinement may improve specific fit indices.

Table 6.1: Summary Table of constructs in the Model

Questionnaire link	Construct Interrogated	Final Model Grouping
NEQ1	Difficulty in identifying stakeholder	NeoFact2=Mean (NEQ1, NEQ3, NEQ4, NEQ5). NeoFact2 was not included in the new composite model - its inclusion caused the model not to work
NEQ3	Stakeholder resistance to change	
NEQ4	Balancing the expectations of multiple stakeholders	
NEQ5	Limited stakeholder involvement.	
NEQ6	Addressing ethical concerns related to AI and automation	NeoFact1=Mean (NEQ6, NEQ7, NEQ8, NEQ9)
NEQ7	Ensuring data privacy for stakeholders	
NEQ8	Ensuring data security for stakeholders	
NEQ9	Lack of soft skills to achieve deliverables	
EM1	Regular communication with stakeholders	EMFact1=Mean (EM1, EM2, EM4,EM5,EM9,EM12,EM13).
EM2	Transparent communication with stakeholders	
EM4	Engaging stakeholders in the project planning process	
EM5	Engaging stakeholders in the decision-making process	
EM9	Proactive mitigation of risks related to stakeholder concerns.	
EM12	Agile project management methodologies for flexibility in adapting to changing stakeholder needs	
EM13	Collaborative tools for efficient communication	
SS1	Clear communication with stakeholders	SSFact1=Mean (SS1, SS2, SS12,SS13,SS14).
SS2	Regular communication with stakeholders	
SS12	Actionable stakeholder feedback	
SS13	Timely stakeholder feedback	
SS14	Transparent reporting of project progress	
SS3	Active involvement of stakeholders in decision-making	SSFact2=Mean (SS3, SS6, SS7,SS8,SS9,SS10,SS11)
SS6	Proactive risk management	
SS7	Proactive risk resolution	
SS8	Utilisation of agile project management methodologies	
SS9	Collaborative digital platforms	

Questionnaire link	Construct Interrogated	Final Model Grouping
SS10	Data analytics insights for decision-making	
SS11	Data AI-driven insights for decision-making	
PS1	The project being completed according to the budget allocated	PSFact=Mean (PS1, PS2,PS3,PS4,PS5,PS6,PS8)
PS2	The outcomes of the project being used by its intended end users	
PS3	The project making a visible positive impact on the target beneficiaries	
PS4	Project specifications being met by the time of handover to the target beneficiaries	
PS5	Project team members being satisfied with the process by which the project was implemented	
PS6	The project having minimal start-up problems	
PS8	The project directly leading to improved performance for the end users/target beneficiaries	

(Author)

6.3 SSFact 1 &2

Result (Default model)

Minimum fit was achieved; Chi-square = 2.307; Degrees of freedom = 1;

Probability level = .129

Interpretation:

Chi-square (2.307): This is a measure of the discrepancy between the observed data and the model's predicted data. A lower Chi-square value indicates a better fit. The value of 2.307 is quite low, which suggests that the model fits the data reasonably well.

Degrees of Freedom (DF = 1): The degrees of freedom represent the number of constraints or parameters estimated. The model is relatively simple with 1 degree of freedom, allowing for a straightforward interpretation.

P-value (0.129): The P-value is greater than 0.05, which means that the Chi-square test does not reject the null hypothesis. This implies that there is no statistically significant difference between the observed data and the predicted data. In other words, the model fits the data well.

Conclusion: The Default Model demonstrates an acceptable fit since the Chi-square is low and the P-value is greater than 0.05. The data does not show significant deviation from the model's predictions, making it a suitable model for analysis.

6.4 Regression Weights: (Group number 1 - Default model)

Table 6.2: Regression

			Estimate	S.E.	C.R.	P	Significance Level
PSFact	<---	NeoFact1	.143	.072	1.985	.047	Statistically Significant P<0.05
PSFact	<---	EMFact1	.287	.184	1.563	.118	Moderately Significant P>0.05
PSFact	<---	SSFact1	.246	.155	1.593	.111	Moderately Significant P>0.05
PSFact	<---	SSFact2	.130	.118	1.103	.270	Moderately Significant P>0.05

(IBM SPSS AMOS SEM Version 27)

6.4.1 Coefficients and Significance (Microsoft Copilot, 2024):

Considering the path PSFact <— NeoFact1, the P-value (P) is 0.047. This path coefficient is statistically significant (P < 0.05), indicating a positive relationship between NeoFact1 and PSFact. For path PSFact <— EMFact1. P-value (P): 0.118. Showing that the path coefficient is not that significant (P > 0.05), implying that the relationship between EMFact1 and PSFact is not as strong enough compared to PSFact <— NeoFact1. The path PSFact <— SSFact1 has a P-value (P): 0.111, This path coefficient is moderately significant (P > 0.05), indicating that the relationship between SSFact1 and PSFact is not very strong. For Path PSFact <— SSFact2, P-value (P): 0.270, this path coefficient is also moderately statistically significant (P > 0.05), suggesting that the relationship between SSFact2 and PSFact is the weakest compared to the other paths. Only the path from NeoFact1 to PSFact is statistically significant, indicating a stronger influence on IT project success as compared to the other variables The paths from EMFact1, SSFact1, and SSFact2 to PSFact are not very significant, suggesting that these variables do not directly affect PSFact in this model , but they have an impact on other factors that impact project success.

6.5 Covariances: (Group number 1 - Default model)

Table 6.3: Covariance

			Estimate	S.E.	C.R.	P	Interpretation
SSFact1	<-->	SSFact2	.243	.072	3.364	***	Strongly, positively correlated
EMFact1	<-->	SSFact2	.249	.068	3.677	***	Strongly, positively correlated
EMFact1	<-->	SSFact1	.331	.077	4.276	***	Strongly, positively correlated
NeoFact1	<-->	SSFact2	.148	.072	2.068	.039	Significant, positively correlated
NeoFact1	<-->	EMFact1	.048	.043	1.138	.255	Not statistically significant

(IBM SPSS AMOS SEM Version 27)

Covariance for paired independent variables. (please refer to Table 6.1 and Appendix I for abbreviation meanings).

For covariance, if $p<0.05$, then the covariance for the paired independent variables is significant, as shown in Figure 6.1 and confirmed in Table 6.2 above.

Correlations and Significance:

SSFact1 <–> SSFact2; P-value (P): ***

Interpretation: This correlation is statistically significant ($P < 0.001$), indicating a strong positive relationship between SSFact1 and SSFact2.

EMFact1 <–> SSFact2; P-value (P): ***

Interpretation: This correlation is statistically significant ($P < 0.001$), indicating a strong positive relationship between EMFact1 and SSFact2.

EMFact1 <–> SSFact1; P-value (P): ***

Interpretation: This correlation is statistically significant ($P < 0.001$), indicating a strong positive relationship between EMFact1 and SSFact1.

NeoFact1 <–> SSFact2; P-value (P): 0.039

Interpretation: This correlation is statistically significant ($P < 0.05$), indicating a positive relationship between NeoFact1 and SSFact2.

NeoFact1 <–> EMFact1

Interpretation: This correlation is not statistically significant ($P > 0.05$), suggesting that the relationship between NeoFact1 and EMFact1 is not strong enough to be considered significant.

6.6 Fit Indices and Interpretation.

Significant Correlations (Microsoft Copilot, 2024): The correlations between SSFact1 and SSFact2, EMFact1 and SSFact2, EMFact1 and SSFact1, and NeoFact1 and SSFact2 are all statistically significant, indicating strong positive relationships. Non-Significant Correlation (Microsoft Copilot, 2024): The correlation between NeoFact1 and EMFact1 is not statistically significant, suggesting a weak or negligible relationship.

Table 6.42: Fit Indices and Interpretation

Index	Level of Acceptance	Result	Interpretation
RMSEA	<0.08	0.163	Goodness of fit not achieved
NFI	>0.90	0.918	Goodness of fit achieved
NNFI/TLI	>0.90	0.277	Goodness of fit not achieved
CFI	>0.90	0.928	Goodness of fit achieved
IFI	>0.90	0.952	Goodness of fit achieved
GFI	>0.90	0.981	Goodness of fit achieved
CMIN	<3.00	2.307	Goodness of fit achieved. The **Default Model** has a low **CMIN**, an acceptable **CMIN/DF** (2.307), and a p-value of 0.129, which suggests that it fits the data well.
FMIN		0.047	Goodness of fit achieved. The **Default Model** shows a **good fit** with a low FMIN (0.047) and a confidence interval close to 0, meaning the model reasonably captures the relationships in the data.

(Author)

The main model was created using the IBM SPSS AMOS Version 29, and the indices mentioned above were tested for the Project Success Model. Figure 6.3 below illustrates the project stakeholder model developed for 4IR IT projects in South Africa.

The RMSEA value of 0.163 indicates a poor fit well above the acceptable threshold. The model fit could be improved, but this would mean removing some observed variables with a definite relationship. Additionally, NNFI/TLI (Non-Normed Fit Index/Tucker-Lewis Index) Level of Acceptance is > 0.90. The NNFI/TLI value of 0.277 is significantly below the acceptable threshold, indicating a poor fit (Microsoft Copilot, 2024). However, it should be noted that according to Hu and Bentler (1999), TLI and RMSEA tend to be too conservative in selecting models and are more likely to show poor fit in small samples. Consequently, these indices were not considered due to the sample size of 50. The Normed Fit Index (NFI), also known as the Bentler-Bonett Index, is another measure of model fit in Structural Equation Modelling (SEM). Generally, an NFI value greater than 0.90 indicates an acceptable fit. Thus, an NFI value of 0.918 suggests that the model fits the data well. It exceeds the commonly accepted threshold value, indicating that the model explains a substantial portion of the variance in the observed data. CFI (Comparative Fit Index) Level of Acceptance is > 0.90; the CFI value of 0.928 indicates a good fit, as it exceeds the acceptable threshold. The IFI (Incremental Fit Index) Level of Acceptance is> 0.90. The IFI value of 0.952 indicates a good fit, as it exceeds the acceptable threshold (Microsoft Copilot, 2024). Moreover, Hu and Bentler (1999) suggest that the IFI is not significantly affected by sample size. GFI (Goodness of Fit Index) Level of Acceptance: > 0.90. The GFI value of 0.981 indicates a good fit, as it exceeds the acceptable threshold. Overall, the model demonstrates a good fit with the data, supported by strong fit indices and robust path coefficients. This suggests that the model is well-constructed and effectively captures the relationships between the variables (Microsoft Copilot, 2024).

6.7 Revised Model

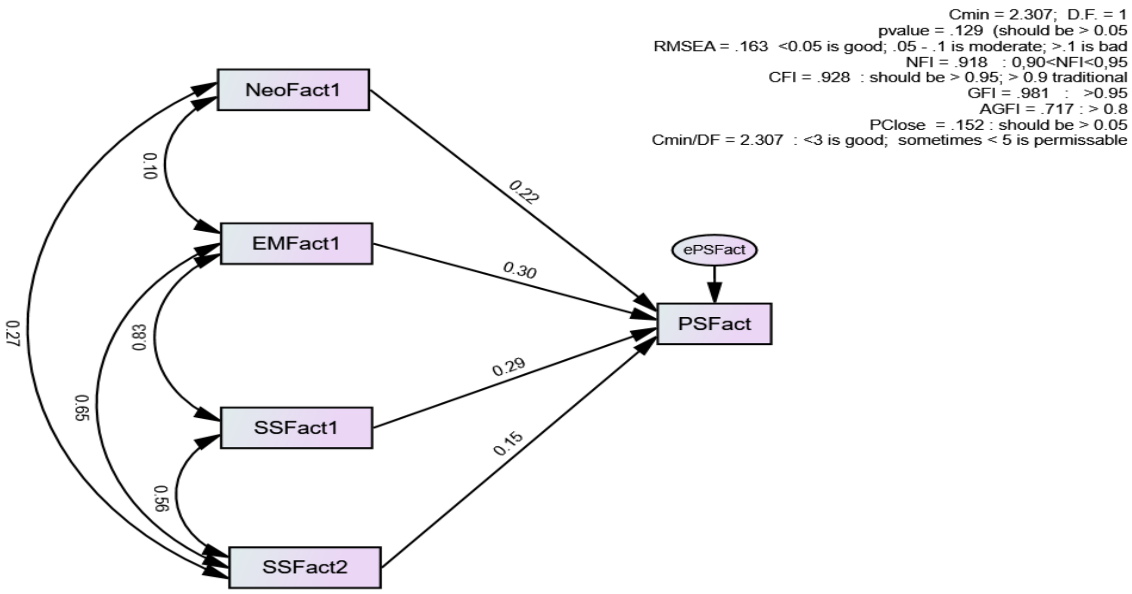

Figure 6.2: Revised Model *(refer to Figure 6.3 for a more detailed illustration)*

(IBM SPSS AMOS Version 27 SEM)

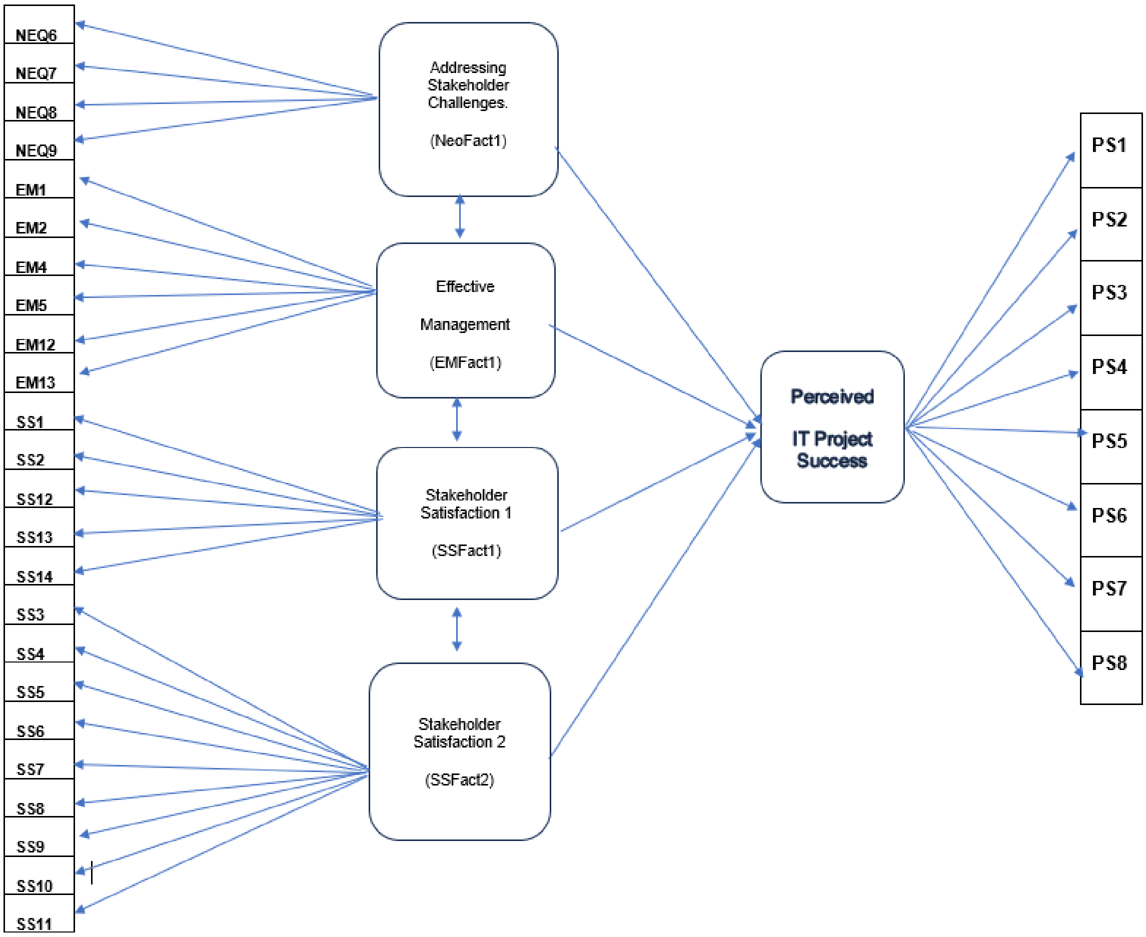

Figure 6.3: Final Model (Author)

The primary model is presented in Figure 6.3, which should be interpreted in conjunction with Table 6.1 on page 150. The Figure illustrates the relationships between latent variables and their indicators. It also illustrates the path from the latent variables to the dependent variable, “Perceived IT Project Success”. Addressing Stakeholder Challenges (NeoFact1) is a variable that is influenced by four indicators: NEQ6, NEQ7, NEQ8, and NEQ9. Effective Management (EMFact1) is a latent variable influenced by six indicators: EM1, EM2, EM4, EM5, EM12, and EM13. Stakeholder Satisfaction 1 (SSFact1) is influenced by five indicators: SS1, SS2, SS12, SS13, and SS14. SSFact1 captures one dimension of stakeholder satisfaction, whilst SSFact2 captures the other. SSFact2 is influenced by seven indicators: SS3, SS4, SS5, SS6, SS7, SS8, and SS9. The dependent variable, representing the success of IT projects, is measured by eight indicators: PS1 through PS8. These indicators capture the various dimensions of success as perceived by stakeholders.

6.8 Research Objectives: Revisited

6.8.1 Main Objective

The main objective of this research was to develop a stakeholder management framework to enhance project success in the IT project industry in South Africa, considering technological changes brought about by the fourth industrial revolution. SEM was used to test the data obtained to see if it fits the model. It was found that the data fit the model, as reflected in Table 6.2.

6.8.1.1 Secondary Objectives and Sub-Questions

The following sub-objectives were sought to be achieved by the end of the research:

Sub-Objective 1: Identify the stakeholder management challenges encountered in information technology projects in the Fourth Industrial Revolution.

Sub-Research Question 1: What are the stakeholder management challenges encountered in information technology projects within the context of the Fourth Industrial Revolution?

Sub-Objective 2: Identify strategies that can be used to effectively manage stakeholders in information technology projects in the era of the Fourth Industrial Revolution and the proliferation of AI.

Sub-Research Question 2: What strategies can be developed to effectively manage stakeholders in information technology projects in the era of the Fourth Industrial Revolution and the proliferation of AI?

Sub-Objective 3: Determine the relationship between stakeholder satisfaction and 4IR IT project success.

Sub-Research Question 3: What is the relationship between stakeholder satisfaction and 4IR IT project success.

Sub-Objective 4: Identify the critical success factors for stakeholder engagement and satisfaction in IT projects, considering the influence of AI and the evolving landscape of the Fourth Industrial Revolution.

Sub-Research Question 4: What are the critical success factors for stakeholder engagement and satisfaction in IT projects, considering the influence of AI and the evolving landscape of the Fourth Industrial Revolution?

The following Hypotheses were suggested at the beginning of the study, based upon the conceptual framework presented in Chapter 3 and tested using inferential statistics in SEM (these results have been presented in Chapter 5, and the indices are presented in Table 6.2 below).

6.9 Hypothesis

These hypotheses are elaborated on in Section 3.13 of Chapter 3 and revisited here below:

Researchers use path coefficients to test hypotheses about the relationships between variables, as discussed below for this particular research.

Hypothesis 1: *The Fourth Industrial Revolution introduces unique stakeholder management challenges organisations must address for successful information technology (IT) projects*.

Firstly. the structure matrix provided insight after the initial pattern matrix, showing the relationship between the variables and the factors. The structure matrix outlines how variables line up with factors. The pattern metrics showed that Component 1 has high loadings in “ensuring data security for stakeholders” with a value of 0.920; the next high loading was in the aspect of ensuring data privacy for stakeholders with 0.913; addressing ethical concerns related to AI and automation is next in line with the value of 0.7 0, and finally lack of skills to achieve project deliverables is 0.622. These were all grouped as **“Stakeholder data and skills concerns”** (Microsoft Copilot, 2024).

Component 2 reflects high loading in “limited stakeholder involvement” with 0.892 “, difficulty in identifying stakeholders”, which had a value of 0.858, and “addressing ethical concerns related to AI in automation” with a value of 0.303. This was consistent with the previous interpretation that these aspects be grouped under the banner **“Stakeholder engagement and identification”**.

Component 3 showed high loadings in “balancing expectation of multiple stakeholders”, which had a value of 0.868, as well as Stakeholder resistance to change (0.829) and addressing ethical concerns related to AI in automation (0.303). Inherent in these high loadings was the notion of **“stakeholder expectation, management and resistance”**. (Microsoft Copilot, 2024).

The structure matrix reflects some variables loaded onto more than one factor. For example, “addressing ethical concerns related to AI and automation” was one of the factors. The implication was that the variable had complex roles in different constructs. Practically speaking, project managers and the team must consider these factors when planning projects.

In the final Model, NeoFact1, EMFact1, SSFact1, and SSFact2 were significant predictors of PSFact. The path coefficients from NeoFact1, EMFact1, SSFact1, and SSFact2 to PSFact suggested that all four factors, in various degrees, contributed to influencing PSFact. EMFact1 and SSFact1 had relatively high path coefficients (0.30 and 0.29, respectively), while SSFact2 had the smallest impact (0.15). The standardised path coefficients were substantial enough to suggest that these factors were significant predictors of PSFact. Therefore, Hypothesis 1 was supported by the data. (Microsoft Copilot, 2024).

This was in line with the finding by Scheepers (2022), who commented on the role played by different stakeholders and said locales responded differently to proposed technological implementation. For the more sophisticated business subsidiaries, the reaction was to argue that more benefits would accrue if their existing systems could be integrated into the new global system. Yohannes (2022) also found that methodology, tools, and techniques significantly and positively influence IT Project Success. Project managers must adapt their skill sets and embrace collaboration with AI to remain relevant in the evolving landscape (Odejide, 2024).

Hypothesis 2: *Adopting effective stakeholder management strategies is essential for successful information technology projects.*

It is apparent that “regular communication with stakeholders” (0.868) was strongly correlated to Component 1 as well, as “transparent communication with stakeholders” (0.805) and “collaborative tools for efficient communication” (0.794), thus inferring that these were closely associated with the first component. Engaging stakeholders in the project planning process (0.779) also loaded onto Component 1, reinforcing the interpretation that this component reflected “Stakeholder engagement and communication”.

On the other hand, “leveraging data AI for informed stakeholder engagement” (0.947) showed a very strong correlation with Component 2 as well as “leveraging data analytics for informed stakeholder engagement” (0.906) has a high loading also on Component 2 and this reinforced the conclusion that this component was focusing on “data-driven decision making”.

However, “collaborative tools for efficient communication” with (0.417) and “proactive mitigation of risk related to stakeholders’ concerns” (0.328) somewhat had a moderate correlation with Component 2. Thus, they had an indirect link and linked primarily to Component 1. So, collaborative tools for efficient communication had moderate loadings on Component 1 and Component 2, suggesting that they contribute to various measures for both components. Component 1 is characterised by variables that emphasise regular transparent communication, stakeholder involvement in planning, and other collaborative tools. Their high correlations imply that the aspects are strongly correlated and form a cohesive factor, summarised as explaining “traditional engagement-focused aspects of stakeholder management.” Component 2 reflects a more technology-centric approach since it mainly uses AI and data analytics for informed stakeholder engagement. In summary, factor analysis has unveiled two separate components that are related to stakeholder engagement, i.e., “Communication and engagement practices”, which focus on strategies and tools that facilitate effective stakeholder communication and involvement, and secondly, “data-driven stakeholder engagement”, which emphasises the use of data and application of technology to enhance stakeholder engagement (Microsoft Copilot, 2024).

In the final model, EMFact1 had a stronger positive influence on PSFact than NeoFact1, SSFact1, and SSFact2. The path coefficient from EMFact1 to PSFact was the highest (0.30), supporting the notion that EMFact1 was the strongest predictor of PSFact among the four factors. While SSFact1 is also a strong predictor (0.29), EMFact1 still had a slightly higher influence. This provided evidence supporting Hypothesis 2, indicating that EMFact1 is the most influential factor on PSFact within this model. Ika et al. (2022) concurs, noting that although discrepancies between a project’s goals and its stakeholders’ interests are common, a proactive approach can be adopted. By actively engaging stakeholders and channelling their interests and influence, it is possible to foster their participation in the project, leading to improved outcomes for everyone involved. Iriarte and Bayona (2020) argue that the literature contains numerous factors, with little agreement among them, prompting ongoing efforts to understand the issue better. They highlight that top management support, user involvement, and internal communication are the most frequently cited factors. These critical factors align closely with those identified by the well-known authors Pinto and Slevin (1987), who also emphasise top management support, client consultation, and communication. Yohanes (2022) also found that communication significantly and positively influences IT project success.

Hypothesis 3: *There is a relationship between stakeholder satisfaction and 4IR IT project success.*

“Timely Stakeholder feedback”, with 0.927, followed by “Clear Communication with stakeholders” (0.913) and “Transparent Reporting of project progress” with 0.897;” Actionable stakeholder feedback” with 0.896; “Regular communication with stakeholders”, with 0.871, were highly correlated to Component 1. This confirms that this component represented “Stakeholder Communication and Feedback”.

“Data Analytics insights for decision-making” with 0.908 “, Collaborative Digital platforms” with 0.890 “, Data AI-driven insights for decision-making” with 0.866 and finally “Utilisation of Agile project management methodologies” with 0.792 were all highly correlated to Component 2. This confirmed the importance of data-driven decision-making and the use of digital tools in Project Management.

“Proactive Risk management”, with 0.919, followed by “Proactive Risk resolution”, with 0.909 and “Active involvement of stakeholders in decision-making”, with 0.759, were all highly correlated to Component 3. This component focuses on managing and resolving risks and involving stakeholders in decision-making potential risk mitigation.

“Timely stakeholder feedback” also had 0.512 with Component 3; “Active involvement of stakeholders in decision-making” had 0.634 with Component 1, 0.494 with Component 2, and 0.759 with Component 3. Thus, these showed moderate correlations with several other components. This suggested that these variables were not unique to only one component. The presence of these moderate cross-correlations implied that the components were somewhat distinct. However, there is some interconnectedness with other components. For example, “Proactive risk management” correlates with risk management (Component 3), and yet it also has some relevance to stakeholder communication (Component 1) and data-driven decision-making (Component 2).

In the final Model, NeoFact1, EMFact1, SSFact1, and SSFact2 correlate, impacting their combined effect on PSFact. The covariance values between NeoFact1, EMFact1, SSFact1, and SSFact2 (e.g., 0.83 between EMFact1 and SSFact1 and 0.65 between SSFact1 and SSFact2) suggested that these factors were indeed correlated. This implies they may share underlying characteristics or dimensions, which could collectively impact their relationship with PSFact. Ika and Pinto (2022:845) share the same sentiments when they posit that “while we argue for the existence of boundary conditions amongst these dimensions, we should note the permeable nature of these boundaries, in that it is possible for overlaps to occur between dimensions”. The strong correlations likely contribute to a shared variance that influences PSFact. Thus, Hypothesis 3 appears to be supported by the data, as substantial covariance exists among these factors. Aligning stakeholder expectations is a critical project success variable (Williams et al., 2015). Miller (2021) studied different models and found that customer consultation and acceptance were success factors in all models.

Hypothesis 4: *There is a relationship between critical success factors and IT project performance in the 4th Industrial Revolution.*

From the above Structure Matrix, it can be seen that Component 1 had a high positive loading for all the variables linked to the project's effectiveness and impact. It had high loadings in: "Project making a visible positive impact on the target beneficiaries" (0.885), "The project directly leading to improved performance for the end users/target beneficiaries" (0.884) and "The outcomes of the project being used by its intended end users," (0.872). It is evident that Component 2, as reflected in the Structure Matrix, can be seen to represent project management and operational efficiencies as it has high loadings in the following: "Project team members being satisfied with the process by which the project was implemented," (0.880); "Project specifications being met by the time of handover to the target beneficiaries," (0.840) and "The project having minimal start-up problems," (0.742).

The structural model fits the data well in the main model based on specific fit indices (e.g., RMSEA, CFI, GFI). The model fit indices provide mixed support for Hypothesis 4:

Good Fit: The **p-value** (.129) is above 0.05, and the **GFI** (0.981) is well above 0.95, indicating good fit.

- **Acceptable Fit**: The **CFI** (0.928) and **NFI** (0.918) are close to the desired threshold of 0.95 but slightly below it, suggesting a reasonable but not ideal fit.
- **Moderate Fit**: The **RMSEA** (0.163) and **AGFI** (0.717) fall short of the ideal ranges, indicating that there may be room for improvement in the model structure.

Yohannes (2022) concluded in her research that three of all the independent variables they studied showed a significant relationship towards the study's dependent variable, IT Project Success. These variables included effective organisational communication, project team capability/ competence, methodology, tools, and techniques. Shi et al. (2024) state that as AI technology matures, its impact on project management will only grow, paving the way for a future of more efficient, predictable, and successful projects.

6.10 Conclusions

Challenges in stakeholder management are mainly centred on stakeholder data and skills concerns, stakeholder engagement and identification, stakeholder expectation, management, and resistance. In summary, Hypotheses 1, 2, and 3 are well-supported by the data, as each factor is a significant predictor of project success (PSFact), with effective stakeholder management (EMFact1) being the strongest predictor, and the covariances indicate shared variance among the predictors. Overall, Hypothesis 4 was partially supported. The model demonstrates an acceptable fit with good indicators (p-value, GFI), though certain indices (RMSEA, AGFI) suggest that the model could be refined further for a better fit. This means that the project manager and the team must address stakeholder satisfaction to attain project success for the IT project. This includes taking care of factors such as Stakeholder Communication and Feedback, Data-Driven Decision-Making and proactive Risk Management. This is related or linked to effective stakeholder management. Effective stakeholder management can be achieved by ensuring that aspects such as stakeholder engagement and communication and leveraging data and technology in stakeholder engagement.

6.11 Recommendations

Based on the structural equation model (SEM), here are some practical recommendations to enhance IT Project success:

6.11.1 Project Success Factors (PSFact):

The factors that define project success (the dependent variable) in this study were the following outcomes:

1. The project is completed according to the budget allocated.
2. The project outcomes are being used by its intended end-users.
3. The project is making a visible positive impact on the target beneficiaries.
4. Project specifications being met by the time of handover to the target beneficiaries.
5. Project team members being satisfied with the process by which the project was implemented.
6. The project having minimal start-up problems.
7. The project directly leading to improved performance for the end users/target beneficiaries.
8. Clearly outline KPIs like budget adherence, stakeholder satisfaction, and impact on beneficiaries. Use post-implementation reviews to track whether the project meets its objectives.
9. Ensure team members feel involved and recognised for their contributions to the project.
10. Focus on outcomes that reflect value for stakeholders and project success metrics.

Large datasets, unforeseen challenges, and repetitive tasks can overwhelm project managers, leading to delays, budget overruns, and project failures (Soushtari et al., 2024). However, it should be pointed out that any generic success model should be adapted to the project's specificity and the project setting's idiosyncrasy (OECD, 2019).

6.11.2 Ethical and technical concerns (NeoFact1).

- Path coefficient: 0.22, indicating a modest positive effect on PSFact.
- The removal of NeoFact2 suggests issues in model stability.
- The focus was shifted to NeoFact1, combining variables.
- Addressing ethical concerns related to AI and automation.
- Develop clear ethical guidelines for AI and automation integration, ensure data privacy for stakeholders, and implement robust data protection mechanisms, especially when handling sensitive stakeholder information.
- Ensuring data security for stakeholders.

- Lacking soft skills to achieve deliverables, team members with interpersonal skills to manage diverse stakeholder expectations and deliverables effectively.
- Further investigation is needed to determine whether NeoFact2's variables (e.g., balancing stakeholder expectations) might fit better as a separate construct.
- Project managers and stakeholders must clearly understand the reasoning behind AI suggestions to ensure ethical decision-making (Odejide, 2024).
- Despite these limitations and ethical considerations, the potential benefits of AI in project management are undeniable (Daudu et al., 2024).
- All stakeholders must feel confident that their private information will not be lost, sold, or otherwise misused (Merhi, 2023).

6.11.3 Enhance Effective Management (EMFact1):

EMFact1 also significantly impacts project success (path coefficient of 0.30). The following must be addressed to ensure effective stakeholder management:

- Regular and transparent communication with stakeholders is essential. This can be achieved by outlining regular updates through meetings, progress reports, or newsletters.
- It is important to seek stakeholder feedback on project goals and align deliverables with their needs.
- Engaging stakeholders in the decision-making process and proactively mitigating risks related to stakeholder concerns is encouraged.
- Agile project management methodologies must be adopted for flexibility in adapting to changing stakeholder needs.
- Collaborative tools for efficient communication should be employed, such as using platforms like Slack, MS Teams, or Asana for efficient and transparent communication.
- AI can facilitate communication and collaboration between project teams and external stakeholders (Odejide, 2024).
- Chatbots can free up project managers' time for more strategic tasks and streamline communication within the team (Shoushtari et al., 2024).

6.11.4 Strengthen Stakeholder Satisfaction (SSFact1):

- Encourage a collaborative culture where team members support each other.
- There must be clear communication with stakeholders; using surveys, interviews, or focus groups to obtain constructive input from stakeholders can be useful.
- Regular communication with stakeholders is important, and relevant stakeholder feedback must be actioned.
- Stakeholder concerns must be addressed in time to avoid bottlenecks. AI can facilitate communication and collaboration between project teams and external stakeholders (Odejije, 2024).
- For an IT system upgrade, stakeholders should provide feedback at each sprint review, ensuring their concerns are addressed before the next development cycle.
- There must be transparent reporting of project progress to all.
- Share transparent updates on milestones and risks to maintain stakeholder trust.

As discussed in the literature, the notion of "ubuntu" manifests itself here. The philosophy is reflected in how African project managers lead their teams, as they often prioritise collaboration, communication, and the well-being of team members over individual success (Tshimanga, 2017). Thompson (2024) says that with the increasing complexity of projects and diverse stakeholder groups, traditional methods of stakeholder engagement and communication are becoming insufficient This resonates well with these findings.

6.11.5 Stakeholder involvement and risk management (SSFact2)

The following steps can be taken to aid in stakeholder involvement and risk management. Project managers must always encourage the active involvement of stakeholders in decision-making. Proactive risk management and risk resolution must be instituted. Full utilisation of agile project management methodologies and available collaborative digital platforms will go a long way in improving stakeholder management and engagement. Data and AI-driven insights for decision-making are important in this modern age. Organisations in SA are encouraged to adopt predictive analytics and AI-driven insights to anticipate and mitigate risks effectively. Practical steps, such as including stakeholders in risk assessment workshops and brainstorming sessions, can be taken to identify potential issues early. Odije (2024) states that AI models are continually advancing, integrating new data sources and becoming increasingly sophisticated. This progression will enhance their ability to predict risks more precisely, empowering project managers to address potential issues proactively. According to Bi et al. (2024), machine learning algorithms can examine historical project data to identify patterns and trends, thereby improving decision-making in resource allocation and scheduling.

6.11.6 Monitor and Adjust Indirect Influences:

Consider the indirect effects of other factors in the model. For example, improving NeoFact1 and SSFact2 might indirectly enhance project success through their influence on other variables.

6.11.7 Regular Assessments and Feedback:

Continuously assess the factors contributing to project success. Use surveys and feedback mechanisms to gather insights from team members and make necessary adjustments. By generating real-time reports and facilitating data sharing, AI can promote transparency and streamline project execution (Odejije, 2024). Focusing on these areas can create a more conducive environment for achieving project success.

6.12 Limitations of the study:

NeoFact1 integrates ethical and technical concerns effectively but was weakened by NeoFact2's exclusion. Explore separating stakeholder-specific challenges (e.g., balancing expectations) into a standalone construct. It would also be interesting to see what the findings would be like with a larger sample size as the AI uptake grows in South Africa. Artificial intelligence (AI) is being implemented across various projects, although many organisations are still in the initial phases of adoption.

There were some challenges faced during the undertaking of the research. Accessing organisations and AI specialists was not easy as these are mostly busy and unavailable.

Some of the constructs had to be removed from the final model as they did not have a significant impact on project success.

6.13 Recommendations for future studies:

While some relationships in the model are statistically significant, the model's overall fit is suboptimal, and many paths are not significant. The model may require further refinement, especially regarding the relationships between EMFact1, SSFact1, SSFact2, and PSFact. Additionally, attention should be paid to the poor RMSEA and NNFI/TLI scores, indicating a need to reconsider the model structure for better alignment with the data. Since, according to Hu and Bentler (1999), the fit indices can be affected by the sample size, it is recommended that the model be tested again in future studies with a larger sample size as the uptake of AI in IT projects grows in South Africa. Thus, a longitudinal study would be recommended instead of a cross-sectional one. Projects, and especially AI projects, are context sensitive. Because the factors presented here are generic, it is vital to adjust and validate these features in specific contexts (Miller, 2021).

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APPENDICES

APPENDIX A: ETHICAL CLEARANCE CERTIFICATE

Cape Peninsula University of Technology [8]

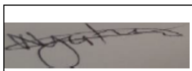
P.O. Box 1906 | Bellville 7535
Symphony Road Bellville 7535
South Africa

Office of the Chairperson Research Ethics Committee	**FACULTY: BUSINESS AND MANAGEMENT SCIENCES**

The Faculty's Research Ethics Committee (FREC) on **28 November 2023**, ethics **Approval** was granted to **Stanley Fore (231446403)** for a research activity for a **Doctor Of BMS: Project Management** at Cape Peninsula University of Technology.

Title of dissertation/thesis / project:	**Stakeholder management in selected IT 4IR projects in South Africa** Lead Supervisor (s): Prof. V.V Mugobo

Decision: APPROVED

 **Signed: Chairperson: Research Ethics Committee**	**07.02.2024** **Date**

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the CPUT Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study requires that the researcher stops the study and immediately informs the chairperson of the relevant Faculty Ethics Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing accompanied by a progress report.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, notably compliance with the Bill of Rights as provided for in the Constitution of the Republic of South Africa, 1996 (the Constitution) and where applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003 and/or other legislations that is relevant.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data requires additional ethics clearance.
7. No field work activities may continue after two (2) years for Masters and Doctorate research project from the date of issue of the Ethics Certificate. Submission of a completed research ethics progress report (REC 6) will constitute an application for renewal of Ethics Research Committee approval.

clearance Certificate No | 2023_FBMSREC_ST22

APPENDIX B: CONSENT LETTERS

pargo.co.za

05/05/2023

Dear Stanley Fore

I, Betine Dreyer at Pargo Points (Pty),

grant permission to collect data at this site for your research project entitled: Stakeholder Management in IT projects in South Africa.

I grant this permission as the authorized person to do so in this company and am aware of the following:

1. The study is conducted as a Cape Peninsula University of Technology researcher and remains the property of Cape Peninsula University of Technology;

2. You may not use the name of the company (Pargo Points), in your research Project and publications.

3. All data and information collected will be solely for academic purposes.

4. The research may be published in the public domain. The company name will be anonymous.

We would appreciate insight into your findings, as a company that values continuous improvement.

I wish you the best and success in this research.

Kind Regards,

Betine Dreyer
Head of Product

pargo

5th Floor, 103 Francis Street, Zonnebloem, Cape Town 7925
Reg # 2013/219029/07 | Directors: D Hoekert, L Veul, J du Preez

T +27 (021) 447 3636
E info@pargo.co.za

BYTE ORBIT

25 May 2023

Dear Stanley Fore,

I, Carel Burger, hereby authorise the collection of data at this site for your research project titled "Stakeholder Management in IT Projects in South Africa." As the authorized representative of this company, I am granting this permission and acknowledge the following:

1. The study is being conducted under the auspices of CPUT, and all rights to the research project belong to CPUT.
2. You are prohibited from using the name of the company in your research project and any subsequent publications.
3. All data and information gathered will be used exclusively for academic purposes.
4. The research findings may be made publicly available; however, the identity of the company will remain anonymous.

I extend my best wishes for your research and trust that it will be successful.

Kind regards,

Carel Burger
Chief Technology Officer

11 May 2023

To whom it may concern

This letter serves to confirm that *Stanley Fore* has our permission to carry out is research entitled *"Stakeholder Management in IT projects in SA"* at our organisation.

Regards

Jamie Chennells
0718584737
jamie@sovtech.com
Co-founder

APPENDIX C: QUESTIONNAIRE

Cape Peninsula University of Technology

Faculty of Business and Management Sciences

Ethics Informed Consent Form

CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Category of Participants (tick as appropriate):

Staff/Workers	✓	*Teachers*		*Parents*		*Lecturers*		*Students*	
Other (specify)									

You are kindly invited to participate in a research study being conducted by *Stanley Fore* from the Cape Peninsula University of Technology. The findings of this study will contribute towards (tick as appropriate):

An undergraduate project		*A conference paper*	
An Honours project		*A published journal article*	
A Masters/doctoral thesis	✓	*A published report*	

Selection criteria

You were selected as a possible participant in this study because you are:

(a) ***A stakeholder involved in IT 4IR Projects.***

(b) ____

The information below gives details about the study to help you decide whether you would want to participate.

Title of the research:

Stakeholder management in selected IT 4IR projects in South Africa

A brief explanation of what the research involves:

This study endeavours to offer valuable insights and practical recommendations for optimising stakeholder management processes and enhancing overall IT project performance in this ever-evolving business landscape. This is conducted within the South African context to help bridge the gap between stakeholder management and project performance.

Research Question: ***How can the stakeholders be managed sustainably for the successful execution of IT projects?***

Sub-Research Question 1: *What are the stakeholder management challenges encountered in information technology projects within the context of the Fourth Industrial Revolution?*
Sub-Research Question 2: *What are the* ***critical success factors*** *for stakeholder* ***engagement*** *and* ***satisfaction in IT projects, considering the influence of AI and the evolving landscape of the Fourth*** *Industrial Revolution?*
Sub-Research Question 3: *What strategies can be developed to effectively manage stakeholders in information technology projects in the era of the Fourth Industrial Revolution and the proliferation of Artificial Intelligence (AI)?*

Procedures

The information that will be collected from this survey will only be used for academic purposes. We would like to ask you to please take 15-20 minutes of your time by completing this survey. You can withdraw participating form the survey anytime. All information received on this form will be treated as strictly in confidentiality and anonymously. It will add more value to the research if all the sections of the research could be filled correctly and accurately.

If you volunteer to participate in this study the following will be done:

1. *Describe the main research procedures to you in advance, so that you are informed about what to expect.*
2. *In a case where there is no clarity, the respondents will be allowed to ask for confirmation or clarity of words/sentences/phrases to ensure accuracy of the data collected.*
3. *Data will be treated with full confidentiality and that, if published, it will not be identifiable as theirs.*

4. *Participants have the option of omitting questions they do not want to answer or feel uncomfortable with.*
5. *The questions do not pose any realistic risk of distress or discomfort, either physically or psychologically, to them.*
6. *Participants will be debriefed at the end of their participation (i.e., give them a brief explanation of the study).*
7. *The target population is anyone that work on projects at Head Office.*
8. *Your identity is protected, please do not make any markings that may be used to identify you.*

You are invited to contact the researchers should you have any questions about the research before or during the study. You will be free to withdraw your participation at any time without having to give a reason.

Kindly complete the table below before participating in the research.

Tick the appropriate column		
Statement	**Yes**	**No**
1. I understand the purpose of the research.	✓	
2. ***I understand what the research requires of me.***	✓	
3. ***I volunteer to take part in the research.***	✓	
4. ***I know that I can withdraw at any time.***	✓	
5. ***I understand that there will not be any form of discrimination against me as a result of my participation or non-participation.***	✓	
6. ***Comment:*** **n/a**		✓

Please sign the consent form. You will be given a copy of this form on request.

TODuncan	06-11-2023
Signature of participant	Date

Researchers

	Name:	**Surname:**	**Contact details:**
1.	Stanley	Fore	073 628 6902
2.	Virimai	Mugobo	079 037 1487

PLEASE MARK THE MOST APPROPRIATE WITH AN 'X"

Please rank the following by crossing (X) the most applicable on a scale 1 to 5.

Where: 1 = Strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree

I am a stakeholder in IT 4IR Project/s		**Yes**		**No**		
If you answered "No" to the above question; kindly discontinue with the study. If you answered "Yes" please proceed to the next section.						
From your own experience, the following are stakeholder management challenges normally encountered in IT projects in the Fourth Industrial Revolution.		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	*Difficulty in identifying stakeholder*	1	2	3	4	5
2	*Difficulty in prioritizing stakeholders*	1	2	3	4	5
3	*Stakeholder resistance to change*	1	2	3	4	5
4	*Balancing the expectations of multiple stakeholders*	1	2	3	4	5
5	*Limited stakeholder involvement*	1	2	3	4	5
6	*Addressing ethical concerns related to AI and automation*	1	2	3	4	5
7	*Ensuring data privacy for stakeholders*	1	2	3	4	5
8	*Ensuring data security for stakeholders*	1	2	3	4	5
9	*Lack of soft skills to achieve deliverables*	1	2	3	4	5
10	*Other (please specify & rank):*	1	2	3	4	5
From your own experience, the following are factors that contribute towards effective management of stakeholders in IT 4IR projects:						
11	*Regular communication with stakeholders*	1	2	3	4	5
12	*Transparent communication with stakeholders*	1	2	3	4	5
13	*Clearly defined roles and responsibilities for project stakeholders*	1	2	3	4	5
14		1	2	3	4	5

	Engaging stakeholders in the project planning process						
15	*Engaging stakeholders in the decision-making process*	1	2	3	4	5	
16	*Establishing a change management plan to address resistance to technology adoption*	1	2	3	4	5	
17	*Continuous stakeholder education on Fourth Industrial Revolution technologies*	1	2	3	4	5	
18	*Proactive identification of risks related to stakeholder concerns*	1	2	3	4	5	
19	*Proactive mitigation of risks related to stakeholder concerns*	1	2	3	4	5	
20	*Leveraging data analytics for informed stakeholder engagement*	1	2	3	4	5	
21	*Leveraging data AI for informed stakeholder engagement*	1	2	3	4	5	
22	*Agile project management methodologies for flexibility in adapting to changing stakeholder needs*	1	2	3	4	5	
23	*Collaborative tools for efficient communication*						
24	*Regular assessment of stakeholder engagement strategies based on project progress and outcomes*	1	2	3	4	5	
	Other (please specify & rank):	1	2	3	4	5	
From your own experience, the following are strategies that contribute to stakeholder satisfaction in AI-driven IT projects:							
25	*Clear communication with stakeholders*	1	2	3	4	5	
26	*Regular communication with stakeholders*	1	2	3	4	5	
27	*Active involvement of stakeholders in decision-making*	1	2	3	4	5	
28	*Effective change management strategies*	1	2	3	4	5	
29	*Stakeholder training on AI technology*	1	2	3	4	5	
30	*Proactive risk management*	1	2	3	4	5	
31	*Proactive risk resolution*	1	2	3	4	5	
32	*Utilization of agile project management methodologies*	1	2	3	4	5	
33	*Collaborative digital platforms*	1	2	3	4	5	
34	*Data analytics insights for decision-making*	1	2	3	4	5	
35	*Data AI-driven insights for decision-making*	1	2	3	4	5	
36		1	2	3	4	5	

	Actionable stakeholder feedback						
37	*Timely stakeholder feedback*	1	2	3	4	5	
38	*Transparent reporting of project progress*	1	2	3	4	5	
	Other (please specify & rank):	1	2	3	4	5	
From your own experience, the following characterise project success in AI-driven IT projects:							
39	*The project being completed according to the budget allocated*	1	2	3	4	5	
40	*The outcomes of the project being used by its intended end users*	1	2	3	4	5	
41	*The project making a visible positive impact on the target beneficiaries*	1	2	3	4	5	
42	*Project specifications being met by the time of handover to the target beneficiaries*	1	2	3	4	5	
43	*Project team members being satisfied with the process by which the project was implemented*	1	2	3	4	5	
44	*The project having minimal start-up problems*	1	2	3	4	5	
45	*The principal donors/sponsor being satisfied with the outcomes of the project implementation*	1	2	3	4	5	
46	*The project directly leading to improved performance for the end users/target beneficiaries*	1	2	3	4	5	
	Other (please specify & rank):	1	2	3	4	5	

THANK YOU FOR YOUR PARTICIPATION.

APPENDIX D: SIMILARITY REPORT

STAKEHOLDER MANAGEMENT IN SELECTED IT 4IR PROJECTS IN SOUTH AFRICA

ORIGINALITY REPORT

12%	8%	11%	7%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	dspace.biblioteca.um.edu.mx Internet Source	1%
2	researcharchive.vuw.ac.nz Internet Source	1%
3	Aga, D.A., N. Noorderhaven, and B. Vallejo. "Transformational leadership and project success: The mediating role of team-building", International Journal of Project Management, 2016. Publication	1%
4	dspace.um.edu.mx Internet Source	<1%
5	eprints.undip.ac.id Internet Source	<1%
6	repository.usu.ac.id Internet Source	<1%
7	repository.ipwija.ac.id Internet Source	<1%

APPENDIX E: LANGUAGE CERTIFICATE

Gerald T du Preez

PhD

8 Arnim Lifestyle Estate

Hoopenberg Street, Brackenfell

7560

+27 (83) 325 1842

geralddu9@gmail.com

PROFESSIONAL EDITING SERVICES

Stand out for the Write reasons

Certificate of Editing

This serves to confirm that copy-editing and proofreading services were rendered to

Stanley Fore for a Doctorate in Project Management

Stakeholder Management in Selected 4IR Projects in South Africa

With an initial word count of 61 089 and a final word count of 51 821 on 3 December 2024

I am a member of the Professional Editors' Guild (member number DUP015) and commit to the following codes of practice (among others):

- *I have completed the work independently and did not sub-contract it out*
- *I kept to the agreed deadlines and/or communicated changes within reasonable time frames*
- *I treated all work as confidential and maintained objectivity in editing*
- *I did not accept work that could be considered unlawful, dishonest or contrary to public interest*

I uphold the following editing standards:

- *proofreading for mechanical errors such as spelling, punctuation, grammar*
- *copy-editing that includes commenting on, but not correcting, structure, organisation and logical flow of content, formatting (headings, page numbers, table of contents, etc.), eliminating unnecessary repetition*
- *checking citation style is correct, punctuating as needed and flagging missing or incorrect references*
- *commenting on suspected plagiarism and missing sources*
- *returning the document with track changes for the author to accept*

I confirm that I have met the above standards of editing and professional ethical practice.

The content of the work edited remains that of the student.

Gerald T du Preez, PhD

APPENDIX F: PUBLISHED ARTICLES

IJARBM – International Journal of Applied Research in Business and Management
Vol. 05 / Issue 02, July 2024
ISSN: 2700-8983 | an Open Access Journal by Wohllebe & Ross Publishing

This paper is available online at www.ijarbm.org

Strategies for Effectively Managing Stakeholders in 4IR Information Technology (IT) Projects

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https://doi.org/10.51137/wrp.ijarbm.2024.sfsa.45625

Abstract – As a result of the Fourth Industrial Revolution (4IR) and the resultant rapid growth in Artificial Intelligence (AI) technologies, effective stakeholder management in Information Technology (IT) projects has become pivotal for project success. This study explores strategies for IT stakeholder management. The emphasis is on proactive and innovative approaches. Using a mono-method research approach, data was collected through online questionnaires distributed using the Lime Survey platform, targeting IT project professionals. The findings highlight the importance of regular and transparent communication, stakeholder engagement in planning and decision-making processes, and the use of data analytics and AI for informed stakeholder engagement. Factor analysis identified two primary components: traditional engagement-focused practices and data-driven decision-making. The results underscore the necessity of integrating human-centred and technology-centric strategies to enhance stakeholder management and project success in the dynamic landscape of 4IR.


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9

FACTORS INFLUENCING EFFECTIVE MANAGEMENT OF STAKEHOLDERS IN IT 4IR PROJECTS IN SOUTH AFRICA

Stanley Fore[1*], Irshaad Desai[2]

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* Corresponding author: fores@cput.ac.za, CPUT. Cnr Tenant/Hanover Street, District 6, Cape Town, 8001.

KEYWORDS

Fourth Industrial Revolution (4IR), IT Projects, Project Stakeholder

ABSTRACT

In a technologically changing world, the roles and expectations of stakeholders are continuously evolving. It behooves project practitioners to understand and appreciate the dynamics of stakeholder management in this new world order. The study was conducted within the South African context to investigate the factors influencing stakeholder management and project performance. A quantitative approach was used, and inferential factor analysis statistics were applied to analyse responses from questionnaire distributed on-line using via the Lime Survey platform. Statistical analyses were performed using the SPSS ® Amos® Version 29. The aim of the research was to identify factors that influence IT project stakeholder management in the Fourth Industrial Revolution (4IR) in South Africa. "Communication and engagement practices," which focus on strategies and tools that facilitate effective stakeholder communication and involvement; and secondly, "Data-driven stakeholder engagement" which emphasises on the use of data and application of technology to enhance stakeholder engagement were identified as major factors impacting stakeholder management.

International Conference on Interdisciplinary Studies in Education Research & Technology 2024 (ISERT – 2024)
December 20 – 23, 2024 | Dubai UAE

Reference No: LAE/Office/2024/032 **Date: Aug 16, 2024**
Reference ID: ISERT_2024_036

Abstract Acceptance cum International Conference Invitation Letter

To,
Mr. Stanley Fore,
Cape Peninsula University of Technology, South Africa

ISERT - 2024 Committee cordially invites you to attend the **"International Conference on Interdisciplinary Studies in Education Research & Technology 2024 (ISERT - 2024)"** which is going to be held during **20 – 23 December 2024 in Dubai, UAE.**

We welcome you to join us and share your knowledge and views in respective to the theme **"Administrative & Financial Development".** We are glad to inform you that **your abstract has been accepted** by the committee for **the conference.**

In this regard, on behalf of the Organising Committee, we are pleased to welcome you to join us and present your research on **"Stakeholder management challenges encountered in IT projects".** The specific details of the day and time of your presentation will be included in the conference program which will be available in December 2024.

All attendees must register for the conference and pay the appropriate registration fee. Please note the Organising Committee does not provide any financial support for visa, travel or accommodation. If it is necessary for you to obtain a travel visa to attend the conference, you may use this letter as an invitation. Early application is suggested to allow for the required processing.

ISERT 2024 will definitely offer you an unforgettable experience in exploring new opportunities.

We look forward to see you at ISERT - 2024 Dubai.

Yours Sincerely

Dr. Vishal Vasistha
Organising Secretary
ISERT - 2024
Laescuela Education, India

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Sweeti
DIRECTOR

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APPENDIX G: FIT STATISTICS-MAIN MODEL

C:\Users\UYSC\Documents\Research Private\ForeStanley\EMDim1.amw

Analysis Summary

Date and Time

Date: Monday, 02 September 2024

Time: 17:37:01

Title

Emdim1: Monday, 02 September 2024 17:37

Notes for Group (Group number 1)

The model is recursive.

Sample size = 50

Variable Summary (Group number 1)

Your model contains the following variables (Group number 1)

Observed, endogenous variables.

EM1

EM2

EM4

EM5

EM9

EM12

EM13

Unobserved, exogenous variables

eEM1

eEM2

eEM4

EMDim1

eEM5

eEM9

eEM12

eEM13

Variable counts (Group number 1)

Number of variables in your model:	15
Number of observed variables:	7
Number of unobserved variables:	8
Number of exogenous variables:	8
Number of endogenous variables:	7

Parameter Summary (Group number 1)

	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	8	0	0	0	0	8
Labeled	0	0	0	0	0	0
Unlabeled	6	5	8	0	0	19
Total	14	5	8	0	0	27

Models

Default model (Default model)

Notes for Model (Default model)

Computation of degrees of freedom (Default model)

Number of distinct sample moments:	28
Number of distinct parameters to be estimated:	19
Degrees of freedom (28 - 19):	9

Result (Default model)

Minimum was achieved

Chi-square = 9.327

Degrees of freedom = 9

Probability level = .408

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Generalized Least Squares Estimates

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
EM4	<---	EMDim1	1.000				
EM5	<---	EMDim1	1.307	.301	4.349	***	
EM1	<---	EMDim1	.813	.174	4.685	***	
EM2	<---	EMDim1	.758	.185	4.096	***	
EM9	<---	EMDim1	1.101	.253	4.350	***	
EM12	<---	EMDim1	1.105	.279	3.957	***	
EM13	<---	EMDim1	.814	.178	4.581	***	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
EM4	<---	EMDim1	.717
EM5	<---	EMDim1	.826
EM1	<---	EMDim1	.643
EM2	<---	EMDim1	.553
EM9	<---	EMDim1	.781
EM12	<---	EMDim1	.792
EM13	<---	EMDim1	.613

Covariances: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
eEM1	<-->	eEM2	.277	.069	3.994	***	
eEM5	<-->	eEM12	-.199	.097	-2.060	.039	
eEM9	<-->	eEM12	-.163	.084	-1.940	.052	
eEM1	<-->	eEM13	.157	.058	2.730	.006	
eEM2	<-->	eEM13	.147	.066	2.222	.026	

Correlations: (Group number 1 - Default model)

			Estimate
eEM1	<-->	eEM2	.759
eEM5	<-->	eEM12	-.795

eEM9	<-->	eEM12	-.659
eEM1	<-->	eEM13	.469
eEM2	<-->	eEM13	.371

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
EMDim1	.330	.128	2.569	.010	
eEM1	.309	.067	4.613	***	
eEM2	.431	.094	4.611	***	
eEM4	.313	.076	4.105	***	
eEM5	.262	.107	2.457	.014	
eEM9	.256	.085	3.004	.003	
eEM12	.239	.102	2.353	.019	
eEM13	.364	.079	4.586	***	

Matrices (Group number 1 - Default model)

Residual Covariances (Group number 1 - Default model)

	EM13	EM12	EM9	EM5	EM4	EM2	EM1
EM13	.057						
EM12	.035	.055					
EM9	.008	-.047	.049				
EM5	-.051	-.033	.023	.024			
EM4	.103	.061	-.026	-.057	.081		
EM2	.062	.017	.028	-.043	.112	.069	
EM1	.028	.039	-.033	-.023	.063	.027	.023

Standardized Residual Covariances (Group number 1 - Default model)

	EM13	EM12	EM9	EM5	EM4	EM2	EM1
EM13	.487						
EM12	.361	.426					
EM9	.083	-.480	.368				
EM5	-.461	-.300	.184	.144			

EM4	1.083	.578	-.246	-.474	.625		
EM2	.619	.175	.280	-.382	1.149	.549	
EM1	.294	.414	-.352	-.214	.686	.249	.214

Notes for Group/Model (Group number 1 - Default model)

The following covariance matrix is not positive definite (Group number 1 - Default model)

	eEM12	eEM9	eEM5
eEM12	.239		
eEM9	-.163	.256	
eEM5	-.199	.000	.262

This solution is not admissible.

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	19	9.327	9	.408	1.036
Saturated model	28	.000	0		
Independence model	7	47.523	21	.001	2.263
Zero model	0	171.500	28	.000	6.125

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.052	.946	.831	.304
Saturated model	.000	1.000		
Independence model	.384	.723	.631	.542
Zero model	.463	.000	.000	.000

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.804	.542	.992	.971	.988
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.429	.344	.423
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	.327	.000	11.926
Saturated model	.000	.000	.000
Independence model	26.523	10.250	50.513

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.190	.007	.000	.243
Saturated model	.000	.000	.000	.000
Independence model	.970	.541	.209	1.031

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.027	.000	.164	.504
Independence model	.161	.100	.222	.004

AIC

Model	AIC	BCC	BIC	CAIC
Default model	47.327	54.742	83.655	102.655
Saturated model	56.000	66.927	109.537	137.537
Independence model	61.523	64.255	74.908	81.908
Zero model	171.500	171.500	171.500	171.500

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	.966	.959	1.203	1.117
Saturated model	1.143	1.143	1.143	1.366
Independence model	1.256	.923	1.745	1.311

Zero model	3.500	2.733	4.420	3.500

HOELTER

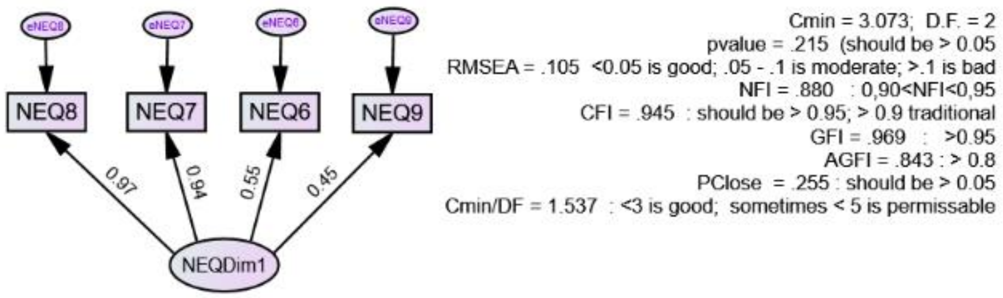
Model	HOELTER .05	HOELTER .01
Default model	89	114
Independence model	34	41
Zero model	12	14

Execution time summary

Minimization:	.059
Miscellaneous:	.250
Bootstrap:	.000
Total:	.309

APPENDIX H: AMOS SEM CONSTRUCTS FOR COMPOSITE MODEL

NEQ Factor 1



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Analysis Summary

Date and Time

Date: Monday, 02 September 2024

Time: 17:04:20

Title

Neqdim1: Monday, 02 September 2024 17:04

Notes for Group (Group number 1)

The model is recursive.

Sample size = 50

Variable Summary (Group number 1)

Your model contains the following variables (Group number 1)

Observed, endogenous variables

NEQ8

NEQ7

NEQ6

NEQ9

Unobserved, exogenous variables

eNEQ8

eNEQ7

eNEQ6

eNEQ9

NEQDim1

Variable counts (Group number 1)

Number of variables in your model:	9
Number of observed variables:	4
Number of unobserved variables:	5
Number of exogenous variables:	5
Number of endogenous variables:	4

Parameter Summary (Group number 1)

	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	5	0	0	0	0	5
Labeled	0	0	0	0	0	0
Unlabeled	3	0	5	0	0	8
Total	8	0	5	0	0	13

Models

Default model (Default model)

Notes for Model (Default model)

Computation of degrees of freedom (Default model)

Number of distinct sample moments:	10
Number of distinct parameters to be estimated:	8
Degrees of freedom (10 - 8):	2

Result (Default model)

Minimum was achieved

Chi-square = 3.073

Degrees of freedom = 2

Probability level = .215

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Generalized Least Squares Estimates

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
NEQ8	<---	NEQDim1	1.000				
NEQ7	<---	NEQDim1	.944	.102	9.245	***	
NEQ6	<---	NEQDim1	.483	.118	4.083	***	
NEQ9	<---	NEQDim1	.484	.153	3.166	.002	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
NEQ8	<---	NEQDim1	.973
NEQ7	<---	NEQDim1	.939
NEQ6	<---	NEQDim1	.554
NEQ9	<---	NEQDim1	.452

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
NEQDim1	1.203	.278	4.325	***	
eNEQ8	.069	.109	.635	.525	
eNEQ7	.144	.102	1.422	.155	
eNEQ6	.631	.139	4.535	***	
eNEQ9	1.096	.239	4.588	***	

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	8	3.073	2	.215	1.537
Saturated model	10	.000	0		
Independence model	4	25.534	6	.000	4.256
Zero model	0	98.000	10	.000	9.800

RMR, GFI

Model	RMR	GFI	AGFI	PGFI

Default model	.094	.969	.843	.194
Saturated model	.000	1.000		
Independence model	.754	.739	.566	.444
Zero model	.961	.000	.000	.000

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.880	.639	.954	.835	.945
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.333	.293	.315
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	1.073	.000	10.125
Saturated model	.000	.000	.000
Independence model	19.534	7.524	39.080

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.063	.022	.000	.207
Saturated model	.000	.000	.000	.000
Independence model	.521	.399	.154	.798

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.105	.000	.321	.255
Independence model	.258	.160	.365	.001

AIC

Model	AIC	BCC	BIC	CAIC

Default model	19.073	20.892	34.370	42.370
Saturated model	20.000	22.273	39.120	49.120
Independence model	33.534	34.443	41.182	45.182
Zero model	98.000	98.000	98.000	98.000

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	.389	.367	.574	.426
Saturated model	.408	.408	.408	.455
Independence model	.684	.439	1.083	.703
Zero model	2.000	1.427	2.725	2.000

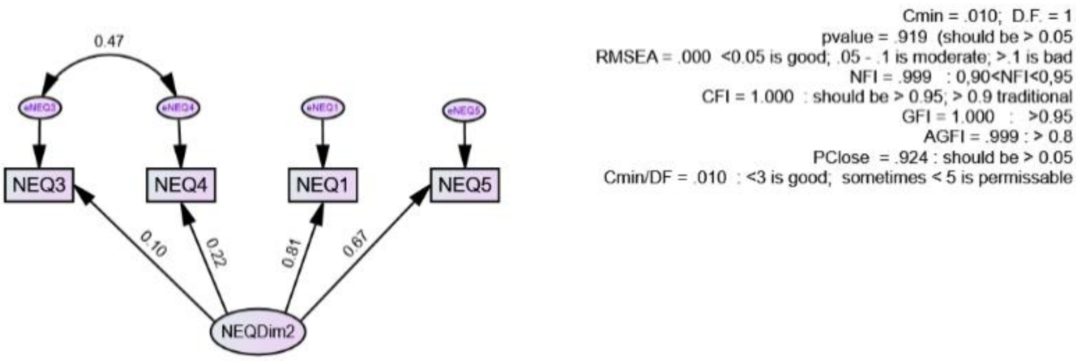
HOELTER

Model	HOELTER .05	HOELTER .01
Default model	96	147
Independence model	25	33
Zero model	10	12

Execution time summary

Minimization:	.038
Miscellaneous:	.159
Bootstrap:	.000
Total:	.197

NEQ Factor 2 (Different to FA)



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Analysis Summary

Date and Time

Date: Monday, 02 September 2024

Time: 17:20:12

Title

Neqdim2 new: Monday, 02 September 2024 17:20

Notes for Group (Group number 1)

The model is recursive.

Sample size = 50

Variable Summary (Group number 1)

Your model contains the following variables (Group number 1)

Observed, endogenous variables

NEQ3

NEQ4

NEQ1

NEQ5

Unobserved, exogenous variables

eNEQ3

eNEQ4

eNEQ1

eNEQ5

NEQDim2

Variable counts (Group number 1)

Number of variables in your model:	9
Number of observed variables:	4
Number of unobserved variables:	5
Number of exogenous variables:	5
Number of endogenous variables:	4

Parameter Summary (Group number 1)

	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	5	0	0	0	0	5
Labeled	0	0	0	0	0	0
Unlabeled	3	1	5	0	0	9
Total	8	1	5	0	0	14

Models

Default model (Default model)

Notes for Model (Default model)

Computation of degrees of freedom (Default model)

Number of distinct sample moments:	10
Number of distinct parameters to be estimated:	9
Degrees of freedom (10 - 9):	1

Result (Default model)

Minimum was achieved

Chi-square = .010

Degrees of freedom = 1

Probability level = .919

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Generalized Least Squares Estimates

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
NEQ1	<---	NEQDim2	1.000				
NEQ5	<---	NEQDim2	.668	.577	1.158	.247	
NEQ3	<---	NEQDim2	.114	.197	.578	.563	
NEQ4	<---	NEQDim2	.192	.184	1.042	.298	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
NEQ1	<---	NEQDim2	.808
NEQ5	<---	NEQDim2	.668

NEQ3	<---	NEQDim2	.103
NEQ4	<---	NEQDim2	.220

Covariances: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
eNEQ3	<-->	eNEQ4	.469	.159	2.952	.003	

Correlations: (Group number 1 - Default model)

			Estimate
eNEQ3	<-->	eNEQ4	.473

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
NEQDim2	1.058	.951	1.113	.266	
eNEQ3	1.290	.262	4.928	***	
eNEQ4	.762	.157	4.839	***	
eNEQ1	.561	.907	.619	.536	
eNEQ5	.586	.418	1.401	.161	

Matrices (Group number 1 - Default model)

Residual Covariances (Group number 1 - Default model)

	NEQ5	NEQ1	NEQ4	NEQ3
NEQ5	.000			
NEQ1	.000	.000		
NEQ4	.000	.000	.000	
NEQ3	-.009	.006	.000	.000

Standardized Residual Covariances (Group number 1 - Default model)

	NEQ5	NEQ1	NEQ4	NEQ3
NEQ5	.001			
NEQ1	-.001	.000		
NEQ4	-.001	.001	.000	
NEQ3	-.056	.029	.000	.002

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	9	.010	1	.919	.010
Saturated model	10	.000	0		
Independence model	4	20.149	6	.003	3.358
Zero model	0	98.000	10	.000	9.800

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.004	1.000	.999	.100
Saturated model	.000	1.000		
Independence model	.440	.794	.657	.477
Zero model	.831	.000	.000	.000

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.999	.997	1.052	1.420	1.000
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.167	.167	.167
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	.000	.000	.974
Saturated model	.000	.000	.000
Independence model	14.149	4.131	31.742

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.000	.000	.000	.020

Saturated model	.000	.000	.000	.000
Independence model	.411	.289	.084	.648

RMSEA

Model	**RMSEA**	**LO 90**	**HI 90**	**PCLOSE**
Default model	.000	.000	.141	.924
Independence model	.219	.119	.329	.006

AIC

Model	**AIC**	**BCC**	**BIC**	**CAIC**
Default model	18.010	20.056	35.219	44.219
Saturated model	20.000	22.273	39.120	49.120
Independence model	28.149	29.058	35.797	39.797
Zero model	98.000	98.000	98.000	98.000

ECVI

Model	**ECVI**	**LO 90**	**HI 90**	**MECVI**
Default model	.368	.388	.408	.409
Saturated model	.408	.408	.408	.455
Independence model	.574	.370	.934	.593
Zero model	2.000	1.427	2.725	2.000

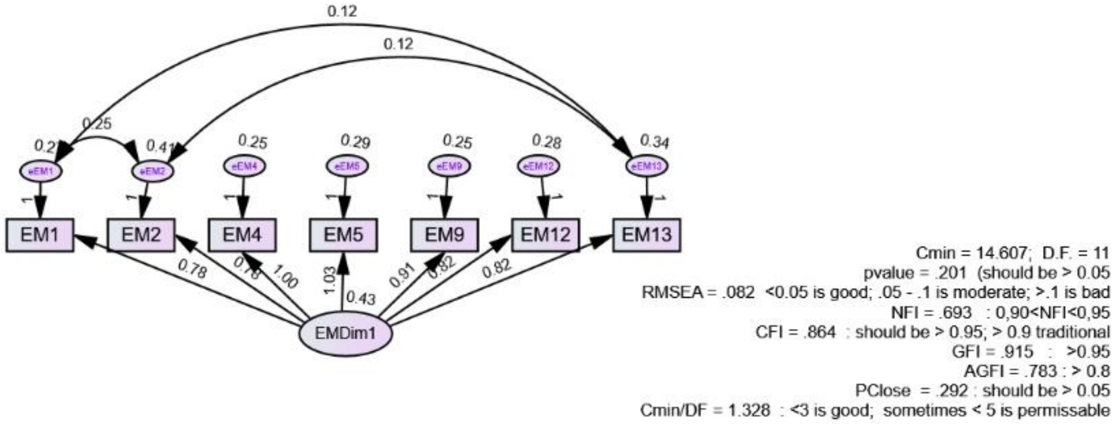
HOELTER

Model	**HOELTER .05**	**HOELTER .01**
Default model	18091	31247
Independence model	31	41
Zero model	10	12

Execution time summary

Minimization:	.022
Miscellaneous:	.158
Bootstrap:	.000
Total:	.180

EMFact1



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Analysis Summary

Date and Time

Date: Tuesday, 03 September 2024

Time: 11:26:24

Title

Emdim1: Tuesday, 03 September 2024 11:26

Notes for Group (Group number 1)

The model is recursive.

Sample size = 50

Variable Summary (Group number 1)

Your model contains the following variables (Group number 1)

Observed, endogenous variables

EM1

EM2

EM4

EM5

EM9

EM12

EM13

Unobserved, exogenous variables

eEM1

eEM2

eEM4

EMDim1

eEM5

eEM9

eEM12

eEM13

Variable counts (Group number 1)

Number of variables in your model:	15
Number of observed variables:	7
Number of unobserved variables:	8
Number of exogenous variables:	8
Number of endogenous variables:	7

Parameter Summary (Group number 1)

	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	8	0	0	0	0	8
Labeled	0	0	0	0	0	0
Unlabeled	6	3	8	0	0	17
Total	14	3	8	0	0	25

Models

Default model (Default model)

Notes for Model (Default model)

Computation of degrees of freedom (Default model)

Number of distinct sample moments:	28
Number of distinct parameters to be estimated:	17
Degrees of freedom (28 - 17):	11

Result (Default model)

Minimum was achieved

Chi-square = 14.607

Degrees of freedom = 11

Probability level = .201

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Generalized Least Squares Estimates

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
EM4	<---	EMDim1	1.000				
EM5	<---	EMDim1	1.026	.224	4.572	***	
EM1	<---	EMDim1	.781	.167	4.683	***	
EM2	<---	EMDim1	.775	.182	4.269	***	
EM9	<---	EMDim1	.910	.202	4.511	***	
EM12	<---	EMDim1	.820	.171	4.783	***	
EM13	<---	EMDim1	.816	.174	4.685	***	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
EM4	<---	EMDim1	.795
EM5	<---	EMDim1	.783
EM1	<---	EMDim1	.703
EM2	<---	EMDim1	.620
EM9	<---	EMDim1	.765
EM12	<---	EMDim1	.715
EM13	<---	EMDim1	.678

Covariances: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
eEM1	<-->	eEM2	.249	.070	3.557	***	
eEM1	<-->	eEM13	.124	.057	2.149	.032	
eEM2	<-->	eEM13	.124	.067	1.851	.064	

Correlations: (Group number 1 - Default model)

			Estimate
eEM1	<-->	eEM2	.747

eEM1	<-->	eEM13	.411
eEM2	<-->	eEM13	.333

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
EMDim1	.429	.142	3.013	.003	
eEM1	.269	.066	4.056	***	
eEM2	.413	.095	4.358	***	
eEM4	.250	.075	3.322	***	
eEM5	.286	.096	2.986	.003	
eEM9	.252	.080	3.142	.002	
eEM12	.276	.083	3.347	***	
eEM13	.336	.080	4.189	***	

Matrices (Group number 1 - Default model)

Residual Covariances (Group number 1 - Default model)

	EM13	EM12	EM9	EM5	EM4	EM2	EM1
EM13	.018						
EM12	.045	.133					
EM9	-.015	-.129	.098				
EM5	-.060	-.117	.097	.112			
EM4	.022	.074	-.053	-.066	.045		
EM2	.016	.021	.001	-.058	.029	.019	
EM1	.007	.060	-.043	-.016	-.004	-.002	.020

Standardized Residual Covariances (Group number 1 - Default model)

	EM13	EM12	EM9	EM5	EM4	EM2	EM1
EM13	.144						
EM12	.476	1.164					
EM9	-.147	-1.351	.797				
EM5	-.543	-1.108	.874	.751			
EM4	.206	.725	-.495	-.558	.325		
EM2	.151	.216	.006	-.515	.269	.137	
EM1	.068	.689	-.463	-.158	-.042	-.015	.182

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	17	14.607	11	.201	1.328
Saturated model	28	.000	0		
Independence model	7	47.523	21	.001	2.263
Zero model	0	171.500	28	.000	6.125

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.063	.915	.783	.359
Saturated model	.000	1.000		
Independence model	.384	.723	.631	.542
Zero model	.463	.000	.000	.000

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.693	.413	.901	.740	.864
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.524	.363	.453
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	3.607	.000	17.737
Saturated model	.000	.000	.000
Independence model	26.523	10.250	50.513

FMIN

Model	FMIN	F0	LO 90	HI 90

Default model	.298	.074	.000	.362
Saturated model	.000	.000	.000	.000
Independence model	.970	.541	.209	1.031

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.082	.000	.181	.292
Independence model	.161	.100	.222	.004

AIC

Model	AIC	BCC	BIC	CAIC
Default model	48.607	55.241	81.112	98.112
Saturated model	56.000	66.927	109.537	137.537
Independence model	61.523	64.255	74.908	81.908
Zero model	171.500	171.500	171.500	171.500

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	.992	.918	1.280	1.127
Saturated model	1.143	1.143	1.143	1.366
Independence model	1.256	.923	1.745	1.311
Zero model	3.500	2.733	4.420	3.500

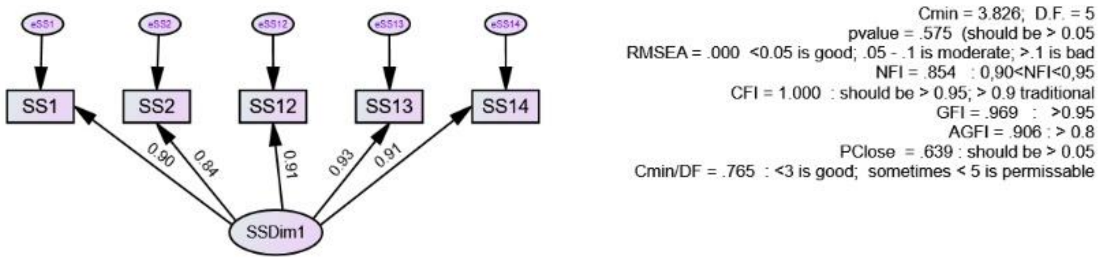
HOELTER

Model	HOELTER .05	HOELTER .01
Default model	67	83
Independence model	34	41
Zero model	12	14

Execution time summary

Minimization:	.065
Miscellaneous:	.233
Bootstrap:	.000
Total:	.298

SS Factor1



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Analysis Summary

Date and Time

Date: Monday, 02 September 2024

Time: 17:49:08

Title

Ssdim1: Monday, 02 September 2024 17:49

Notes for Group (Group number 1)

The model is recursive.

Sample size = 50

Variable Summary (Group number 1)

Your model contains the following variables (Group number 1)

Observed, endogenous variables

SS1

SS2

SS12

SS13

SS14

Unobserved, exogenous variables

eSS1

SSDim1

eSS2

eSS12

eSS13

eSS14

Variable counts (Group number 1)

Number of variables in your model:	11
Number of observed variables:	5
Number of unobserved variables:	6
Number of exogenous variables:	6
Number of endogenous variables:	5

Parameter Summary (Group number 1)

	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	6	0	0	0	0	6
Labeled	0	0	0	0	0	0
Unlabeled	4	0	6	0	0	10
Total	10	0	6	0	0	16

Models

Default model (Default model)

Notes for Model (Default model)

Computation of degrees of freedom (Default model)

Number of distinct sample moments:	15
Number of distinct parameters to be estimated:	10
Degrees of freedom (15 - 10):	5

Result (Default model)

Minimum was achieved

Chi-square = 3.826

Degrees of freedom = 5

Probability level = .575

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Generalized Least Squares Estimates

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
SS1	<---	SSDim1	1.000				
SS2	<---	SSDim1	.955	.114	8.365	***	
SS12	<---	SSDim1	1.040	.112	9.284	***	
SS13	<---	SSDim1	1.056	.098	10.789	***	
SS14	<---	SSDim1	1.130	.130	8.719	***	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
SS1	<---	SSDim1	.897
SS2	<---	SSDim1	.840
SS12	<---	SSDim1	.905
SS13	<---	SSDim1	.932
SS14	<---	SSDim1	.909

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
SSDim1	.438	.111	3.947	***	
eSS1	.106	.029	3.691	***	
eSS2	.167	.038	4.390	***	
eSS12	.104	.028	3.739	***	
eSS13	.074	.023	3.259	.001	
eSS14	.118	.033	3.555	***	

Matrices (Group number 1 - Default model)

Residual Covariances (Group number 1 - Default model)

	SS14	SS13	SS12	SS2	SS1
SS14	.013				
SS13	-.002	.004			
SS12	.015	-.011	.006		
SS2	-.003	-.004	.001	.001	
SS1	-.025	.011	-.006	.007	.012

Standardized Residual Covariances (Group number 1 - Default model)

	SS14	SS13	SS12	SS2	SS1

SS14	.097				
SS13	-.020	.036			
SS12	.134	-.105	.054		
SS2	-.024	-.040	.012	.012	
SS1	-.221	.102	-.061	.068	.107

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	10	3.826	5	.575	.765
Saturated model	15	.000	0		
Independence model	5	26.262	10	.003	2.626
Zero model	0	122.500	15	.000	8.167

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.010	.969	.906	.323
Saturated model	.000	1.000		
Independence model	.473	.786	.678	.524
Zero model	.515	.000	.000	.000

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.854	.709	1.055	1.144	1.000
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.500	.427	.500
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90

Default model	.000	.000	7.329
Saturated model	.000	.000	.000
Independence model	16.262	4.759	35.412

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.078	.000	.000	.150
Saturated model	.000	.000	.000	.000
Independence model	.536	.332	.097	.723

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.000	.000	.173	.639
Independence model	.182	.099	.269	.009

AIC

Model	AIC	BCC	BIC	CAIC
Default model	23.826	26.617	42.946	52.946
Saturated model	30.000	34.186	58.680	73.680
Independence model	36.262	37.657	45.822	50.822
Zero model	122.500	122.500	122.500	122.500

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	.486	.510	.660	.543
Saturated model	.612	.612	.612	.698
Independence model	.740	.505	1.131	.769
Zero model	2.500	1.855	3.298	2.500

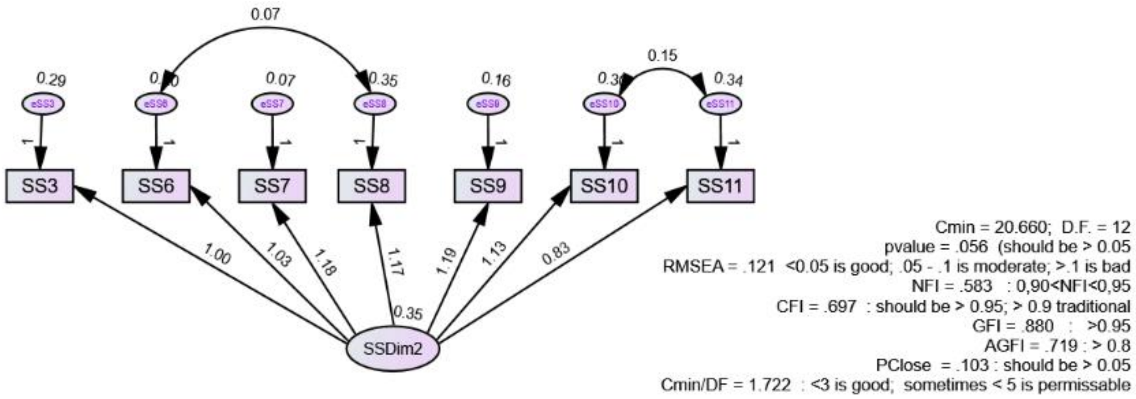
HOELTER

Model	HOELTER .05	HOELTER .01
Default model	142	194
Independence model	35	44
Zero model	10	13

Execution time summary

Minimization:	.041
Miscellaneous:	.204
Bootstrap:	.000
Total:	.245

SS Factor 2 (incorporating SS Factor 3)



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Analysis Summary

Date and Time

Date: Tuesday, 03 September 2024

Time: 10:50:44

Title

Ssdim2 new: Tuesday, 03 September 2024 10:50

Notes for Group (Group number 1)

The model is recursive.

Sample size = 50

Variable Summary (Group number 1)

Your model contains the following variables (Group number 1)

Observed, endogenous variables

SS3

SS6

SS7

SS8

SS9

SS10

SS11

Unobserved, exogenous variables

eSS3

SSDim2

eSS6

eSS7

eSS8

eSS9

eSS10

eSS11

Variable counts (Group number 1)

Number of variables in your model:	15
Number of observed variables:	7
Number of unobserved variables:	8
Number of exogenous variables:	8
Number of endogenous variables:	7

Parameter Summary (Group number 1)

	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	8	0	0	0	0	8
Labeled	0	0	0	0	0	0
Unlabeled	6	2	8	0	0	16
Total	14	2	8	0	0	24

Models

Default model (Default model)

Notes for Model (Default model)

Computation of degrees of freedom (Default model)

Number of distinct sample moments:	28
Number of distinct parameters to be estimated:	16
Degrees of freedom (28 - 16):	12

Result (Default model)

Minimum was achieved

Chi-square = 20.660

Degrees of freedom = 12

Probability level = .056

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Generalized Least Squares Estimates

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
SS3	<---	SSDim2	1.000				
SS6	<---	SSDim2	1.034	.192	5.377	***	
SS7	<---	SSDim2	1.183	.194	6.104	***	
SS8	<---	SSDim2	1.170	.252	4.636	***	
SS9	<---	SSDim2	1.187	.247	4.801	***	
SS10	<---	SSDim2	1.131	.265	4.262	***	
SS11	<---	SSDim2	.830	.218	3.805	***	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
SS3	<---	SSDim2	.741
SS6	<---	SSDim2	.808
SS7	<---	SSDim2	.933
SS8	<---	SSDim2	.758
SS9	<---	SSDim2	.870
SS10	<---	SSDim2	.774
SS11	<---	SSDim2	.641

Covariances: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
eSS10	<-->	eSS11	.147	.065	2.242	.025	
eSS6	<-->	eSS8	.074	.049	1.518	.129	

Correlations: (Group number 1 - Default model)

			Estimate
eSS10	<-->	eSS11	.459
eSS6	<-->	eSS8	.280

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
SSDim2	.348	.124	2.815	.005	
eSS3	.286	.070	4.101	***	
eSS6	.198	.056	3.561	***	
eSS7	.073	.045	1.604	.109	
eSS8	.354	.092	3.853	***	
eSS9	.157	.058	2.727	.006	
eSS10	.298	.080	3.720	***	
eSS11	.344	.082	4.214	***	

Matrices (Group number 1 - Default model)

Residual Covariances (Group number 1 - Default model)

	SS11	SS10	SS9	SS8	SS7	SS6	SS3
SS11	.135						
SS10	.141	.178					
SS9	.169	.185	.193				
SS8	.117	.143	.193	.196			
SS7	-.097	-.099	-.124	-.127	.076		
SS6	-.115	-.126	-.111	-.106	.075	.074	
SS3	-.025	-.092	-.057	.003	.029	.024	.050

Standardized Residual Covariances (Group number 1 - Default model)

	SS11	SS10	SS9	SS8	SS7	SS6	SS3
SS11	1.146						
SS10	1.219	1.184					
SS9	1.686	1.552	1.475				
SS8	1.063	1.099	1.540	1.168			
SS7	-1.017	-.868	-1.123	-1.066	.674		
SS6	-1.243	-1.146	-1.045	-.872	.741	.638	
SS3	-.264	-.815	-.521	.022	.281	.239	.390

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF

Default model	16	20.660	12	.056	1.722
Saturated model	28	.000	0		
Independence model	7	49.577	21	.000	2.361
Zero model	0	171.500	28	.000	6.125

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.122	.880	.719	.377
Saturated model	.000	1.000		
Independence model	.478	.711	.615	.533
Zero model	.546	.000	.000	.000

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.583	.271	.770	.470	.697
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.571	.333	.398
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	8.660	.000	25.341
Saturated model	.000	.000	.000
Independence model	28.577	11.750	53.105

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.422	.177	.000	.517
Saturated model	.000	.000	.000	.000
Independence model	1.012	.583	.240	1.084

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.121	.000	.208	.103
Independence model	.167	.107	.227	.002

AIC

Model	AIC	BCC	BIC	CAIC
Default model	52.660	58.904	83.252	99.252
Saturated model	56.000	66.927	109.537	137.537
Independence model	63.577	66.309	76.961	83.961
Zero model	171.500	171.500	171.500	171.500

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	1.075	.898	1.415	1.202
Saturated model	1.143	1.143	1.143	1.366
Independence model	1.297	.954	1.798	1.353
Zero model	3.500	2.733	4.420	3.500

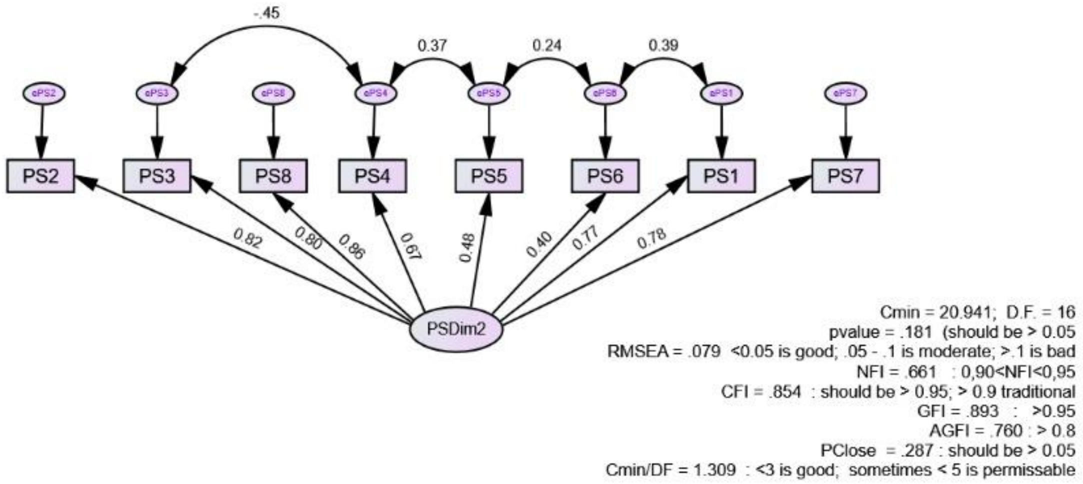
HOELTER

Model	HOELTER .05	HOELTER .01
Default model	50	63
Independence model	33	39
Zero model	12	14

Execution time summary

Minimization:	.083
Miscellaneous:	.220
Bootstrap:	.000
Total:	.303

PS Factor



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Analysis Summary

Date and Time

Date: Tuesday, 03 September 2024

Time: 12:09:25

Title

Psdim1: Tuesday, 03 September 2024 12:09

Notes for Group (Group number 1)

The model is recursive.

Sample size = 50

Variable Summary (Group number 1)

Your model contains the following variables (Group number 1)

Observed, endogenous variables

PS2

PS3

PS8

PS4

PS5

PS6

PS1

PS7

Unobserved, exogenous variables

ePS2

PSDim2

ePS3

ePS8

ePS4

ePS5

ePS6

ePS1

ePS7

Variable counts (Group number 1)

Number of variables in your model:	17
Number of observed variables:	8
Number of unobserved variables:	9
Number of exogenous variables:	9
Number of endogenous variables:	8

Parameter Summary (Group number 1)

	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	9	0	0	0	0	9
Labeled	0	0	0	0	0	0
Unlabeled	7	4	9	0	0	20
Total	16	4	9	0	0	29

Models

Default model (Default model)

Notes for Model (Default model)

Computation of degrees of freedom (Default model)

Number of distinct sample moments:	36
Number of distinct parameters to be estimated:	20
Degrees of freedom (36 - 20):	16

Result (Default model)

Minimum was achieved

Chi-square = 20.941

Degrees of freedom = 16

Probability level = .181

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Generalized Least Squares Estimates

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
PS2	<---	PSDim2	1.000				
PS3	<---	PSDim2	.818	.136	6.009	***	
PS8	<---	PSDim2	1.029	.164	6.293	***	
PS4	<---	PSDim2	.642	.166	3.858	***	
PS5	<---	PSDim2	.511	.187	2.734	.006	
PS6	<---	PSDim2	.712	.288	2.470	.013	
PS1	<---	PSDim2	1.132	.210	5.381	***	
PS7	<---	PSDim2	.895	.215	4.154	***	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
PS2	<---	PSDim2	.818
PS3	<---	PSDim2	.802
PS8	<---	PSDim2	.861
PS4	<---	PSDim2	.674
PS5	<---	PSDim2	.485
PS6	<---	PSDim2	.405
PS1	<---	PSDim2	.769
PS7	<---	PSDim2	.783

Covariances: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
ePS6	<-->	ePS1	.236	.113	2.099	.036	
ePS3	<-->	ePS4	-.077	.030	-2.574	.010	
ePS5	<-->	ePS6	.141	.081	1.751	.080	
ePS4	<-->	ePS5	.097	.051	1.895	.058	

Correlations: (Group number 1 - Default model)

			Estimate
ePS6	<-->	ePS1	.388
ePS3	<-->	ePS4	-.446
ePS5	<-->	ePS6	.237
ePS4	<-->	ePS5	.371

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
PSDim2	.403	.131	3.083	.002	
ePS2	.199	.058	3.451	***	
ePS3	.149	.039	3.805	***	
ePS8	.148	.044	3.407	***	
ePS4	.199	.056	3.584	***	
ePS5	.342	.084	4.079	***	
ePS6	1.041	.224	4.636	***	
ePS1	.357	.103	3.467	***	
ePS7	.203	.067	3.050	.002	

Matrices (Group number 1 - Default model)

Residual Covariances (Group number 1 - Default model)

	PS7	PS1	PS6	PS5	PS4	PS8	PS3	PS2
PS7	.172							
PS1	-.140	.177						
PS6	.098	.041	.159					
PS5	.099	.063	.153	.135				
PS4	.020	.113	.139	.109	.099			
PS8	.034	-.072	-.039	-.053	-.049	.028		
PS3	.000	-.051	-.071	-.068	-.052	.017	.025	
PS2	-.127	.052	-.108	-.071	-.055	.007	.029	.088

Standardized Residual Covariances (Group number 1 - Default model)

	PS7	PS1	PS6	PS5	PS4	PS8	PS3	PS2
PS7	1.615							

PS1	-1.242	1.003						
PS6	.806	.242	.632					
PS5	1.333	.659	1.337	1.490				
PS4	.278	1.246	1.390	1.646	1.348			
PS8	.363	-.589	-.302	-.671	-.646	.245		
PS3	-.006	-.503	-.654	-1.018	-.877	.204	.296	
PS2	-1.331	.423	-.832	-.887	-.725	.067	.337	.722

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	20	20.941	16	.181	1.309
Saturated model	36	.000	0		
Independence model	8	61.737	28	.000	2.205
Zero model	0	196.000	36	.000	5.444

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.092	.893	.760	.397
Saturated model	.000	1.000		
Independence model	.379	.685	.595	.533
Zero model	.473	.000	.000	.000

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.661	.406	.892	.744	.854
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.571	.378	.488
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	4.941	.000	20.961
Saturated model	.000	.000	.000
Independence model	33.737	14.773	60.431

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.427	.101	.000	.428
Saturated model	.000	.000	.000	.000
Independence model	1.260	.689	.301	1.233

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.079	.000	.164	.287
Independence model	.157	.104	.210	.002

AIC

Model	AIC	BCC	BIC	CAIC
Default model	60.941	69.941	99.182	119.182
Saturated model	72.000	88.200	140.833	176.833
Independence model	77.737	81.337	93.033	101.033
Zero model	196.000	196.000	196.000	196.000

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	1.244	1.143	1.571	1.427
Saturated model	1.469	1.469	1.469	1.800
Independence model	1.586	1.199	2.131	1.660
Zero model	4.000	3.180	4.974	4.000

HOELTER

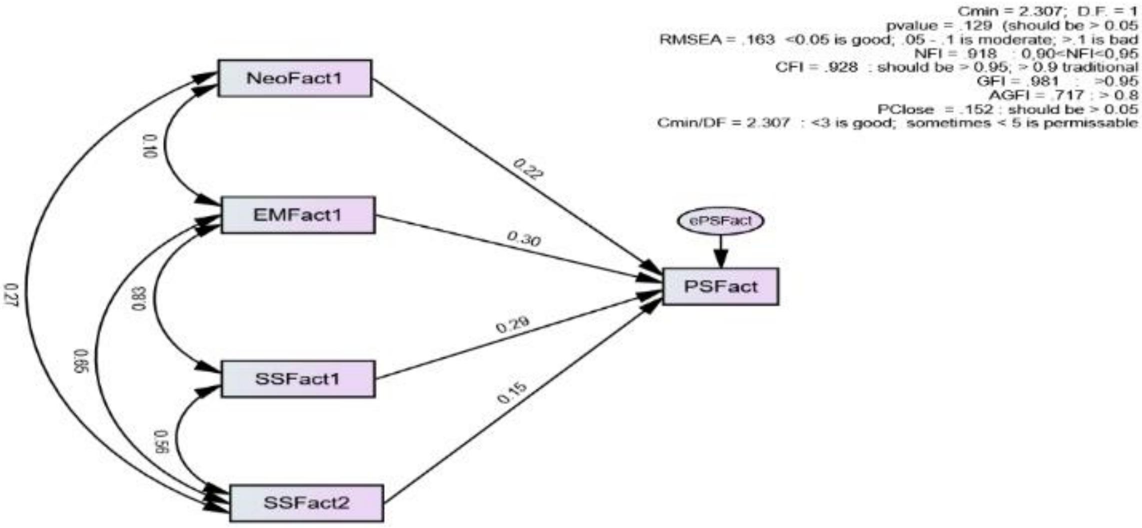
Model	HOELTER .05	HOELTER .01
Default model	62	75
Independence model	33	39

Zero model	13	15

Execution time summary

Minimization:	.097
Miscellaneous:	.324
Bootstrap:	.000
Total:	.421

FINAL FULLCOMPOSITE MODEL



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Analysis Summary

Date and Time

Date: Thursday, 05 September 2024

Time: 11:45:39

Title

New composite model sept03: Thursday, 05 September 2024 11:45

Groups

Group number 1 (Group number 1)

Notes for Group (Group number 1)

The model is recursive.

Sample size = 50

Variable Summary (Group number 1)

Your model contains the following variables (Group number 1)

Observed, endogenous variables

PSFact

Observed, exogenous variables

NeoFact1

EMFact1

SSFact1

SSFact2

Unobserved, exogenous variables

ePSFact

Variable counts (Group number 1)

Number of variables in your model:	6
Number of observed variables:	5
Number of unobserved variables:	1
Number of exogenous variables:	5
Number of endogenous variables:	1

Parameter Summary (Group number 1)

	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	1	0	0	0	0	1
Labeled	0	0	0	0	0	0
Unlabeled	4	5	5	0	0	14
Total	5	5	5	0	0	15

Models

Default model (Default model)

Notes for Model (Default model)

Computation of degrees of freedom (Default model)

Number of distinct sample moments:	15
Number of distinct parameters to be estimated:	14
Degrees of freedom (15 - 14):	1

Result (Default model)

Minimum was achieved

Chi-square = 2.307

Degrees of freedom = 1

Probability level = .129

Group number 1 (Group number 1 - Default model)

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Generalized Least Squares Estimates

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
PSFact	<---	NeoFact1	.143	.072	1.985	.047	
PSFact	<---	EMFact1	.287	.184	1.563	.118	
PSFact	<---	SSFact1	.246	.155	1.593	.111	
PSFact	<---	SSFact2	.130	.118	1.103	.270	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
PSFact	<---	NeoFact1	.216
PSFact	<---	EMFact1	.302
PSFact	<---	SSFact1	.292
PSFact	<---	SSFact2	.149

Covariances: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
SSFact1	<-->	SSFact2	.243	.072	3.364	***	
EMFact1	<-->	SSFact2	.249	.068	3.677	***	
EMFact1	<-->	SSFact1	.331	.077	4.276	***	
NeoFact1	<-->	SSFact2	.148	.072	2.068	.039	
NeoFact1	<-->	EMFact1	.048	.043	1.138	.255	

Correlations: (Group number 1 - Default model)

			Estimate

SSFact1	<-->	SSFact2	.563
EMFact1	<-->	SSFact2	.649
EMFact1	<-->	SSFact1	.833
NeoFact1	<-->	SSFact2	.270
NeoFact1	<-->	EMFact1	.096

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
NeoFact1	.723	.153	4.711	***	
EMFact1	.353	.075	4.712	***	
SSFact1	.447	.095	4.711	***	
SSFact2	.417	.089	4.713	***	
ePSFact	.151	.030	4.950	***	

Matrices (Group number 1 - Default model)

Residual Covariances (Group number 1 - Default model)

	SSFact2	SSFact1	EMFact1	NeoFact1	PSFact
SSFact2	.048				
SSFact1	.054	.046			
EMFact1	.046	.044	.040		
NeoFact1	.091	.139	.108	.075	
PSFact	.046	.051	.044	.088	.044

Standardized Residual Covariances (Group number 1 - Default model)

	SSFact2	SSFact1	EMFact1	NeoFact1	PSFact
SSFact2	.570				
SSFact1	.761	.515			
EMFact1	.704	.592	.556		
NeoFact1	1.124	1.718	1.494	.515	
PSFact	.764	.801	.759	1.235	.677

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	14	2.307	1	.129	2.307

Saturated model	15	.000	0		
Independence model	5	28.091	10	.002	2.809
Zero model	0	122.500	15	.000	8.167

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.070	.981	.717	.065
Saturated model	.000	1.000		
Independence model	.279	.771	.656	.514
Zero model	.371	.000	.000	.000

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.918	.179	.952	.277	.928
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.100	.092	.093
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	1.307	.000	10.009
Saturated model	.000	.000	.000
Independence model	18.091	5.946	37.867

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.047	.027	.000	.204
Saturated model	.000	.000	.000	.000
Independence model	.573	.369	.121	.773

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.163	.000	.452	.152
Independence model	.192	.110	.278	.005

AIC

Model	AIC	BCC	BIC	CAIC
Default model	30.307	34.214	57.075	71.075
Saturated model	30.000	34.186	58.680	73.680
Independence model	38.091	39.487	47.651	52.651
Zero model	122.500	122.500	122.500	122.500

ECVI

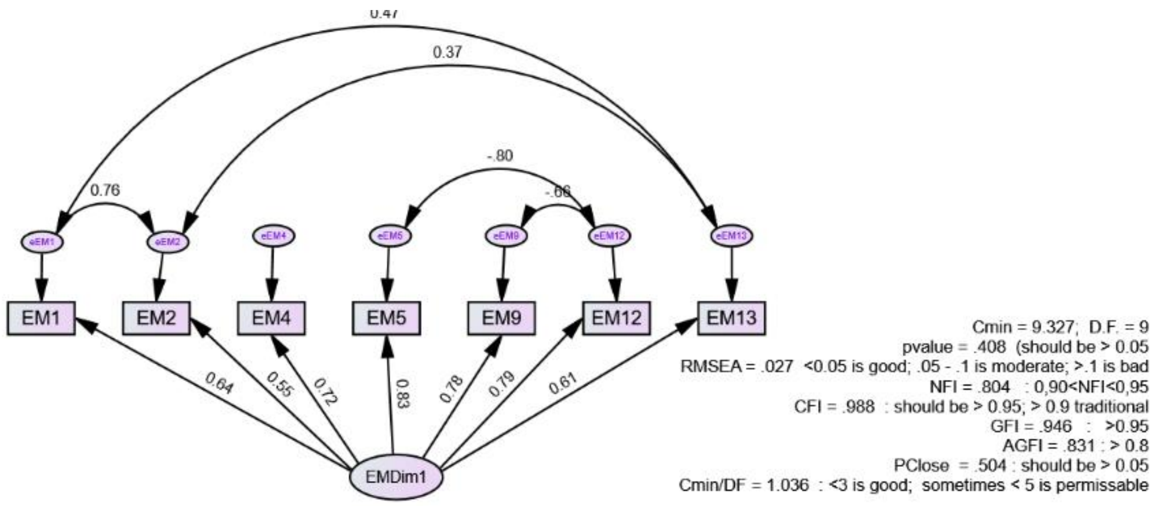
Model	ECVI	LO 90	HI 90	MECVI
Default model	.619	.592	.796	.698
Saturated model	.612	.612	.612	.698
Independence model	.777	.530	1.181	.806
Zero model	2.500	1.855	3.298	2.500

HOELTER

Model	HOELTER .05	HOELTER .01
Default model	82	141
Independence model	32	41
Zero model	10	13

Execution time summary

Minimization:	.037
Miscellaneous:	.184
Bootstrap:	.000
Total:	.221



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Analysis Summary

Date and Time

Date: Monday, 02 September 2024

Time: 17:37:01

Title

Emdim1: Monday, 02 September 2024 17:37

Notes for Group (Group number 1)

The model is recursive.

Sample size = 50

Variable Summary (Group number 1)

Your model contains the following variables (Group number 1)

Observed, endogenous variables

EM1

EM2

EM4

EM5

EM9

EM12

EM13

Unobserved, exogenous variables

eEM1

eEM2

eEM4

EMDim1

eEM5

eEM9

eEM12

eEM13

Variable counts (Group number 1)

Number of variables in your model:	15
Number of observed variables:	7
Number of unobserved variables:	8
Number of exogenous variables:	8
Number of endogenous variables:	7

Parameter Summary (Group number 1)

	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	8	0	0	0	0	8
Labeled	0	0	0	0	0	0
Unlabeled	6	5	8	0	0	19
Total	14	5	8	0	0	27

Models

Default model (Default model)

Notes for Model (Default model)

Computation of degrees of freedom (Default model)

Number of distinct sample moments:	28
Number of distinct parameters to be estimated:	19
Degrees of freedom (28 - 19):	9

Result (Default model)

Minimum was achieved

Chi-square = 9.327

Degrees of freedom = 9

Probability level = .408

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Generalized Least Squares Estimates

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
EM4	<---	EMDim1	1.000				
EM5	<---	EMDim1	1.307	.301	4.349	***	
EM1	<---	EMDim1	.813	.174	4.685	***	
EM2	<---	EMDim1	.758	.185	4.096	***	
EM9	<---	EMDim1	1.101	.253	4.350	***	
EM12	<---	EMDim1	1.105	.279	3.957	***	
EM13	<---	EMDim1	.814	.178	4.581	***	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
EM4	<---	EMDim1	.717
EM5	<---	EMDim1	.826
EM1	<---	EMDim1	.643
EM2	<---	EMDim1	.553
EM9	<---	EMDim1	.781
EM12	<---	EMDim1	.792
EM13	<---	EMDim1	.613

Covariances: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
eEM1	<-->	eEM2	.277	.069	3.994	***	
eEM5	<-->	eEM12	-.199	.097	-2.060	.039	
eEM9	<-->	eEM12	-.163	.084	-1.940	.052	
eEM1	<-->	eEM13	.157	.058	2.730	.006	
eEM2	<-->	eEM13	.147	.066	2.222	.026	

Correlations: (Group number 1 - Default model)

			Estimate
eEM1	<-->	eEM2	.759
eEM5	<-->	eEM12	-.795
eEM9	<-->	eEM12	-.659
eEM1	<-->	eEM13	.469

eEM2	<-->	eEM13	.371

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
EMDim1	.330	.128	2.569	.010	
eEM1	.309	.067	4.613	***	
eEM2	.431	.094	4.611	***	
eEM4	.313	.076	4.105	***	
eEM5	.262	.107	2.457	.014	
eEM9	.256	.085	3.004	.003	
eEM12	.239	.102	2.353	.019	
eEM13	.364	.079	4.586	***	

Matrices (Group number 1 - Default model)

Residual Covariances (Group number 1 - Default model)

	EM13	EM12	EM9	EM5	EM4	EM2	EM1
EM13	.057						
EM12	.035	.055					
EM9	.008	-.047	.049				
EM5	-.051	-.033	.023	.024			
EM4	.103	.061	-.026	-.057	.081		
EM2	.062	.017	.028	-.043	.112	.069	
EM1	.028	.039	-.033	-.023	.063	.027	.023

Standardized Residual Covariances (Group number 1 - Default model)

	EM13	EM12	EM9	EM5	EM4	EM2	EM1
EM13	.487						
EM12	.361	.426					
EM9	.083	-.480	.368				
EM5	-.461	-.300	.184	.144			
EM4	1.083	.578	-.246	-.474	.625		
EM2	.619	.175	.280	-.382	1.149	.549	
EM1	.294	.414	-.352	-.214	.686	.249	.214

Notes for Group/Model (Group number 1 - Default model)

The following covariance matrix is not positive definite (Group number 1 - Default model)

	eEM12	eEM9	eEM5
eEM12	.239		
eEM9	-.163	.256	
eEM5	-.199	.000	.262

This solution is not admissible.

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	19	9.327	9	.408	1.036
Saturated model	28	.000	0		
Independence model	7	47.523	21	.001	2.263
Zero model	0	171.500	28	.000	6.125

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.052	.946	.831	.304
Saturated model	.000	1.000		
Independence model	.384	.723	.631	.542
Zero model	.463	.000	.000	.000

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.804	.542	.992	.971	.988
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.429	.344	.423
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	.327	.000	11.926
Saturated model	.000	.000	.000
Independence model	26.523	10.250	50.513

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.190	.007	.000	.243
Saturated model	.000	.000	.000	.000
Independence model	.970	.541	.209	1.031

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.027	.000	.164	.504
Independence model	.161	.100	.222	.004

AIC

Model	AIC	BCC	BIC	CAIC
Default model	47.327	54.742	83.655	102.655
Saturated model	56.000	66.927	109.537	137.537
Independence model	61.523	64.255	74.908	81.908
Zero model	171.500	171.500	171.500	171.500

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	.966	.959	1.203	1.117
Saturated model	1.143	1.143	1.143	1.366
Independence model	1.256	.923	1.745	1.311
Zero model	3.500	2.733	4.420	3.500

HOELTER

Model	HOELTER .05	HOELTER .01
Default model	89	114
Independence model	34	41
Zero model	12	14

Execution time summary

Minimization:	.059
Miscellaneous:	.250
Bootstrap:	.000
Total:	.309

APPENDIX I: CONSTRUCTS IN THE FINAL MODEL

NEQ1	Difficulty in identifying stakeholder	NeoFact2=Mean(NEQ1,NEQ3,NEQ4,NEQ5).
NEQ2	Difficulty in prioritizing stakeholders	NeoFact2 was not included in the new composite model - it's inclusion caused the model not to work
NEQ3	Stakeholder resistance to change	
NEQ4	Balancing the expectations of multiple stakeholders	
NEQ5	Limited stakeholder involvement.	
NEQ6	Addressing ethical concerns related to AI and automation	NeoFact1=Mean(NEQ6,NEQ7,NEQ8,NEQ9)
NEQ7	Ensuring data privacy for stakeholders	
NEQ8	Ensuring data security for stakeholders	
NEQ9	Lack of soft skills to achieve deliverables	
EM1	Regular communication with stakeholders	EMFact1=Mean(EM1,EM2,EM4,EM5,EM9,EM12,EM13).
EM2	Transparent communication with stakeholders	
EM3	Clearly defined roles and responsibilities for project stakeholders	
EM4	Engaging stakeholders in the project planning process	
EM5	Engaging stakeholders in the decision-making process	
EM6	Establishing a change management plan to address resistance to technology adoption	
EM7	Continuous stakeholder education on Fourth Industrial Revolution technologies	
EM8	Proactive identification of risks related to stakeholder concerns	
EM9	Proactive mitigation of risks related to stakeholder concerns.	
EM10	Leveraging data analytics for informed stakeholder engagement	
EM11	Leveraging data AI for informed stakeholder engagement	
EM12	Agile project management methodologies for flexibility in adapting to changing stakeholder needs	
EM13	Collaborative tools for efficient communication	
EM14	Regular assessment of stakeholder engagement strategies based on project progress and outcomes	
SS1	Clear communication with stakeholders	SSFact1=Mean(SS1,SS2,SS12,SS13,SS14).

SS2	Regular communication with stakeholders	
SS3	Active involvement of stakeholders in decision-making	SSFact2=Mean(SS3,SS6,SS7,SS8,SS9,SS10,SS11)
SS4	Effective change management strategies	
SS5	Stakeholder training on AI technology	
SS6	Proactive risk management	
SS7	Proactive risk resolution	
SS8	Utilization of agile project management methodologies	
SS9	Collaborative digital platforms	
SS10	Data analytics insights for decision-making	
SS11	Data AI-driven insights for decision-making	
SS12	Actionable stakeholder feedback	
SS13	Timely stakeholder feedback	
SS14	Transparent reporting of project progress	
PS1	The project being completed according to the budget allocated	PSFact=Mean(PS1,PS2,PS3,PS4,PS5,PS6,PS8)
PS2	The outcomes of the project being used by its intended end users	
PS3	The project making a visible positive impact on the target beneficiaries	
PS4	Project specifications being met by the time of handover to the target beneficiaries	
PS5	Project team members being satisfied with the process by which the project was implemented	
PS6	The project having minimal start-up problems	
PS7	The principal donors/sponsor being satisfied with the outcomes of the project implementation	
PS8	The project directly leading to improved performance for the end users/target beneficiaries	