Toward relevant measures of performance to manage complexity in inclusive development projects

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Declaration

I, Nonhlanhla Patience Mkhize, hereby declare that the work on which this dissertation/thesis is based is my original work (except where acknowledgements indicate otherwise). I confirm that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university. I empower the university to reproduce for the purpose of research, either the whole or any portion of the contents in any manner whatsoever.

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Abstract

The 2030 Agenda on Sustainable Development advocates for innovation for inclusive development. It is a fundamental issue that should make progress in South Africa and globally. When one considers how to improve on the lack of success we have had so far, there are many areas of possible focus. This study looked at the management of innovation for inclusive development projects. These projects are complex. They harness science, technology, and innovation to achieve a more inclusive and sustainable society. Their execution remains challenging despite models and tools to manage project complexity.

The study focused on how complexity exerts an influence on the management of these projects. It concurs with the literature that time, cost, and scope are inadequate measures on their own to assess complex project management performance and sought relevant measures of performance that could expand the iron triangle model to deal with complexity.

To build a theory on the issues of concern, I used the lens of a project as a complex and adaptive temporary organisation. My qualitative study focused on five projects in the Department of Science and Technology in South Africa. Data were collected from project management personnel, users, and sponsors involved in these projects. The interviewees assisted me in understanding the practices and processes of project management organisation and subsequent performance management. Secondary data were collected from various archival records. The Gioia approach was used to analyse and interpret the data systematically and rigorously.

The study contributes to complex project management theory which is still an evolving field. It expands the existing knowledge by demonstrating how complexity influences the organisation of project management. It highlights how the plurality of stakeholders influences the definition and prioritisation of project goals. The prioritisation informs the allocation of resources, a task that is laden with conflict.

The stakeholders establish a temporary organisation. The organisation has a unique identity, defined by the collective values of the stakeholders. Its governance is flexible,

inclusive, and responsive and embraces Ubuntu. Flexibility enhances its response to fluid and unpredictable changes in its context. This study underscores that learning is critical to the continuous improvement of the management of these projects. The stakeholders must recognise different ways of knowing to learn from each other. The findings stress technology appropriateness and its influence on organising project management. Technology itself might be exclusionary and marginalise other stakeholders within the temporary organisation.

It shows the link between project management organisation and performance measurement and highlights how complexity influences the selection of measures of performance. It proposes a four-dimensional model to expand the iron triangle measure. The dimensions are process, scope, context, and good governance. The findings recommend further research to understand how complexity influences the management of innovation for inclusive development projects.

Table of Contents

List of Tables

List of Figures

List of Boxes

List of Abbreviations / Acronyms

ALOE	Attributes, links, objects, and events
APM	Association for Project Management
APMBOK	Association for Project Management Body of Knowledge
DSI	Department of Science and Technology
DST	Department of Science and Technology
HoPC	House of Project Complexity
ICCPM	International Centre for Complex Project Management
IHSI	Intelligent Human Systems Integration
IPAP	Industrial Policy Action Plan
KPI	Key performance indicators
PMBOK	Project Management Body of Knowledge
SADC	Southern African Development Community
SMME	Small, medium, micro-enterprise
TOE	Technical, Organisation and Environmental

CHAPTER ONE: THE RESEARCH PROBLEM

1.1 Project Management Failure of Complex Projects

In 2005, the South African government introduced inclusive development projects to speed up transformation. The projects prioritise economic inclusion, social well-being, and a healthy environment. In 2005, I managed the delivery of these projects in a provincial department and advocated for a standardised project management practice. I involved project managers to develop and implement it, using agreed tools and techniques. The performance was inconsistent across the programme with frequent failures. These failures manifested in time and cost overruns and delivery contrary to contracts. The department failed its stakeholders as it did not make a significant contribution to provincial growth and development.

I encouraged a review of our efficiency and success rate. We modified the methods and tools but the change in performance was subtle. I searched for successful methods in the public sector and found none, so I delved deeper to understand the dilemma. In my desperation to understand the challenge, I tapped into Microbiology.

I studied Microbiology up to the postgraduate level. It taught me a key lesson in problem-solving, which is to examine a concept from its simplest to its most comprehensive form. With my Microbiology hat on, I used the analogy of a human being to dissect a complex project. I reflected on what would constitute cells, as the basic unit of a complex project. I deliberated on what would form the red blood cells that carry oxygen into the human body. I pondered on what would constitute the tissue and organs.

A human being has core or life-critical organs such as the brain, heart, and liver. There are other organs, like the gall bladder and spleen that, although important, we can live without. In a complex project, I imagined the critical elements that needed intense focus to increase the likelihood of success.

The dissection indicated that, much like a human being, a complex project comprises many parts. This revealed that projects are complex systems comprising interlinked elements with different functions. Each element has its own complexity and can further be dissected to its simplest unit. The elements interact in an unpredictable, non-linear, and fluid manner. They are susceptible to their environment, e.g., political changes. The review exposed dominant elements including diverse stakeholders, unique demographics, and development possibilities. Like a human body, fluidity and non-linearity constitute organised chaos.

In 2012, I moved to another programmes management role. This programme added a later innovation to inclusive development. It promotes innovative solutions to improve the quality of life for all, particularly the marginalised communities. It empowers them to participate, access, and actualise innovation opportunities. It consists of technology demonstration, transfer, and research projects, which prioritise local economic development, capable state and human settlements (Department of Science and Technology [DST], 2019). The 2030 Agenda on Sustainable Development highlights innovation for inclusive development (DST, 2019; Gupta et al., 2015; Hoffecker, 2020).

Innovation for inclusive development projects prioritises social protection and human and social capital development. Social protection addresses the risks and vulnerabilities of unemployment, poverty, and inequality. Social capital development includes participatory and inclusive decision-making (Gupta et al., 2015). These projects deliver amongst others, sustainable jobs, access to services and inclusion in the innovation ecosystems, with such inclusion involving participants and beneficiaries.

These projects respond to science, technology, and innovation, as well as social welfare policies. Inclusive economic development and sustainability policies motivate their investment (DST, 2016; Gupta et al., 2015). Others refer to innovation for inclusive development as social innovation or inclusive innovation (Organisation for Economic Cooperation and Development, 2015). The 2019 Science, Technology and Innovation White Paper policy adopted innovation for inclusive development. This

aligns with the principles of the National Development Plan which pursues an inclusive, prosperous, and innovative society and developmental state (DST, 2019).

Different organisations across the world pursue innovation for inclusive development through projects. These projects deliver different outputs and outcomes for their diverse stakeholders. I identified innovation for inclusive development projects as complex for various reasons. These include:

- Many and diverse stakeholders. The diversity may be in culture, language, technical expertise, and geographies (Ika et al., 2020).

- Many distinct but interdependent elements. This feature enforces these projects' tendency as adaptive complex systems wherein a change in one element influences the overall project.

- Fluid, self-organising with emergent properties and non-linear character (Gupta et al., 2015; Bakshi et al., 2016).
-
- Focus on technology demonstration, diffusion or transfer into new environments.

- Encounter uncertainty and ambiguity throughout their life cycle (Gupta et al., 2015; San Cristóbal et al., 2018).

Gupta et al. (2015) emphasised the many gaps that exist in the concept of innovation for inclusive development and the achievement thereof. These gaps persist despite increased focus on this concept in the science and policy literature.

In my new programme management role, I advocated for systems thinking to manage innovation for inclusive development projects. This allowed project managers to appreciate the complexity of each project. I confronted opposition from colleagues who asserted that complexity was a new fad. They discounted the influence of complexity on project management. They disputed existing research (see Baccarini, 1996; Dao et al., 2016; International Centre for Complex Project Management, 2012; Saynisch, 2010). The failures have persisted and averted investment and progress since

democracy. My employer conceded to research to improve performance. I focused my inquiry on project organising and performance management.

Researchers recognise the difference between traditional, simple, complicated, and complex projects. Complex projects exhibit uncertainty, ambiguity, and many obvious and unknown interdependencies. They are fluid with chaos as an intrinsic factor (Baccarini, 1996; Saynisch, 2010). The interdependencies lead to dynamic and non-linear interactions amongst the project elements. The interactions are within the project and with its context (Baccarini, 1996; De Rezende et al., 2018; International Centre for Complex Project Management, 2011).

Project managers must recognise the interdependencies and their impact. Ignorance of this connection could have dire consequences for project management. For example, a project manager ignored a legislated 30% set aside for local procurement. He miscalculated the influence of entrepreneurs who used their bargaining power to suspend all activities. The project procurement plan was revised to include 30% local procurement which delayed the schedule of implementation. The project manager further organised training to bolster their capacity for future contracts.

The term ‘project ’is both a noun (an individual or collaborative enterprise planned to achieve a particular aim) and a verb (to estimate or forecast (something) based on present trends). In addressing these aspects, my research acknowledges existing literature (see De Rezende et al., 2018; International Centre for Complex Project Management, 2011; Sage et al., 2014; Project Management Institute, 2018).

Albert Einstein said, “No problem can be solved from the same level of consciousness that created it”. I concur with this, given the fact that researchers have investigated using traditional standards and methods to manage complex projects. These standards and methods are linear and assume certainty and stability, which contradict complexity. They fail to respond to interfaces and heterogeneity. They are rigid and react to ambiguity and the dynamic change of complex projects (Cicmil et al., 2006; International Centre for Complex Project Management, 2012; Sage et al., 2014; San Cristóbal et al., 2018; Sewchurran et al., 2010; Transportation Research Board, 2014).

Given this concern, the research expanded the fundamental project management theory and tools (Cicmil et al., 2006; De Rezende et al., 2018; Hodgson & Cicmil, 2008; Sage et al., 2014; Yun et al., 2016). It concentrated on performance metrics, organisation, leadership, and governance (De Rezende et al., 2018; Falcão Mamédio & Meyer, 2020; International Complex Project Management, 2011; Sage et al., 2014; San Cristóbal, 2017; Transportation Research Board, 2014). The research highlights the higher frequency of project management failures in Africa (Rwelamila & Ssegawa, 2014). Marnewick (2012) emphasised limited project management research conducted in South Africa as part of the Southern African Development Community (SADC).

Many studies underscore that complex project management requires a different set of skills compared to simple or conventional and complicated project management. They show that it requires responsive leadership, that can efficiently manage multi-cultural and multidisciplinary teams (Hass, 2009; International Centre for Complex Project Management, 2012). They empower project managers to understand the influence of complexity on organising the project.

This research underscores the influence of the project's properties, e.g., the self-evolving nature and sensitivity to their contexts on their management (Cicmil, 2008; Cicmil et al., 2009; De Rezende et al., 2018; Hodgson & Sage et al., 2014). It alerts practitioners to the main reasons for failure. Scope creep is amongst the leading causes of project management failures. Research depicts how interactions amongst stakeholders result in scope creep, advising project managers on how to administer it (Project Management Institute, 2018).

Current research is advancing from a technical and positivist perspective (De Rezende et al., 2018; International Complex Project Management, 2012; Sage et al., 2014). It accommodates theoretical pluralism, i.e., draws from different theoretical approaches. This enriches the Project Management Body of Knowledge (PMBOK) and complex project management (International Centre for Complex Project Management, 2012; Sage et al., 2014; San Cristóbal, 2017). Some practitioners draw from systems engineering to manage their projects.

For example, a certain project manager, who is responsible for innovation for inclusive development projects, applies design and social and behavioural sciences to manage projects (DST, 2015). His approach is intended to enhance the inclusion of the client (the marginalised) in framing the challenges and solutions. This inclusion allows the project to be grounded in innovative solutions that respond to the challenge. Such solutions are also appropriate for the local context. His approach provides lessons for the revitalisation of school agriculture and its integration into local economic development initiatives (DST, 2015).

The design approach accentuates responsive planning and implementation as it aligns project management to the context. His methods stimulate marginalised stakeholders to participate and take accountability in project management. The design aspect ensures that the projects are rooted in the demographic profiles of their contexts. The social and behavioural sciences focus identifies enablers for positive change and capacities required to sustain the projects. His approach creates alternative forms of performance evaluation and reporting, thus distinguishing his projects from outdated approaches.

Performance management provides vital information for decision-making as it confirms progress against the approved plan. It exposes resource utilisation efficiencies (Centre for Business Practices, 2005; International Centre for Complex Project Management, 2011; Sage et al., 2014). It relies on measures to judge the importance, value, and quality of the effect. (Cambridge Dictionary, 2020). Measures of performance are criteria or dimensions used to assess progress and show the quality and efficiency of project management. They delineate the scope of performance management (Centre for Business Practices, 2005).

Measures inform the formulation of key performance indicators. For instance, the number of changes and compliance with quality specifications measures scope (Centre for Business Practices, 2005). The indicators of variance with the allocated budget and resource efficiency measure finance (Centre for Business Practices, 2005). Measures of performance are identified and defined as part of project

management (Centre for Business Practices, 2005; International Centre for Complex Project Management, 2012). They validate whether a project is a success or a failure.

Traditional project management assesses success or failure using cost, time, and scope (Marnewick, 2012). These measures are inadequate for complex project management (Cicmil et al., 2006; Hodgson & Cicmil, 2008; International Centre for Complex Project Management, 2012; Sage et al., 2014; Yun et al., 2016). Marnewick (2012) drew attention to the transition from the triple constraint triangle to business-related criteria. This includes user satisfaction and delivering the expected business benefits.

Researchers suggest additional measures that consider processes, activities, and context (Transportation Research Board, 2014; Yun et al., 2016). Such measures include assessing the creation of new capabilities and business opportunities. The Transportation Research Board (2014) recommended five measures of performance for complex project management. These are time, money, design, context, and financing. Key performance indicators are defined for each measure. They recognise cost and finance as distinct measures wherein cost is expressed as the value of the scope of work. Finance focuses on how the project is resourced, which influences the scope of work (Transportation Research Board, 2014).

Despite the uniqueness of individual projects, rigid project management practices still use the triple constraint triangle measures of time, cost, and scope to assess performance (Project Management Institute, 2018). Regardless of whether a project is characterised as simple, complicated, or complex, scope management is fundamental. It concentrates on delivering the intended outputs and results (Project Management Institute, 2018).

It minimises scope creep, which has implications for allocated resources (Project Management Institute, 2018). Controlling scope requires vigilance and innovative management of the relationships with various stakeholders. The Centre of Business Practice (2005) proposed the inclusion of innovation and learning as part of the measures of performance. Both are key to strengthening project management capabilities.

Recent research gives precedence to complex attributes and how to measure them (Table 1-1). It demonstrates sectoral approaches such as in construction and information technology to respond to peculiarities.

Table 1-1: Example of published research on complexity in the construction sector

Author	Key contribution
Baccarini (1996)	Recognition of construction sector projects as amongst the most complex
Gidado (1996)	Proposed a model to measure complexity of the production process in construction
Tatikonda & Rosenthal, (2000)	Applies task uncertainty to highlight the relationship between product development project attributes and outcomes
Vidal & Marle (2008)	Developed the attributes, links, objects, and events (ALOE) model
Wood & Ashton (2010)	Developed a two-stage model to understand project complexity
Geraldi et al. (2011)	Summarised the complexity framework recognising different types and sources of complexity
Bosch-Rekveldt et al. (2011)	Introduced the Technical, Organisation and Environmental (TOE) framework to ascertain complexity
Lebcir & Choudrie, 2011	Model to assess effect of project complexity on time
Xia & Chan (2012)	Developed a complexity index for construction projects, in China
Owens et al. (2012)	Proposed a five-dimensional model – a framework to map the complexity of projects
Lessard et al. (2013)	Proposed the House of Project Complexity (HoPC) model – a structural and process-based theoretical framework
He et al. (2015)	Proposed a six-dimensional complexity framework
Nguyen et al., (2015)	Framework on different categories of complexity
Eriksson et al. (2017)	Proposed a structural equation model to advance flexibility-focused complex project management

The research (Table 1-1) demonstrates sectoral approaches adapted in such sectors as construction and information technology to respond to peculiarities. The research

in managing complex projects in the construction sector offers complexity models and indices (see Table 1-1). It proposes the use of broader indicators to measure project management performance. Despite the availability of these models and indices, complex project management failures persist in this sector.

The research indicates that systems thinking is the cornerstone of managing complex projects. It empowers understanding of social and technical facets and their interfaces (Utulu & Sewchurran, 2016). It recognises the different agendas that converge on an agreed project goal. Table 1-1 samples performance management concerns in construction, which is a complex sector. It indicates the sector's commitment to identify, measure, and respond to complexity. It also illustrates a sectoral approach to managing complexity.

Table 1-1 highlights the focus on the construction sector which has varied from understanding complexity to models on how to manage it. It indicates the sector's commitment to identify, measure, and respond to complexity. Table 1-1 attests to different views from various researchers on core and essential elements. To illustrate, Wood and Ashton (2010) proposed a two-stage model to understand complexity. Table 1-1 demonstrates the existence of various frameworks to ascertain, respond to, and manage complexity during project management. Despite this knowledge, the management of complex projects continues to fail. The failures advocate for further research.

1.2 Objectives of the Research

In 2018, the Project Management Institute surveyed 4455 project managers. The survey uncovered an increase in complex projects, estimating that 9.9% of every dollar is wasted due to poor performance (Project Management Institute, 2018). This finding has motivated organisations to strengthen their capabilities to remain competitive (Project Management Institute, 2018). A 2019 global survey of 223 construction organisations revealed that 60% of poor performance still prevails in complex projects. Each affected project is worth more than $10 million (Project Management Institute, 2018).

The persisting predicament exemplifies disharmony between literature and practice. It calls for creativity in organising complex projects, affirming that traditional models undermine complexity. Some suggest additional research to support different forms of organisation (Discenza & Forman, 2007; San Cristóbal et al., 2018). Prominent project management related conferences express concerns about organisation and performance management. These concerns justify further research (De Rezende et al., 2018; International Centre for Complex Project Management, 2011; Project Management Institute, 2018).

Innovation for inclusive development projects and their management is complex. It entails partnerships amongst diverse stakeholders to achieve sustainable socio-economic well-being. The partnership pursues collective action and collaboration, a 'power-with' and 'power from within' perspectives. The latter focuses on the ability of particularly those conventionally perceived as development beneficiaries. It intends to enhance their self-confidence and ability to effect change to improve their livelihoods (Gupta et al., 2015).

The partnership might be noble but oftentimes, competing and hidden agendas merge during project management (Daniel et al., 2017; Gupta et al., 2015;). These projects are not immune to influence by dynamics in their contexts. My research is relevant as domestic and global governmental and non-governmental organisations continue to engage in development cooperation through the commission of these projects (International Centre for Complex Project Management, 2012; San Cristóbal et al., 2018; United Nations, 2015).

The 2030 Agenda on Sustainable Development increases pressure to deliver innovation successfully for inclusive development projects. These complex projects characterise the social-economic-technology nexus in addressing global challenges such as the digital divide and economic inclusion (Andrew & Petkov, 2003; Gupta et al., 2015). Complex management requires agile socio-technical systems-based approaches (Andrew & Petkov, 2003).

Research is essential to improve and expand knowledge (International Centre for Complex Project Management, 2011; Project Management Institute 2018). The

challenge of managing innovation for inclusive development projects calls for goal-oriented action. The challenge comprises specific questions or an intellectual problem that justifies the research. Kotzé (2007) defined an intellectual problem as a gap in the knowledge or understanding of a specific phenomenon. It is an inconsistency or contradiction in the academic literature on a particular subject.

In 2016, the DST commissioned research on its innovation for inclusive development projects. This research intended to provide insights into and expand knowledge on the improvement of complex innovation management. It addressed two questions:

1. How does complexity influence how stakeholders organise for the management of complex innovation for inclusive development projects?

2. What are the additional measures, to time, cost, and scope, needed to assess the performance of the management of innovation for inclusive development projects?

1.3 Expected Contributions to the Field of Project Management

Shenhar et al. (2016) and Hoffercker (2020) argued that innovative complex projects face limited theory development and research attention. I concur with Daniels et al. (2017) who highlighted considerable gaps in the literature on achieving innovation for inclusive development. These gaps limit the knowledge and understanding of innovation for inclusive development ecosystems, landscape, dynamism, and how best to operationalise it (Daniels et al., 2017; Hoffecker, 2020). Globally, different development partners pursue innovation for inclusive development through projects. The management of innovation for inclusive development projects is ripe for research.

I perceive the gaps in the literature as a contributing factor to the rate of failure of the management of innovation for inclusive development projects. The reasons for failure include (i) use of inappropriate performance metrics; (ii) uncertainty in appropriate and responsive methods and (iii) application of outdated implementation models (Narsalay

et al., 2015). Uncertainty expresses itself in the likelihood of success and use of appropriate implementation models. The uncertainty, ambiguity, and fluidity in innovation for inclusive development projects calls for a more flexibility-focused paradigm to manage them.

Literature shows the growing interest between international development and project management (Geraldi & Söderlund, 2018). Ika et al. (2020) indicated an increase in efficient ways of organising to deliver change. Ika et al. (2020) emphasised the limited cross-pollination between international development and project management. I perceive this cross-pollination to be limited, particularly in the context of the management of complex innovation for inclusive development projects. These projects are increasingly employed in international development. Different organisations employ them to catalyse and deliver sustainable change (Gupta et al., 2015; Ika et al., 2020).

The dearth of literature in organising and managing these projects is more prominent in the context of developing countries (Ika et al., 2020). These contexts feature weak institutional settings, limited or lack of knowledge of infrastructure, which limits the sharing of evidence-based practice. Crosby (2017) urged for a focus on learning from failures and documenting what works as the key to improving complex project management. Crosby asserted that the failure of complex projects that deliver or transfer new technology is prominent.

Research highlights the influence of complexity attributes on project management processes (Falcão Mamédio & Meyer Jr, 2020; San Cristóbal, 2017; San Cristóbal et al., 2018). It provides evidence on aspects of complexity that can lead to failure (Baccarini, 1996; San Cristóbal et al., 2018). Ika et al. (2020) reported on trillions of dollars lost due to the failure of development projects. Failures continue to plague different organisations, despite existing complex project management knowledge. The failures include the delivery of projects after the designated deadline and spending more than the allocated budget. They include an inability to manage scope and as such, failure to deliver the stakeholders' expected outputs and outcomes (Ika et al., 2020).

I hope that my research will contribute to the project management body of knowledge. It provides practice-based insights on how we respond to and organise complex project management. Furthermore, by drawing from practice, the research intended to propose appropriate measures to expand the triple constraint triangle (time, cost, and scope). The triple constraint triangle is outdated and inadequate for performance measurement in complex project management. These measures of performance are critical since they drive productivity and behaviours. This research will also offer reasons for the disharmony between existing complex project management literature and practice.

CHAPTER TWO: LITERATURE REVIEW

PART 1: THE INFLUENCE OF COMPLEXITY ON THE ORGANISATION OF PROJECT MANAGEMENT

2.1 Introduction

Globally, organisations use projects to deliver goods and services. They employ projects to respond to market demand, customer requests, or technological advances (Ika et al., 2020; Project Management Institute, 2018). Organisations use projects to execute their business strategy. Projects are flexible and a creative form of work organisation (Koskela & Howell, 2002; Project Management Institute, 2018). Literature conveys many descriptions of a “project”. These descriptions include:

- A project is a unique and transient undertaking wherein human, financial, and other resources are allocated to deliver beneficial qualitative and quantitative change within constraints of cost and time (Turner & Müller, 2003).

- A project is “a temporary endeavour undertaken to create a unique product, service or result” (Project Management Institute, 2004:5).

- A project is an explicit undertaking commissioned within certain specifications, over a defined time, funding, and other resources. The resources include people and equipment (Kerzner, 1998).

- A project is a resource (time and cost) constrained operation to attain a set of defined deliverables. The scope specifies the project’s objectives and quality standards (International Project Management Association, 2006).

Projects are temporary but their outputs and impact are not. These may be medium-term or permanent (Ghosh et al., 2012; Ika et al., 2020). The outputs produced by a project may be an artefact or product, a capability or knowledge (Project Management

Institute, 2018). Despite different definitions and descriptions of a “project”, it must deliver something unique. It must be resourced to deliver as expected.

The various descriptions and definitions also indicate the diverse nature of a project (Figure 2-1). Projects are productive functions since they produce goods or services, realised using allocated resources (Meredith & Mantel, 2003). The temporary feature demands flexibility and progressive work organisation. It differentiates them from operations, which are repetitive, standard functional activities to produce products or services (Meredith & Mantel, 2003; Turner & Müller, 2003). Resources are organised to deliver the project. The organisation is disbanded after the project (Project Management Institute, 2004; Turley, 2013).

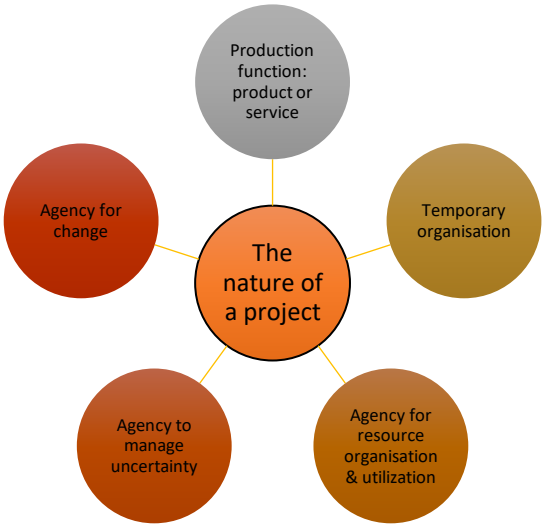


Figure 2-1: The critical aspects of the nature of a project (Turner & Müller, 2003)

Archibald (1997) and Turner and Müller (2003) recognised the project as a focal point to assimilate all management responsibilities. They applied organisational management principles which include resource allocation, utilisation, and control (Project Management Institute, 2021; Turner & Müller, 2003; Wideman, 2000). A project is a production function. It is a collection of plans, presided over by a manager who buys and sells the project’s inputs and outputs on the open market and optimises benefits to accrue to the owner (Turner & Müller, 2003).

Figure 2-1 aligns with the critical aspects of innovation for inclusive development projects. These projects are agents of change and enable access to basic services and support local economic development. They support grassroots innovators through access to innovation ecosystems. They harness science, technology, and innovation to deliver the desired sustainable change (DST, 2015; Gupta et al., 2015; Ika et al., 2020). Diverse stakeholders converge, form, and engage in a temporary organisation to achieve the desired change. The stakeholders hold different roles and responsibilities to enable successful project management (Eskerod et al., 2015).

Innovation for inclusive development straddles different policy priorities and as such, is risky and laden with uncertainly as success is not guaranteed. Projects are fluid and susceptible to changes in their contexts, e.g., change in political leadership has policy implications. These projects can transcend national borders and comprise partnerships between developed and developing countries. In international development, these projects serve as agencies to allocate, utilise, and manage resources; as such, they are a productive function for the outputs and outcomes they deliver (Ika et al., 2020).

2.2 Project Management Practice

Project management emerged as a practice post-World War II. The technology and infrastructure sectors development propelled it (Cicmil & Hodgson, 2006). The United States' defence and aerospace industries developed project management methods from 1950 to the 1960s (Morris, 1998). Research expanded project management from its base of quantitative techniques and integrates theories from disciplines such as business and management (Cicmil & Hodgson, 2006).

The traditional project management practices use the command-and-control approach. Gorod et al. (2018) argued that command-and-control supports static and linear project management. Gorod et al. (2018) contended that the increasing complexity of projects defies the use of linear management approaches. They emphasised that technology transcends national borders, with implications and shifts in socio-economic and geopolitical power relations. These features limit the

appropriateness of the use of linear approaches to manage innovation for inclusive development projects.

The management of innovation for inclusive development projects compels drawing from various disciplines. Their management requires an appreciation of human and social sciences, innovation, and economic development. Cicmil et al. (2009) acknowledged a growing body of literature linking innovation and technological development with complex project management and stated that this literature enriches understanding of the management of complex projects.

The inclusion of theories from other disciplines pursues comprehensive and creative models and prescripts that are ideal for successful design, implementation, and control of project activities (Cicmil & Hodgson, 2006; Winch, 2014). The combination of disciplines provides tools and techniques essential for consistent performance. Most project management definitions include and instil time, cost, and scope as measures of performance (Kerzner, 2003; Meredith & Mantel, 2003; Pinto & Slevin, 1987; Project Management Institute, 2004).

Different project management associations, standards, and good practices exist across the world. The Project Management Institute (2004) described a standard as a manuscript to optimise performance and specified methods and criteria for repeatable tasks. Standards and good practices include the PMBOK, Projects in Controlled Environments II (PRINCE2), Association for Project Management Body of Knowledge (APMBOK), among others (Morris, 1998). They recognised project management from either execution or prescriptive perspectives. Others applied an organising perspective, which includes competence and capability (Ghosh et al., 2012; Morris, 1998).

The International Centre for Complex Project Management introduced competency standards in 2012 (International Centre for Complex Project Management, 2012). These standards respond to limitations of traditional project management tools and competencies to complexity. They recognise the intrinsic complexity, which is driven by user expectations, diversity in culture, political, technological, and environmental

concerns. Researchers such as Bjorvatn and Wald (2018) emphasised the absorptive capacity of the project management teams as key to managing complexity.

Researchers concur that many bodies of knowledge inspire linearity in project management. They advocate functionalist, sequential, and mechanistic approaches which renders them inflexible to adapt to complex instances (Cicmil & Hodgson, 2006). Considerable research has been undertaken to improve the practice of project management. Yet, researchers disagree on the theory of project management, with some claiming that it is non-existent or obsolete (Wideman, 2000).

Researchers such as Saynisch (2010) asserted that these diverse views justify a new order of project management that would recognise that it is a social process with inherent features. It has non-linear interactions and interfaces, with multicausal structures and processes and can self-organise and evolve over time. It may be better positioned to respond to the complexity of projects (Cicmil et al., 2009) and with the increasing number of complex projects globally, it renders this response relevant.

While researchers argue for a rethink of traditional or classical project management and call for a new order, others claim that there is no dedicated project management theory (Gorod et al., 2018). Daniel and Daniel (2018:194) emphasised that “the next challenge of project management science should be to generate a theory of emergence, just as a theory of regulation”.

Researchers elaborate that, in certain instances, project management practices draw from specific sectoral theories. For example, aerospace projects draw from systems engineering, configuration management, and integrated logistics management (Morris, 2004). Koskela and Howell (2002) contended that two theories influence project management. They are the theory of project and the theory of management. The theory of project departs from the transformation of inputs into outputs which breaks down the process into manageable tasks over a predefined time frame. The theory of project introduces value creation and customer satisfaction.

The theory of management advances three tasks: planning, execution, and control (Koskela & Howell, 2002). In management-as-planning, the key tasks are identified

and implemented to realise the project goals. It plans the transformation of project inputs into outputs and its main output is the plan (Meredith & Mantel, 2003; Project Management Institute, 2004).

Management-as-planning accounts for the organisation of project management, e.g., organising resources to fulfil the project (Koskela & Howell, 2002). To expound, it deploys requisite human resources to ensure successful project management. It draws from design thinking as it focuses on the social design of the process and acknowledges the influence of the teams' culture and diversity on project management (Klein, 2010).

Management-as-execution and management-as-control focus on the execution of the project management plan. They enforce performance as per the agreed plan and allocate resources (Koskela & Howell, 2002; Meredith & Mantel, 2003; Project Management Institute, 2004). The project manager deals with social dynamics in the project itself and between the project and its environment. This responsibility is more taxing in complex projects, wherein the project manager confronts the diverse views of the many stakeholders.

Complex projects exhibit multiple levels and directions of communication and interactions. These occur within the project management team, with the stakeholders, and the project's context (Gorod et al., 2018). Communication concerns collaboration, negotiation, and relationship management amidst diverse stakeholders (Eskerod et al., 2015; Klein, 2010). The interactions and interdependencies amongst elements of innovation for inclusive development evolve over time. Evolving complexity cannot be responded to and understood based on traditional linear project management methods (Gorod et al., 2018).

Stakeholders are people and organisations who influence the project. Their level of engagement and perceived roles convey their interest. They are either primary or secondary stakeholders, with varying susceptibility to project outcomes (Eskerod et al., 2015; Project Management Institute, 2004). An efficient project management team recognises the different categories of stakeholders and ascertains their expectations,

requirements, and influence over the project management (Project Management Institute, 2004; Flyvbjerg et al., 2003).

Classifying stakeholders guides the level of effort invested in engaging them. It clarifies whether to inform, consult, or involve them (Flyvbjerg et al., 2003). Eskerod et al. (2015) declared that stakeholders are essential in each project. They (i) contribute financial and non-financial resources; (ii) define criteria and measures of success; (iii) may pose risks to success due to their potential for resistance; and (iv) enjoy positive or suffer negative impacts from the project.

Stakeholder engagement starts at the conceptualisation phase of the project (see Figure 2-2). The primary stakeholders perform some duties, to varying extents. The client, the sponsor, and the project management team comprise this category. The client is the user of the output and generally commissions the project. The management team comprises human resources that execute activities to deliver the project.

The project sponsor is generally the funder of the project (Ghosh et al., 2012; Project Management Institute, 2004). In some instances, the client and sponsor are identical. In innovation for inclusive development projects, the government or donors is the sponsor. The communities that are beneficiaries of the project constitute the client.

The primary stakeholders must communicate and document their expectations, such as intended benefits from the project (Meredith & Mantel, 2003; Project Management Institute, 2004). Moreover, each project has secondary stakeholders. They influence project management despite not being directly involved in its execution. They include legislators and regulators, politicians, competitors, suppliers, and various lobby groups. There are many examples of projects terminated or delayed by secondary stakeholders.

2.2.1 Traditional project management

The literature documents the different phases of the project management lifecycle (Figure 2-2) (Cicmil et al., 2009). Distinct phases constitute the lifecycle of the project and management thereof. These phases include conceptualisation and initiation,

planning, implementation, and closure. The lifecycle defines the duration and resource requirements for each phase.

Each phase delivers different outputs, e.g., planning produces the project management plan. Each phase varies in the use of resources. Financial and human resources are lower at the project initiation phase. The execution phase demands more resources as it implements all activities (see Figure 2-2). It ventures into intensive stakeholder engagement to assure them of the progress.

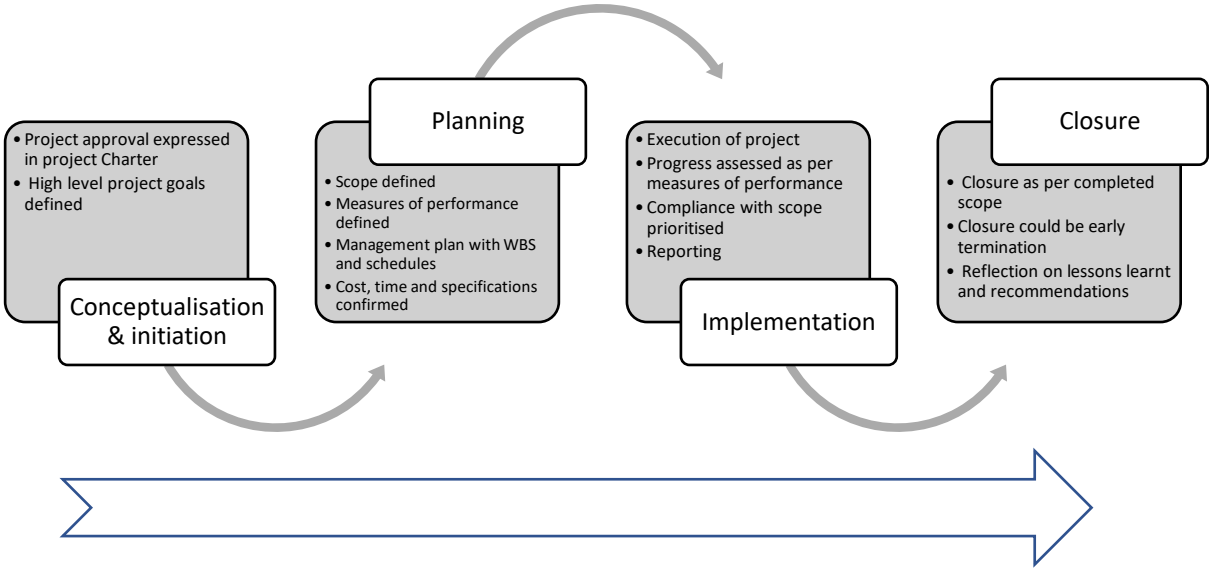


Figure 2-2: A depiction of the traditional linear project management lifecycle (Cicmil et al., 2009)

The likelihood of completing the project as planned increases over the lifecycle (Project Management Institute, 2004). The uniqueness of each phase reinforces the adoption of responsive measures of performance. Measurable, verifiable, and tangible outputs from implemented activities inform the performance management approach (Meredith & Mantel, 2003; Project Management Institute, 2004). Tracking the progress using these measures guides decision-making (Cicmil et al., 2009). These measures enable management to assess the efficiency and effectiveness of implemented actions (Mellado et al., 2020).

Each phase is distinct and unique in its intent and processes and may use tools and techniques not applicable to other phases. The lifecycle starts at conceptualisation, which outlines the business case. It validates the need and defines the project goals and intended benefits (Meredith & Mantel, 2003; Pinto & Slevin, 1988; Project Management Institute, 2004).

Planning, execution, and termination follow. The termination phase confirms completion or close-out. Each phase produces a different output, for example, project conceptualisation outputs include a project charter. The planning phase produces the project management plan (see Figure 2-2) (Project Management Institute, 2004).

The planning phase conceptualises the requisite actions that must be implemented timeously to achieve the objectives (Meredith & Mantel, 2003; Pinto & Slevin, 1988). The project management plan provides a schedule of tasks for execution and guides the transformation of inputs to outputs (Koskela & Howell, 2002; Meredith & Mantel, 2003; Project Management Institute, 2004). It defines and finalises the measures of performance to evaluate progress and efficiency and specifies how each measure should be assessed (Pinto & Slevin, 1988; Project Management Institute, 2004). Various frameworks emphasise the planning phase in project management (Baccarini, 1999; Belassi & Tukel, 1996; Rozenes et al., 2006). For example, the Project Management Institute's PMBOK breaks it into a significant number of process groups (Project Management Institute, 2004).

The execution phase brings to life the main output of the planning phase, i.e., the project management plan. Slevin and Pinto (1986) stated that the execution phase uses financial, human, technical and other resources to accomplish a series of activities. It is generally the longest and most resource-intensive phase of the project lifecycle (Jugdev & Müller, 2005). It emphasises project control and monitors the implementation of the plan.

Some researchers recommend more effort to improve control tools and techniques and contend that inefficient control is one of the leading causes of failure (Rozenez et al., 2006). It extends beyond controlling progress against time, cost, and scope and

includes management of human resources, stakeholders, information, and knowledge (Bellasi & Tukel, 1996; Pinto & Slevin, 1988).

Project management control comprises responding to project context factors that encompass various interdependent actors and their interactions within and beyond the project boundaries (Cicmil et al., 2006; Rozenes et al., 2006). These actors include the stakeholders such as regulators, politicians, and user communities. The culture and expectations from the project influence their interactions in project management (Mahalingam & Levitt, 2007).

The termination phase is the closure and exit stage and denotes the completion of all activities and delivery of outputs (Cicmil et al., 2009). The acceptance of the project output by the client/end-user is an important indicator of success (Pinto & Slevin, 1988). The existing literature proclaims that success is a multidimensional construct whose meaning varies according to different project stakeholders (Atkinson, 1999; Wideman, 2000).

Regardless of these meanings, success/failure remains interpreted based on the measures of time, cost, and scope (Atkinson, 1999; Wideman, 2000). This pre-occupation sometimes overshadows the interpretations of success by the different stakeholders (Pinto & Slevin, 1988; Wideman, 2000). The focus on time, cost and scope is concerned with measuring the efficiency of the project management, and the focus on outputs assesses whether the aim of the project has been fulfilled (Cicmil & Hodgson, 2006; Diallo & Thuillier, 2003; Serrador & Turner, 2014).

The pre-occupation with the three measures reduces project management to planning, execution, and a reporting-oriented quantitative activity (Atkinson, 1999; Morris, 2004). It ignores and underplays the management of strategic and technical matters (Mellado et al., 2020; Morris, 2004).

The existing project management frameworks, tools, and prescripts have not eradicated project management failures (International Centre for Complex Project Management, 2011; Morris, 2004; San Cristóbal et al., 2018). The Project

Management Institute (2018) stated that, on average, more than 70% of projects in large organisations fail to realise their objectives.

Reasons for failure include cost overruns, delayed completion, non-achievement of predetermined quality criteria, poor scope change management, unsuccessful risk management, user dissatisfaction, among others (Hodgson & Cicmil, 2006; Morris, 1998; Williams, 2017). Williams (2017) highlighted that increasing project complexity and ignorance or under-estimating it are some of the major causes of failure. Complexity presents a myriad of factors that are beyond the control of the project management team (Belassi & Tukel, 1996).

2.3 Complex Project Management

Researchers argue that complex project management defies the application of traditional, linear, and deterministic tools. The complex project management lifecycle is non-linear and allows for iterations, variability, and dynamism (Cicmil et al., 2009). The management of innovation for inclusive development projects affirms the need for flexibility and responsiveness over their lifecycle. Gorod et al. (2018) argued for new approaches to enable and enhance the management of complex projects. They contended that existing tools are inadequate to manage complexity as these tools are static, reductionist, and cannot accommodate the evolving and self-organising features of complex project management (Mellado et al., 2020).

Literature confirms the extent of research performed on the complexity of projects (see Figure 2-3). Despite such research, there is still no universal definition of what complexity is. Many researchers have described and suggested features to identify complexity (Baccarini, 1996; Dao et al., 2016; San Cristóbal et al., 2018; Vidal & Marle, 2008). Some descriptions of a complex project include the following:

- A complex project consists of “many varied interrelated parts and can be operationalised in terms of differentiation and interdependency” (Baccarini, 1996, p. 202).

- A complex project is characterised by an uncommon degree of uncertainty and unpredictability. Its elements tend to dynamically intermingle with each other

(Transportation Research Board, 2014). According to Dombkins (2009), dynamic interactions make complex projects amenable to considerable disorder and instability.

- “Project complexity is the degree of interrelatedness between project attributes and interfaces, and their consequential impact on predictability and functionality” (Dao et al., 2016, p. 478). The elements interact with each other and with the external environment, i.e. the project context (Dao et al., 2016).

- Complexity is “the property of a project that makes it difficult to understand and predict its behaviour, even when given complete information about the project system. Its drivers include project size, variety, interdependence, and context” (Vidal & Marle, 2008, p. 1101).

De Rezende et al. (2018) demonstrated that earlier research focused on understanding complexity (see Figure 2-3) and various concepts on the attributes of complexity emerged from it. Recent research indicates the extent of literature on the management of complex projects (Crosby, 2017; San Cristóbal et al., 2018). The systemic review of De Rezende et al. (2018) highlighted trends and different areas of focus to understand and manage complex projects over time (see Figure 2-3).

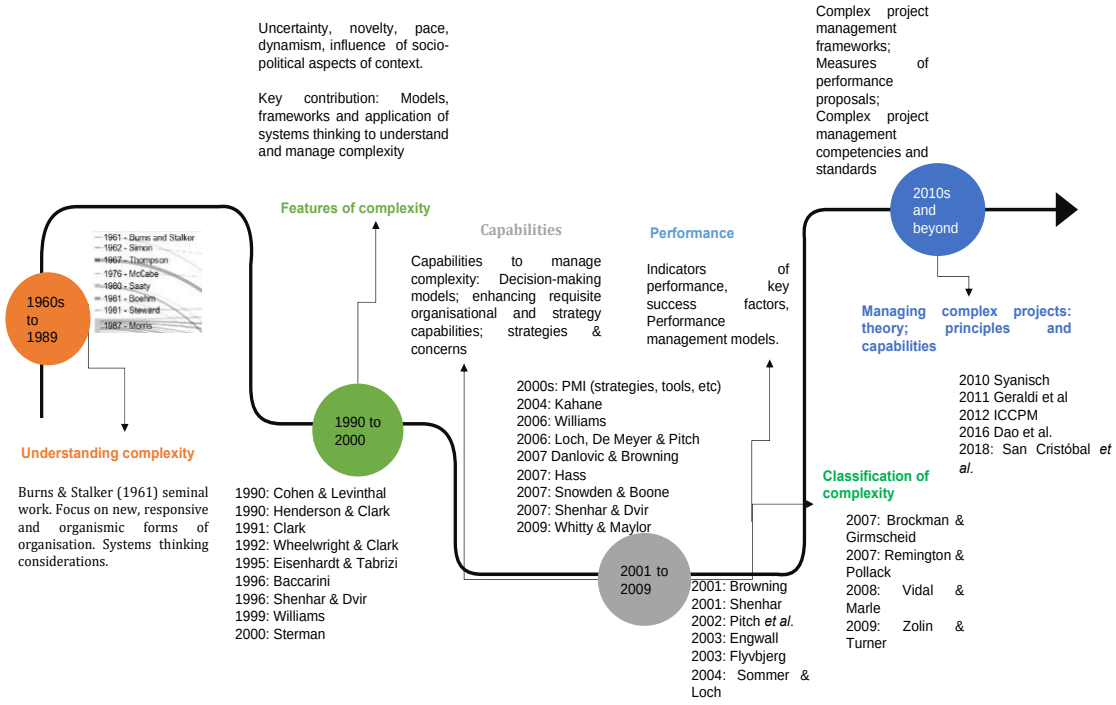


Figure 2-3: An overview of project complexity research over time (adaptation of De Rezende et al., 2018)

The literature review indicates considerable research invested into understanding complexity, including identifying its attributes starting in the 1960s. San Cristóbal et al. (2018) concurred that early complex project management research started with a need to understand complexity.

The analysis by De Rezende et al. (2018) demonstrated that early project complexity research focused on understanding aspects of complexity. It identified factors or elements that make a project complex. It identified dominant features of complexity that include the uncertainty, size, and number of elements and interdependencies thereof. It highlighted the interdependencies amongst project elements and their impact on complexity (Luo et al., 2017).

Luo et al. (2017) reflected on research conducted to identify and disaggregate different types of complexity. This research confirms the absence of a uniform project complexity classification framework. Existing literature shows that the dominant types of complexity include organisational, task, and technical.

Organisational complexity is comprehensive and includes human resources (number, diversity, and structure), technology, and information management systems. Such aligns with San Cristóbal et al. (2018) who presented factors that affect the complexity of a project including size, number of interrelated and interconnected elements, and clear objectives, among others. Figure 2-3 showed that complex project management research considered building capabilities and approaches to manage performance. This research provides frameworks and tools to define and ascertain features of complexity and the focus on capabilities includes identifying the requisite skills to manage complex projects.

The formative inquiry by Burns and Stalker in 1961 demonstrated the need for alternative organisational structures to manage complexity (De Rezende et al., 2018). It considered that these structures need to respond to the dynamism and uncertainty of the contexts wherein organisations exist and operate (see Figure 2-3). It gave prominence to different skills required to manage complexity, e.g., identifying its features and recognising and responding to interdependencies and interfaces.

Training project managers to identify and respond to complexity develops competencies appropriate for high performance (Whitty & Maylor, 2009). Researchers have proposed various tools and standards to manage complexity, which includes the Complex Project Manager Competency Standards (International Centre for Complex Project Management, 2012).

Complex Project Management in an evolving practice requires absorptive capacity which encompasses individual and organisational abilities to recognise, analyse, assimilate, exploit, and apply knowledge (Bjorvatn & Wald, 2018; Cohen & Levinthal, 1990). It is a binary construct that comprises transformation exploitation capabilities and acquisition and assimilation capabilities.

Transformation and exploitation capabilities (i.e., the actual absorptive capacity) strengthen and add value to short-term project management performance (e.g., compliance with project scope, time, and budget allocations). Acquisition and assimilation capabilities (i.e., potential absorptive capacity) enhance long-term project

performance (Bjorvatn & Wald, 2018). Absorptive capacity influences the project managers' ability to select techniques from good practice options.

Researchers expanded on the seminal work of Burns and Stalker. The expansion proposed many concepts and models to improve decision-making and manage complex projects (see Figure 2-3). De Rezende et al. (2018) highlighted that the focus on features or dimensions of complexity arose in the 1990s. The research showed that leadership, culture, politics, and legislative requirements and communication influence complex project management. From 2005 onwards, there has been an increasing focus on performance matrices and systems (see Figure 2-3).

The research depicted the consensus on the attributes of complexity. These include difficulty, complicatedness, emergent and self-organising nature, uncertainty, and the tendency to adapt and evolve. Non-linear and simultaneous interactions amongst the project elements and with the project context are important but not well-understood attributes (Dao et al., 2016; San Cristóbal et al., 2018). Uncertainty is expressed and associated with ambiguity in project goals, project context, and delivery methods (Williams, 2002). Marle and Vidal (2008) included the culture and values of the team and their interactions within the project and between the project and its context.

Literature differentiates between a complicated and complex project. A complicated project consists of a large number of distinct components that are amenable to orderly implementation and analysis (Cillers, 1998; Dao et al., 2016). A complex project is not defined by the number of tasks involved, and the interactions, interfaces, and interdependencies amongst different components define it (Dao et al., 2016; International Project Management, 2011).

The most influential context attributes include the political landscape, socio-economic profile, legislation, and environmental sustainability (Baccarini, 1996; Cicmil & Hodgson, 2006; Cicmil et al., 2009; Dao et al., 2016; Transportation Research Board, 2014; Vidal & Marle, 2008; Williams, 2002). They guide the project management team in selecting appropriate tools and techniques which include the use of indigenous languages and targeting employment for youth and women.

Systems and complexity theories influence complex project management (Dao et al., 2016; San Cristóbal et al., 2018; Vidal & Marle, 2008). The systems theory aspect sanctions the project as a system since it is an object that exists in a given context. It exists to achieve predefined objectives (teleological aspect) through undertaking a series of activities (functional aspect). Its internal structure (ontological aspect) evolves through time (genetic aspect) without it losing its identity (Vidal & Marle, 2008).

Systems theory empowers practitioners and researchers to recognise the project's interconnected elements. These elements interact with each other, resulting in the emergence of new behaviours. This leads to further changes in other parts of the project (Whitty & Maylor, 2009; Williams, 2002). The emergent and evolutionary character needs agile project management (Whitty & Maylor, 2009; Williams, 2002).

Literature confirms the development of many models to recognise and respond to project complexity. Vidal and Marle (2008) suggested that complexity is either descriptive or perceived. Descriptive complexity is a distinct intrinsic feature of a project. It describes the attributes and drivers of complexity and proposes relevant responses (Vidal & Marle, 2008). Perceived complexity is subjective as it is dependent on an observer's perceptions (Vidal & Marle, 2008).

Baccarini (1996) advocated two aspects to understand complexity, namely organisational complexity and technological complexity. Organisational complexity establishes the project as a temporary organisation. It considers the structural elements of the organisation to execute a series of tasks (Brulin & Svensson, 2012; Dao et al., 2016; Williams, 2002). Organisational complexity further enables vertical and horizontal differentiation (Baccarini, 1996). The former focuses on the depth and levels of the project organisation structure and the latter concentrates on the number of units and the division of tasks.

The project's hierarchical structure, roles, and division of responsibilities require due consideration (Baccarini, 1996). Interactions within the project are multidimensional, non-static, and spatiotemporal as they relate to a particular project context, space, and time (Baccarini, 1996). They advance emergent and self-organising behaviour

amongst the different project elements and constituents. The multi-layered and multidimensional project structure nullifies value-free decision-making.

Understanding these tendencies distinguishes between chaos and non-chaos. It capacitates practitioners to ascertain competition and cooperation amongst and between the project elements (Cicmil et al., 2009; Sato et al., 2005). Saynisch (2010) highlighted dynamic complexity as that which occurs during the interaction amongst project elements. It aligns with the concept of organisational complexity.

Technological complexity considers the three aspects of technology, namely operations, features of materials involved, and the attributes of knowledge (Baccarini, 1996). It relates to task characteristics in project delivery (Baccarini, 1996; Dao et al., 2016). It also considers innovative technologies and their associated levels of uncertainty (Baccarini, 1996).

Innovation for inclusive development projects may be analysed using the two aspects of the Baccarini (1996) approach. The technology complexity aspect is appropriate since these projects include technology demonstration, diffusion, and transfer. The nature of the technology includes certainty of performance in a new context and the capability to operate and maintain it (DSI, 2016).

Remington and Pollack (2007) and Remington et al. (2009) identified structural, technical, directional, and temporal complexity. Structural complexity proceeds from managing the various interfaces amongst the interconnected elements and tasks (Saynisch, 2010). It stems from the stakeholders' individual, uncertain and conflicting goals and their distinct goal-paths. Stakeholders discern distinct goal-paths with their agenda (Williams, 2002).

Technological complexity arises from unknown technical aspects or design features. Uncertainty in interactions and interdependent design solutions aggravate technical complexity (Remington & Pollack, 2007). The interdependencies may exist as (i) pooled, (ii) sequential, or (iii) reciprocal. Pooled interdependencies manifest when an element makes a distinct contribution to the project. Sequential interdependencies dominate when one element's outputs translate to input for the next element.

Reciprocal interdependencies appear when each element's output is the input for others (Remington & Pollack, 2007).

Directional complexity emanates from uncertainty in the direction of the project (Remington & Pollack, 2007). It underscores a lack of clarity on what to deliver and how to deliver the project. Temporal complexity ensues from context or environmental aspects such as changes or ambiguity in regulation, politics, and social factors (Saynisch, 2010).

Dao et al. (2016) insisted that project difficulty is a lever to appreciate complexity. It expresses the extent of the challenge to meet the objectives amidst risks. It increases the risk and possibility of failure and strengthens the case for a responsive and adaptable project management practice (Dao et al., 2016). The existing complexity models have not transformed and maximised successful complex project management.

Baccarini (1996) and Sato et al. (2005) concurred that complexity arises from non-linear interactions, interrelationships, and interconnectivity of different elements. These include external stakeholders (influencers), task characteristics, technical, and organisational complexity. Brockman and Girmscheid (2007, p. 221) recognised the different categories of the complexity of a project as follows:

- Social complexity, which is concerned with the number and diversity of actors and stakeholders working together and engaged in project management.
- Task complexity which focuses on "the density of activities in a given spatial and temporal frame".
- Cultural complexity is concerned with the "history, experience and sense-making processes of the different groups" that come together and participate in project management.
- Operative complexity refers to the extent to which "organisations of the project are independent when defining their operations to achieve given goals".

- Cognitive complexity is concerned with sense-making processes, the ability to manage and process complexity, uncertainty and ambiguity and as such, can exist at an individual or group level. Cognitive complexity is important in assessing complexity and in formulating and implementing concepts appropriate in the management of complex projects (International Complex Project Management, 2011).

Different models to identify and classify complexity are applicable to study innovation for inclusive development projects. Individual or a combination of models is usable. To illustrate, a combination of the Baccarini (1996), Remington and Pollack (2007), Remington et al. (2009) and Brockman and Girmscheid (2007) enabled comprehensive analysis. The combination might empower project managers to identify and respond to complexity at the organisation (social, cultural, cognitive, and structural), technology (technical), temporal, and task levels.

Research on project complexity provides proposals on classification frameworks. These assist project managers to decipher whether a project is complex or not. They codify considerations for the development and implementation of project management plans and consider the non-linearity and dynamism of complex projects and their influence on management (Cicmil et al.; 2006; Cicmil et al., 2009). These frameworks include that of Turner and Cochrane (1993), whose classification approach considers how well defined the project goals are. It reviews project management knowledge, access to the applicable methods, and the likelihood of success (see Figure 2-4).

The Turner and Cochrane Goals and Methods matrix classifies projects into four types. Type 1 projects are those whose goals and methods are well defined and as such, the likelihood of success is higher (see Figure 2-4). Type 1, e.g., engineering projects, may also be perceived as simple projects and are delivered using existing methods. Their project management can draw from lessons learnt from previous exercises and available best practices (Turner & Cochrane, 1993).

Type 2 projects consist of well defined goals despite not knowing the methods to attain them. These projects include product development projects and as such, they require innovation.

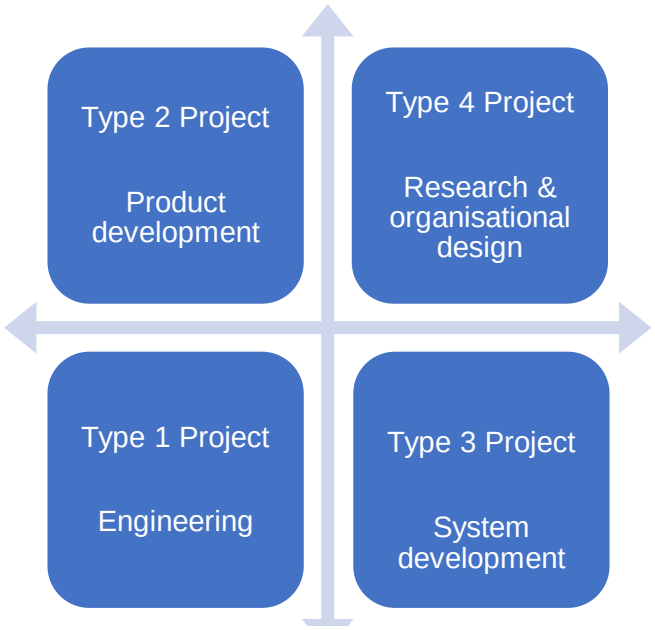


Figure 2-4: The goal-method project classification approach (Turner & Cochrane, 1993)

Type 3 projects are characterised by not well defined goals despite having clarity in execution methods. Clear project goals are part of critical factors and minimum requirements to embark on any project (see Figure 2-4) (Project Management Institute, 2004).

Type 4 projects portray initiatives with a limited or lack of clarity in project goals and methods to realise it. Project management must be flexible and iterative to acquire clarity in goals and delivery methods (Turner & Cochrane, 1993). Based on Figure 2-4, complex projects may fall into the category of Type 4 projects since the goals may not be well defined and the methods to achieve them may be unknown. The complexity of these projects may require a combination of tactics to execute and manage them (Luo et al., 2017). Efficient communication, creativity, and experience of staff affect the successful management of Type 2 and 4 projects. Innovation for inclusive development projects falls into Type 2 and 4 categories.

The Stacey Matrix (1996) model classifies projects based on five categories. The classification locates projects on two dimensions, namely the level of agreement amongst stakeholders and the degree of certainty of goals (see Figure 2-5).

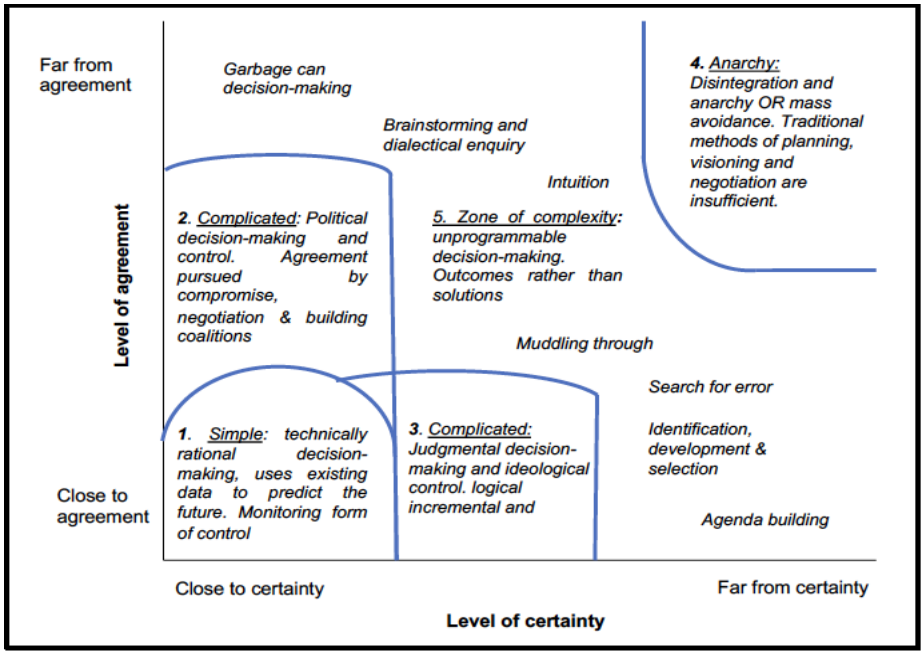


Figure 2-5: The Stacey Matrix framework for classifying projects based on the dimensions of the level of agreement (y-axis) and degree of certainty (x-axis) (Zimmerman, 2001)

Both dimensions focus on the agreement on goals and requisite methods to manage the projects. Zones assort the projects depending on the level of agreement (y-axis) and degree of certainty (x-axis) (Zimmermann, 2001). Close agreement in goals and confidence in the requisite project management approach typifies Zone 1 projects. Stacey (1993) alluded that such projects are simple and rely on existing linear project management approaches (see Figure 2-5).

Zone 2 depicts complicated projects characterised by high certainty on how to generate outcomes. They feature high levels of agreement to achieve the desired outcomes. They are amenable to political influence, requiring negotiation in selecting outcomes (Cillers, 1998; Dao et al., 2016; Zimmermann, 2001).

Zone 3 entails complicated projects characterised by agreement in project goals without certainty on management methods. According to Stacey (1996), these projects are not amenable to management through traditional approaches. The extent of agreement, e.g., in project outcomes, differentiates Zone 4 projects. High uncertainty

is unwanted in both goals and project management approaches as this can lead to a breakdown or anarchy.

Stacey (1996) located complex projects in Zone 5, which acknowledges that, despite consensus on desired outcomes, conflict prevails on how to deliver them. It materialises from political agendas which affect decision-making processes and execution techniques. Due to the prevalent interfaces and the interconnectedness, conventional project management is unsuitable.

Innovation for inclusive development projects may fall into Zone 5. The characteristic diversity of stakeholders expresses itself in different ways (Gupta et al., 2015) and includes expertise, culture, power, and authority. The debates in project management methods partly arise from this diversity. To illustrate, politicians, in an agro-processing project might argue for labour-intensive implementation; in contrast, scientists could advocate for automated approaches, and development practitioners may advance methods that build skills and enable economic inclusion.

Stacey (1993) attested that high levels of creativity and innovation characterise Zone 5 resulting in adaptive and agile leadership. It adopts comprehensive systems-level thinking to decode the nature and extent of complexity (International Complex Project Management, 2011) and offers practice-based and valuable knowledge for the management of complex projects.

Shenhar and Wideman (2002) provided a project classification approach that considers aspects not considered earlier (see Figure 2-6).

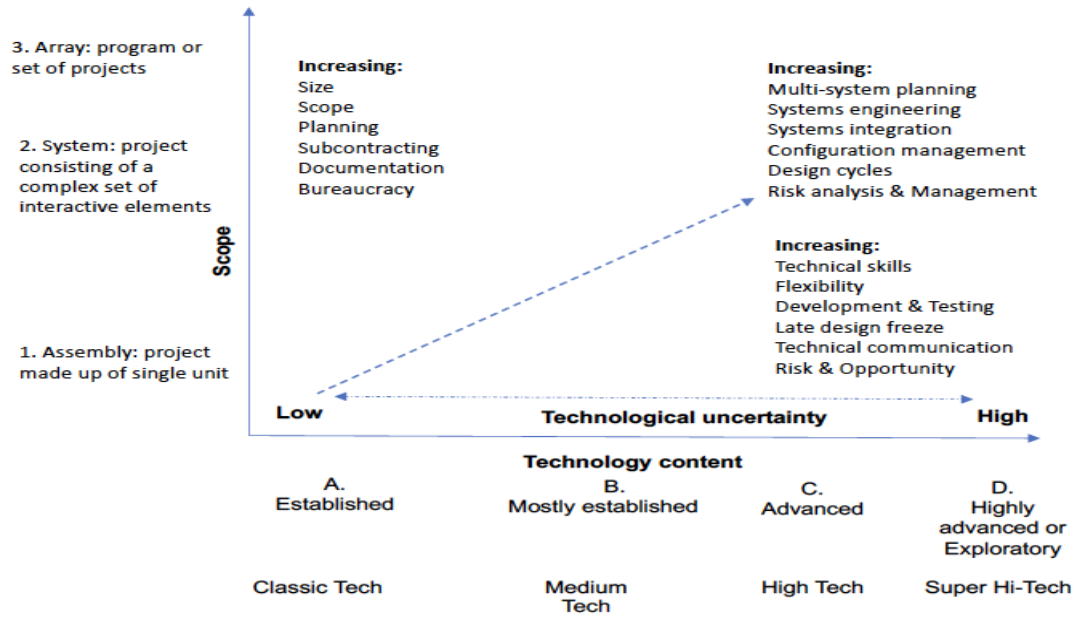


Figure 2-6: The Shenhar and Wideman (2002) project classification framework

The Shenhar and Wideman (2002) model grounds classification on two dimensions. These are programme/project management scope (y-axis) versus technological uncertainty (x-axis) (see Figure 2-6). It affirms that uncertainty in technology influences the selection of project management methods. This framework classifies projects based on four types. Type A projects have known and well-established technologies. The project size combined with a limited set of interconnected project elements distinguishes them and renders them amenable to conventional project management approaches.

Well-established technologies, with low levels of uncertainty typify Type B projects. Advanced technologies with higher degrees of uncertainty categorise Type C projects. High uncertainty arising from highly advanced or non-existing technologies categorises Type D projects (see Figure 2-6). The confidence in the technology combined with an increase in project complexity guide the selection of tools and techniques. Increasing uncertainty and complexity requires creativity in combining distinct methods to deliver the project (Shenhar & Wideman, 2002).

The y-axis in the Shenhar and Wideman (2002) model categorises projects based on three levels. Level 1 accommodates simple projects manageable by conventional

techniques. Level 2 denotes projects with a degree of complexity due to interconnected elements. Level 3 comprises projects combined for a common predefined purpose. The Shenhar and Wideman framework requires consideration of both the x-axis and y-axis. Agile and fit-for-purpose project management approaches apply to this model (Shenhar & Wideman, 2002).

The Cynefin Framework proclaims itself as a possible solution. It enhances sense-making and decision-making due to its potential to examine complexity in each context. It focuses on aspects including leadership, strategy, and cultural change (Snowden & Boone, 2007). The Cynefin Framework (see Figure 2-7) enables the analysis and sense-making of how individuals in a group perceive and learn, thereby contributing towards allowing the emergence of shared understanding in a particular context (Snowden & Boone, 2007).

The Cynefin Framework consists of five aspects based on the nature of cause-and-effect. The first domain is known knowns with clear and validated rules and techniques. Snowden and Boone (2007) enunciated that the simple domain has clear contexts, wherein the cause-and-effect relationship is clear. The use of the rules of this domain requires stakeholders to collectively apply available best practice. Projects in this domain are executable by conventional tools and techniques.

The complicated domain features known unknowns. The cause-and-effect relationship is not clear, and it requires analysis (Snowden & Boone, 2007). Decision-making in this domain departs from assessing the facts (sensing), analysing, and responding by applying good practice (see Figure 2-7). In applying this in complicated projects, the framework enables the decision-makers to systematically navigate the substantial number of components of the project and prioritise them for implementation (Cillers, 1998; Dao et al., 2016).

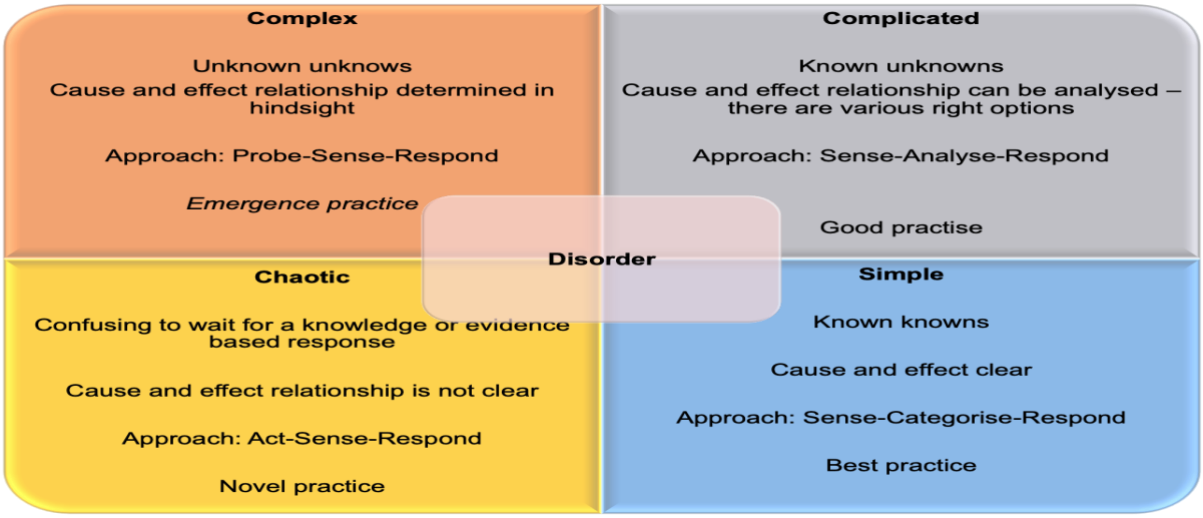


Figure 2-7: The Cynefin Framework to assist in the classification of interventions (Snowden & Boone, 2007)

The Cynefin Framework complex domain comprises the unknown unknowns. The cause-and-effect are not known and require probing (see Figure 2-7). The sense-making establishes an appropriate response in uncertain conditions. This approach supports the construction of realities.

The chaotic domain is represented by chaos, “unknown unknowns” and ambiguity. Its primary task is to establish order and to ascertain where stability is present and absent. This is addressed before developing responses that shift the situation from chaos to complexity.

The fifth aspect of the Cynefin Framework is the disorder/confusion domain. It applies when there is no clarity in the domain that is the situation at hand (Snowden & Boone, 2007). Many perspectives attempt to dominate this domain. It first collapses the challenge into its constituent parts when analysing it and this analysis informs the development and implementation of appropriate interventions (Snowden & Boone, 2007).

The extent to which there is a correct and appropriate diagnosis of the situation hampers the use of the Cynefin Framework. The domains are established by observing behaviours and establishing cause-and-effect relationships. This increases the risk of over-simplifying the process.

The International Centre for Complex Project Management introduced the Complexity Diagnostic Tool as an attempt to contribute towards enhancing the management of complex projects (see Figure 2-8). The Complexity Diagnostic Tool embraces the views of various stakeholders in the diagnostic activity. It considers their input and extracts meanings and insights to inform the risk management plan. This plan may reflect on the complexity and craft requisite responses to manage risk and uncertainty. It accepts the certainty of change during project management and its implementation provides crucial information that confirms readiness to progress to the next phase (International Centre for Complex Project Management, 2011).

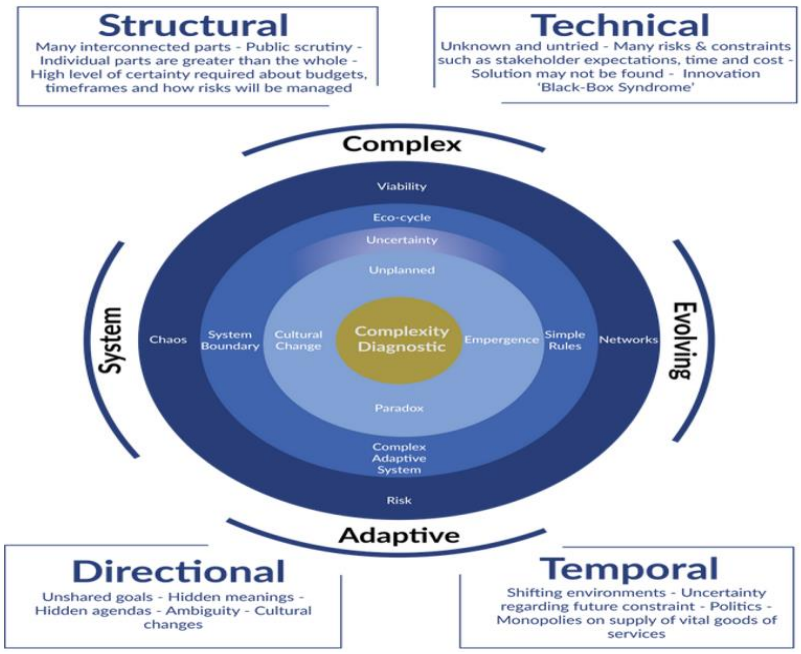


Figure 2-8: An extract of the Complexity Diagnostic Tool of the International Centre for Complex Project Management (2011)

The Complexity Diagnostic Tool determines complexity attributes and identifies the influences of the project context. It proposes appropriate activities to address complexity, including allocating roles and responsibilities (see Figure 2-8). The tool highlights user influences and the external regulatory and political environment and prioritises value for money in financial resources (International Centre for Complex Project Management, 2011).

Other researchers have proposed means to ascertain and define project-level complexity based on attributes. Dao et al. (2016) offered a framework that groups complexity attributes according to 11 categories, namely (1) stakeholder management, (2) project governance, (3) legal, (4) fiscal planning, (5) interfaces, (6) scope definition, (7) location, (8) design and technology, (9) project resources, (10) quality, and (11) execution targets. Each category defines complexity indicators for each complexity attribute.

The Transportation Research Board (2014) classified complexity according to five dimensions, namely (1) cost, (2) schedule, (3) technical, (4) context, and (5) finance. A list of requirements is identified and must be met for each dimension to assure successful project management. These requirements influence the selection of tools for project execution and risk management (Transportation Research Board, 2014).

Existing research indicates that not all project management frameworks and tools respond to the complex nature of projects. The analysis by De Rezende et al. (2018) highlighted performance management. It incorporates critical success factors and criteria and measures of performance for complex projects management.

2.4 Conclusion

Substantial research provides numerous models to analyse and understand complexity and empowers practitioners to identify and incorporate mechanisms to respond to complexity (International Centre for Complex Project Management, 2011; San Cristóbal, 2017; San Cristóbal et al., 2018; Vidal & Marle, 2008). The widespread application of these models in different sectors may be the root of the problem. For example, the use of construction sector complexity models is unsuitable for other sectors. The differences in dynamics and profiles and the extent of available knowledge on project management may justify sectoral approaches.

Innovation for inclusive development is an emerging field. Its layers of complexity include its attempt to reconcile the science, technology, and innovation agenda with inclusive development aspirations. Its foundation disrupts current practices as it pursues equitable access, participation, and benefit-sharing. The failures of innovation

for inclusive development projects testify of a possible disharmony between research and practice.

My research aimed to expand existing knowledge by delving into how complexity influences the organisation of innovation for inclusive development project management. It departed by seeing the project as a complex and adaptive temporary organisation that organises itself in a particular manner to achieve its predetermined purpose in its context. Different stakeholders characterise innovation for inclusive development projects as complex (Gupta et al., 2015). Their management cannot be based on conventional, top-down approaches and demand participatory and agile approaches (Gupta et al., 2015).

The stakeholders engage, create, and interpret the meaning and social realities during project management. The temporary organisation is not static due to the evolving internal interactions with its context which render it fluid, with a degree of chaos and ambiguity. The organisation features interconnected and interrelated activities wherein a change in one aspect affects the whole organisation. The collaboration of different stakeholders in these complex projects makes their management a social process with the values and culture of the stakeholders influencing this process.

The literature review affirms the need to understand how complexity influences how organisations organise complex project management. I pursued this need particularly for innovation for inclusive development projects. Such knowledge may be part of the new order of project management that some researchers recommend and may contribute towards better organising and enhancing project management performance. The prominence of innovation for inclusive development projects increases as developing and developed countries pursue inclusion. Investors, beneficiaries, and project management practitioners seek comprehensive measures of performance to assess success or failure.

LITERATURE REVIEW PART 2: MEASURES OF PERFORMANCE IN PROJECT MANAGEMENT

2.5 Research on Measures of Performance

Considerable research exists on performance management frameworks for complex projects. It advocates for the review of what makes up successful project management. The discourse acknowledges the inadequacy of time, cost, and scope as the only relevant measures of performance. It suggests the expansion of these measures to reflect other aspects (Andersen, 2006; Belassi & Tukel, 1996; Cicmil & Hodgson, 2006; De Wit, 1988; Hyväri, 2006; Kerzner, 2015; Serrador & Turner, 2014). Cicmil et al. (2017) highlighted the inadequacy of the iron triangle and suggest the inclusion of other considerations such as the community, health and safety, and environment. Mellado et al. (2020) stated that the iron triangle provides an incomplete view of project management.

The term ‘measure’ is both a noun and a verb. The noun form applies to dimensions, a standard, or unit of measurement. The verb format refers to the act of measuring something. It focuses on estimating the size, quantity, or degree of something (Merriam-Webster, 2020). My research focused on the noun aspect, i.e., it investigated measures or units of performance applicable to the management of complex inclusive development projects.

Measures of performance are an essential aspect of control and progress assessment. They apply throughout the project lifecycle and as such, command due respect (De Wit, 1988). The deliberation gives clarity on the purpose of measurement. It confirms what to measure and how to achieve this (De Wit, 1988; Turner & Zolin, 2012).

Research on performance management unveils the multidimensional nature of success and failure. It emphasises enabling conditions critical for success. It inspires project managers to identify and embed prerequisite conditions for success and to

consider many tactical actions to reduce the likelihood of failure (Cicmil & Hodgson, 2006; Kerzner, 2015; Osorio et al., 2014; Pinto & Slevin, 1988).

The discourse on complex projects provides alternative perspectives to performance management. Some propose sectoral approaches, e.g., measures of performance for the infrastructure sector – examples include the five-dimensional project management model (5DPM) (Transportation Research Board, 2014). Others cater to the needs of different industries and as such are generic. They use measures such as time, cost, human resources, quality, etc. and include the recommendations of the Centre for Business Practice (2005). The generic models may be customisable for specific sectors.

Others motivate frameworks grounded on the motive of the project (see Table 2-1). The measures of performance may be influenced by either the motive or main objective of the project (see Table 2-1).

Table 2-1: Example of a project classification framework intended to classify projects by motive (De Wit, 1988)

Motive	Project	Main objective	Primary discipline
Necessity	Thames	It should work	Engineering
Opportunity	Nuclear power plant, oil field development, renewable energy development	It should pay	Economics
Prestige	Eiffel Tower, Sydney Opera House, Robben Island Museum	It should exist	Politics
Research	CERN project, Centre for Tuberculosis research	Reaching a solution	Science

A project may be motivated by a commercial opportunity, a research question, or a necessity (see Table 2-1) (De Wit, 1988). Table 2-1 acknowledged that some projects may have more than one motive and various objectives and may incorporate many disciplines. The application of the project classification framework needs prioritisation of the dominant motive, objective, and discipline (De Wit, 1988).

Researchers assert that the project's motives influence measures of performance (Freeman & Beale, 1992; Osorio et al., 2014) and are defined based on the motive and not the nature or type of project. This view differs from authors such as Slevin and Pinto (1986) and Meredith and Mantel (2003). They believed that measures of performance vary for different projects and industries. These authors endorsed an approach that aligns with the nature of projects. In this regard, a construction project would be measured differently from a research and development project.

Project management research has delivered many recommendations and frameworks on critical success factors (see Table 2-2) (Bellasi & Tukkel, 1996; Mellado et al., 2020). Critical success factors are prerequisite factors that ensure success and are the enabling conditions that optimise the performance of project management. They must be duly considered as they influence the likelihood of success (see Table 2-2) (De Wit, 1988; Cooke-Davies, 2002; Pinto & Slevin, 1988).

Critical success factors do not assess or measure progress (De Wit, 1988). Research conducted since the 1960s has not produced a conclusive set of criteria for success (see Table 2-2). Divergent views on their scope of applicability contain an innuendo, e.g., generic, or too specific to contexts. Occasionally, there is no differentiation between success factors for the project and project management (see Table 2-2). The project is the intended unique goods or services, i.e., it is an output. Project management is the process of creating a product or service and deploys and utilises resources to deliver the project as specified.

Different stakeholders may have varied and even conflicting interpretations of success. This complicates the discourse, as interpretations differ on what success is. It also influences perceptions on critical success factors (Cicmil & Hodgson, 2006; De Wit, 1988; Freeman & Beale, 1992; Kerzner, 2015; Pinto & Slevin, 1988; Wideman,

2000). The interpretation extends beyond whether the project was delivered within cost and on time and if the predetermined quality specifications were met.

Hayfield (1979) categorised critical success factors based on macro- and micro-factors. The macro-factors are concerned with project and project management. They include the meticulous definition and clarity of the project goals and support of the executive or top management (see Table 2-2). Micro-factors are concerned with the project management policy and framework which the managing organisation employs. It focuses on the organisation's project control systems and the deployment of appropriate personnel for the project.

Table 2-2 shows that the critical success factors can be both inward and outward-looking. The inward aspect focuses on the organisation, its strategy, and its processes. These include (i) parent organisation (e.g., organisational project management framework and philosophy) and (ii) project management competencies, at individual and team levels. Project management tools, techniques, and systems constitute the second criterion (Belassi & Tukkel, 1996; Radujković & Sjekavica, 2017). Radujković and Sjekavica (2017) further recognised critical success factors for both the (i) project and (ii) project management.

The outward-looking aspect focuses on the context of the project. Gunduz and Almuajebh (2020) categorised critical success factors based on their relation to the project, business, work environment, client, project management, design team, contractor, and project manager-related factors.

Table 2-2: Example of research studies on critical success factors

Researcher(s)	Critical success factors recognised
Bellasi & Tukkel, 1996; Morris & Hough, 1987; Silvius et al., 2012; Gudiené et al., 2013; Transportation Research Board, 2015; Mellado et al., 2020.	Clear project goals and objectives
Bellasi & Tukkel, 1996; Radujković & Sjekavica, 2017; Gunduz & Almuajebh, 2020.	Competent project management team, organisational culture, and structure
Bellasi & Tukkel, 1996; Pinto & Slevin, 1988; Gunduz & Almuajebh, 2020.	Clients buy-in and top management support
Morris & Hough, 1987; Silvius et al., 2012; Khang & Moe, 2008; Ika et al., 2012, Turner & Zolin, 2012; Howsari & Eager, 2014.	Power, politics, and context
Bellasi & Tukkel, 1996; Pinto & Slevin, 1988; Radujković & Sjekavica, 2017.	Project management tools and systems

Critical success factors include the competency of the project management team. Radujković and Sjekavica (2017) insisted that competency includes behavioural, contextual, and technical elements. Pinto and Slevin (1988) recognised the project manager's administrative, technical, and interpersonal character. Pinto and Slevin (1988) and Radujković and Sjekavica (2017) considered that the project manager's emotional intelligence is critical for success as it affects interpersonal relations in project management. Radujković and Sjekavica (2017) grouped critical success factors as follows: (i) project management competence, (ii) organisational structure

and culture, and (iii) project management methodologies, methods, tools, and techniques.

Kwak (2002), Struyk (2007) and Khang and Moe (2008) supported the inclusion of the project context as part of the critical success factors. They recognised this as being progressive, based on the influence of the context on project management (Gunduz & Almuajebh, 2020). The context includes the social, economic, regulatory, and political factors (Gunduz & Almuajebh, 2020). Ignorance of the context increases the likelihood of project management failures (Howsawi & Eager, 2014; Ika et al., 2012; Turner & Zolin, 2012).

The context comprises a multitude of factors including support by the political regime and local leadership. Context factors encompass enabling policy, culture, and economic aspects and the number of implementing agencies involved in the project (Ika et al., 2012). Project management bodies of knowledge and standards such as the Association for Project Management (APM) concur with this approach.

Research has produced knowledge on success criteria, measures of success, and key performance indicators, among others (Cooke-Davis, 2002; Belassi & Tukel, 1996; De Witt, 1988; Freeman & Beale, 1992; Müller & Turner, 2007; Kerzner, 2015; Pinto & Slevin, 1988). These models do not always differentiate between the project and project management. It is important to recognise the project as an output and project management as its process of delivery. These are distinct but related phenomena.

Project management must identify and define appropriate measures of performance. The selected measures must enable the collection of important information for decision-making (Kerzner, 2015). Articulation for the purpose of measurement is crucial to identify measures of performance as these measures are the basis for crafting relevant key performance indicators. Key performance indicators (KPI) are quantifiable factors used to monitor the progress (Kerzner, 2015); a measure of performance may employ more than one KPI.

Success criteria appraise whether the project has met its objectives (Kerzner, 2015). They extend beyond the iron triangle measures of time, cost, and scope. Some

frameworks do not differentiate amongst measures of performance, success criteria, and critical success factors. They use these related but distinct terms interchangeably. This confuses practitioners when applying them (see Table 2-3) (Baccarini, 1996; Belassi & Tukel, 1996; Crawford, 2000). Others contend that frameworks should differentiate between the project and its management (De Wit, 1988).

Meredith and Mantel (2003) and Slevin and Pinto (1986) cautioned against the widespread application of generic frameworks. They insisted that application must vary by project type and industry. Other bodies of knowledge concur with this approach (see Table 2-3). The application of these frameworks has not improved project management. Researchers acknowledge that success is a multidimensional construct and that ideal frameworks should contain holistic measures of performance that are customisable to specific projects.

Diez-Silva et al. (2013) revealed that many performance management approaches maintain the iron triangle measure. The iron triangle of time, cost, and scope is the predominant measure, regardless of project type. Diez-Silva et al. (2013) illustrated that most of the existing approaches focus on the production function of the project. They show that, since the 1960s, the emphasis on measures of performance has been on technical terms and reflected on whether the intended output complies with the predefined standards and whether the product worked or not (Diez-Silva et al., 2013).

Table 2-3: Approaches to measures of performance post-2001 research publications (Diez-Silva et al., 2013)

Sector or project type	Measures of performance	Author(s)
Construction	Cost, time, quality, schedule, specification, safety management, health, environment, customer satisfaction, communication, project team, continuous improvement, monitoring of standards, materials management, conflict, stakeholders, change management, training, resource efficiency and effectiveness.	Chan et al., 2002; Bryde, 2003; Cheung & Cheung, 2004; Ling, 2004; Sohail & Baldwin, 2004; Jha & Iyer, 2007; Cho & Hyun, 2009; Toor & Ogunlana, 2010; Mellado et al., 2020.
Research and Development	Cost, time, customer interaction, Profitability, communication, coordination.	Sánchez & Pérez, 2002.
Information Technology	Cost, time, scope, customer satisfaction.	Barclay & Osei-Bryson, 2010; Barclay, 2008.
Generic	Nine areas of PMBOK, staff, leadership, policy and strategy, partnerships and resources, project lifecycle management processes, indicators.	Bryde, 2003; Westerveld, 2003; Project Management Institute, 2004.

In the 1980s, the iron triangle measure was the holy grail of performance management (Khosvari & Afshari, 2011). Kenny (2003) suggested success appraisal at both the project and project management levels. The project level judges success by the effectiveness and efficiency. Effectiveness focuses on the value that the project added to the strategic goals of the organisation.

Efficiency measures the extent to which the project was delivered as per predefined criteria (Jugdev & Müller, 2005; Kenny, 2003). Project management concentrates on efficiency, i.e., the use of the resources for the right activities and efficiency optimises performance to meet outputs (Jugdev & Müller, 2005).

Table 2-3 demonstrated that the bodies of knowledge have expanded measures of performance. The authors acknowledge that efficiency and effectiveness cannot only be evaluated using the iron triangle measures of performance. This expansion aligns with the recommendation by Kerzner (2015) and others for additional measures. Mellado et al. (2020) contended that the measures of time, cost, and scope are inadequate. They provide neither metrics nor means to comprehensively evaluate performance in a way that predicts and facilitates success.

The additional measures are required to accommodate the multidimensional nature of success (see Table 2-3). They would enable assessment based on various elements, e.g., human resources concerned with team and individual growth and continuous learning. They would incorporate organisational growth, e.g., project management return on investment, client satisfaction, and stakeholder support (Freeman & Beale, 1992; Jugdev & Müller, 2005).

Some researchers highlight that using time and cost as measures of performance may be undesirable. Estimates at the start of project management craft these measures (Cicmil et al., 2009) but unfortunately, they tend to ignore the context of the project management. Some project management stakeholders accept them as absolute and any deviation from them denotes failure (Cicmil et al., 2009).

Cooke-Davies (2002, p. 189) stated that “it is people who deliver projects, not processes and systems”. This view supports the inclusion of human resources management as “an aspect in any measure of performance framework” (Cooke-Davies, 2002, p. 189). The KPIs for this measure include individual and team performance, development, and learning. The latter is essential for the continuous improvement of the project management practice (Freeman & Beale, 1992).

Prominent project management bodies of knowledge and standards concur that time, cost, and scope as measures remain significant measures. These measures are common across various frameworks (see Table 2-4) (Diez-Silva et al., 2013).

Table 2-4: Measures of performance advocated by the different project management standards and guidelines (adapted from Diez-Silva et al., 2013)

Standard	Measures of performance	Technique
PMI PMBOK	Time, cost and scope	KPIs; earned value management
PRINCE2	Time, cost, scope, risk, benefits	Earned value management
APM APMBOK	Comparison of actual performance versus plan	Earned value management
IPMA ICB	Objectives, contracts and plans	Earned value management
ISO 10006	Progress, contracts	
AGILE	Constraints (cost, schedule, scope), quality (intrinsic quality), and value (extrinsic quality)	Earned value management
Managing Successful Programmes (MSP)	Benefits, value, leadership and stakeholder engagement, quality, risks	

The review of the different project management bodies of knowledge and standards revealed stark differences in the additional measures of performance. These include benefits, value, and customer acceptance (see Table 2-4). However, there is a caution that adding more measures of performance may not be ideal nor necessary and may not enhance project management.

Some measures are project or sector-specific and cannot be generalised for all projects (Belassi & Tukel, 1996; Cooke-Davis, 2002; Müller & Turner, 2007; Pinto & Slevin, 1988). Wright (1997) suggested a reduction to two indicators to measure performance, namely time and budget. The time factor is crucial wherein the project must realise market opportunities and comply with legal deadlines (Dynamic Systems

Development Method, 2016). Mellado et al. (2020) underscored that focusing measures of performance on final outcomes might compromise decision-making. They suggested that the focus should rather be on the process of achieving the results.

2.5.1 Examples of frameworks on the measures of performance

The literature on measures of performance concurs that project management is multifaceted (Cicmil et al., 2009; Dao et al., 2018; Pinto & Slevin, 1988). Performance management frameworks must respond to the multifaceted nature and recognise the various interrelated activities executed simultaneously. Slevin and Pinto (1986), Shenhar et al. (2000), Centre for Business Practice (2005) and Shenhar and Dvir (2007) suggested that these frameworks need to consider a range of elements including efficiency, effectiveness, client acceptance, and team performance.

Efficiency addresses whether the project is executed and finalised according to the approved plan. It considers performance against the technical and financial specifications, i.e., delivery within cost and schedule. Effectiveness emphasises the optimal allocation and use of the resources.

Measures on commercial success aim at the project's commercial contribution to the organisation's results and added value. Examples include return on investment and economic value-added or sales growth (Centre for Business Practice, 2005). These measures may sometimes not be possible to assess immediately after delivery of the project. It may require a medium- to long-term impact assessment.

Measures of client acceptance and impact related to how the project has met the client's expectations and improved the client's business. There are proposals for a measure of team performance impact to reflect on the satisfaction of the team. It prioritises performance recognitions and rewards and skills development. One can argue that the team performance impact measure may be a key performance indicator of the human resource management category.

Some researchers propose a measure of preparing for the future. Its purpose is to assess the extent to which the project has created new skills and opportunities critical

for the current and future business objectives (Morris & Hough, 1987, as cited in Jugdev & Müller, 2005; Pinto & Slevin, 1988; Shenhar & Dvir, 2007).

The Transportation Research Board (2014) proposed a five dimensions model of project management (5DPM). It reviews performance based on five dimensions: cost, finance, schedule, technical, and context. The cost measure is concerned with "project estimates, uncertainty, contingencies, project-related costs, and project cost drivers and constraints" (Transportation Research Board, 2014:1).

The finance measure centres on how the project is financed. It acknowledges that the financing mechanism influences the pace of project implementation. The schedule measure applies to calendar-driven properties of the project. It prioritises compliance to the approved schedule and milestones and management of schedule risks and resources.

The technical measure is rooted in technical aspects such as design specifications and requirements, quality requirements, and scope. The context measure accentuates external factors that influence the project and project management (Transportation Research Board, 2014). Shenhar and Dvir (2007) provided a framework based on five dimensions to measure performance (see Table 2-5).

Table 2-5: Shenhar and Dvir's (2007) five dimensions model of project success

Dimension of project success	Measures
Efficiency	Meeting schedule, cost, yield, performance, functionality, and other predetermined aspects
Impact on the team (Human resources)	Team morale, satisfaction, growth, skill, retention, and no burnout
Impact on the customer	Meeting expectations and predefined requirements, specifications, satisfaction, loyalty, benefits to the customer, extent of use, brand name recognition
Business success	Sales, profits, market share, return on investment, cycle time, cash flow, service quality, regulatory approval, any other organisational measures
Preparation for the future	New market, new technology, new product line, new organisational capability, new core competency

The Shenhar and Dvir model expands beyond the measures of time, cost, and scope management. Despite being inadequate, the iron triangle measures remain relevant to assess project management performance (International Complex Project Management, 2011). The Shenhar and Dvir model adds the measures of customer expectations and team performance (see Table 2-5). Team satisfaction accommodates individual and group absorptive capacity and skills development. This model thus recognises the project management personnel as beneficiaries.

The benefits accrue at individual and group levels. They include the development of skills, new competencies, and organisational capabilities. This is ideal for continuous improvement and future business opportunities (Shenhar & Dvir, 2007). The Shenhar

and Dvir model is somewhat inward-looking. It excludes measures that recognise the influence and impact of the project context.

Koelmans (2004) added client satisfaction to the measures of time, cost, and scope (see Figure 2-9). It concedes that project management is a people-driven social process. It appreciates the contribution of the project management team and reflects on access and use of appropriate tools and techniques which are critical for optimal performance (Koelmans, 2004).

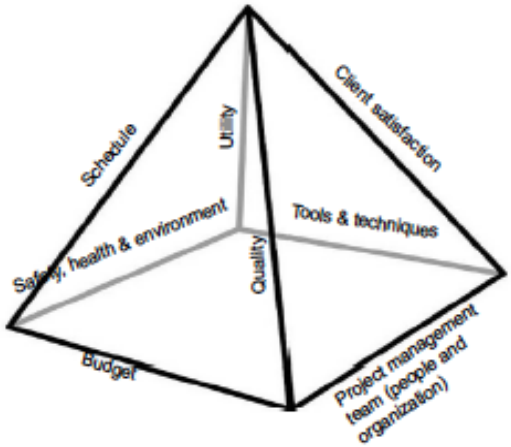


Figure 2-9: An adaptation of the four components model with consideration of impacts of the project (Koelmans, 2011)

The model reflects on the project's impact on health, safety, and the environment. Its uniqueness is in its attempt to reconcile enabling conditions for performance, rewards for the team and client satisfaction with the efficiency of resources (see Figure 2-9).

The consideration of the human resources aspect corresponds with Bryde (2005). Bryde (2005) challenged and deemed that, frameworks that ignore the contribution of the project management team and the context are incomplete. Khosvari and Afshari (2011) proposed a similar model (see Figure 2-9) that excludes the project management team component.

Atkinson (1999) introduced the Square Route model on success criteria. This model adds two measures to the iron triangle: information systems and benefits accrued. Information systems concentrate on information quality, reliability, validity, and

maintainability. The benefits measure reflects on improved efficiencies and effectiveness, increased profits, strategic goals, and organisational learning. The model also considers benefits to the stakeholder community. Satisfied users, good social and environmental impacts, and personal and professional learning express this measure (Atkinson, 1999).

The Square Route model addresses performance gaps based on the needs of the client and the project management team. It is adaptable as a measure of performance as it addresses aspects relevant to implementation. The benefits aspect is not applicable since the indicators provided apply beyond the lifecycle of the project (Atkinson, 1999).

The Centre for Business Practice (2005) evaluates project management performance and its value to the organisation. It uses measures to appraise the efficiency of the project management process and derives KPIs for each measure of performance. These measures include finance, cost, customer satisfaction, learning, and process. The process KPIs comprise schedule performance, process errors, and resource utilisation.

The significance of performance management proposes models that accommodate unique activities. Such activities only apply to certain stages of the project lifecycle (Howsawi & Eager, 2014; Mellado et al., 2020). These proposals suggest flexible and customisable approaches. The specification of measures by project lifecycle phase aligns with the approach that classifies projects by motive.

Many projects and project management performance frameworks are biased towards the project as an agency for production. For example, Kerzner (1998), Turner (1999), Wideman (2000) and the Project Management Institute (2004) defined the project as an agency for production. The definitions cover the deployment of resources to create unique goods or services and the production happens within a stipulated time frame and quality specifications.

Project management organises and manages the conversion of inputs to outputs (Kerzner, 2003). The focus on the production function of the project ensures that

project management is only concerned with resource utilisation efficiencies. This perspective restricts performance management to the iron triangle measures of time, cost, and scope.

2.6 Conclusion

Despite the absence of a universal or agreed definition of complexity of a project, there is consensus that it influences project management, e.g., project planning and control, selection of a suitable form of organisation, and selection of project management personnel, among others (San Cristóbal et al., 2018). The literature stresses the need for more knowledge to improve the management of complex projects as well as more measures to comprehensively assess performance.

The literature further attests to the existence of many models and tools to assess project management performance (International Centre for Complex Project Management, 2011; San Cristóbal, 2017; San Cristóbal et al., 2018; Vidal & Marle, 2008). Despite these models and tools, the management of complex projects is a persisting challenge which requires further research. The challenge may be greater in the management of complex innovation of inclusive development projects.

The management of innovation for inclusive development projects is assessed based on time, cost, and scope. Literature concedes on the inadequacy of using the iron triangle measures to assess performance. Based on the literature review, I focused my research on two aspects: (i) how complexity influences project management organisation, and (ii) proposing additional measures of performance to expand the iron triangle to assess the management of innovation for inclusive development projects.

The analysis of the literature review led me to approach this research by looking beyond the project as just a production function. My perspective of the project as a complex and adaptive temporary organisation acknowledges that it has been established to achieve a particular purpose. It is provided with resources that are converted to outputs in a particular context. The project is not immune to changes or flux in its context. My view recognises the interest of the stakeholders to ensure that the temporary organisation achieves its purpose.

I anticipated that the view of the project as a complex and adaptive temporary organisation was appropriate for this research. I intended to profile lived experiences of stakeholders as they position and structure themselves in the management of complex innovation for inclusive development projects. The experiences would provide insight into how complexity influences how stakeholders prioritise and measure performance.

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

Cicmil and Hodgson (2006) recommended that further research should transition from the familiar normative and prescriptive approaches to alternative theoretical propositions. These alternative theoretical lenses enrich the research, e.g., systems and the complexity theories provide constructive means to study the complexity of projects and management (Cicmil et al., 2009; Dao et al., 2016; De Rezende et al., 2018; International Complex Project Management, 2011). Hodgson and Cicmil (2008) further encouraged research to respond to the political, social, and ethical aspects of project management. They advocated for a responsive and context-aligned practice that extends beyond the conventional mechanistic and instrumentalist perspectives.

My research focused on the social nature of complex project management. It focused on the interactions and lived experiences of the stakeholders. It sought to give a voice to the stakeholders, including the beneficiaries of innovation for inclusive development projects. These beneficiaries are generally marginalised communities in innovation ecosystems. Their voice is associated with agency and power in the management of complex projects. My research addressed the following questions, posed in Chapter One:

1) How does complexity influence how stakeholders organise the management of complex innovation for inclusive development projects?

2) What are the additional measures to time, cost, and scope needed to assess the performance of the management of innovation for inclusive development projects?

3.2 Theoretical Framework

Eisenhart (1991, p. 205) articulated a theoretical framework as “a structure that guides research by relying on a formal theory, that is, the framework is constructed by using

an established, coherent explanation of certain phenomena and relationships". My research drew from the systems, complexity, and management theories.

The rationale for the use of the systems theory is its view of the project as a system comprised of interconnected and interdependent elements with various interfaces (Baccarini, 1996; International Complex Project Management, 2011; Transportation Research Board, 2014; Vidal & Marle, 2012). The complexity theory lens enables the appreciation of features of complexity which include considerable uncertainty, chaos, fluidity, and unpredictable dynamic interactions amongst various elements (San Cristóbal et al., 2018; Transportation Research Board, 2014). Management theory guides the management of projects. It provides principles to plan, lead, organise, and control organisations. These three theories enabled me to study project management, recognising a project as a complex and adaptive temporary organisation made up of various interrelated and interconnected interfaces, existing in a particular context and as part of a particular story.

3.3 Strategy Of Inquiry: Qualitative Research

Research is a systematic process to collect, organise, and translate data for different purposes. It arises from an unresolved problem, a question, or a hypothesis, which provides a provisional explanation on the issue of concern. Creswell (2009) distinguished three research strategies: quantitative, qualitative, or mixed. They guide data collection to develop theories on the issue of concern.

Creswell (2009) emphasised quantitative and qualitative strategies as being discrete. The difference between them lies in the fundamental philosophical assumptions of the researcher. The assumption influences the selection of research methods (Creswell, 2009).

Quantitative research is a systematic empirical investigation that collects and generates numerical data in the development of a theory. It departs from one or more hypotheses to investigate a causal relationship between variables. It is deductive and aligns with the positivist paradigm since it assumes one reality. It focuses on testing a

hypothesis to explain what, why, and where a phenomenon exists (Leedy & Ormrod, 2005).

Mixed methods research combines quantitative and qualitative strategies. Its core principle is that the combination enables a better process and response to the research questions. The combination thus supports a more comprehensive response to the research problem. This is beneficial compared to the individual application of either the qualitative or quantitative research strategies (Creswell, 2009).

The present research did not originate with a hypothesis nor an intention to test a causal relationship between complexity and project management. It was conceptualised and implemented to assess a causal relationship between the use of the iron triangle measures of time, cost, and scope and performance management efficiency. The nature of the research questions was meant to identify and include appropriate measures of performance that expand the iron triangle measures of time, cost, and scope into what I call a golden circle.

The research questions required that I engage different individuals and groups to explore and understand the perceptions and experiences attached to the management of complex projects. I expected this qualitative research strategy to expose the possible disharmony between complex project management theory and practice. The literature review revealed complex project management as an evolving field, dedicated to the development of knowledge to improve practice. This observation motivated the adoption of the qualitative research strategy as ideal for studying complex phenomena and human behaviours (Sutrisna, 2009).

Qualitative research is narrative based. It examines how people experience life, makes sense of their world, and construct meaning based on lived experiences (Yin, 2012). It enables participant description and understanding of a phenomenon (Leedy & Ormrod, 2005). It exposes what stakeholders consider and value when they organise for complex project management and subsequent performance evaluation.

Yin (2009) and Creswell (2009) emphasised that the researcher is a focal point in qualitative research facilitating a naturalistic approach to the world. The researcher

does not manipulate or control any variable in this setting. Qualitative research makes it possible to understand what happens, how it happens, and why it happens that way (Henning et al., 2004).

Based on existing literature and recommendations for further research, I acknowledge that this research might not generate a prescriptive theory. However, its value would be the generation of a practice-based albeit context-dependent theory, on how complexity influences organising complex project management. I also propose additional measures of performance ideals in expanding the iron triangle to a golden circle.

3.4 Research Design

A research design (see Figure 3-1), adapted from the approach of Saunders et al. (2019), was implemented as a roadmap or "blueprint" for this study. It gave direction in terms of what questions were studied and what and how data were collected, analysed, and interpreted (Saunders et al., 2019).

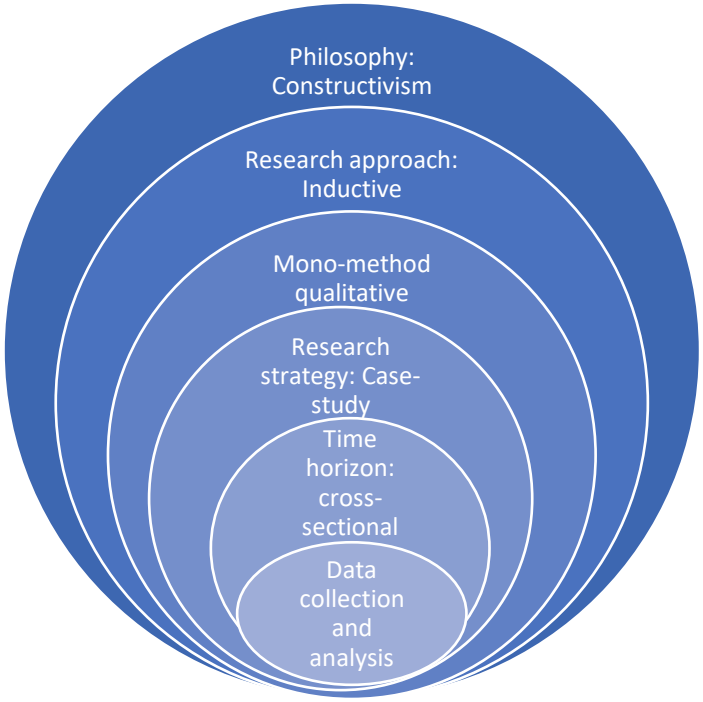


Figure 3-1: An overview of the research design as adapted from the research onion approach (Saunders et al., 2019)

My study responded to recommendations for further research on the intellectual gap and discrepancy between theory and practice (Cicmil et al., 2009; International Complex Project Management, 2011). It used three theoretical lenses: complexity, systems, and management. The use of these three theories offered more dimensions to study the issue of concern. A theoretically plural approach might enhance the existing theory. Theoretical pluralism was central to understanding how complexity influences project management and were valuable in suggesting more measures of performance to expand the iron triangle.

3.4.1 Research philosophy: Constructivism

In selecting research philosophy, I acknowledged the extensive research on public sector project management that assumes one objective reality of project management. It hinges the organisation of project management on conventional methods and assesses performance based on delivery within time, cost, and scope specifications (Shivambu & Thwala, 2019; Van der Waldt, 2007).

I concur with Bredillet (2010), International Complex Project Management (2012), Sage et al. (2014) and De Rezende et al. (2018) that project management research predicates from the positivist philosophy. The positivist paradigm positions itself as being value-free and not amenable to influence by the researcher, context, and the research process (Guba & Lincoln, 1994).

A clear research philosophy guides the pursuit of research. Research philosophy has three core elements: ontology, epistemology, and axiology. Ontology deals with the assumptions of how reality is perceived, i.e., the nature of knowledge. Epistemology pursues what knowledge is and how it is obtained and questions how we know what we know. It ponders on what acceptable knowledge is. Axiology investigates the role of values and ethics and their influence on the research process. It shapes the research questions, determines which data to collect and analyse and responds to the questions (Creswell, 2009). It guides the selection of methods used to conduct the research and the interpretation of findings (Saunders et al., 2019). I selected subjectivism as the ontology assumption. Subjectivism enabled me to draw from the different views of the interviewees and inductively construct meaning on the issue of

concern (Baxter & Jack, 2008; Creswell, 2009). It assisted me to delve deeper into the research questions and explore other possible realities.

I immersed myself in the research to understand the different experiences and realities of the interviewees. I did this to comprehend their intentions and actions in a meaningful way. I engaged interviewees at project sites and workspaces to understand their perspectives in natural settings and committed to observing social interactions and how they influenced the participation of the interviewees. I was involved while being mindful that my values could somehow influence the research.

I assert that, although the meanings constructed through this research were rooted in the five case studies, the knowledge produced is relevant. It may shed light on addressing the two research questions, which are ongoing concerns in the complex project management practice. Subjectivism positioned me as a co-creator with the research interviewees in the social construction of reality, implying the intersubjective construction of reality (Saunders et al., 2019).

I accept that complex project management is a social process. It is subject to the perceptions, lived experiences, and expectations of the stakeholders. I chose constructivism as the epistemology for this research (see Figure 3-1) which is essentially a subjectivist perspective that acknowledges that theories emerge from the researcher's interaction with research subjects (Saunders et al., 2019).

Constructivism epistemology recognises different types of knowledge. This flexibility accommodates a variety of knowledge, e.g., textual, and shared stories of the interviewees to address the research questions. I selected constructivism since it recognises the diversity in culture, circumstances, time, and spatial location of the research subjects. These differences facilitate different social realities. I envisaged this to be of benefit when co-creating knowledge in response to the research questions. I perceived that its rejection of one objective reality would benefit this research and uncover how the interviewees practically consider complexity when they organise and evaluate performance. In so doing, I would be able to understand the type and sources of knowledge used to manage these projects. This aspect was critical for understanding the disharmony between theory and practice.

The philosophical assumptions identified in this research were deemed central to the research process. Leedy and Ormrod (2005) stated that an assumption is that which is accepted as real without which undertaking the research is irrelevant. Based on the philosophical assumptions, my expectations also stemmed from the following:

- The increase in project complexity and how it influences the organisation of project management require deeper understanding and are issues of concern for both researchers and practitioners globally. The influence of complexity on the organisation of complex project management may be due to multifaceted underlying factors.

- Project management stakeholders attach meanings and have valuable experience that shapes how they approach and participate in management.

- The interviewees of this research would be able to share their current practices on how they respond to complexity in the management of complex projects. Such practices would incorporate their approach to measures of performance.

- The expansion of measures of performance from the iron triangle measure of time, cost, and scope is an issue of concern in complex project management.

- The interviewees would participate truthfully and freely as I committed to protecting their anonymity and confidentiality.

3.4.2 Inductive approach

The research was structured to collect data to explore the research questions, develop an understanding, and build a theory based on the analysis of the data and as such, was deemed as inductive (Saunders et al., 2019). Theory development can either be deductive, abductive, or inductive. I rejected deductive reasoning since it tests and confirms existing theories and assesses causality amongst variables (Saunders et al., 2019). My research did not test the existing theory. It sought the meaning and interpretation of the issue of concern from various perspectives.

In deductive reasoning, a hypothesis is developed from an existing theory and then tested during the research process (Creswell, 2009; Saunders et al., 2007). The

deductive approach is appropriate for quantitative data and like the inductive approach it follows a structured and well-planned process based on scientific principles. The structured process in deductive research assumes that the researcher is independent and objectively executes the research, i.e., impartial (Guba & Lincoln, 1994; Saunders et al., 2007). According to Saunders et al. (2019), the deductive approach is generally underpinned by the positivist research philosophy.

This research was designed based on an inductive approach to theory development. I opted for this approach since it would allow me to observe and collect data on a phenomenon to generate theory (Saunders et al., 2019). The inductive approach also enables a bottom-up approach to the development of theory, and it supports knowledge generation not limited by what is already known (Gioia et al., 2012). Furthermore, this approach did not impose existing theoretical constructs on the research participants, which might have constrained their input and participation.

The inductive approach enables the collection of data from various sources to gather the views and perceptions of the interviewees. This was critical for the research to construct a practice-based albeit context-dependent theory. The inductive approach recognises people as knowledgeable agents who create their organisational realities and as such, construct meaning and sense-making in their contexts (Gioia et al., 2012). Its nature enables the researcher to not impose existing theoretical constructs, particularly those that may limit the participation of the interviewees of the research.

I expected that the interviewees would provide insight into what aspects or features of complexity are considered when organising for complex project management and evaluation. The value of the inductive approach is its ability to give voice to the research interviewees in the emerging theory (Creswell, 2009). I anticipated that the views and meanings of the interviewees might uncover previously undocumented concepts and stories as opposed to affirming or validating existing theory (Gioia et al., 2012). The inductive approach enabled me to generate a theory that might contribute to addressing the intellectual gap and discrepancy that exists between theory and practice. This would in turn advance the narrative.

3.4.3 Research strategy: Case study

The literature review highlighted the interchangeable use of a research strategy, research, or research method (Kotzé, 2007; Lee & Saunders, 2019). Despite this interchangeable use, in line with Saunders et al. (2019), I opted for the term 'research strategy'. Qualitative research employs various strategies, which include phenomenology, ethnography, grounded theory, and case studies (Yin, 2009). I considered that my qualitative research drew from the constructivism philosophy when selecting the research strategy.

Research strategies differ in how data are collected and analysed. Each has its strengths and limitations. Three considerations guide the selection of a research strategy, as shown in Table 3-1. It must consider the nature and type of research questions. It must reflect on the degree of manipulation that the researcher has over the issue of concern and it must be clear on the extent of interest and focus on current or historical events (see Table 3-1) (Creswell, 2013; Kotzé, 2007; Yin, 2009).

Based on the answers to these three questions, the researcher may select either an experiment, surveys, archival analyses, histories, or case studies (see Table 3-1). Yin (2009) stated that it is possible for the case study and the historical methods to overlap. The key differentiation is the degree of control over the issue of concern. Based on the responses to the three questions (see Table 3-1) and the questions that I intended to address, I selected the case study as an appropriate method of enquiry.

I was drawn to the case study's flexible and iterative nature which enables the collection of data from a variety of sources (Creswell, 2009; Yin, 2009). The case study research strategy accommodates both numeric and non-numeric data such as text, audio, and visual (Kotzé, 2007). This method enables close engagement between the researcher and the interviewees without compromising or limiting their participation and input. By being engaged in the research process, the researcher becomes involved and is not only a mere observer (Baxter & Jack, 2008; Creswell, 2009). During this study, my story interacted with the participants' stories.

Table 3-1: Guiding questions for the selection of a research method of enquiry (Yin, 2009)

Method of enquiry	Form of research question?	Need for control for behavioural events?	Focus on current event?
Experiment	How? Why?	Yes	Yes
Case study	How? Why?	No	Yes
Survey	Who? What? Where? How many? How much?	No	Yes
Archival analysis	Who? What? Where? How many? How much?	No	Yes/No
History	How? Why?	No	No

Yin (2009:18) defined a case study as an “empirical enquiry that investigates a contemporary phenomenon in-depth and within its real-life context, especially when the boundaries between phenomenon and context are not evident”. The case study method concedes to the influence of the context on the issue of concern. Thus, its design considers the context, without requiring control of the behaviours (see Table 3-1).

Baxter and Jack (2008) and Yin (2009) affirmed that one of the benefits of the case study is its ability to facilitate the development of context-based theory. The context-specific nature may limit the extent to which the results are generalisable. The results may be transferable to other complex project management initiatives. The transferability of the results secures the contribution of this research to expanding the

relevant theoretical propositions on the management of complex innovation for inclusive development projects. It may provide knowledge that is adaptable for the management of other public sector complex projects.

In choosing the case study, I acknowledged that it has inherent limitations, e.g., its susceptibility to influence from my values and bias (Yin, 2009). Flyvbjerg (2006) argued that there are various misunderstandings of the case study research strategy that relate to its reliability, validity, and contribution to the development of theory. These misunderstandings include:

- General, theoretical, and context-independent knowledge is of higher value and more valid than context-dependent and practical knowledge generated through case studies.
- There are limits to which the findings of an individual case study may be generalisable, implying that the case may not make a substantive contribution to scientific development.
- The use of a case study is limited to the development of a hypothesis.
- A case study is prone to manipulation to confirm biases and preconceived beliefs (Flyvbjerg, 2006).

Research has not reduced failures of complex project management (Cicmil et al., 2009; De Rezende et al., 2018; International Complex Project Management, 2011). Some researchers argue that this is due to results that are not generalisable as they are context dependent. Others contend that the uniqueness of sectors and their project classification systems limit the extent to which results are generalisable or transferable.

There are proposals for the classification of complex projects by sector, e.g., construction, research, and development. Others advocate for project motive to be the basis of the differentiation. The rationale may be a necessity (e.g., community development), opportunity (market access), prestige, and research (De Wit, 1988; Diez-Silva et al., 2013).

Despite these misgivings, I argue that context-dependent knowledge is relevant and compelling to expanding theory. I concur with Flyvbjerg (2006), that the intense understanding generated from concrete case studies is crucial for human learning and building bodies of knowledge. The benefit of the case study is that it enables the researcher to study a phenomenon in its natural setting providing access to a wealth of information and the construction of a more nuanced view of reality.

The knowledge that is not generalisable is still critical in any field of study. Flyvbjerg (2006) emphasised that generalisation cannot be the sole method to authenticate scientific inquiry. A strategic selection of cases that provides the largest volume of information on an issue of concern can enhance the generalisability (Flyvbjerg, 2006).

3.4.4 Descriptors of the research

Typical of this research is that it is descriptive and exploratory, and it aimed to extract meanings from interviewees on organising and performance evaluation of complex project management. It was expected that, through lived experiences, the research would not be limited by what was already known and documented.

This approach aligns with Gioia et al. (2012, p. 16) who stated that “advances in knowledge that are too strongly rooted in what we already know delimit what we can know”. It also concurs with existing literature on how a complex project is perceived and its influence on how organisations organise for the project management process (Dao et al., 2016; International Centre for Complex Project Management, 2011; San Cristóbal, 2017; San Cristóbal et al., 2018). By implicit meanings being made visible through actions and perceptions, it is argued that they may be attributes of a complex project.

According to Saunders et al. (2007) and Kotzé (2007), the purpose of descriptive research is to portray an accurate profile of a situation as it exists and to enable the description of the nature and types of relationships between concepts (Saunders et al., 2007). The descriptive aspect of this research arose from its stated intention. There was no manipulation of the research or any of its components. The views of all interviewees on the management of complex projects were critical in holistically describing the issue of concern (Page & Meyer, 2000).

The goal of this research directed the exploratory descriptor. This aspect of the research drew practice-based (despite being context-limited) considerations from the interviewees. In line with Page and Meyer (2000), I anticipated that the exploratory information would reveal patterns or themes important towards expanding existing frameworks on the measures of performance for managing such projects.

The research aligns with the principle of qualitative research being exploration rather than verification (Kotzé, 2007). Based on the collected data, I interpreted my findings and the meanings that the interviewees and relevant secondary data projected on the issue of concern. The exploratory information was useful to the research approach in identifying ways and means to improve it.

3.4.5 Assessing the quality of the research design

Yin (2009) gave prominence to employing criteria that assist the researcher in judging the quality of the research design and provided a selection of established logical tests (see Table 3-2). The existing criteria to test the research design included credibility, confirmability, trustworthiness, and data dependability (Yin, 2009).

This research was empirical in nature, and as such, I considered the range of the criteria shown in Table 3-2. I deliberated on requirements to assess and select which test was appropriate for each case study. According to Eriksson and Kovalainen (2008) and Yin (2009), construct validity can be enhanced through three tactics, namely the use of multiple sources of evidence, establishing a chain of evidence as well as the review of the research report by key interviewees.

Table 3-2: Four tests used in judging the quality of a research design (Yin, 2009)

Tests	Case study tactic	Phase of research
Construct validity	• use multiple sources of evidence	• data collection
	• establish chain of evidence	• data collection
	• key interviewees review the report	• composition
Internal validity	• pattern matching	• data analysis
	• explanation building	• data analysis
External validity	• use theory in single case study	• research design
Reliability	• use case study protocol	• data collection
	• develop case study database	• data collection

The use of multiple sources of evidence was critical during the data collection stage and enabled convergent lines of inquiry. Yin (2009) stated that internal validity is applied in experimental and quasi-experimental research as it focuses on pattern matching and explanation building to establish causal relationships between events (see Table 3-2).

Since this research was not experimental but mainly exploratory and descriptive, I disregarded this test. This decision aligns with Yin's stance that the logic of internal validity is inappropriate and may not apply in descriptive and exploratory studies (Yin,2009). I selected the construct validity test (see Table 3-2) in judging the research design.

3.4.6 Data sampling

To address the two research questions, I selected, as case studies, five innovations for inclusive development complex projects in the public sector, i.e., a multiple-case studies approach. This portfolio included programmes and projects intended to harness science and technology to catalyse or advance local economic development. The projects varied in size, plurality, and diversity of stakeholders, number of project interrelated elements, and the context of implementation. These differences were identified as features of complexity (Dao et al., 2016; Vidal & Marle, 2008; International Centre for Complex Project Management, 2011; San Cristóbal, 2017; San Cristóbal et al., 2018; Vidal & Marle, 2008).

Saunders et al. (2019) indicated that small sample sizes are typical for the inductive approach, which also enables the collection of data from multiple sources. Although it may be argued that the sample size appeared small, this sample of five cases was purposefully selected to achieve relative homogeneity (see Table 3-3). The total funding allocated to each project exceeded R5 million.

Each selected project represented a unique attempt to democratise science, technology, and innovation. These projects demonstrated tangible collaboration, the action of policy, research, business, and community development stakeholders. The successful delivery of these projects was a common priority for all concerned. I believed that this research would provide answers to improve the delivery of these complex projects.

Table 3-3: An overview of the five complex projects that constituted the units of analysis of the research

Case	Sector	Location	Project management approach	Project initiator
Project 1	Agro-processing	Eastern Cape	Decentralised and shared	Technology developer
Project 2	Agro-processing	Limpopo	Decentralised and shared	Community and technology developer Researchers
Project 3	Agro-processing	North-West	Centralised	
Project 4	Agro-processing – indigenous knowledge innovations	Gauteng	Centralised	Indigenous knowledge holders and scientists
Project 5	Built environment	Eastern Cape, Limpopo	Centralised with local coordinators (representatives)	Technology developers

I chose interviewees based on their experience, which I felt would enable them to provide considerable and rich information to address the two research questions. According to Bickman (2008), a purposefully selected sample provides more confidence in data interpretation compared to a larger randomly selected sample. The advantages of purposeful sampling include its appropriateness for small sample sizes. It supports the focus on specific features of the population concerning the issue of

concern. I anticipated that the diversity across the sample would present various perspectives.

To reduce the risk of bias, the following criteria were used for the selection of the five projects:

- Diffusion or transfer of innovative technologies to support local economic development and service delivery. These innovative technologies were new to the location and contexts of the projects.
- Those that displayed features of complexity. These features included diverse stakeholders, distinct but interdependent and interrelated elements, and ambiguity in project management methods (Bakshi et al., 2016; Gupta et al., 2015; Ika et al., 2020).
- Those implemented in marginalised rural settings, with limited or no science, technology, and innovation infrastructure.
- Those that promoted sustainable use of natural resources, e.g., indigenous plants in local economic development.
- The ones that aligned with provincial and national economic sectoral growth strategies such as the Industrial Policy Action Plan (IPAP).

The criteria excluded pure research projects and those implemented in urban and peri-urban settings. Each of these projects created jobs that provided training and development priorities in their localities.

I considered who were the ideal interviewees to respond to the research questions. I resolved that the interviewees needed requisite experience and expertise. I applied three conditions when selecting interviewees:

- involvement in innovation for inclusive development complex projects for at least two years;

- execution of project management responsibilities, as project leader, manager, or team member, for a minimum period of at least two years; and
- currently involved in innovation for an inclusive development project, including those not funded by the DSI.

Based on Yin (2009), my selection considered the likelihood (i) for each case to predict similar results, and (ii) to predict contrary results with compelling reasons (Yin, 2009). To test tolerance for results contrary to assumptions, I presented the preliminary findings to two critical colleagues. One of them raised a concern about the risk of fair and open participation in focus group discussions. He suggested that I omit this method from data collection. I considered his suggestion and decided to proceed with the focus group discussions. I was open to including them based on the experience of their usefulness.

Yin (2009) expounded that multiple-case studies are considered more credible compared to single cases, but unfortunately, demand more time and resources. I provide more details of each case below. The implementation phases of these projects ranged from 2010 to 2018. I selected a time frame to be specific and to clarify the scope boundary. I bound the research by time and activity, as per the approach by Stake (1995).

The DSI sponsored the technology demonstration or transfer projects sampled in this research. The standard outputs in all projects in the research sample included (i) job creation and training for the local communities, (ii) delivery of technology infrastructure to support innovation-based local economic development, and (iii) production of knowledge products.

The knowledge products included policy and technical briefs, which highlighted policy and practice implications. They document lessons learnt and contribute towards improving evidence-based decision-making. The decisions included enabling factors for innovation-led local economic development and propagation protocols. They provided evidence for harnessing indigenous knowledge for viable and sustainable enterprises.

The recognition and support of indigenous knowledge are fundamental to realising an inclusive and responsive national system of innovation. It affirms that indigenous knowledge holders have a significant contribution to growth and development. They are supported by existing ecosystems or value chains that are alternatives to what is conventionally accepted.

The national system of innovation must be responsive and collaborate with indigenous knowledge holders for commercial gain. This includes techniques to enhance sustainable propagation and processing and commercialisation techniques. Indigenous knowledge holders shared information on the benefits of certain plants and entrepreneurs created commercially viable products using this information. The examples include *Hoodia gordonii* or hoodia and *Sceletium tortuosum* or Kanna, used for health and wellness benefits.

3.4.6.1 Case 1: Agro-processing project, Eastern Cape (Project 1)

Project 1, an agricultural and agro-processing project located at the Nciba Circuit within the Intsika Yethu Local Municipality. The municipality is one of the distressed rural municipalities of the Eastern Cape province. The area had previously received substantial investments in agricultural infrastructure, but the infrastructure has not been maintained and thus, has not optimally contributed to local economic development.

The DSI sponsored this project as a technology-intensive, holistic, and multi-layered intervention. It tested and piloted several technologies in distressed rural educational spaces (DSI, 2011). I selected it based on its plurality and diversity of stakeholders, connectedness, and interfaces with its context. The project was an important milestone to revitalise agriculture in the Nciba Circuit.

It employed a unique implementation approach entrenching the school as a catalyst for innovation-driven local economic development. It was in an area where, before its introduction, access to technology and innovation support platforms at schools were non-existent. The number of primary participants exceeded 60 (learners, teachers, and community members), with an intended benefit for a community of more than 300

households. The goals of Project 1 included the development of a primary agricultural and agro-processing facility. The facility was established on the school farm and was fitted with appropriate technologies.

Project 1 sought to encourage and support rural innovation and serve as a small business incubator. The incubator provided agricultural and agro-processing training to Grade 11 and 12 learners, which included experimenting with innovative agro-processing techniques. The incubator was contingent on a collaboration model between the school, community leaders with the requisite expertise, and the technology developer.

The primary stakeholders comprised the school governing body (educators, parents, and learners), technology developer (incidentally the project management service provider) and the sponsor. The secondary stakeholders included representatives of governing bodies of neighbouring feeder schools, the local political leadership, local business owners, science councils, institutions of higher learning, and the local municipality.

3.4.6.2 Case 2: Agro-processing project, Limpopo (Project 2)

Project 2 is an agro-processing project based within the Greater Giyani Local Municipality, Limpopo province. Plants with healing properties inspired this project. Traditional leaders use *Lippia javanica* to cure malaria. The Council for Scientific and Industrial Research identified the potential of essential oils from *Lippia javanica.*

At that point, essential oils were one of the sectors to drive growth in the national IPAP. The DSI funded a *Lippia javanica* project initially to manufacture *Lippia javanica* candles as mosquito repellents. The project has experienced several iterations and its focus has been more on operationalising it as a viable community-owned enterprise.

The users established a community trust which was part of the project steering committee. The users provided labour for the project and a selected number had project management responsibilities. The trust deployed a trustee as the project

manager. The project employed 27 staff, in line with demographic targeting of women, youth, and people with disabilities and recruited seasonal workers when required.

The project harnessed the agency of the users to take part in innovation activities to support their development. It established a commercial-scale facility to participate in national and global value chains. The Council for Scientific and Industrial Research partnered with the project to provide cultivation and distillation technologies to produce oils. The quality of the oils had to comply with relevant national and international sector standards.

The South African Essential Oils Business Incubator was introduced at a later stage to strengthen the capacity of the entrepreneurs and realise the commercialisation potential. The project was premised on a collaboration model that included the DSI (sponsor), the community and indigenous knowledge providers (users), the initial technology providers, and eventually the business incubator.

3.4.6.3 Case 3: Agro-processing project, North-West (Project 3)

Project 3 was based in Brits, North-West province. It focused on supporting the conservation of wild ginger, a plant used for various medicinal purposes in African traditional healing practices. The plant is sold at local markets. Over-harvesting and exploitation for commercial purposes threaten its existence.

The threat urged conservation of the plant, whose use contributes to the recognition and preservation of African traditional medicines. The plant is used in the agro-processing sector and has demonstrated the potential to contribute to inclusive development. The project intended to establish a commercial-scale nursery to produce wild ginger.

A government-funded experimental farm was the implementation site of the project. Two research councils partnered on technology transfer and the DSI collaborated as a sponsor. The local communities provided labour for this project. I did not confirm whether indigenous cultivation and processing methods were incorporated into this project. The project provided lessons on technology procurement and deployment for community-based projects.

3.4.6.4 Case 4: Agro-processing project, Gauteng (Project 4)

Project 4 is an agro-processing project located in the city of Tshwane. The DSI advocates for the recognition of indigenous knowledge-based innovative solutions. It sponsors and collaborates with other indigenous knowledge holders and researchers in this project. The researchers are part of a science council and a university.

The project is in a former dumping site linked to various atrocities of the pre-1994 apartheid era. The users recounted robberies, murders, and disappearances at this site. A traditional healer realised its healing potential, transforming it from a crime spot to a community facility. The project encourages sustainable use of natural resources, which aligns with national conservation legislation. It creates a safe park with indigenous plants for the community.

A traditional healer originated this project. The department and the researchers collaborated to commercialise indigenous knowledge products. Its secondary stakeholders include other government departments and the local municipality. The latter availed land for the project.

3.4.6.5 Case 5: Built environment project, Eastern Cape (Project 5)

Section 2 of the constitution states that everyone has a right to access basic services in a dignified manner. The constitution commits the state to take reasonable measures and meet basic rights. More people have gained access to basic services since 1994. Despite this progress, service delivery challenges persist and not everyone has access to decent housing, water, sanitation, among others.

The department collaborates with researchers to demonstrate off-grid service delivery solutions. Project 5 is an off-grid sanitation technology demonstration project. It piloted off-grid sanitation services in 200 households in a rural village, Eastern Cape. The off-grid solution has enabled access amidst challenges with bulk infrastructure as well as the commitment to enhance sustainable use and management of water.

A national research agency was appointed to manage this project. It collaborated with the local municipality and community leadership. The demonstration optimised the use

of local materials and attempted to empower local enterprises. It sought linkages with local value chains, which were critical for maintenance and infrastructure sustainability.

3.4.6.6 Selection of interviewees

I limited interviewees to innovation for inclusive development projects that fell within the local economic development and service delivery portfolios. I selected 35 interviewees comprising project managers, the sponsor, and the project users. The latter is generally referred to as beneficiaries of the sampled projects. I contacted and explained the aim of the research and requested their participation, stressing that it was valuable. No one rejected the invitation to participate; however, I struggled in some instances with the availability of the interviewees.

The sample size of 35 may seem small. Saunders et al. (2019) affirmed that, despite the size, qualitative research samples can produce data of considerable depth and detail about the issue of concern. I contemplated whether a bigger sample size would provide unique and valuable information. Dubois and Gadde (2014) reassured me that gathering copious amounts of data and increasing the number of observations would not necessarily surface new features of a problem. Saunders et al. (2019) bolstered my confidence in the chosen sample size. As mentioned earlier, they affirmed that small sample sizes are typical of the inductive approach, which this research followed.

The interviewees were:

- Nine DSI senior and middle managers responsible for the innovation of inclusive development projects. They had immense experience and expertise, with one holding professional project management certification. Not all of them had professional project management training. They were diverse in academic qualifications, ranging from natural sciences, humanities, and commerce. Some of them had prior leadership and support roles in complex projects of national importance. These projects were in economic development and service delivery.

- One DSI Chief Risk Officer responsible for risk management in the DSI. He held vast experience in risk management and had given precedence to the project management practice in the department. He consistently highlighted risks associated with failures and stressed the urgency to find appropriate alternative models.

- Ten practitioners from various agencies contracted by the DSI to provide project management services. They were diverse project managers with technical expertise in their fields. Like the DSI sample, not all of them had professional certifications or training in project management.

- Fifteen users of the DST complex projects. The level of education varied across the sample. Project management training was received while in service. They had different ways of organising aligned with the contexts. The sample comprised people with different leadership roles in their communities. The communities differed in size, culture, and customs. Their inclusion was critical as it gave them a voice and agency towards improving complex project management.

The 35 participants were purposefully sampled to represent the DSI and practitioners from agencies contracted by the DSI for complex project management and the project users. The interviewees were diverse, with distinct roles and identities in complex project management. The DSI sample included a member of the executive management, who was the project sponsor for four of the five sampled projects. The users represented a group of individuals who were generally recognised as beneficiaries of innovation for inclusive development. It was not usual for them to perform project management duties and in many instances, they provided the labour of the projects.

3.4.7 Unit of analysis

The use of the case study as a research strategy requires the appropriate identification of a unit of analysis. According to Yin (2009), this unit in a case study is the focus of the enquiry. The research questions inform the identification of the unit. It enables the collection of data to address the research questions. The unit of analysis in this

research was project management, specifically its organisation in response to the complexity and performance management, thereof.

This case study focused on organisational processes as they pertained to the management of complex innovation for inclusive development projects. It explored and described forms of project organisation and the measures of performance used to manage these projects. The consideration of the performance management aspect focused on identifying practice-based measures of performance expedient to expanding the iron triangle measures of time, cost, and scope. The unit of analysis as an organisation conformed with the project as a complex and adaptive temporary organisation.

I acknowledge that the size character of the case study research, based on an in-depth inquiry on the issue of concern, might have limited the extent to which the findings could be generalisable. I argue that, despite the challenges of generalisability, the results of the research might be transferable. They might provide valuable lessons for the management of innovation for inclusive development projects and contribute to the evolving and growing body of knowledge on complex project management.

3.5 Data Collection

I collected data from both primary (interviewees) and secondary sources (documents) over eight months between October 2017 and June 2018. I provide more information on data collection below (see 3.5.1 and 3.5.2). I developed a case study database to organise the collected data. The advantages of establishing a case study database include enabling tracking and organising of data, and the coding of data for ease of analysis (Baxter & Jack, 2008).

The collection of primary and secondary data was done to ensure that there was no confusion between units of data collection and units of analysis. Interviewees provided data as individuals involved in the organisational project management activities. Secondary data were collected to gather insight relevant to the two research questions.

3.5.1 Primary data collection

According to O'Leary (2014), primary data are created through the research process. It is new and would not necessarily exist without the research. It is authoritative as first-hand sources provide its reason for being. These sources have direct knowledge of the issue of concern (Creswell, 2009; Yin 2009). It was crucial to ascertain whether complexity was recognised, and how the stakeholders prioritised and factored it into complex project management. Primary data collected through this research suggested additional measures of performance to expand the iron triangle.

I collected primary data from 37 interviewees, as opposed to the initially planned 35. The two additional interviewees were users in Project 2. They requested permission to participate in the research. They met the criteria I had set for the selection and participation of interviewees and formed part of the focus group discussions.

I intended to employ individual and focus group interviews to collect primary data from the interviewees. I opted for interviews as they are widely deemed appropriate as a data collection tool. They were ideal for this inductive case study research due to their potential to provide relevant data. Such data were critical for me to construct possible meanings around the issue of concern, which is why one of the requirements was experience in complex projects and management for at least two years.

I envisaged that the data that I had collected were instrumental in identifying critical issues and trends. I anticipated that, despite the limitations being context-based, the data would offer many insights. It could lead to recommendations for remedial actions to improve the management of innovation for inclusive development projects. I concurred with Page and Meyer (2000) who proclaimed that interviews are appropriate for descriptive and explorative research studies.

I opted for interviews rather than structured questionnaires due to their flexibility. They enabled and offered more in-depth data collection. I anticipated that my direct engagement with the interviewees during an interview would enrich the discussion. It would enable probing and facilitate immediate and direct clarity on responses (Page & Meyer, 2000). I researched an evolving social context that provided insight into the social process of managing innovation for inclusive development projects.

Interviews remain the preferred option despite being open to challenges through response biases and potential reflexivity. These two challenges concern the interviewee's input which may be amenable to influence through social interactions with the researcher. The interviewees may participate according to their assumptions of what the interviewer wants to hear. However, the advantages and potential gains of interviews outweigh these challenges (Creswell, 2009).

I used semi-structured interviews to avoid limiting data collected based on my biases and to guide the data collection process. I situated them on complex project management and assessed their performance. There was no standard set of questions for the interviews. I sought alignment with Mason (2002) who identified four features of semi-structured interviews:

- an interactional exchange of dialogue;
- a relatively informal interview style;
- a thematic, topic-centred narrative or biographical approach; and
- a knowledge-situated and contextual element.

I held face-to-face individual and focus groups interviews, administered according to the case study protocol of Yin (2009). Before the administration of the interviews, I requested consent from the interviewees and approval was formalised through signed forms (see Appendix I). As much as possible, the interviews were held at the interviewees' place of work.

In each individual or focus group discussion, I expressed gratitude for the interviewees' participation. I reminded them that they were free to stop the interviews should they feel the need to do so. In both discussions, I explained that the study was intended to improve the management of complex projects.

I emphasised that the data collected in this study would be used in addressing the two research questions; therefore, the interviewees were contributing to the creation of a practice-based theory. I requested the interviewees' permission to record the

interviews, which was granted. The permission was given based on an understanding that it was to ensure that I recorded correctly and did not miss out on inputs. I assured them that I would safeguard the recordings and that the report would respect the anonymity of inputs.

I asked basic questions to initiate the interviews, namely:

- What is your understanding of project management?
- What is your understanding of the complexity of a project?
- How does complexity influence project management?
- Is there anything you would do differently to manage the project?
- What measures do you use to assess performance?

The interviews did not follow a rigid approach as I allowed the conversations to flow within the context of two research questions. I recorded the data collected through the interviews in two ways: text (notes) and audio. I saved the notes electronically by date and project name. As much as possible, I confirmed whether the interviewees' inputs were documented correctly.

The semi-structured interviews were expected to facilitate an inductive probing of the data collected, which addressed the two research questions (Creswell, 2009). To allow openness in data collection, I initially held separate focus group discussions for the sponsor, the project managers, and the users.

I intended to have a combined group session during which the sponsor, project management personnel, and users would jointly participate. Based on the challenges experienced with three focus group discussions, I opted not to proceed. The biggest challenge, voiced by two interviewees in separate instances, concerned collective participation with their supervisors. They advised that the presence of their supervisors might limit their participation.

All interviews, except for two focus group discussions with the users, were mainly in English. The two focus group discussions were in indigenous languages. This was a challenge for me as one of the technicians had to occasionally translate. I gave due consideration to the cultural contexts when engaging with the interviewees.

I encountered fascinating individuals amongst the interviewees. The most interesting were those who had been part of projects that had undergone several iterations of project deliverables. One of them was a project manager whose passion for innovation of inclusive development led him to draw from design and social and behavioural sciences to manage his projects. Another interviewee, a user, shared how leadership and competing agendas delayed these projects. It was interesting to note during focus group discussions the impatience of younger users, over senior project management personnel, who called for innovation in the management of these projects.

3.5.2 Secondary data collection

Secondary data were collected from five complex projects, according to the documentation listed below:

- approved contracts incorporating project proposals;
- approved project management plans;
- progress reports to assess how project management was assessed and monitored;
- project site visit reports as part of the project management oversight;
- minutes of project meetings to unpack project management monitoring and as much as possible, project management discourse;
- project governance mechanisms and other relevant physical artefacts; and
- project reviews and where applicable, audit reports.

The documentation I reviewed straddled different phases of project management, e.g., project proposals that would have indicated feasibility; site visit reports and minutes of

project steering committee meetings that were at the implementation phase. I perceived that archival data would be valuable to respond to the research questions. I anticipated that it would provide me with the language, perceptions, and positions of the project management stakeholders (Creswell, 2009).

3.6 Data Analysis

This study collected primary and secondary data from a variety of sources. The use of multiple sources of evidence was key to triangulating the data and strengthening the case study's findings.

The data were integrated to enhance a complete and systemic understanding of the case in its entirety (Baxter & Jack, 2008). To address the second question on additional measures of performance to expand the iron triangle, I combined the primary data subjected to the Gioia analysis with secondary data collected from project management documents. The data collected were subjected to the following analysis:

- Patterns or theme analysis: The pattern or theme analysis is an integral aspect of the Gioia methodology. According to Creswell (2009), thematic analysis enables identifying unspoken (implicit) and unambiguous (explicit) issues within the data. The content and pattern analysis borrows from the coding technique of the grounded theory research method.

I executed these processes simultaneously to fast-track analysis and data collection (Dubois & Gadde, 2002). Case study research is not linear nor based on a sequential and phased process. I also expected that overlapping data collection and analysis would allow me to note and take advantage of emerging themes and features that might be unique to the case study. I anticipated it might allow me to adjust methodology if required (Dubois & Gadde, 2002; Eisenhardt, 1989).

The perspective I adopted was of a project as a temporary organisation. It organises, directs, and coordinates the conversion of inputs into the desired unique goods or services. I trusted that the findings in response to the two research questions would contribute to expanding the complex PMBOK.

3.7 Research Ethics

This research sample comprised human subjects; therefore, I considered applicable ethics requirements. The study complied with the ethics requirements of the University of Cape Town and ethics clearance was obtained from the University's Ethics Committee. Two ethical principles guided this research, namely consent and confidentiality. The participants were informed about the details and intentions of this study and all participants in the interviews gave their consent before participating in this research.

The consent was in writing, indicating their approval to freely participate without being unduly pressurised or coerced. The consent form also stated that the interviewees were free to withdraw their participation at any point. The ethical commitments were shared during the focus group discussions and the fact that non-disclosure of the focus group information could not be guaranteed was pointed out. The interviewees were advised that they might disclose this information to other people without my consent.

There were no identified risks to interviewees. I committed to informing the interviewees of any risks that might arise during the research. I did not disclose the identity of the interviewees in the research report to honour confidentiality and anonymity. The information they provided was kept secure and confidential, to the degree permissible by law. In doing so, I ensured that the interviewees were protected from any possible harm, e.g., humiliation and unfair labour practices.

I coded the personal information that was collected (e.g., name, age, location, and project name) and did not share it with other research participants. The collected data were kept in a password-protected computer and locked filing cabinets in an access-controlled office building.

The categorisation and classification of data further protected the research interviewees by guaranteeing their anonymity. All research data and results are the sole property of the DSI, the sponsor of this research project. On this basis, I committed to seeking approval or support from the DSI before releasing or publishing

the data collected. I also undertook to eliminate and avoid biases that might lead to certain results.

3.8 Conclusion

The research and methodology chapter implies that I developed a grounded theory. The inductive constructivism approach was an opportunity for an in-depth focus on the management of innovation for inclusive development projects. The case study approach allowed me to listen carefully and observe unspoken exchanges in the communication of the project stakeholders.

I am convinced that the inductive approach provided meaningful information. This is in contrast with deductive studies of complex project management that assessed performance according to the conventional measures of time, cost, and scope.

The data collection and analysis exercises challenged me considerably. I consistently reminded myself of the analogy of a complex project as a human being. Throughout the data collection and analysis process, I sought the brain and heart of the management of the complex innovation for inclusive development projects. I met people genuinely interested in the improvement of these projects which is why I conceded to the additional two users who requested participation in this research.

Some of the project managers and users appreciated participation in this research. Some even suggested that this research could propose periodic surveys as part of the continuous improvement of the practices. They perceived it as exercising their agency on the realisation of an inclusive and responsive national system of innovation that would continue to employ projects to deliver on strategic agendas.

CHAPTER FOUR: FINDINGS (PART I)

4.1 Introduction

In this chapter, I present the findings of the data collection and analysis activities expounded in the preceding section. The findings are presented in two sections, in line with the research questions. The findings are based on lived experiences of innovation by inclusive development project management stakeholders. I begin by sharing observations on the data collection activities and then discuss the findings from the primary and secondary data.

I believe that the case study approach provides insights that can enhance the management of innovation for inclusive development projects. I selected five cases that were implemented in different contexts which offered the opportunity to learn how complexity influences project management. Each of the five cases provided detailed practical, albeit context-dependent information. I concur that such “concrete, context-dependent knowledge is, therefore, more valuable than the vain search for predictive theories and universals” (Flyvbjerg, 2006:7).

The five cases were intensive observations of the issue of concern in their natural contexts. The multiple cases enabled the knowledge from this research to be transferable. The five cases delivered information essential to the development of complex project management. It provided practical knowledge that demonstrated *how* complexity influences the management of innovation for inclusive development projects. Information from real-life contexts was collected and actual measures of performance used to assess the efficiency of project management were demonstrated.

My research presents practical knowledge to expand the evolving theory and tools of complex project management on two issues of concern: project organisation and performance measurement. The five cases delivered a considerable amount of information on the issue of concern. I argue that the inductive design of the research presented opportunities to create knowledge, without a restriction of preconceived

theories to test and validate. The inductive enquiry elevated how organising complex project management is a dynamic and fluid social process. The psyche and values of the stakeholders and their perceptions of complexity shape their responses and participation in project management.

4.1.1 Observations from primary data collection

I collected data from 37 interviewees instead of the planned target of 35. The two additional interviewees were users in Project 2. Based on their zeal for improved project management, I agreed to their participation as a sign of responsiveness, valuing their opinions on the issue of concern. I perceived no risks to the research regarding their participation and considered that I might benefit from their contributions. Furthermore, not accommodating their request might not have augured well with other interviewees.

The interviewees were diverse in age, gender, culture, and academic qualifications. I did not analyse the influence or implications of demographic variables regarding the two research questions. All interviewees that were requested to participate accepted my invitation. I invited interviewees who participated in the five projects of the research sample.

The individual and focus group interviews showed the benefits of using criteria to select interviewees. The interviewees were able to share their views and meanings attached to the issue of concern. They drew from their lived experiences, which I found valuable in the development of the grounded theory. In each session, I collected a considerable amount of data which I analysed and distilled into categories to avoid duplication.

Primary data collection emphasised the lack of control I had over certain aspects of this process and environment. I experienced many challenges in using interviews to collect data, including requests to change scheduled appointments and the availability of interviewees. My limited fluency in other indigenous languages concerned me and I faced anxiety that I might have lost important inputs when translating into English.

On average, the individual interviews were 60 to 90 minutes. Scheduling them in the afternoons afforded more time. I observed that they took longer than 60 minutes with interviewees who were already implementing interventions to improve project management. The focus group also took longer than scheduled. Not all interviewees participated with the same vigour. Diversity in culture, gender, and age influenced participation. In Project 2, I observed the influence of language in interactions amongst the interviewees.

4.1.2 The data structure

I analysed the data to describe and explore how complexity influences project management organisation and its performance appraisal. The findings were represented in the data structure, developed through the application of the Gioia method (Figure 4-1). The Gioia method captured the voice of the interviewees and featured them prominently in the data structure. It supported the development of the grounded theory from the research.

I constructed the data structure according to the categories of the Gioia method. The 1st-order concepts are solely comprised of the voices of the interviewees. The analysis of the 1st-order concepts resulted in the emergence of 2nd-order themes. The analysis of the 2nd-order themes provided the aggregate dimensions (Figure 4-1). The aggregate dimensions represented the responses to the first question. They addressed how complexity influences the organisation of the management of innovation for inclusive development projects. I drew from the aggregate dimensions to propose measures of performance to expand the iron triangle.

4.1.2.1 1st-order concepts

I performed the 1st-order analysis using the Gioia method, which restricted the focus to interviewee-centric terms and codes (Figure 4-1). Five categories of 1st-order concepts emerged (Figure 4-1). The first category showed that all interviewees recognised that a project exists to fulfil a purpose. It is temporary, although its outputs might be permanent, with considerable impact on the socio-economic profile of its locality. For example, all projects in the research sample had aspects of infrastructure delivery, enterprise development, and capacity building.

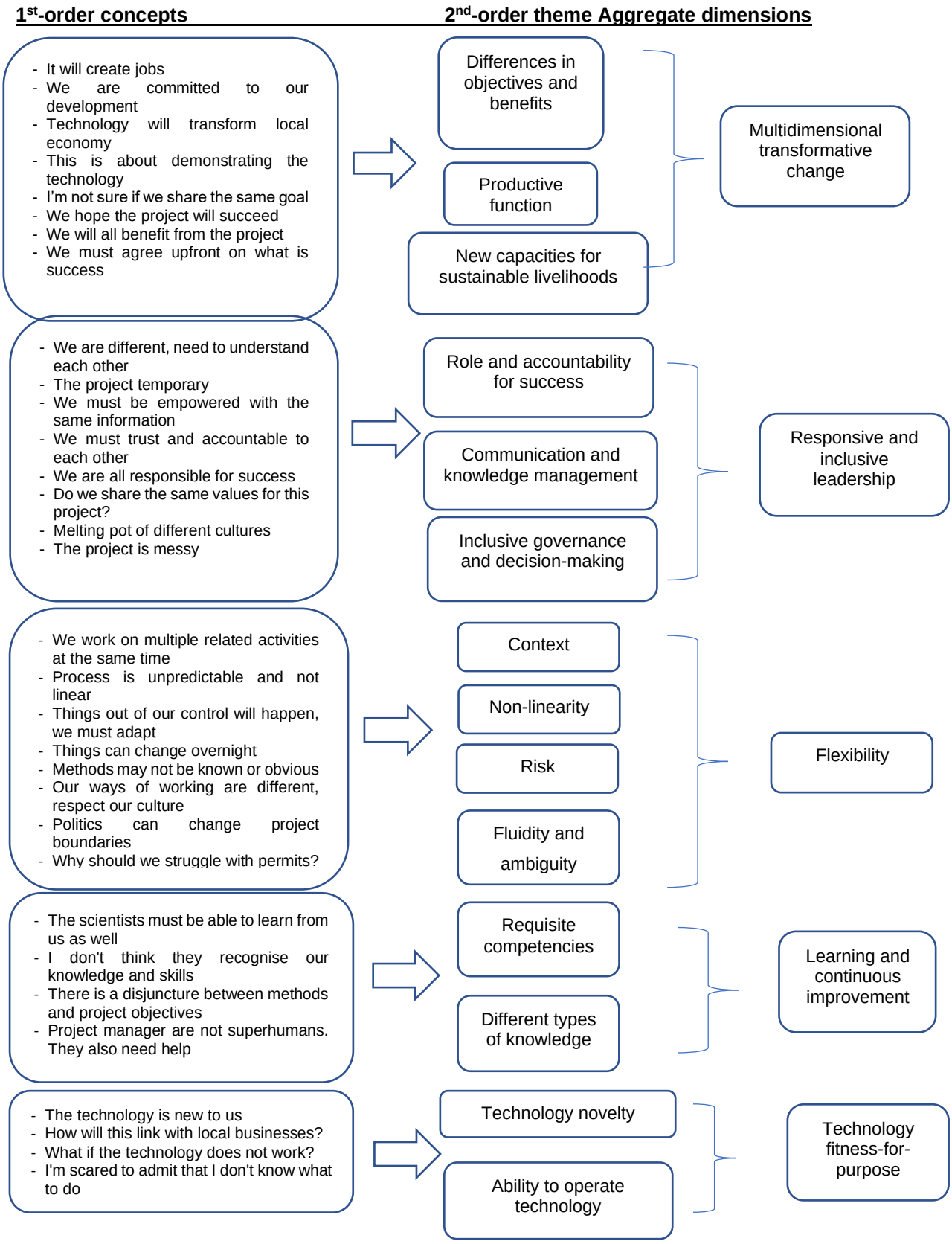


Figure 4-1: Data structure highlighting features attached to complex projects

(i) 1st-order concept 1

The stakeholders committed to collaborating on the project to meet specific needs. Entrepreneurship, market opportunities, and human capital development need motivated Projects 1, 2, and 4. The inclusion of marginalised communities in creating, actualising, and benefitting from innovation anchored them. Projects 3 and 5 focused on technology demonstration and research.

The interviewees shared that, although they concurred on an overall project goal, individual agendas drove their participation. Each interviewee tended to engage in the research based on their specific interests in the projects. The sponsor and project managers prioritised technology demonstration and evidence-informed policymaking. They approached job creation as a secondary objective, a means to an end.

Users identified enterprise development and job creation as primary objectives. They perceived technology demonstration as secondary, a means to local economic development. This contrast amongst stakeholders was prevalent in Projects 1, 2, and 4. An interviewee shared that "*whilst scientists focus on technology demonstration, our interest is different. We want to create successful businesses from the project. This is important to sustain ourselves, once the government no longer funds the project*".

Managers in Projects 1, 2, and 4 encountered the challenge of incorporating diverse interests in framing the objectives and performance indicators. There were fewer stakeholders in Projects 3 and 5. The objectives in both projects were clearer and focused on technology demonstration and research. They consisted of the sponsor, the implementing agency, and/or researchers. Users became secondary stakeholders and provided labour. Projects 3 and 5 did not exhibit variation in objectives amongst stakeholders, as shared by interviewees of Projects 1, 2, and 4.

These agendas expressed themselves in the project objectives. The interviewees engaged in project management based on the prioritisation of their objectives. An interviewee conveyed that "*the technologies we demonstrate have potential to change the profile of rural economies. Their success could contribute to reducing rural-urban*

migration". Another insisted that "*It is difficult to support any initiative that does not speak to our needs. The government must try to understand and work with us. There should be nothing about us without us*".

Interviewees projected the prioritisation of objectives as an influencing factor in resource allocation. The users highlighted that consideration of their objectives strengthened their conviction on ownership. The perceptions of ownership motivated their level of contribution, even to assuming some responsibilities (Box 4-1). Project 1, 2, and 4 engaged users who invested time to find solutions for the challenges that hampered progress. They executed project management duties, albeit to different extents. Users in Projects 3 and 5 did not take part in project management. Box 4-1 shows an extract of a report by the users presented to a multi-stakeholder project steering committee. The committee provided oversight and monitored project management progress.

Box 4-1: Extract of the report presented by the users

guidance and HR	matters in place. ii. The leadership team that was established is in place. staff training and empowerment to take place	team working at [redacted] farm); - Time registers, pay roll management is well under control; [redacted] s managing the pay roll - A new security company [redacted] on site is doing well. We have more control over them as the previous and we try to make them as being part of us, but separate. - All project Occupational Health and Safety (OSH) requirements are met - Some of the staff are informed and involved in the business so they understand the project targets, their role in achieving these targets and they are encouraged to contribute when developing the day to day management plan. - Training and development needs should be identified for all staff and steps taken to meet these As mentioned previously: the People vs Production model is very important to me and I am trying to balance this at Hi Hanyile. - The human capital is the most important asset to acknowledge and therefore develop and empower. - Some internal training or skills transfer amongst the workers is taking place. -
3. Financial management	The budget has to be managed and in line with the strategic plan; reporting to DST and NSTF	- The financial management is now under control after having someone coming in as needed to cover the backlog and bring the financial statements up to date, according to [redacted] account, income and expenditures and all invoices recorded - Reports to the [redacted] on accounting and payroll related matters and discussing with them needs and requirements
4. Assets management	Manage the project assets and infrastructure and maintain the project assets	- The infrastructure is in good and working order - All is constantly checked, and service providers called in to service and/or repair and maintenance takes place; - The asset register is up to date; - Quotations are obtained for the most important repairs, maintenance and other needed acquisition. -
2. STRATEGIC LEVEL INTERACTION AND OTHER MATTERS		
2.1 Strategic level planning and business plan development	[redacted] to do feasibility study and development of a business model and investors prospectus	- - [redacted] presented proposals and a plant on various occasions - They did a site visit to inform their study - We have submitted relevant documents. - Due to slow progress and time that is not on our side, we Trustees

In one of the focus group discussions, a project ownership debate ensued. The interviewees debated the meaning and indicators of project ownership. Users in Projects 1, 2, and 4 expressed ownership of the projects. I noted that those who identified themselves as co-owners participated in project management. Box 1 demonstrated Project 2 users' participation and accountability, provided the objectives aligned with their needs. Appendix II summarises the perceptions of the stakeholders on project goals, purpose, and ownership.

(ii) 1st-order concept 2

I arranged the interviewees' inputs related to collaboration in the project in the second category (Figure 4-1). All interviewees acknowledged that several diverse stakeholders collaborate in a project, based on a common goal and accommodation of individual interests. An interviewee viewed diversity as *"both an opportunity and a threat. It creates a dynamism that can either enrich the project or hamper its progress*". Another questioned the terms of collaboration between the sponsor and the users. His view was that *"these projects are not typified by users able to make their own choices. The financial power of the sponsor disenfranchises their expression and participation in decision-making*".

Interviewees stressed that clear rules of engagement, common values, and language enhance collaboration. An interviewee remarked that "*although we are different, we are committed to this project. We had to find ways to work with each other. It was not easy at the beginning*." Another explained that:

> *Simple things can make or break the collaboration. In our case, the project manager almost ruined the project by not sharing information. If we are real partners, we must be empowered with the same information to trust and be accountable to each other* (see Figure 4-1).

Another insisted that "*true partnership reveals itself in inclusion in decision-making, especially those decisions concerning finances*".

Most interviewees confessed that the many unknowns necessitated timely and flexible communication. An interviewee declared that "*the project manager must be a good*

communicator". Another pointed out that communication must use appropriate language due to its connotations. He elaborated that "*language is a power that makes or breaks cooperation. It is potent when it recognises different forms of organising in the community*".

An interviewee was emphatic about the collaboration to embrace Ubuntu.

> *It must be humane, ethical, respectful and considerate. Ubuntu promotes solidarity and enables all to recognise the interfaces amongst these interrelated activities. It reinforces that no single stakeholder is greater than the others. None can singlehandedly execute and deliver the project.*

He elaborated that "*Ubuntu supports the creation of a unique identity for the collaboration".* The identity is *"our way of being, the alternative way of doing things as well as our theory of knowledge. It democratises project management, which is exclusive. It demotivates the perpetuation of classes and top-down knowledge systems".*

I watched the segregation of interviewees based on the level of responsibility during the focus group interviews. The association by perceived class might have limited participation for some stakeholders. It might have bolstered groupthink.

The interviewees recognised that they were accountable to each other. They highlighted that power relations compromised their engagements and influenced language usage, e.g., users *vs*. beneficiaries. In Projects 1, 2, and 4, users referred to themselves as partners and participated in project management. They partook in project management oversight and governance platforms. Projects 3 and 5 opted for the term 'beneficiaries', interpreted as passive and helpless. Projects 3 and 5 beneficiaries did not participate in decision-making nor accounted for performance. An interviewee discouraged the use of the term 'beneficiary' as it was not ideal and "*took away the sense of agency in self-development*." The interviewees' views on collaboration and engagement appear in Appendix II.

(iii) 1st-order concept 3

The interviewees concurred that it was not always clear how best to implement the project. A project manager said:

> *Finding the best method is sometimes not possible. You must remember that most of them originate from the built environment, which is very different to the development arena we focus on. Inclusive development projects are social interventions. They are not straightforward. Tell me, how can you apply linear methods to non-linear and fluid objects?*

Project managers relayed that change was a constant and its impact was unpredictable. One chuckled when he said:

> *Sometimes I'm not sure whether I'm coming or going. I keep a confident face. My team cannot see me panic or lost. We work on multiple activities at the same time. The interfaces are not always obvious. If my grey hair could speak it would tell you everything is certain and good when you go home. The next day you return to find chaos and face uncertainty. Things can change overnight. You must have the maturity and intelligence to deal with these difficult situations and such is not taught at university.*

The perspectives harmonised on the influence of politics. They correlated on how this could bolster or derail project management. A user recalled how they were "*represented by political chameleons in a steering committee. They were more interested in their benefit rather than the broader collective, us the users*".

I noted that the management arrangement differed across the sampled projects. Projects 1 and 2 exhibited a participatory approach characterised by engaged and proactive users. Projects 3, 4, and 5 indicated a top-down management approach. A project manager stressed that the "*top-down approach to management contradicts the cooperative and participatory leadership associated with Ubuntu*". This perspective aligned with users who consistently raised that project managers ignored their ways of working and self-organising.

Another emphasised that "*top-down management compromises and locates failure or success to the project manager. It limits flexibility as that are beyond our control will happen, we must adapt*". An interviewee stated that "*when the project succeeds, we all celebrate and own the success. If it fails, it is the project manager's fault*".

(iv) 1st-order concept 4

The interviewees included skills and competencies in their uncertainty when implementing the projects. Some claimed that undue pressure was placed on project managers to possess all the skills required to deal with any uncertainties. An interviewee indicated that it was the project managers who put pressure on themselves. She elaborated that "*project managers need to remember that they are not superhumans, they also need help*". They failed to draw from indigenous knowledge, learning from local ways of organising and governance, among others.

An interviewee sounded aggrieved on the competencies required. She explained that:

> *The way I see it, the government does not consider how much and what the project manager knows. If that was not the case, how could they appoint that one? He does not know anything. It is worse that he is not prepared to learn from others, including his educated colleagues. It is a pity he does not recognise the value of learning.*

Another concurred that *"he likes telling us of his experience but he forgets that projects are different. What worked in another community might not work here. We are all different*".

A project manager suggested that the department and its agencies should invest in building skills for complex project management. He recognised the emotional intelligence, creativity, and nimbleness of the project manager as underrated attributes for success. He shared that, in his experience, few project managers were creative by integrating other disciplines to enhance the delivery of innovation for inclusive development projects. He demonstrated how he applied systems thinking in project design, execution, and impact evaluation (Box 4-2).

Box 4-2: An illustration of a systems-based design to Project 1

1. Design with a holistic and systemic orientation ('Virtuous Cycle')

Against the complex backdrop of the **implicit systemic approach** of the NDP, the initiative specifically cross-examined **technology intensive systemic interventions** and its **influence on human behaviour**.

The initial work in the Cofimvaba region led the initiative team to utilise a "virtuous cycle" **approach towards the development of a rural innovation systems model to address education challenges, rural poverty and unemployment.** The **model** developed and tested is portrayed in Figure 2 and is explained in the paragraphs that follow. Initially the **School-system** - with its local eco-system and ambitions - was seen as the **"initiative driver and centre of opportunity"**.

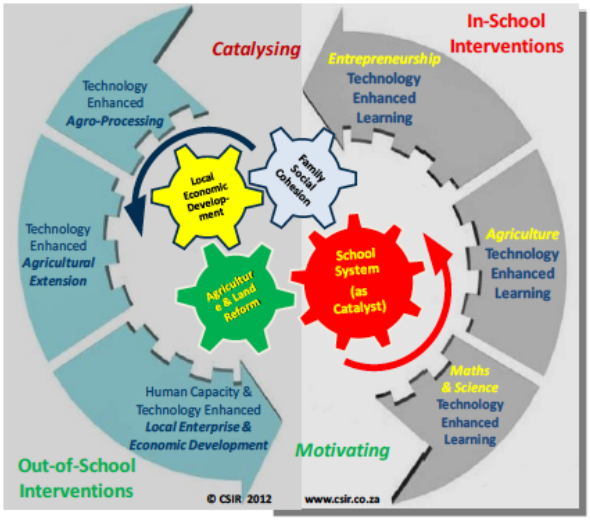


Figure 2: "Virtuous cycle" - a holistic, systemic model for rural innovation and economic development.

In addition to the Project 1 manager, four interviewees underscored the ability to draw from various methods and other disciplines as a strategic competency. The interviewees of Project 1 shared that applying systems thinking enabled holistic planning and implementation. The project manager described how it empowered the project team to identify various project interlinkages and interfaces (see Box 2). They were able to plan better knowing which activities were the critical path activities where change could have dire consequences on the project. Such influences were identified within the project and in its context.

(v) 1st-order concept 5

Interviewees reflected on the influence of the complexity of technology. The project's choice of technology dictated the specification of materials and equipment. The ease of understanding and operating the technology either motivated or compromised participation. A user explained that the ability to operate the technology became a factor in undermining and marginalising others and induced technical superiority amongst them. She vented that some "*became high and mighty because they know*

the technology better than us. They hog the information so that we depend on them. Sometimes it feels like we are begging them to do their work".

Interviewees expressed concern and uncertainty about whether the technology transfer or demonstration would work. They concurred on the need for adequate technical competencies to sustain and operationalise the projects. One interviewee identified absorptive capacity as an ignored factor. It addressed the ability to recognise strategic information, assimilate it, and apply it for the organisation's competitive advantage. It was a decisive factor to sustain and advancing innovative organisations.

4.2 2nd Order Analysis

Using the Gioia method, I analysed the data collected from many sources. I envisaged that it would enhance the interpretation of the results towards plausible conclusions. The Gioia method "encourages the presentation of the research findings in a way that demonstrates the connections among data, the emerging concepts and the resulting grounded theory" (Gioia et al., 2012:17).

Based on the 1st-order interviewee-centric terms and codes, 2nd-order themes emerged (Figure 4-2). The 2nd-order analysis employed "researcher-centric concepts, themes, and dimensions". "Taken together, the tandem reporting of both voices—interviewee and researcher—allowed not only a qualitatively rigorous demonstration of the links between the data and the induction of this new concept, sense giving but also allowed for the kind of insight that is the defining hallmark of high-quality qualitative research" (Gioia et al., 2012:18).

Five 2nd-order themes emerged from the 1st-order concepts. They were:

- Project objectives dissonance
- Multi-stakeholder project organisation
- Context
- Requisite competencies
- Novelty of the technology

(i) Project objectives dissonance

Projects 1, 2, and 4 comprised research, development, and innovation. Their goals included enterprise development and capacity building to contribute to local economies. Technology transfer or demonstration tended to preoccupy the project managers. The managers were affiliates of the research or technology developers' organisations. Such affiliation might have been a source of conflict for the project managers and caused bias in the allocation and use of resources (see Box 4-3).

Box 4-3: An extract of a project management document demonstrating financial allocations for activities in Project 1 (i) and 4 (ii)

(i)

Period	Interventions	Outcomes	Investment (incl. VAT)	Report Pages
Aug '11 to Mar '12	*Scoping and design* of appropriate rural innovation and education development model (*Tech4RED* Project)	*Systemic, holistic "virtuous cycle" approach* towards agri-business revitalisation with the *school system as catalyst.*	R2m (DST)	Covered in 2011 /12 **Tech4RED** Final Report
Apr '12 to Mar '13	Initiate an *experimental farm* on Arthur Mfebe Agricultural School ground (*Tech4RIED* Initial Phase)	Built farm and initiated *practical agricultural participation from learners* towards *agri-business teaching and development*	R7,5m (DST)	Covered in 4th Quarter 2012/13 **Tech4RIED** Report
Apr '13 to Mar '14	Enhance *Agri-teaching* and raise *winter and summer crops* and *livestock* and provide *production plans*(*Tech4RIED* Extended Phase)	*Agricultural teaching requirements satisfied* as well as crop and livestock *feasibility studies and production plans* for the school and area generated.	R1m (DST)	Covered in 4th Quarter 2013/14 **Tech4RIED** Report
Apr '14 to Jun '15	*Institutionalisation* and *local ownership transfer* as well as further *technology and Agri-ICT platform enhancements* to support *communal small-scale farming* (Tech4RIED Final Phase)	Re-configured and capacitate the *local management and control arrangements* to ensure a more *entrepreneurial and open approach.* Expand initiative into local economy.	R9,5m (DST)	*Detail follows under 3.1*

(ii)

INSTITUTION	COMMUNITY	ACTIVITIES	AMOUNT (Rands)
Tshwane University of Technology	Mothong & Eastern Cape Community	Production system for LS, Multiplication of material of GF, PM, BS, HO; Student assistant; Student; Conference attendance; Community support and Admin	300 000.00
University of South Africa	Mothong & Eastern Cape Community	Synergistic effects of isolated compounds; Effect of storage on extracts; Effect of growing conditions on essential oils (GR, GF, LS, PM); Student support/Postgraduate assistant; community support; Security	450 000.00
University of Pretoria	Mothong & Eastern Cape Community	Clinical studies for UP leads; Research running expense; Small equipment	500 000.00
University of Pretoria	Mothong & Eastern Cape Community	THP/Community support	99 705.00
University of Pretoria	Mothong & Eastern Cape Community	Admin; Research/Technical assistant; General studentships; Bursaries; Conferences; Exhibitions	250 000.00

Box 4-3 demonstrated that Project 1 allocated considerable funding for institutionalisation and local ownership. Compared to other projects, it pursued partnerships with local stakeholders and engaged them for activities such as entrepreneurial coaching for the learners. Community development activities were allocated an amount above R1m within the R9.5m (see Box 4.3). The project design

had a strong focus on behavioural change and local economic development for the community.

Interviewees recognised Project 2 as a community development initiative. It created jobs and infrastructure to support local economic development. The users provided the labour and performed project management duties. Projects 3 and 5 were approached as research and development and technology demonstration projects with no community development aspect. The community benefitted through short-term seasonal employment.

Project 4 prioritised research and development activities. It allocated a budget for community development and other activities to strengthen the participation of indigenous knowledge holders in product development. The users provided certain plant species for the research. Box 1 showed an allocation of less than 10% of the total project funding to support community development. This amount might have been higher for Project 4 as it excluded the funding of bursaries for members of the community.

Dissonance on objectives increases the likelihood of tensions due to implications on resource allocation and prioritisation of activities, for example, projects where the overriding goal was a technology demonstration, biased resource allocations on testing and validation (see Box 3). Projects 3 and 5 demonstrated that oversight prioritised technology over other aspects. Project management progress reports reflected technology performance and research and development progress. The limited regard for human development and labour issues was motivated by perceptions that they were secondary.

Project 4 users' objectives included exploiting their knowledge for enterprise development. They expected that it would contribute to incorporating indigenous knowledge in the activities of the national system of innovation. Project 4 users wished that the project would enhance social cohesion and regenerate their community (see Box 4-4). They passionately shared these objectives during the interviews. This was not reflected in the documentation, although some activities indirectly contributed to it.

Box 4-4: An extract of a news article profiling Project 4's role in improving its community

https://www.iol.co.za/pretoria-news/news/tshwane-healer-makes-list-of-science-oscars-b4cd2503-b0a3-4c1b-abda-3fc16639416c

Mabena is on the list along with experienced scientists, engineers, innovators, science communicators, engineering capacity builders, organisational managers and leaders, as well as data and research managers.

He is the only traditional healer among various professors in his category. He is the founder of Mothong African Heritage Trust. "For me, it is important to know that what you do makes a difference.

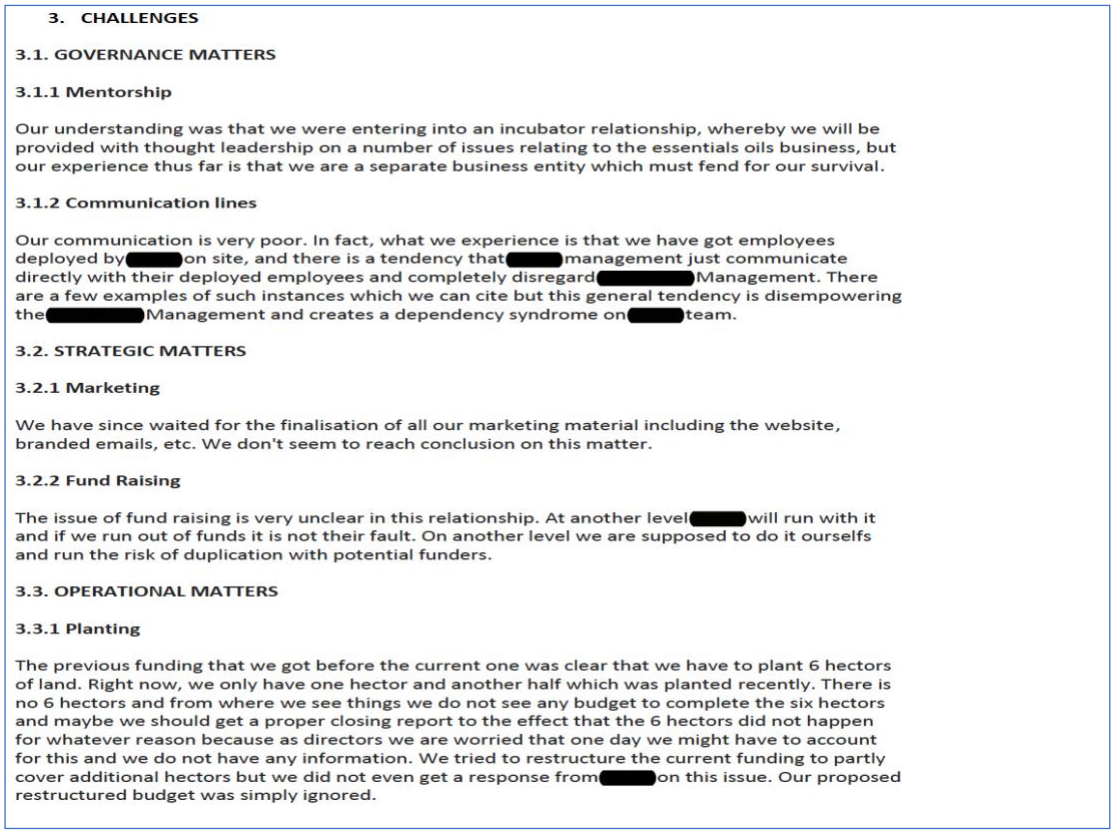
"I would like to thank the organisation for the recognition of my contribution." The botanical park is situated above Section H and is part of the Magaliesberg. It forms part of the Magaliesberg biosphere, which has been recognised by the Unesco.

This once smelly dump, where murderers dumped bodies, is now the pride of Mamelodi. "I am overwhelmed by the acknowledgement. I still can't believe it. To think that when I started it I found a dead body there now it has turned into a place of learning for indigenous knowledge systems," said Mabena, a traditional doctor and a former Umkhonto we Sizwe operative.

Boxes 4-2, 4-3, and 4-4 demonstrated variations in how the users, the sponsor, and the researchers perceived project objectives. To meet the needs of all stakeholders, the project manager accommodated their priorities in project design, albeit to different extents. I contend that the plurality of stakeholders' challenges to achieve consensus affected project objectives. The primary data suggested that achieving consensus is a dynamic and unstable process, influenced by many factors, including power. It requires an astute project manager to steer and navigate different stakeholders to converge on a set of objectives.

I assert that since the project objectives perspective appeared to influence how and on which matters the interviewees engaged during the interviews, the same may apply to project management. The different views on what the primary goal and objectives were, were unfortunate. The objectives inform project outputs and as such, influence the design, execution, and governance of project management. The dissonance may have caused tensions when stakeholders negotiated and prioritised activities (see Box 4-5).

Box 4-5: An example of discord on project objectives among stakeholders in Project 2



3. CHALLENGES

3.1. GOVERNANCE MATTERS

3.1.1 Mentorship

Our understanding was that we were entering into an incubator relationship, whereby we will be provided with thought leadership on a number of issues relating to the essentials oils business, but our experience thus far is that we are a separate business entity which must fend for our survival.

3.1.2 Communication lines

Our communication is very poor. In fact, what we experience is that we have got employees deployed by [redacted] on site, and there is a tendency that [redacted] management just communicate directly with their deployed employees and completely disregard [redacted] Management. There are a few examples of such instances which we can cite but this general tendency is disempowering the [redacted] Management and creates a dependency syndrome on [redacted] team.

3.2. STRATEGIC MATTERS

3.2.1 Marketing

We have since waited for the finalisation of all our marketing material including the website, branded emails, etc. We don't seem to reach conclusion on this matter.

3.2.2 Fund Raising

The issue of fund raising is very unclear in this relationship. At another level [redacted] will run with it and if we run out of funds it is not their fault. On another level we are supposed to do it ourselfs and run the risk of duplication with potential funders.

3.3. OPERATIONAL MATTERS

3.3.1 Planting

The previous funding that we got before the current one was clear that we have to plant 6 hectors of land. Right now, we only have one hector and another half which was planted recently. There is no 6 hectors and from where we see things we do not see any budget to complete the six hectors and maybe we should get a proper closing report to the effect that the 6 hectors did not happen for whatever reason because as directors we are worried that one day we might have to account for this and we do not have any information. We tried to restructure the current funding to partly cover additional hectors but we did not even get a response from [redacted] on this issue. Our proposed restructured budget was simply ignored.

Box 4.5 illustrated the frustration of the users in what they understood as the objectives of the project. It corroborated the link between objectives and apportioning resources and highlighted the confusion and inefficiencies that could arise due to the dissonance. For example, the users requested clarity on 3.2.2: fundraising, wherein they perceived likely duplication of efforts.

Box 4.5 showed the frustration between the users and the project manager on any scope changes. It exemplified how the users harnessed allegiance to the leadership to resolve matters. The tone of the communiqué signed by their traditional leader symbolised users using their agency as development partners. One user narrated that "*we prefer partnerships where we are accepted as responsible adults who can think and do things for themselves*". The interviewees complained that poor communication and lack of access to information disempowered them.

(ii) Multi-stakeholder temporary project organisation

The different stakeholders partnering in project management were diverse in race, age, level of education, and expertise. Interviewees used words such as *"coming together"* and *"working together"* to symbolise collaboration. They did not specifically mention a temporary project organisation as the hub of managing the complex innovation for inclusive development projects. They did, however, mention aspects that relate to an organisation, e.g., culture, values, performance management, etc.

The temporary organisation hosts the brain and the heart of project management. It is a system comprised of many interrelated micro-systems that function together to achieve its goals. The micro-systems include finance and administration, human resources management, technical services, information systems, among others. Any change or incident in one micro-system affects the whole organisation. For example, one interviewee shared that "*delayed payment of wages in Project 4 discouraged users to a point that some quit the project*". The project confronted unforeseen human resources challenges which affected productivity.

Project 1 partners, including the school, had earlier agreed that the project steering committee would oversee the management of the farming activities. Project 1's progress encouraged the school to identify the new opportunities it offered. The school changed its view from a community to a school ownership model (see Box 4-6). The ambiguous communication from the school to the project steering committee on this matter led to an unforeseen recommendation to disband the steering committee. This caused chaos and ambiguity in the project management oversight and limited community development support activities.

The implementation of farming activities created new revenue streams for the school. The school asserted its power over other stakeholders when it decided to reallocate new funding without consulting other stakeholders (see Box 4-6). This concerned other stakeholders as this behaviour were unexpected. It confused the roles between the school as a user and the management team responsible for project delivery and this behaviour threatened the completion of the project.

Box 4-6: An extract from minutes of a project steering committee meeting highlighting the emergence of a new behaviour from the school

5. Processing unit and marketing tools – [redacted]	[redacted] read [redacted] report	Vernon is not happy with the external structure and it will now be clad in IBR. The floor has been sealed in epoxy. The slag list is being dealt with and eventually an engineering certificate will be issued.	Vernon will finalise structure. The school must decide on processing and value addition in the future of the project.
6. Discussion & way forward - All	Management of farming activities	A decision was made in 2014 to transfer the management of farming activities to the PSC as custodian of the resources and run the ABL programme for independent teams. The school however has not relinquished control over some activities. It is clear that the school wants to retain control, even though there is a lack of planning or proper management.	The PSC should be disbanded and the school must take control of all the operations. The school can run it through the SGB and the SMT. The [redacted] will leave the school to their own devices to run the operations as they see fit. The Tribal Authority will be consulted on their stance on the PSC issue and their decisions on the way forward.
	DST funding	The current funding will end at the end of June 2015. The school want to run the project their way. They have not been open to advice and learning. There seems to be a lack of commitment to the bigger project and the focus of attention has remained on the school.	The [redacted] will withdraw at the end of June.
7. Closure – Chief [redacted]	Overview of the previous Chief and his commitment to development of the community.	The Chief is grateful for being included in the discussions as he needs to know what is going on in his community.	Always invite the Chief for school meetings

Applying the lenses of complexity, systems, and management theories assisted my consideration of the different project organisations. Each temporary organisation has macro- and micro-systems. The macro-systems are concerned with culture, power, politics, diversity, and values. The micro-systems focus on recruitment of personnel, performance management, and team dynamics. The data portrayed how an incident in micro-systems influenced the whole organisation.

Project managers maintained that macro- and micro-systems combined with external forces demand creative governance. The stakeholders originated from different parent organisations with their values and cultures and each project manager had to recognise the individual and collective priorities of the stakeholders. One interviewee cautioned that "*just because we work together on the project does not mean we'll agree on everything. My priority is my community*".

The plurality of stakeholders suggested that a cooperative approach was critical for each temporary organisation to create its own identity, values, and culture. As a platform, it sets the boundaries for a preferred style of leadership, e.g., shared power, participatory project management, among others. The interviewees relayed that the different stakeholders participated in creating the culture, values, and identity. These defined its

character and terms of engagement and influenced important processes such as decision-making and communication.

Project management recognises diversity in culture as a feature of complexity that affects it. The diverse cultures congregate and interact with each other in the temporary organisation. One project manager expressed that "*the temporary organisation is a melting pot of cultures*". He stated that the cultural identity of the temporary organisation arises from the interactions and interfaces amongst the stakeholders. The organisation is not immune to influence from its context. Changes in its context might prompt certain decisions for the temporary organisation to survive. The project managers stressed that the values, culture, and identity of the temporary organisation influence how governance mechanisms are established and executed.

The interviewees mentioned the values of the temporary organisation as an important feature for efficient project management. The interviewees' inputs prompted me to identify the values the different projects focused on. The values communicated by the interviewees during the interviews were (i) courtesy and mutual respect, (ii) consultation, (iii) partnership, and (iv) transparency and equal access to information. Interviewees mentioned that "*we must respect each other", "we are different, we need to understand each other*". Access to information appeared as an issue related to trust (see Box 4-7). Interviewees highlighted transparency and equal access to financial information, technology performance, and agro-processing sales.

Box 4-7: An extract from minutes of a project steering committee meeting showing users' concerns on equal access to information

Q4	Additional task	Hi-Hanyile (Dzundze) Trust requests access to project information (business plan, production processes, description of machinery, forecasted financial performance data, technical analytical data re Rose geranium and chemical composition information of the patented BP1 Lippia javanica oil for mosquito repellency).	Assist Hi-Hanyile (Dzundze) Trust with available Hi-Hanyile project data	Provide Trust with information that is not subject to confidentiality due to the BP1 oil patent.	**Partially completed:** Non-confidential data on Hi-Hanyile project was sent to DST CSIR's IP office requested clarity from the Trust as to why the confidential information is required.

For example, users in Project 2 requested access to project information deemed as confidential by the project manager. The users were concerned about the implications of their future operations. Patent ownership and the recognition of their indigenous knowledge contribution demanded clarity (see Box 4-7).

Projects 2 and 4 users were concerned with access to financial information, e.g., current expenditure and projections. One user pointed out that the project manager *"made us justify why we need financial information about the project".* She elaborated that this attitude was inappropriate and *"it made us feel powerless and like she was hiding things from us".*

The review of secondary data revealed ambiguity in stating values. They were implied in some documents, e.g., Project 1 highlighted learning and partnership in its approach. The commitment to the communicated values across the projects was questionable. Aside from not being incorporated in project documents, the values were not displayed on project sites. In not documenting them, the stakeholders exposed themselves to different interpretations of the character of the temporary organisation.

The interviewees highlighted governance of the temporary organisation as a priority. They were deliberate in deploying representatives in governance structures. The representatives had to be loyal to their cause and able to negotiate on their behalf. Each stakeholder considered the extent to which the deployed would defend their interests. The deployment also considered positional and personal power.

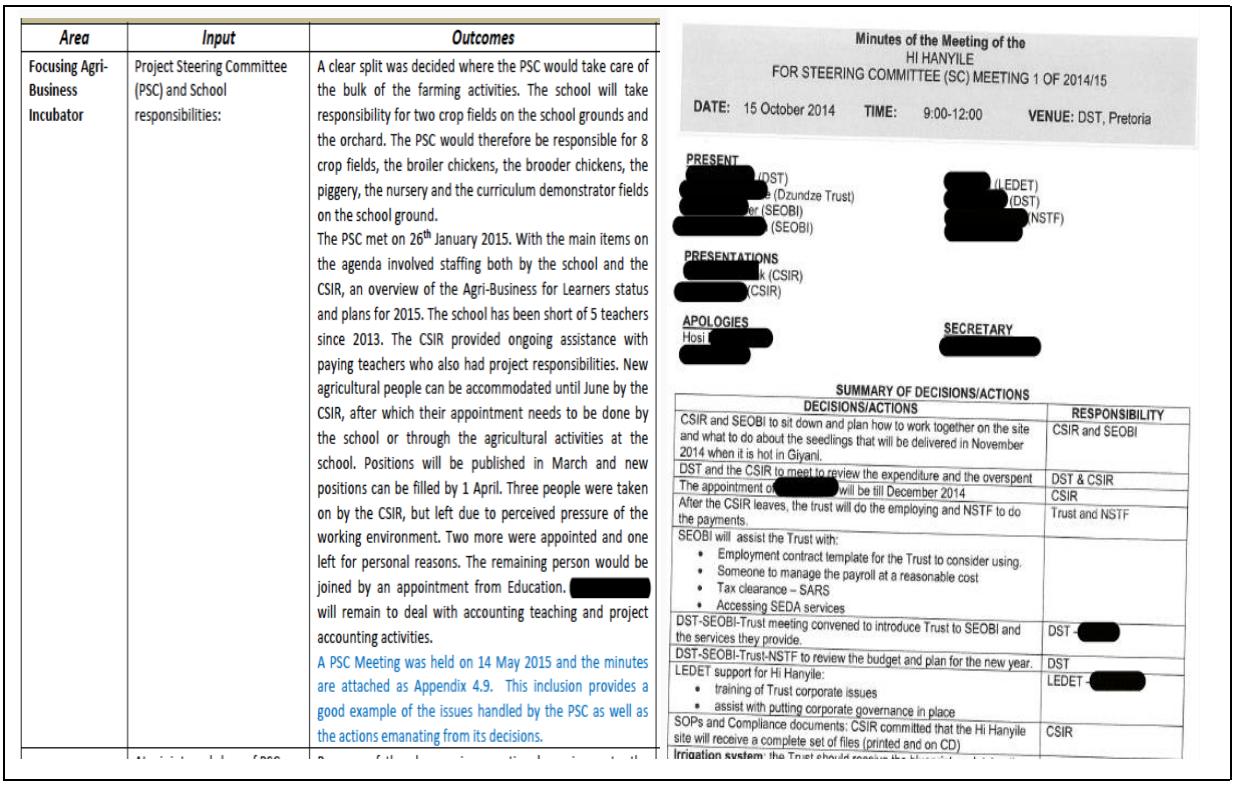
The DSI and the project management service providers considered allocated roles when deploying their representatives. The DSI, project manager, and users collectively reflected on the recruitment of additional members for governance purposes. The project management teams provided secretariat services and accounted for progress and related matters at these committees.

All five projects sampled in this research established committees to govern the temporary project organisation. Projects 1, 2, 4, and 5 formed steering committees while Project 3 opted for management committees. The organisation of Projects 3 and 5 demonstrated a bias towards research and technology demonstration and transfer. This bias affected the crafting and ranking of outputs. Research and development activities dominated Project 3's documentation. The project disseminated the stocks it generated to small scale farmers as part of a broader rural development intervention. The project also did not provide evidence of training traditional healers on how to propagate and sustainably harvest African ginger.

The steering committee is the foundation for decision-making and a platform for the different stakeholders to account to each other. This structure enforced transparent and timely access to adequate information for all. It was a common form of governance and comprised of senior representatives of all stakeholders. It monitored compliance with the plan and guided the governance of the temporary project organisation. The participation at this governance structure aligned with perceptions of ownership and alignment to development priorities (see Figure 4-1).

Projects 1 and 2 users communicated their ownership of the project as confirmed by different documents. They were concerned about operations and participated in governance. Box 4-8 highlights an extract of minutes, showing the participation of users in decision-making.

Box 4-8: An extract of minutes of a project steering committee meeting



Area	Input	Outcomes
Focusing Agri-Business Incubator	Project Steering Committee (PSC) and School responsibilities:	A clear split was decided where the PSC would take care of the bulk of the farming activities. The school will take responsibility for two crop fields on the school grounds and the orchard. The PSC would therefore be responsible for 8 crop fields, the broiler chickens, the brooder chickens, the piggery, the nursery and the curriculum demonstrator fields on the school ground. The PSC met on 26th January 2015. With the main items on the agenda involved staffing both by the school and the CSIR, an overview of the Agri-Business for Learners status and plans for 2015. The school has been short of 5 teachers since 2013. The CSIR provided ongoing assistance with paying teachers who also had project responsibilities. New agricultural people can be accommodated until June by the CSIR, after which their appointment needs to be done by the school or through the agricultural activities at the school. Positions will be published in March and new positions can be filled by 1 April. Three people were taken on by the CSIR, but left due to perceived pressure of the working environment. Two more were appointed and one left for personal reasons. The remaining person would be joined by an appointment from Education. [redacted] will remain to deal with accounting teaching and project accounting activities. A PSC Meeting was held on 14 May 2015 and the minutes are attached as Appendix 4.9. This inclusion provides a good example of the issues handled by the PSC as well as the actions emanating from its decisions.

Minutes of the Meeting of the
HI HANYILE
FOR STEERING COMMITTEE (SC) MEETING 1 OF 2014/15

DATE: 15 October 2014 TIME: 9:00-12:00 VENUE: DST, Pretoria

PRESENT
[redacted] (DST)
[redacted] (Dzundze Trust)
[redacted] (SEOBI)
[redacted] (SEOBI)
[redacted] (LEDET)
[redacted] (DST)
[redacted] (NSTF)

PRESENTATIONS
[redacted] (CSIR)
[redacted] (CSIR)

APOLOGIES
Hosi [redacted]

SECRETARY
[redacted]

SUMMARY OF DECISIONS/ACTIONS

DECISIONS/ACTIONS	RESPONSIBILITY
CSIR and SEOBI to sit down and plan how to work together on the site and what to do about the seedlings that will be delivered in November 2014 when it is hot in Giyani.	CSIR and SEOBI
DST and the CSIR to meet to review the expenditure and the overspent	DST & CSIR
The appointment of [redacted] will be till December 2014	CSIR
After the CSIR leaves, the trust will do the employing and NSTF to do the payments.	Trust and NSTF
SEOBI will assist the Trust with: • Employment contract template for the Trust to consider using. • Someone to manage the payroll at a reasonable cost • Tax clearance – SARS • Accessing SEDA services	
DST-SEOBI-Trust meeting convened to introduce Trust to SEOBI and the services they provide.	DST - [redacted]
DST-SEOBI-Trust-NSTF to review the budget and plan for the new year.	DST
LEDET support for Hi Hanyile: • training of Trust corporate issues • assist with putting corporate governance in place	LEDET - [redacted]
SOPs and Compliance documents: CSIR committed that the Hi Hanyile site will receive a complete set of files (printed and on CD)	CSIR
Irrigation system: the Trust should receive the [redacted]	

Steering and project management committees provided access to information. They facilitated collective reflection on the progress of the implementation and efficiency of the project management. Interviewees concurred that such committees required the participation of all primary stakeholders to execute their mandate effectively. Projects 1, 2, 4, and 5 committees included the users. The management committee of Project 3 excluded users and this might have compromised oversight and accountability. The non-participation of the users as evidenced by project documents was questioned by the sponsor. There was no evidence of consequences for the project managers for inactive, exclusionary, or dysfunctional governance mechanisms.

Evidence of the users' involvement in steering committees was available for Projects 1, 2, and 5. Projects 1 and 2 structured as local economic development projects witnessed active user participation in the administration and governance of the temporary organisations. Project 1 appointed an experienced individual as a site manager to work in tandem with the project manager and the sponsor. The users' rationale centred on

taking ownership and actively participating in the processes to realise the project (see Box 4-9).

Box 4-9: An extract from Project 2 steering committee minutes

guidance and HR	matters in place.	team working at [redacted] farm); - Time registers, pay roll management is well under control; [redacted] s managing the pay roll - A new security company [redacted] on site is doing well. We have more control over them as the previous and we try to make them as being part of us, but separate. - All project Occupational Health and Safety (OSH) requirements are met - Some of the staff are informed and involved in the business so they understand the project targets, their role in achieving these targets and they are encouraged to contribute when developing the day to day management plan. - Training and development needs should be identified for all staff and steps taken to meet these
	ii. The leadership team that was established is in place. staff training and empowerment to take place	As mentioned previously: the People vs Production model is very important to me and I am trying to balance this at [redacted] - The human capital is the most important asset to acknowledge and therefore develop and empower. - Some internal training or skills transfer amongst the workers is taking place. -
3. Financial management	The budget has to be managed and in line with the strategic plan; reporting to DST and NSTF	- The financial management is now under control after having someone coming in as needed to cover the backlog and bring the financial statements up to date, according to [redacted] account, income and expenditures and all invoices recorded - Reports to the [redacted] on accounting and payroll related matters and discussing with them needs and requirements
4. Assets management	Manage the project assets and infrastructure and maintain the project assets	- The infrastructure is in good and working order - All is constantly checked, and service providers called in to service and/or repair and maintenance takes place; - The asset register is up to date; - Quotations are obtained for the most important repairs, maintenance and other needed acquisition. -
2. STRATEGIC LEVEL INTERACTION AND OTHER MATTERS		
2.1 Strategic level planning and business plan development	[redacted] to do feasibility study and development of a business model and investors prospectus	- - [redacted] presented proposals and a plant on various occasions - They did a site visit to inform their study - We have submitted relevant documents. - Due to slow progress and time that is not on our side, we Trustees

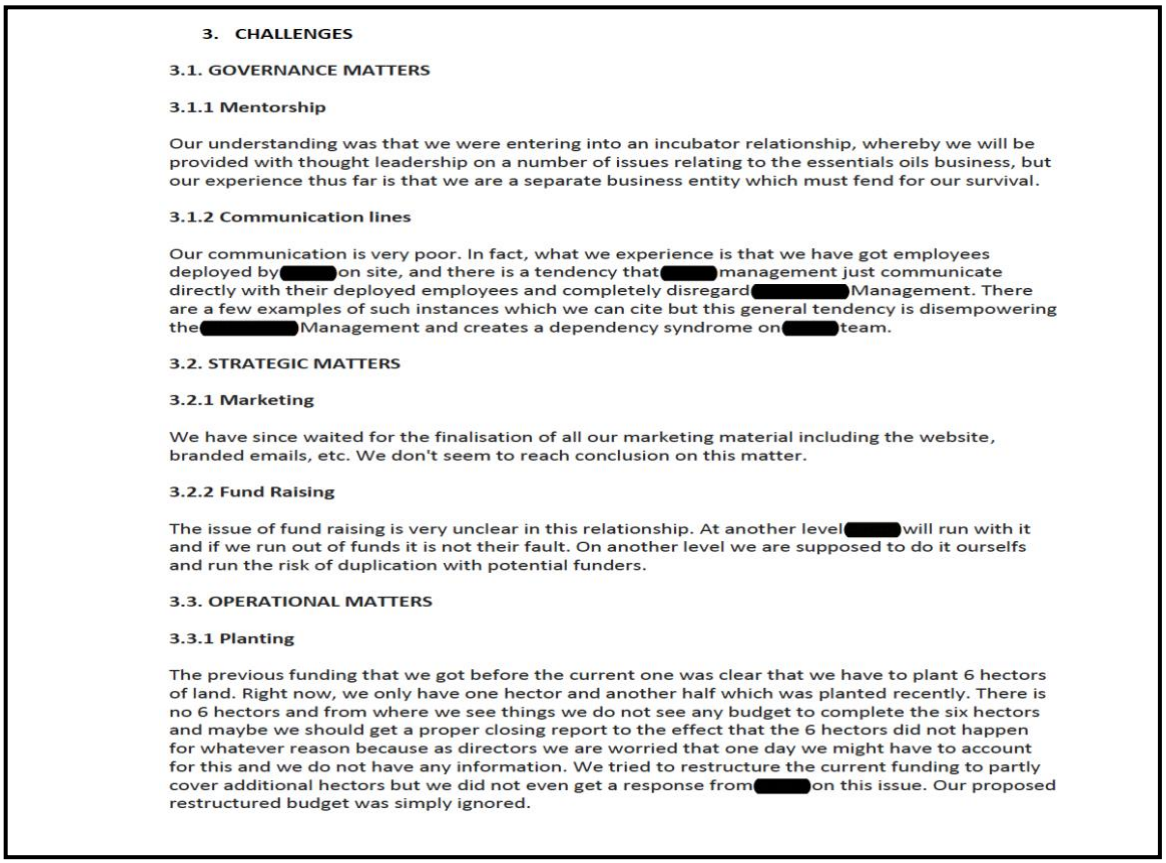
The administration and governance approaches of Projects 1 and 2 demonstrated how the projects were designed and organised according to the users' needs. Project 1 tracked interfaces with the broader community which included local enterprises. The plurality of its stakeholders with different objectives and the vision of the primary users justified the design of its administration and governance approach.

I reviewed the secondary data to ascertain the terms of reference of the steering committees. I found that not all committees operated with terms of reference. The lack of terms of reference could have compromised oversight due to the lack of guidance, boundaries, and responsibilities of members. It might have created ambiguity on representation in this decision-making body. It cultivated space for inconsistencies in decision-making and terms of engagement. These steering committees decided on scope changes amongst various matters and if they malfunctioned, the incidence of

risk would increase. A unilateral scope change decision of a project manager in one project caused tensions and exposed it to unnecessary risk.

The scope changes exerted pressure on the stretched finances and human resources. It caused confusion and tensions as the users felt compromised. They were concerned about being held accountable for the consequences of decisions they were not part of. To address this matter, they harnessed their relationship with the traditional council whose support in addressing this matter proved advantageous. They sent a letter to the users to raise concerns on the inefficiency of the administration and governance structures (see Box 4-10). The traditional leader elevated the matter to the project manager and head of the DSI.

Box 4-10: An extract of a letter the users sent to the sponsor



3. CHALLENGES

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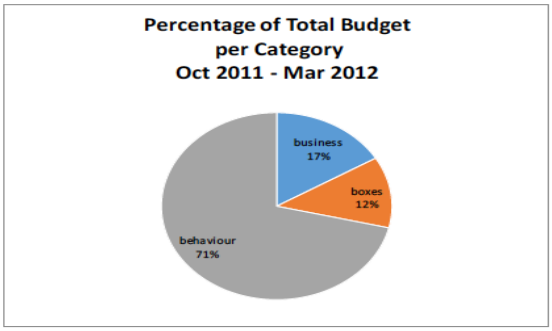
Interviewees viewed the scope change decision as an abuse of positional power which did not reflect the spirit of collaboration. The letter (see Box 4-10) demonstrated the users' concern and commitment to account for the project management's success or failure.

I asked the project manager for clarity on this matter. I needed to understand what had led to the unilateral decision. The response was that there were time pressures that did not allow convening a steering committee meeting; furthermore, the relationships with the users had degenerated due to lack of trust. In the response, the manager mentioned other projects where scope changes were affected without agreement with users. She mentioned that the "*steering committee discussions are muddied by hidden agendas and shifting goalposts*". She raised her frustration on how governance needed to acknowledge other platforms, e.g., a project management committee. This is an operational committee headed by the project manager. The steering committee had oversight over this committee and other project matters, e.g., additional financing and opportunities worth pursuing to operationalise the project.

The primary data suggested that participation in governance structures aligned with perceptions on project ownership (see Figure 4-1). The diverse stakeholders' views on who owned the project differed across the sample. Project 1 stakeholders demonstrated a sense of collective ownership. Project 1 documented the approach taken to ensure collective ownership of the project and its interviewees illustrated how its design and implementation encouraged ownership. The users were included in framing objectives (see Box 4-11).

Box 4-11: A Project 1 document excerpt



The **consultation with Cofimvaba** District Education led to the identification of AM SSS as the starting point for project actions extending to all the schools in the Nciba circuit. A **visioning workshop** was conducted with the principals, SGB members, educators and learners from the Nciba schools asking this fundamental question: **"What does the community look like when it is fixed?"** The participants presented their vision for the future and **identified 48 issues that needed to be addressed**. The visioning was followed by a **baseline survey of the main target area** around St Marks in Nciba circuit, dealing with the **analysis of capitals/resources** and the opinions of stakeholders. **Surveys** were then done with principals, educators, learners, traditional leaders and households. The focus was first on one individual school's eco-system and to develop the **school as the "centre of opportunity",** to take the local context and ambitions of the school into account and to establish a **"virtuous cycle" of development** as shown earlier in the document. It is evident that the **bulk of the investment** was in ***people mobilisation and collaborative design (71%)*** during this stage.

I queried the rationale for integrating the aspirations of the users and other community stakeholders in framing the vision and objectives of the project. The project manager reiterated that project purpose and design had to respond to the local context (see Box 4-11). It had to invest in strengthening existing and building new capabilities. The project manager elaborated that the project segregated users into different categories. The educators, learners, and school governing boards formed the primary users. Local enterprises, households, and the community comprised the secondary users. The segregation clarified decision-making authority, which was limited to the sponsor, project manager, and the primary users.

Project 1's design tracked changes in behaviour to sustain and transform agriculture and agro-processing in the Nciba Circuit. This activity was unique to the project in the research sample. The project manager justified this as an intervention to monitor transformative change. Project 1's temporary organisation held objectives that represented the priorities of the different stakeholders (see Box 4-11).

(iii) Context

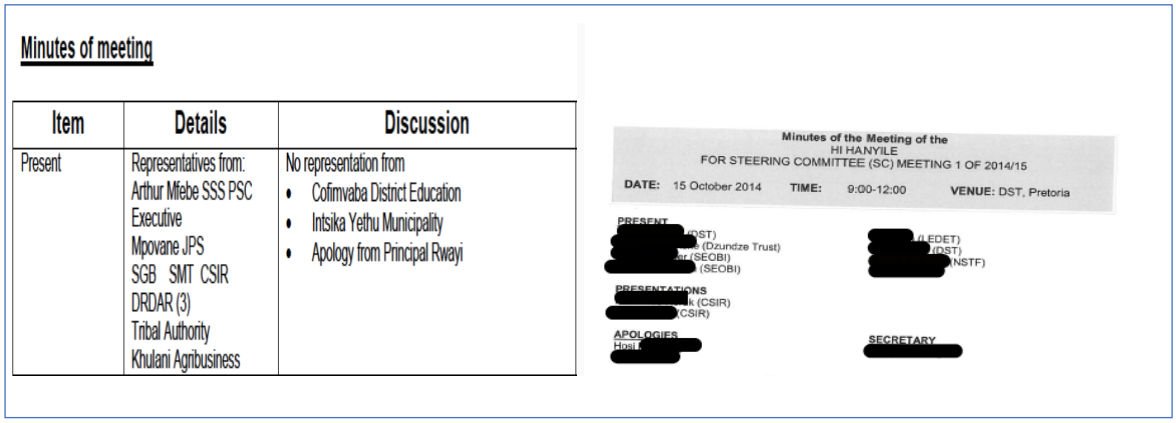
Interviewees implied that positional power and politics influenced decisions on the use of resources and the recruitment of labour. I observed that the steering committees for

Projects 1, 2, 4, and 5 incorporated participations of senior and respected members of their communities. By their positions and standing in their communities, these representatives held considerable power.

The steering committee for Project 1 incorporated traditional leaders who actively participated in overseeing and shaping the projects. Project 2 enjoyed the participation of the traditional leader who was also part of a community development trust. Project 4's representation included a traditional healer respected by the community for his role in development and social cohesion. These leaders harnessed their power to advance their community development goals.

The participation of traditional and community leaders as members of the steering committees might have strengthened the link with other community activities. Their inclusion was intended to serve the needs of the communities. For example, Projects 1, 2, and 4 incorporated aspects of community development. The traditional leaders were part of the Tribal Authorities in their localities. Their participation in steering committee meetings implied that, when required, the projects could draw from the input or support of the Tribal Authorities.

Box 4-12: Extracts of steering committee meetings illustrating participation of Tribal Authorities in Projects 1 and 2



Minutes of meeting

Item	Details	Discussion
Present	Representatives from: Arthur Mfebe SSS PSC Executive Mpovane JPS SGB SMT CSIR DRDAR (3) Tribal Authority Khulani Agribusiness	No representation from • Cofimvaba District Education • Intsika Yethu Municipality • Apology from Principal Rwayi

Minutes of the Meeting of the
HI HANYILE
FOR STEERING COMMITTEE (SC) MEETING 1 OF 2014/15
DATE: 15 October 2014 TIME: 9:00-12:00 VENUE: DST, Pretoria

PRESENT
(DST)
(Dzundze Trust)
(SEOBI)
(SEOBI)
(LEDET)
(DST)
(NSTF)

PRESENTATIONS
(CSIR)
(CSIR)

APOLOGIES

SECRETARY

Traditional leaders should be apolitical and support development, regardless of the political affiliation of participants. One interviewee indicated that their inclusion was a risk management activity. It secured their buy-in and participation in decision-making and it created safe spaces to alleviate their undue influences. Another interviewee indicated

that the participation of the apolitical leaders shielded the projects from political interference. She shared how interference in procurement and recruitment decisions delayed decision-making (see Appendix I).

The Project 5 steering committee incorporated membership of the local municipality to ensure their inclusion in the integrated development plan. The inclusion enabled the municipalities to support the project in line with their mandates, e.g., supply water, road infrastructure, making land available, among others. The municipalities assisted the projects with community facilitation to secure buy-in and gather feedback from the users. I noticed that, in some instances, the local municipality representatives did not consistently attend meetings which compromised progress on some activities. In Project 4, this delayed the municipality's responsiveness and affected the scope of Project 2's intention to establish a community processing facility.

One project manager advised that establishing a relationship with the local municipality extended beyond risk mitigation. It assisted to unlock process delays, e.g., permit applications. For example, Project 5 leveraged its relationship with the municipality to address user education challenges. The municipal Infrastructure Standing Committee was approached to fund user education as an important aspect of the technology demonstration. The project manager cautioned that political dynamics might compromise the relationship. He shared examples of how some officials were a risk to the project when they attempted to redirect its ward location to satisfy their political constituencies.

The relationships cultivated within the steering committee prioritised securing buy-in on project management. Project 1 demonstrated how it considered alignment and devised its scope to include support for other community development initiatives. It developed specific and measurable objectives to monitor the implementation of these support mechanisms. It executed its intention to locate the school as a catalyst for community development.

Project 5 was implemented a few months ahead of municipal elections. The timing of implementation was risk-laden, e.g., project management challenges could be used as political ammunition. Its implementation was parallel to that of the Municipal Sanitation

Backlog Elimination Programme. The technology demonstration deployed different sanitation units to those implemented through the backlog elimination intervention. These differences caused confusion and tension.

Project 5 garnered the support of the municipality and used local media and community engagements to communicate that it was not a sanitation service delivery roll-out project (see Box 4-13). During the demonstration of the technology, it amended the design of the toilets according to feedback from the participating households. It updated the steering community and community development platforms on the progress and challenges. It used these structures to secure additional resources, e.g., the municipality funded unforeseen activities that posed risks to implementation.

Box 4-13: Extracts of Project 1 and 5 showing alignment with other community development initiatives and clarifying their objectives

Below are the details of the bulk of community engagement in Tech4RIED:

Community engagement activity	Details
Lucerne farmers	Discussions with lucerne farmers, survey of their needs and feedback session on the way forward. 26 farmers Land allocation formalisation for this with the Chief. Business plan for 600 ha of lucerne. Off-take agreement from Aldarah SA. Funding for the start-up sought but not found yet.
Agribusiness for learners ABL1	Inclusion of community teams in ABL1 for: • Piggery (17 people) • Chickens (10 people) • Crops (2 teams with total of 8 people involved)
ABL and other schools	Attendance of the ABL start-up by Gando, St Marks and Mpovane schools (7 people)
School garden development support	Direct engagement with Gando (4 members), St Marks (5 members), Mpovane 6 members), Bangilizwe (3 members) and Siyabalala (2 members) to assist with preparing ABL plans for school gardens involving teachers and school garden teams. A number of facilitation sessions with these schools, were done, ABL loaded on tablets Assistance with the completion of the details. We stopped because we ended up with no time to do this on the subsequent visits. The schools did not respond to the offer of emailing and getting written support.
Mpovane garden team support	Ongoing support of [redacted] and the school gardening team at Mpovane.
Community inclusion in ABL2	Two community teams in ABL2. (2 members and 4 members) One community team for the groundnuts. (2 members)
NARYSEC candidate assistance	Assisting [redacted] with his home garden and drawing him in to ABL 2 on condition he does a plan for his home garden and St Marks.
Other irrigation schemes overview	Site visit with [redacted] and engagement with local stakeholders there to judge potential for expansion.
DICLA maize initiative	Field visits and engagement with participants on the Dicla initiative of planting maize and exploration of the implications of this initiative
External initiatives	Site visit to the Catholic school in Tsomo and the proposed Tsomo hydroponics project. Due diligence on the hydroponics business plan and seeking potential sources of funding. Cooperative with 8 members

THE REPRESENTATIVE 4 December 2015 3

New toilets to be tested

By Abongile Balinbwa

TWO hundred environmentally friendly sample toilets have been distributed in the Chris Hani district by the South African Sanitation Technology Demonstration Programme (SASTEP).

The toilets, which were manufactured in China and designed in North America, were funded by the Bill and Melinda Gates Foundation and will be installed in Ilinge.

Water Research Commission assistant research manager Stuart Woolley said SASTEP was an initiative to test the latest cutting-edge sanitation solutions in real world environments.

This platform afforded new technologies the opportunity to prove themselves while being continuously assessed and evaluated for the feasibility of widespread use and commercialisation. Chris Hani District Municipality executive mayor Mongameli Koyo received a demonstration from Woolley on how the equipment operated.

Woolley said the Earth Auger model was an affordable urine-diverting dry toilet that had functional and user-friendly features designed to increase the acceptability of dry sanitation.

The model, which required no water or energy, accommodated both high-density and rural communities, with the ability to fit the financial constraints of low-income residences. "The Earth Auger offers solutions for rural households as well as rural schools and clinics which do not have access to a reliable water supply. The advantages it offers are doing away with deep pit toilets and associated pit toilet emptying, as well as all the other issues of detergents etc."

The toilets were hygienic and safe and dry material could be used as compost and soil conditioner. The Earth Auger currently costs around R2 000 per model which excludes the superstructure, but the cost of the superstructure is reduced as no pit need to be dug.

During demonstration trials, the new technology model will be evaluated over a six month period in order to establish the performance of the equipment. "Business opportunities for entrepreneurs and employment will be availed through implementation of the technologies."

He said the project had proved successful in South America, adding that if it succeeded a factory would be opened to manufacture the units in South Africa. The Chris Hani district is the first testing site in the country.

TOILET PROJECT: Chris Hani District mayor Mxolisi Koyo is shown a sample toilet by assistant research manager Stuart Woolley of the South African Sanitation technology demonstration programme

Picture: ABONGILE SOLUNDWANA

The publication of the article clarified the objectives of the project (see Box 4-13). The project met the number of units deployed. However, the users later rejected the

deployed units citing difficulty in maintaining them. Some users requested replacement with the ventilated pit latrine. This request, coupled with other challenges, demotivated the municipality to consider the two technologies when rolling-out sanitation services.

(iv) Requisite competencies

Interviewees pointed out that the requisite techniques to execute innovation for inclusive development projects were not always known. This ambiguity can manifest itself in a disconnection between selected methods and project objectives (see Section 4.1.2, Figure 4-1). Some interviewees insinuated that project managers disregarded collective decision-making when considering appropriate methods and tools. Others alluded to the project manager's ignorance of the users' capabilities and knowledge.

The users added that project managers were not willing to learn from them and that this disregard robbed the project managers of opportunities to learn from them. One user expanded that

> *Project managers failed to recognise indigenous conservation practices. Even when we suggested combining their proposed method with our existing practices he refused. He claimed their proposal was scientific and technically valid. Who says our ways are not scientific? Why do they fail to recognise indigenous knowledge? We have been using it for ages and it has not failed us.*

Another user claimed:

> *The project manager refused to consider a method I developed to extract more essential oils from the plants. I admit I had not tested it, but the smell and colour of the oils were stronger with my method than that one from Pretoria. He could have at least allowed us to test the oils to confirm whether I was right or wrong. He just dismissed me. That was painful and rude.*

I enquired how the project managers would know about the users' existing capabilities. Interviewees for Project 1 shared an example of a skills audit undertaken to identify existing capabilities and skills gaps in respect to the project. Some users expressed

their discontent on how project managers imposed forms of organising that did not comply with their norms. They claimed that a good project manager would invest in understanding the socio-economic profile of the context. They elaborated that this understanding would assist the project manager to avoid inappropriate approaches. They would recognise users as partners and engage users in selecting requisite methods.

Many interviewees suggested that creativity was required to manage innovation for inclusive development projects. I detected differences in how they approached project management across the research sample. The skills, experience, and creativity of the project manager might have caused these differences. Projects 1 and 2 ventured into other disciplines to empower and enrich their management. Their management approach attempted to be collaborative, and cooperation based.

Projects 3 and 5's execution followed conventional top-down project management approaches. One interviewee argued that "*the sponsor and project manager claim their commitment to inclusive development. They forget it during the project management. Their actions denounce commitment to doing things with the users and not for the users*". Another shared that:

> *The project manager's know it all attitude annoys me. He does not listen to anyone else except the department and himself. It is impossible to suggest alternative solutions to him. When you do that, he becomes defensive. What do we do except to be patient?*

The diverse and multidimensional changes expected by the stakeholders allude to the core competencies of the project managers. They must be flexible and function efficiently with multidisciplinary teams. For example, Project 1 incorporated teachers, agricultural scientists, and social scientists. The project manager worked with these different disciplines to deliver the project. Stakeholders expected project managers to be good communicators and enforce timely and equal access to project management information. I noted that not all projects exploited social media as a means for real-time communication for teams spread across the provinces.

I concede that complex projects are unique and what works in one instance may fail elsewhere. However, based on the data of this project, I contend that the experience of managing complex innovation for inclusive development projects is invaluable. It is a reference for what does or does not work. It offers lessons on how to work with diverse teams and understand the context and its influence. It improves the awareness of features of complexity and their implications for project management.

(v) Novelty of the technology

The case study sample comprised projects harnessing science, technology, and innovation to achieve inclusive development. Technology was a core focus area across the research sample. The novelty of the technology created various risks. The sponsor, researchers, project management personnel, and the users were concerned with whether the technologies would succeed in the rural contexts.

Users communicated that their concerns included whether they would be able to operate the technologies on their own. Some questioned the design and selection of the technologies, indicating that the projects should have accommodated locally developed solutions. Others contended that the novelty implied non-alignment with local value chains. Interviewees shared how the non-availability of certain goods in local value chains delayed the scheduled implementation of some activities. One shared how "*for almost a month we stopped work. We had to wait for someone from Pretoria to come and fix the machine*". Another concurred that "*they did not think this thing through properly. The ash for the toilets is not available here. If something breaks, there is no way to fix it*".

The primary data collection indicated a fear of failure which, in understanding the technology, might have affected their participation. In Project 2, the more familiar some became with operating the technology, the more confident they became. The familiarity was not only based on the training, but improved by investing time in understanding the technology – which included how it works, why it works that way, and troubleshooting.

In one focus group discussion, I observed the undeclared superiority of some individuals due to their familiarity with the technology. One interviewee responded to a question of clarity I asked by saying "*only he knows the technology more than any of us. He hides information to make himself superior. Things stop if there is a problem when he is not around to fix it".*

4.3 Aggregate Dimensions

The 1st order concepts and 2nd order themes were considered in ascertaining the aggregate dimensions (see Figure 4-1). Based on the data analysis, five aggregate dimensions emerged. These dimensions represent how features of complexity influence the organisation of the management of innovation for inclusive development projects.

The five aggregate dimensions are:

- Multidimensional transformative change. This dimension arises from the collaboration of distinct stakeholders driven by individual needs to participate in the project. The collective change the project pursues is multidimensional.
- Responsive and inclusive leadership. This dimension recognises the plurality of the stakeholders in the formation, administration, and operations of the temporary project organisation.
- Flexibility. This dimension focuses on the influence of the context on project management.
- Learning and continuous improvement. This dimension acknowledges uncertainty in skills and methods for the successful delivery of the project.
- Technology fitness-for-purpose. This dimension focuses on how the technology is appropriate for the project and its context.

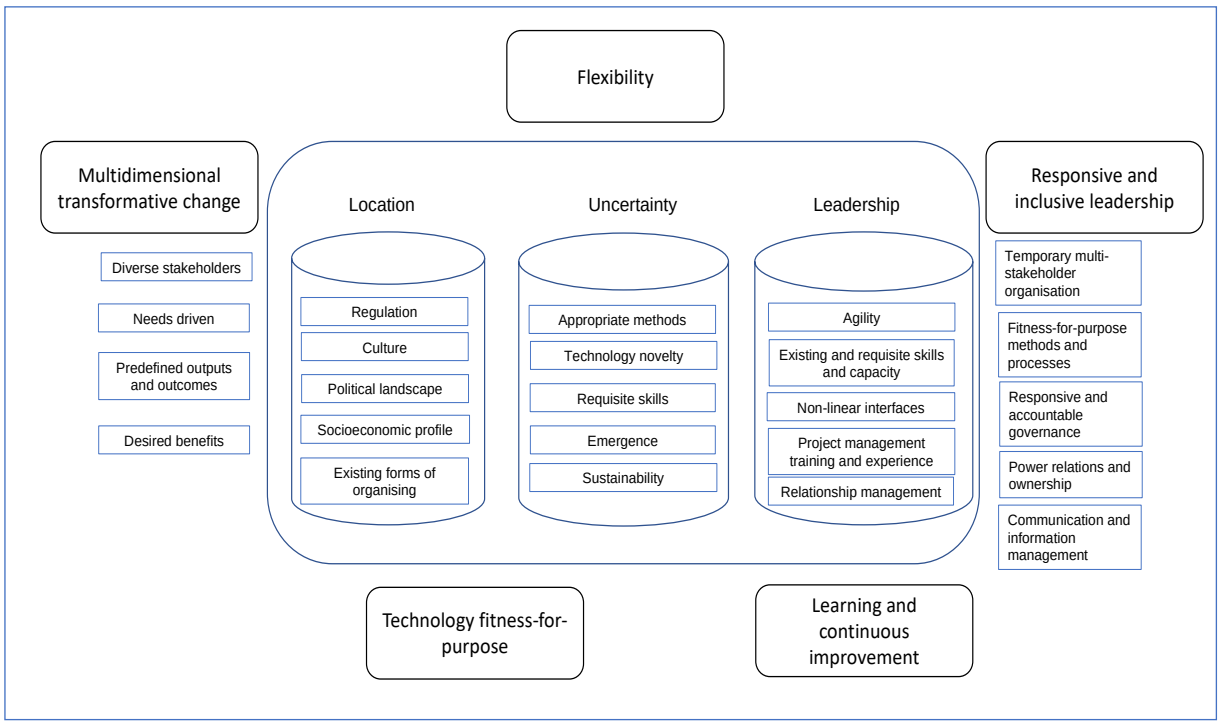


Figure 4-2: Aggregate dimensions arising from 1st order concepts and 2nd order themes

(i) Multidimensional transformational change

The first aggregate dimension is multidimensional transformative change. It is concerned with the joint purpose and objectives of the project. How the transformative change is negotiated and agreed to, despite the stakeholders' unique agendas and intended benefits, is a factor that influences the organisation of complex project management.

Its influence expresses itself in the scope of the project and terms of reference of the governance structure, i.e., the project steering committee. It influences the recruitment and deployment of human resources. The multidimensional transformative change influences the selection of measures of performance to assess project management.

Interviewees accepted that participation in project management was transformative in different ways and led to the emergence of new behaviours. It was beyond the conversion of inputs to outputs but included social aspects such as the creation of new capabilities amongst all stakeholders, development of new processes, development

of new infrastructure, among others. This change is associated with distinct but complementary benefits and value for each primary stakeholder that collaborated in the project and its management.

The commitment to the transformative change may have enabled the stakeholders to maintain their collaboration in project management when unpredicted change and unfavourable circumstances occurred. For example, Projects 2 and 4 had, at various points, been subjected to administrative delays that impacted available funds to pay wages (see Box 4-14).

Box 4-14: An example of an evaluation report stating the transformative change delivered by Project 1

Kleine observed the following achievements in the **TECH4RIED** initiative (quoted from her report):

1) The practice-based ABL learning represents a key paradigm shift towards a) practical, b) business-orientated and c) team-based learning. This stands in stark contrast to dry textbook learning and results in much greater likelihood of uptake of agricultural practice by learners. The learners spoke enthusiastically about their learning and very positively about these opportunities. Most learners are keen to now apply what they have learned and some have concrete plans. **(Educational, Information, Psychological resources improved)**.
2) The outside learning fields are a very visible sign of a positive transformation at the school which members of the community also remarked upon. The environment is conducive, with good soil and a functioning irrigation scheme. The fields can be a source of pride for learners and educators and broadcast the ambition of AMSSS to be a leading school of agriculture **(Dialogue/Engagement)**. They also help to demonstrate to learners (and potential farmers in the community) the opportunities of what **can be done with the good soil and comparatively easy water access (Material resources improved; demonstrating Geographical and Material resources).**
3) Learners found the training by the CSIR contractor on time management and business plans demanding yet they felt that they had learned a lot and had gained a mentor **(Educational, Social resources, Information, Psychological resources improved)**.

Many interviewees highlighted that there were benefits gained through participating in project management. I, however, observed that not all project management documents specified expected benefits. Project 1 captured the benefits gained through its implementation (see Box 4-14). The tendency to not document the expected benefits might have compromised the extent to which they could monitor their achievement.

Some interviewees suggested that stakeholders should develop a benefits realisation matrix for each project. The matrix could be broad to accommodate lessons learnt, capacities developed or strengthened, and policy influences. It could be inclusive of the sponsor, the users, and project management personnel.

The primary and secondary data showed that, although the concerns of the sponsor, users, and project management teams were broadly similar, there were discrepancies that might have influenced how they engaged and participated in project management. For example, the sponsor's concern on the uniqueness of the project was associated with potential value for money, risk of failure, and sustainability. The users' concerns on the uniqueness of the project appeared to be mainly on its fitness-for-purpose, its alignment and contribution to strengthening local value chains.

The analysis of the primary and secondary data revealed that, despite the uniqueness of each complex project, some common factors and interests influence how organisations organise for complex project management (see Figure 4-2). The factors demonstrated in Figure 4-2 are not exhaustive as it is possible that, with further research, more may be identified.

I assert that the plurality of stakeholders in a complex project is one of the first factors influencing the organisation of project management. These various stakeholders have specific needs, expectations, and intended benefits from the project and its management. Each project is motivated by a desire to deliver change which some of the interviewees expressed as transformative. The transformative change may, therefore, be expressed as objectives and benefits of the complex project and as such, failure to attain consensus in this regard has dire project management consequences.

Consensus on project objectives is key as it may signify the different stakeholders commitment to partnerships in project management, e.g., governance and oversight responsibilities. The consensus interconnects the individual agendas of the different stakeholders and as such, reinforces their interdependency. The consensus on project objectives recognises their interrelatedness and confirms the stakeholders' coalition on the project and as such, influences the development and approval of the project management plan.

The consensus is an end to an intricate process characterised by negotiation amongst major stakeholders. It is therefore critical for the finalisation of the project charter, which informs the project management plan. Consensus on the project objectives confirms agreement amongst the stakeholders on the desired transformative change

(see Figure 4-2). Based on this research, agreement on the transformative change influences decisions in the allocation and deployment of human, financial and other resources, selection of measures of performance and their associated KPIs, among others.

Consideration of the context and stakeholder intentions influenced the consensus on project objectives and the intended transformative change. I observed inconsistencies in how objectives were documented across the projects sampled in this research. In some instances, the objectives were stated in a specific and measurable manner and demonstrated consideration of the context of the project. For example, one objective was stated as: "*to establish an SMME* [small, medium, micro-enterprise] *with a minimum of 30 hectares of rose geranium*". The project would provide a steam distillation factory to extract the oil from the plants.

Another objective was stated as "*to investigate the systemic innovation needed to address educational performance and inclusive economic growth; fund technology-intensive innovation and initiate links between in-school and out-of-school activities to enhance the agricultural, economic and social welfare of the surrounding communities".* This objective statement is broad, not specific, and not measurable. It is open to different interpretations and possible disputes on whether the desired outputs and performance have been achieved. For example, it is not quantifiable, e.g., the number of technology-intensive innovations funded neither the number and type of in-school nor of out-of-school activities that would be targeted.

(ii) Responsive and inclusive leadership

The temporary organisation may offer a space for the different stakeholders to engage as equals and as such, requires that its governance be responsive and inclusive. The temporary organisation requires responsiveness to recognise the strengths and weaknesses of the collective and existing capabilities for the benefit of project management. For example, the primary data highlighted that, in some instances, based on their knowledge of the project context, the users influenced the definition and execution of project activities. The users advised on relevant community engagement platforms for the project.

The composition of each complex project is primarily defined by the diverse stakeholders who originate from different organisations with different cultures and values, with a bias towards certain work organisation systems and processes. These diverse stakeholders unite in a temporary organisation, whose culture, values, and means of engagement emerge from interactions. The culture, values, and essentially the identity of the temporary organisation should emerge in line with the context of the project.

Despite not being a legal entity, the governance of the temporary organisation must appear to pursue compliance with good practice. The governance must be responsive to the complexity arising from interconnected, interdependent, and non-linear interactions during project management. It must ensure collective accountability amidst instances of uncertainty in project management.

The perceptive project manager encourages the different stakeholders to recognise that the temporary organisation is a complex system and project management must respond appropriately. In so doing, it becomes possible for all in the temporary organisation to collectively identify and consider attributes or features of complexity in project management. There was no evidence of any complexity model applied across the project sample.

The interviewees of this research highlighted the role and influence of the project manager on the successful management of complex projects. The project manager's leadership of project management is multifaceted and extends beyond the development, execution, monitoring, and conclusion of the project management plan. The research highlighted the role of the project manager as a leader of the temporary project organisation, with a focus on managing relationships with stakeholders in the project's context.

(iii) Flexibility

The context is a composite of the location (e.g., regulation, cultural, socio-economic, and political factors). I observed that of the five sampled projects, Projects 1, 2, and 4 considered different forms of complexity that influenced the project management

process. These projects incorporated development issues in their contexts. They sought alignment with other development initiatives and local value chains to sustain themselves post DSI exit. Their development orientation influenced the selection of skills transfer and they included and allocated project management responsibilities to the users.

The accountability for project management success or failure was shared between the project management personnel and the users. They led certain aspects of complexity and risk management, e.g., community leaders engaged Tribal Authorities on the progress of projects. The traditional leadership intervened in Project 1 when the users attempted to change the scope of the project. The local municipality collaborated with Project 5 to manage the risk of the community's rejection of the sanitation demonstration technologies.

Projects 1, 2, and 4 considered forms of organising within the users' communities. This empowered them to align with other initiatives in a way appropriate for the context. The understanding of the context permitted the project managers to assess interconnected activities. For example, Project 1 designed activities that supported and benefitted from other government-funded initiatives. Project 1 provided training to beneficiaries of other projects and created a learnership opportunity for a beneficiary of the National Rural Youth Service Corps (NARYSEC). NARYSEC is a flagship skills development targeting rural youth as part of economic inclusion and transformation. Project 1 partnered with local businesses to mentor learners in agribusiness.

Identifying the interfaces with other activities enabled stakeholders to identify interactions and predict the possible emergence of new behaviours during the project management (Cicmil et al., 2009; Dao et al., 2016; International Centre for Complex Project Management, 2011). Project 1 responded to the needs of other government and non-government-funded initiatives in its context. It supported farmers, school gardens, and the community. This consideration was strategic for the operationalisation and sustainability of the project.

Projects 1, 2, and 4 considered existing capabilities, development priorities, and the political landscape of their contexts. Project 3 did not provide this evidence. It was

designed as a research project responding to the conservation of the wild ginger species. It did not provide evidence of building the capacity of users to propagate and sustainably harvest the plant with multiple healing properties. Project 5 constrained itself to the technology demonstration to support service delivery.

The influence of the context across the five projects might be witnessed in how they designed and administered governance. This could have influenced how users were allocated and held accountable for project management. For example, users in Projects 1 and 2 were involved in governance, administration, and influenced decision-making. Project 4 users participated in governance and supported the research activities of the project. The design of the implementation approach was influenced by the project objectives and the context of the project.

Project 2 shared how its context influenced compliance with public employment programmes' demographic targeting. The principles of fairness, transparency, and ethics informed the compliance. All projects were expected to allocate work opportunities in line with the targets of 55% women, 55% youth, and 2% persons with disabilities. Project 2 could not meet the youth target and as such, compensated by adjusting the quotas for women and persons with disabilities. The poor interest of the local youth to participate in agricultural projects motivated the adjustment.

The projects' interface with their contexts influenced the recruitment of labourers, deployment of users in project management, and capacity building opportunities. The projects' response to their contexts demanded flexibility when responding to cultural dynamics and political interference. Interviewees shared how interference from ward councillors and traditional leaders affected the recruitment and deployment of personnel.

In one instance, younger workers were paired with an elderly supervisor as part of succession planning. This decision was intended to enhance collaboration between the users amidst perceptions of patriarchy and favouritism. This was unfortunate and regressive since it had considerable negative implications on project management efficiencies and accountability.

The projects indicated how flexibility minimised disruptions from other stakeholders in their contexts. The compliance with the 30% local procurement determination was a challenge for some projects as local suppliers were not readily available. To avoid non-compliance, stakeholders collectively acknowledged persisting limitations, e.g., inadequate technical skills and non-availability of materials in existing value chains. They identified alternative mechanisms to achieve the 30% specification.

The contexts of the projects were fluid and their influence on the projects were not predictable. The projects were sensitive to issues in the contexts, e.g., changes in power dynamics, individuals attempting to exploit the projects for their political aspirations, among others. These issues required flexibility and openness to change.

Projects 1, 2, and 4 demonstrated how the projects had attempted to combine technology, local economic development, and change behaviours. Despite not being explicit in classifying various types of complexity, I argue that their design and organising considered social (number and diversity of stakeholders collaborating in the project), technical (technology), and task complexity.

(iv) Learning and continuous improvement

I observed that there were variations in the professional composition of the project management teams. For example, Projects 1 and 2 teams were transdisciplinary in that they comprised of experts from natural, social and information technology. Project 2 transitioned from purely natural scientists to include economists and people with development expertise during implementation. The transdisciplinary teams were diverse in technical skills and experience in development projects.

One interviewee expressed that his project team's transdisciplinary nature facilitated openness to learning and continuous improvement. He proudly stated that:

> *having social scientists and development practitioners in the team helped us. It made us more sensitive to the social and behavioural aspects of the project. It allowed us to ensure the technology responded to the socio-economic profile and not dictate to it. This was a valuable lesson for me.*

He elaborated that the multidisciplinary team facilitated cross-pollinating ideas. It enhanced the potential to craft holistic and responsive project management plans.

Projects 3, 4 and 5 were interdisciplinary as they comprised of personnel from two or more related natural sciences disciplines. They consisted of technical experts of disciplines relevant to project objectives. For example, Project 3 personnel were mainly life or biological science researchers. Project 5 consisted of researchers in the water and sanitation sector. The participation of narrow disciplines might have constrained the creativity and adaptability of these projects. The project management documents revealed that these two projects focused on and were implemented in line with their disciplines. They did not venture into other aspects such as community and enterprise development.

The complexity of each project and unknown unknowns implied that requisite methods might be unknown or did not exist. Project 1 and 2 demonstrated creativity in drawing from other disciplines and techniques. The project managers insisted that flexibility and openness to learning were critical as the meticulous application of one project management framework or body of knowledge to manage complex projects might limit agility and creativity. One project manager shared that applying systems thinking in the design of Project 1 provided invaluable lessons. Its benefits included collective framing of objectives, outputs, and measures of performance.

Project 1 applied a Living Lab method to project implementation. This approach ensured “a participatory response catering for user-driven, open innovation within complex real-life, rural and urban settings”. The Outcomes Mapping Monitoring and Evaluation framework strengthened the application of the Living Labs approach. It informed both the intentional design and the adjustments made during the project (DSI, 2015). Project 1 customised the monitoring and evaluation framework based on its objectives.

I noted that not all the project managers demonstrated the use of enterprise-level project management guiding frameworks, basic methods, and tools. In the absence of these, they executed their responsibility according to their experience, training, and interests. Despite identifying risk management as critical, not all project management

plans approached it with vigour. Some documents documented specific risks without monitoring them throughout. The interviewees felt that scope management was one of the most critical activities.

The absence of project management guidelines in the temporary organisation meant that the scope change processes were not clearly defined. There were variations in how they were dealt with. The absence of organisational guiding frameworks led to differences in how the project management was approached. It created a variation on how collaboration and engagements with project users were recognised and executed. This collaboration was critical for the agency and the voice of users as they were recipients of project outputs. They were not funders of these projects, although they benefitted from their outputs.

The variation in the engagement of the users was demonstrated across the research sample projects based on their involvement in governance (e.g., steering committee meetings), allocation of project management (e.g., supervisory responsibility for certain work packages) and as workers. How users were perceived by the project manager influenced how they participated in project management.

The variations in project management emphasised the role of the project manager's skills and experience in the management of complex projects. Despite complex projects being unique, they shared similarities in that they had multiple diverse stakeholders and they were characterised by interconnected and interdependent activities, whose outcome might be uncertain. In this regard, the role and competency of the project management team to recognise the complexity of a project and design project management to respond accordingly, cannot be underestimated.

I concur with the interviewees that, to improve the management of complex projects, training and access to research and tools are crucial. Some interviewees indicated that there were not many options for formal training and certification in complex project management training in South Africa. I agree with Sewchurran et al. (2010) that lack of access to contemporary complex project knowledge might perpetuate the use of the existing deterministic and linear approaches.

(v) Technology fitness-for-purpose

The projects sampled in this research were technology diffusion and transfer projects. In the absence of guiding project management frameworks, I also observed that some of the project managers had prioritised technology over other factors in how they organised for project management. For example, the project managers for Projects 4 and 5 were technical experts and as such, how they structured project activities and the tools and systems they employed, were influenced by their technical expertise.

The ease to understand and operating the technology aligned with the interviewees' perceptions on its appropriateness for the context. Interviewees raised the level of difficulty to maintain technology as a concern. Interviewees linked the maintenance and servicing with empowering local value chains. If no parts were locally made available, the risk of depending on external parties to operate the technology increased.

A frequency of mention analysis revealed that these projects prioritised technical complexity, i.e., the complexity in the technical or design aspect of the project (Box 4-15). The project management documentation, including minutes and progress reports, exposed likely prioritisation of the technology dimension over other aspects. The technology dimension was concerned with the performance of the technology, productivity optimisation and compliance with industry standards where applicable.

Box 4-15: An illustration of the extent of prioritisation of complexity by the project management personnel in line with the complexity framework by Baccarini (1996)

Technology is an aspect of innovation for inclusive development projects. Yet, it must be considered in tandem with other aspects, e.g. skills, quality of products, maintenance efficiencies, etc. When it is over-emphasised or enjoys bias, other priorities might be compromised (Box 4-15). These include socio-economic development objectives and participatory project management that are inclusive of all stakeholders. The bias towards technical complexity might have been at the expense of recognising and responding to the social complexity of the project management process and the temporal and structural complexity of the project (Box 4-15).

The bias is a cause for concern, considering how complexity attributes influence and inform decision-making, nature and the level of stakeholder participation in project management, as stated by Baccarini (1996). This research revealed that complexity attributes of the plurality of stakeholders, the project context, technology and skills of the project management team affect project management. The research further indicated variation in the inclusion of users in governance structures and their deployment to perform specified project management responsibilities. The latter built the users' capacity and were critical for the operationalisation of the project as a viable enterprise, where applicable. Projects 3 and 5 could have built the capacity of the users to be able to secure other employment opportunities post project closure.

The bias towards technological complexity was evident in how Projects 4 and 5 were not able to appreciate and respond to the structural and temporal complexity of the project organisation. The structural and temporal aspects include recognising the number and interconnectedness and interfaces amongst the various structural elements and the uncertainty in the project context. This bias towards technical complexity (Box 4.15) aligns with my observations on how the organisation of the temporary project organisation varied across the five projects sampled.

Baccarini (1996) asserted that complexity should be duly considered as it influences the identification, selection and allocation of required resources and capacities for the efficient functioning of the temporary project organisation. Furthermore, the extent of complexity that project management has to respond to ultimately affects the overall resource requirements, e.g. cost and time for the project.

Although it cannot be claimed that there was a balance between technological and organisational complexity in Projects 1, 2 and 4, the primary and secondary data indicates that they considered and to some extent influenced the project management process. This actual observation aligns with Baccarini (1996) who states that complexity influences the selection of the appropriate project management organisation form.

The project management personnel involved in these projects are generally technology developers or experts in technical fields relevant to the technologies being demonstrated, transferred or researched. These observations may be part of the reason for much focus being placed on ensuring that the technology can perform in line with its design. In prioritising technical complexity, some of the projects, e.g. Projects 4 and 5, were not able to utilise existing local skills and capacities.

The technical bias was observable in Projects 3 and 5. Both focused on technology over other aspects. Project 5 underestimated the interfaces between project management and the socio-political factors in the project context. Despite using the media to clarify itself as a technology demonstration rather than a service delivery roll-out initiative, it encountered context-related challenges.

Project 5 invested in social facilitation to engage the community in the technology demonstration. The facilitation assured Project 5 of community buy-in conditional on certain terms, e.g. visits to other areas where the technologies were successfully demonstrated. Despite the prior technical performance reports of the technology, it failed to demonstrate its fitness-for-purpose and appropriateness for a rural context as an off-grid sanitation solution.

Its operation required additional fixtures that were not immediately available at the locality. The households experienced difficulties with accepting the dry sanitation option and did not have access to the dry sawdust and ash required to operate and maintain them. The users indicated that the sanitation facility challenged certain cultural norms, e.g. dry material storage. A site visit report highlighted that different views on the appropriateness of the technology and the fact that it was worse than other solutions, compounded the difficulties in the projects. The report indicated that

some users felt that the technology was taking them back to the apartheid era where the undignified bucket system prevailed.

Noting the performance of projects within the research sample, one of the critical observations is that technical specialists are not necessarily competent project managers. In this regard, human resource deployment for the management of complex projects must incorporate a balance between technical expertise and appropriately skilled and professional project management personnel, with the ability to manage complex projects.

4.4 Conclusion

The 1st-order concepts classification revealed complexity features documented as 2nd-order themes. The aggregate dimensions (see Figure 4-2) revealed the following:

- The plurality of stakeholders influenced decision-making processes. The stakeholders' agreement on the objectives directed the project plan and the allocation of resources to execute it. The objectives were multidimensional in attempting to respond to the needs of the different stakeholders. They were structured to meet policy imperatives and technology aspirations of the sponsor and development priorities of the users. The multidimensional nature of the objectives indicated the desired transformative change each project was expected to deliver.

- Responsive and inclusive leadership approaches adopted by some of the projects enhanced collective ownership and accountability for project management performance. The leadership approach might have affected the efficiency of the temporary multi-stakeholder project organisation.

- The influence of the context required project management to be flexible and quick to identify and respond to change. The context influenced governance arrangements, e.g., inclusion of traditional, political, and other appropriate community leaders in the decision-making steering committees. The project management approach had to consider the socio-economic, political, and

environmental profile of its context. The project management design, execution, and evaluation had to respond and be appropriate for the context.

- The requisite skills to manage the innovative for inclusive development projects were broad. They might be best executed and managed by transdisciplinary project management teams. The complexity of technologies, stakeholders, and the contexts of these projects motivated practitioners to be able to function in chaotic, ambiguous, and fluid settings. The experience and complexity orientation of the project manager influenced how the stakeholders responded to unpredictable change.

- The novelty of the technology influenced how the project organised itself to evaluate and assure the fitness-for-purpose of the technology. The effort had to consider that the technology was but one element of the innovation for inclusive development projects. Project management failures might arise from social and political aspects. The former is critical as project management is increasingly being recognised as a social phenomenon. The technology focus had to be in combination with the broader context.

The aggregate dimensions indicate how an organisation identifies and interprets complexity and it influences how it organises the management of innovation for inclusive development projects. I observed that these dimensions informed the measures of performance used by stakeholders to assess project management. The next chapter presents findings on the measures of performance that might be considered to expand the iron triangle.

FINDINGS (PART II): MEASURES OF PERFORMANCE TO EXPAND THE IRON TRIANGLE IN ASSESSING COMPLEX PROJECT MANAGEMENT

4.5 Introduction

Researchers acknowledge that the iron triangle measures are inadequate to assess the performance of complex project management. In this chapter, I draw from my research to propose relevant measures of performance to expand the iron triangle. I describe measures of performance as a set of criteria or dimensions selected to direct the evaluation of the progress, quality, and efficiency of project management that guide the collection of verifiable data for decision-making purposes (Diez-Silva et al., 2013). The decisions include the sequencing of project activities, risk management, among others. Each measure of performance could have one or more KPIs; for example, the human resources management measure is assessable through individual and team performance and development (Shenhar & Dvir, 2007).

I contend that existing performance evaluation frameworks view the project either as a production function or an agency to allocate, use, and manage resources (Association of Project Management, 2006; Cicmil & Hodgson, 2006; De Witt, 1988; Kerzner, 2003; Project Management Institute, 2004; Turner & Müller, 2003; Wideman, 2000). This view limits the evaluation of project management performance to delivery on time, within cost, and in compliance with scope and quality specifications. It disregards the social aspect of project management and underscores the influence of the context and regulatory compliance aspects.

My research used the five case studies to generate a measure of performance framework to expand the iron triangle. I propose more measures of performance based on the project as a temporary organisation (see Figure 4-3). I contend that the temporary organisation perspective is comprehensive and recognises project management as a human endeavour empowered with financial, technological, and other resources to produce goods or services. The organisation uses resources, processes, and tools to realise the specified project. The specifications incorporate

quality and quantity aspects. All projects in my research integrated technology as part of the scope specifications.

The temporary organisation exists in a particular context, which influences its performance. The context features include legislation and sectoral strategies. How the organisation recognises risks, fluidity, and uncertainty influence the efficiency of its response to the context. The temporary organisation creates systems and processes to govern, communicate, and achieve its objectives. Such a system enables it to comply with good governance requirements.

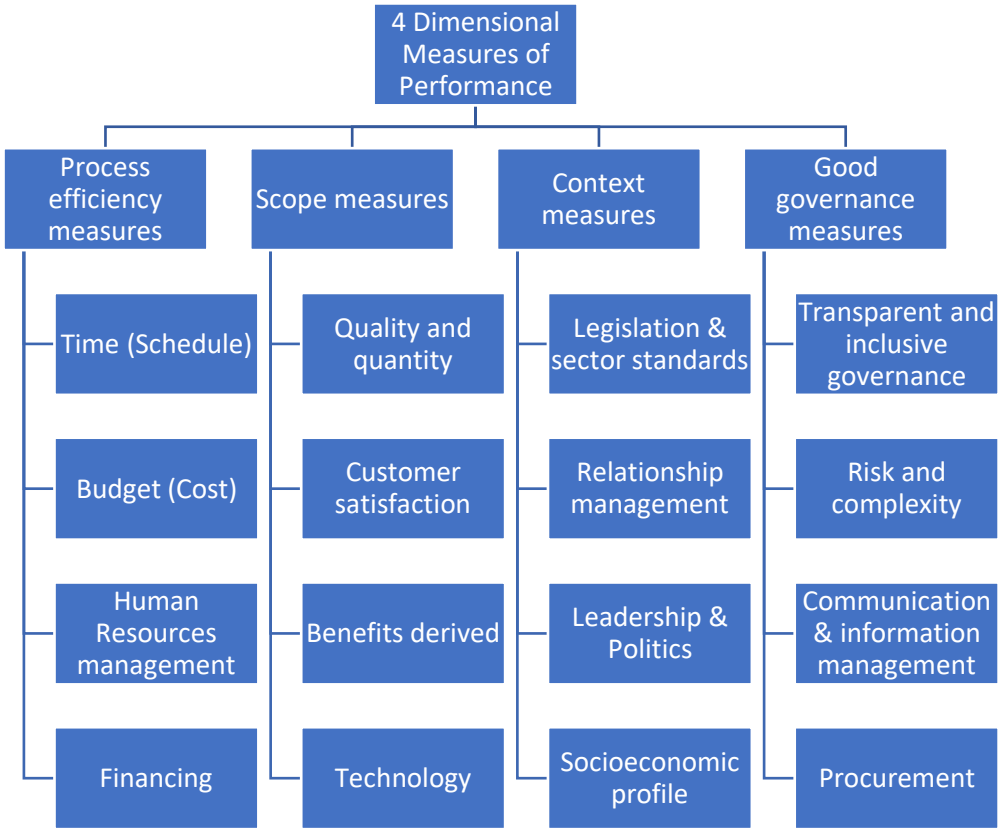


Figure 4-3: The proposed measures of performance to expand the iron triangle to assess the management of complex innovation for inclusive development projects

Figure 4-3 depicts my proposal of a four-dimensional measure of performance approach. I classified the measures of performance based on four categories, namely (i) process efficiency, (ii) scope, (iii) context, and (iv) good governance. The process measures are concerned with the efficiencies in resource allocation and use. The scope measures focus on the performance based on quality and quantity specifications. I added customer satisfaction, benefits derived, and technology as part of this dimension and detailed the motivation for this in the relevant section. There are interfaces and interconnections amongst the four dimensions.

The temporary organisation exists in a particular context. I concur with the interviewees that the context influences the success or failure of project management. Good governance measures relate to the administration and management of the temporary organisation. The four-dimensional measures which I propose are generic. I acknowledge that the information requirements to enable stakeholders to make evidence-based decisions guide the selection of measures of project management performance.

4.5.1 Process efficiency measures of performance

All projects I sampled in this research applied the iron triangle measure of time, cost, and scope to evaluate performance. I introduced the category of process efficiency measures. I concur with an interviewee that "*complex project management is about the allocation and use of the right resources for the right activities, in fluid and uncertain circumstances*". Efficiencies in human resources management affect the delivery within cost, time, and scope.

The interviewees perceived human resources management as a composite responsibility. One project manager explained that "*human resources management is an underrated measure of performance. It is time-consuming and is the backbone of project management. It is people that make or break project management. The best systems and tools are useless without the right and adequate human resources*". He expounded with examples of how the deployment of inappropriately qualified human resources delayed the execution of some activities.

Another interviewee elaborated that limiting performance measures to time, cost and scope,

> *hides the depth and expanse of efforts implemented to create an enabling environment for people to perform optimally. I manage, correct, encourage people whilst complying with regulations. I manage conflicts within my team to avoid a breakdown in project management. I address disruptive behaviours such as power struggles, marginalisation based on age, gender, and race. I have to lead by example in appreciating and leveraging diversity to optimise performance.*

She expanded that the iron triangle ignored these critical activities.

Projects 1, 2, and 4 demonstrated that human resource management included capacity building. Projects 1 and 2 created an enabling environment for multi-directional learning. Multi-directional learning contributes to agile and inclusive decision making. It is a contrast to top-down decision making that prevails in linear and deterministic decision-making (Sewchurran et al., 2010). This approach differed in Projects 3 and 5, where the learning was unidirectional and flowed from the researchers and project management practitioners to the users. Indigenous knowledge interviewees criticised it as "*it reduced the likelihood and extent to which researchers and project managers were able to learn and adopt alternative knowledge*".

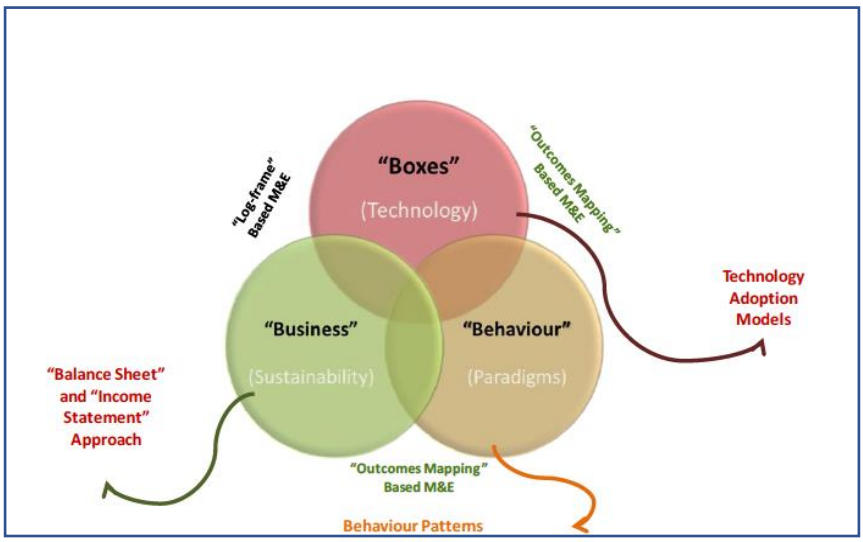
Interviewees indicated that human resources management was one of the contentious responsibilities and was open to the influences of political dynamics and cultural practices. This manifested as patriarchy and nepotism which compromised performance. They pointed out that some managers failed to use their power to manage these bad practices and insisted that the project manager's competence and maturity were critical to circumvent bad practices.

The frequency of mention motivates the inclusion of human resources management as a measure of performance. This multifaceted activity is core amongst all projects.

Based on the data, its KPIs could include employee productivity and efficiency in task completion. It incorporates training completed, learning, and team satisfaction.

Projects 1, 2, and 4 introduced financing as a measure to achieve financial sustainability and operationalisation of the project. Plans were developed using existing resources to secure additional support for the project and were implemented and monitored. Project 1's approach to process efficiency measured reconciled business, behaviour, and technology (see Box 4-16).

Box 4-16: Three aspects of process efficiency measures in Project 1 (DST, 2015)



The customised monitoring and evaluation approach of Project 1 was unique. Project 1 considered economic viability (business), with the development of ideal behaviours for the technology to deliver the desired change (see Box 4-16).

The behaviour aspect aligned with my proposal of including human resources management as one of the measures of performance. The behaviour aspect comprised skills development of the project management practitioners, technology developers, and the users. Projects 1 and 2 invested in developing design thinking skills to improve project design and management. The training empowered the project managers to "*marry the aspirations of the people affected by the change and*

technology with funder objectives and agendas." Projects 3 and 4 trained users to improve cultivation methods.

Project 1 recognised technology as a distinct but interlinked process efficiency measure. The approach ensured that technology performance reviews were in tandem with financing and behavioural aspects, critical for transforming the local economy. The project manager expanded that this approach was essential since "*technology is after all in service to humans, and not the other way round*". I differed with the inclusion of technology as a process efficiency measure and included technology as one of the scope measures of performance (see Figure 4-3).

The business aspect reflected on the efficiency of the use of a budget and also focused on financing the operationalisation of the project. The financing priority was critical for the project's financial sustainability. Projects 2 and 4 also incorporated financing as one of the measures of success or failure (see Box 4-17) and monitored the implementation of financing activities. Interviewees indicated that the financing aspect was critical to sustain and operationalise projects.

Box 4-17: Financial sustainability planning and monitoring efforts in Projects 2 and 4

2.2 NETWORKING WITH POTENTIAL PARTNERS	Searching for potential partners, investors and others who show an interest to get involved	I have reported about this in some detail in June report
2.1 CBI - Export Coaching Program, a Netherlands initiative (Natural Ingredients for Cosmetics)	- CBI contributes to sustainable economic development in developing countries through the expansion of exports from these countries. -	- CBI is eager to have a community-owned business to be operating in the export market; also in view of the medium and longer terms; - They assist us in institution building and I have regular contact to discuss ways foreword.

11.3. Interested companies for the commercialisation of the leads

Table 3: Interested manufacturers and formulators

Manufacturer			
Company	**Director**	**Actives**	**Stage**
[redacted]	[redacted]	GF, LS & HO	• Developmental license signed • BABS permit to be submitted soon • Full (non-exclusive) license underway
Formulators			
Company	**Director**	**Actives**	**Stage**
[redacted]	[redacted]	GF, LS &	• NDA signed • Project plan for developmental

Project 2 and 4's focus on financial sustainability was evident in the plans implemented to secure business partners (see Box 4-17). Interviewees viewed the ability to secure additional finances as a critical aspect for the sustainability of the project. Securing additional funds would be based on the viability and value for money of the projects. The financial sustainability or financing measure was a joint responsibility between the sponsor and users (see Box 4.17).

Each of the four measures in the process efficiency dimension could be associated with one or more KPIs. For example, KPIs for the human resources management measure included individual and team performance recognition and development. The latter counted the number of training opportunities attended and completed. The financing measure included KPIs such as the number of potential investors engaged and support secured. The time measure monitored delivery on time and the number of timeline adjustments.

4.5.2 Scope measures of performance

The data structure revealed scope management as a priority amongst stakeholders (see Figure 4-1). The interviewees prioritised scope definition to accommodate their objectives which informed scope quality and quantity and as such, they monitored its attainment. Projects 1, 2, and 4's scopes included delivery of technology infrastructure, the number of jobs created, and enterprises supported. The quality aspect measured the number of technical activity repeats and failures. This information prompted a scope revision in Project 2.

The interviewees regarded customer satisfaction and benefits realisation as important elements of success or failure. They associated the two with the ability to secure financing and further support. This view aligns with Sewchurran et al. (2010) who suggested consideration of benefits realised in measures of performance frameworks. I accepted that some researchers recognise customer satisfaction as a critical success factor, but I positioned it as a measure of performance since it requires considerable efforts to maintain and improve. One project manager attested that "*pursuing customer satisfaction in complex projects is not an easy feat. We must do it regardless. A satisfied customer is a happy customer. A happy customer supports you and can help secure other investment opportunities*".

The interviewees agreed that each project delivered different benefits for its stakeholders. The benefits were positive outcomes and were distinct from project objectives. The tracking of realised benefits was inconsistent and unsystematic across all five projects. Interviewees suggested that projects should document the measures of performance and benefits expected by each stakeholder. The suggestion aligns

with Jugdev and Müller (2005) who motivated stakeholders to document measures of performance and expected benefits early in the project.

The recommendation implies that the projects develop a benefits realisation matrix. The matrix enables collective reflection and removes ambiguity in assessing performance and benefits at the end of the project. This is a critical success factor due to different interpretations of success stakeholders. All five projects measured technology performance as one of the measures of performance. Projects 1 and 2 assessed technology performance in combination with local economic development. Project 1 assessed how it aligned and supported other community development projects (see Box 4-18).

Box 4-18: Technology-enabled inclusive local economic development in Project 1

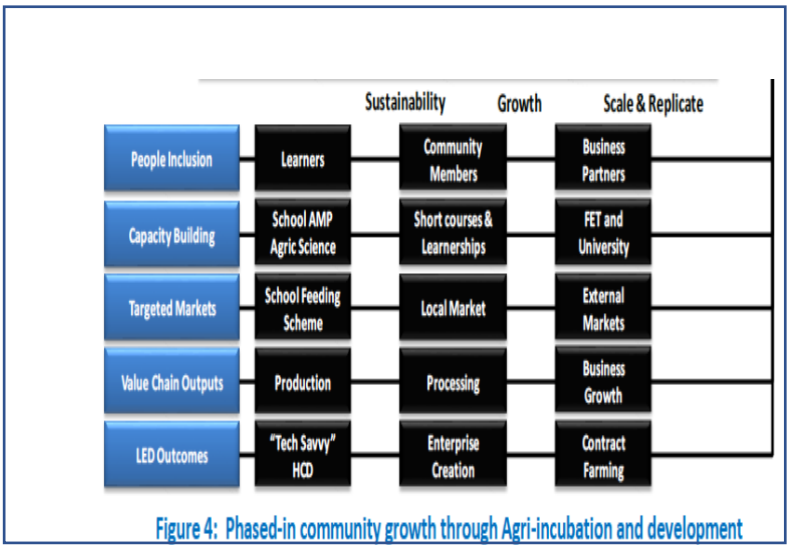


Figure 4: Phased-in community growth through Agri-incubation and development

Project 1's technology measure was disintegrated based on different stakeholder needs and contributions. It attempted to build the capacity to operate, maintain, and adapt the technology to support agricultural local economic development (see Box 4-18). Project 3's technology performance aligned with sustainable cultivation and use of wild ginger. Project 4's technology performance aligned with industrial development and recognition of indigenous knowledge.

Project 5's technology performance focused on the feasibility of innovative off-grid sanitation solutions. The technology performance measure involved the creation of

new technical skills to operate and maintain it. Projects 1 and 2 trained users to an extent that product modifications were initiated by users in Project 2.

Projects 3 and 4 trained and monitored users on basic agricultural techniques. Project 5's training was limited to understanding and operating sanitation technologies. Projects 1, 2, and 4 considered alignment or linkages with local value chains. They used the technology to harness and strengthen local innovation awareness and capacity. In Projects 1 and 2, this might have unlocked new maintenance and repairs services. Project 1, 2, and 4's technology infrastructure supported social cohesion and community development.

I observed that the implementation of Projects 1, 2, and 4 in rural and township settings facilitated the inclusion of marginalised stakeholders in the national system of innovation. One interviewee contended that the inclusion "*destroys the notion that technology is for the elite*". It "*democratises the national system of innovation and makes it responsive to our development context*". Projects 1, 2, and 4's technology demonstration and transfer efforts built new skills, infrastructure, and created new products. The technologies contributed to the transformation of local economies.

The interviewees stated that scope management was a critical activity whose inefficiency could lead to failures and conflict. Project 1 and 2's managers shared that, for any consideration of scope changes, they engaged all stakeholders to collectively reflect on budget, completion, and quality implications. They shared that, in their experience, scope creep could be curbed by the collective understanding of scope change implications on deliverables. The engagement happened within and outside the project steering committee. They highlighted implications on quality and quantity specifications, benefits derived, and customer satisfaction at these engagements.

The considerable regard for scope management was influenced by its perception as one of the leading causes of project management failures. The project managers indicated that they invested in managing the risk of scope creep, which could significantly alter project outputs. The plurality of stakeholders and views on project activities rendered scope management more fluid and dynamic. It demanded project

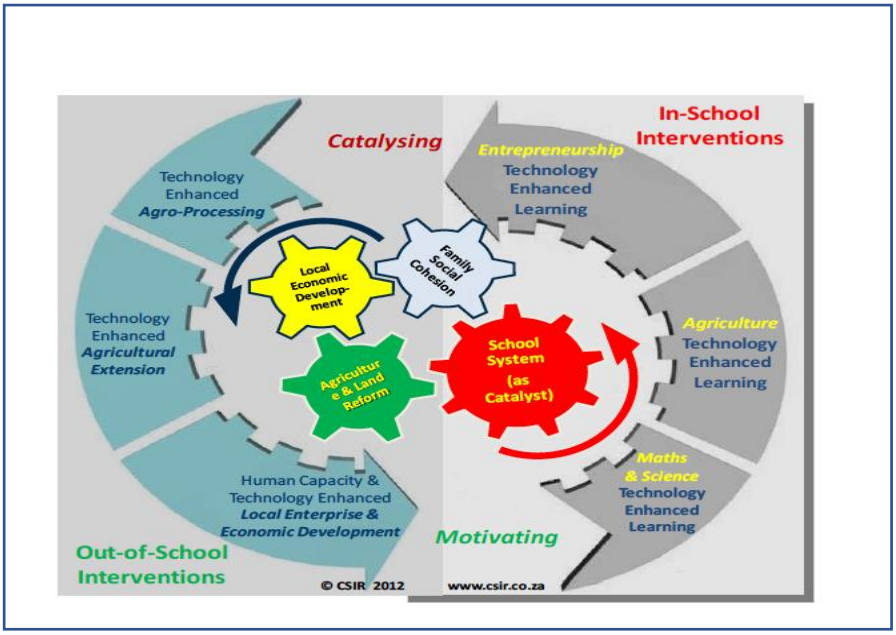
managers with capacity that was agile in systemically analysing and communicating possible implications of the scope changes.

4.5.3 Context measures of performance

The context is the operational environment within which the project exists. It affects the character and behaviour of the temporary project organisation and management thereof. The character incorporates the culture and diversity which influence how it interfaces with its external environment. The context includes politics and the socio-economic profile of the external environment (see Box 19).

Politics and power relations between the projects and their external environments influenced decisions on the recruitment of labour and procurement of services. This influence was prevalent in Projects 1, 2, 4, and 5. Project 1's design, implementation, and impact evaluation considered the socio-economic profile of its external environment (see Box 4-19).

Box 4-19: An illustration of how Project 1's design and implementation considered the external environment (Council for Scientific and Industrial Research, 2015)



Project 1 designed, implemented, and evaluated the impact of its activities on the external environment. Its in-school activities catalysed community level or out-of-

school interventions. This included training of youth and increasing access to agricultural extension services for the community (see Box 4.19).

The managers of Projects 1 and 2 emphasised the strategic importance of understanding the socio-economic profile of the external environment. This profile influences the design and types of training and capacity building initiatives selected for the project. "*The training must be linked to existing or create new exit opportunities for the users. If this is not the case, the project might build good but irrelevant skills*". Some interviewees suggested that projects should provide technical and generic training. The generic training would include driver's licenses, hospitality, agricultural production, and processing, among others. The users highlighted that these are skills that are valuable for survival in different environments.

Project managers considered compliance as a critical activity, with critical implications for project management. They recounted instances of projects put on hold due to non-compliance with regulations e.g., water abstraction and local procurement. They shared how changes in industry standards led to failures e.g., project output that could not be commercialised. They narrated examples of how non-compliance to local procurement led to costly schedule delays.

All five projects pursued compliance with regulation and industry standards. Project 1, 2, and 4 focused on agricultural product safety and industry standards. Projects 2, 3, and 4's compliance measures included the attainment of licences to cultivate and trade with indigenous species. Project 5 pursued compliance with water and sanitation regulations in its technical design and performance but demonstrated uncertainty about legislation, human dignity, and technology appropriateness.

Project 5's technology performed well at the laboratory stage. It complied with legislation and aligned with the transition to waterless sanitation. The users' earlier acceptance changed when they experienced using it. They requested that the sanitation units be uninstalled as they defied human dignity and the initially accepted specifications became contentious due to how the users experienced the technology. One user relayed that "*this technology shows the government does not care about us. This technology is an injustice. I bet none of the managers would want this technology*

for themselves. Why is it acceptable for us and not for them?" The users rejected plans to scale it up and roll it out as a viable sanitation service delivery solution.

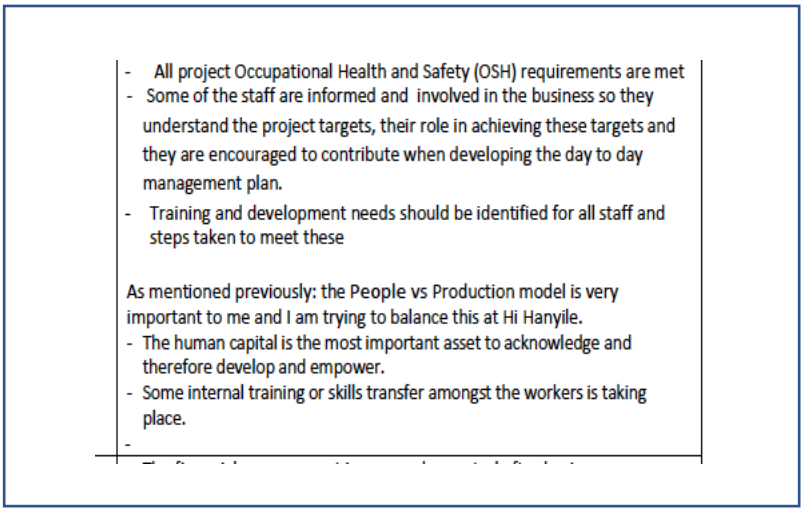
The project managers acknowledged that, despite the influence of complexity features, they did not consistently develop and implement complexity matrices. They recognised that non-linearity characterises the temporary organisation. They shared how they invested in understanding the interfaces amongst the measures of performance (see Figure 4-3) and explained that a change in scope (e.g., quality and quality specification) affected the budget measures.

Changes in the context dimension (political interference and compliance requirements) affected the project scope, process efficiency, and good governance measures. For example, Project 2's compliance with industry standards, water use, and local procurement legislation resulted in schedule delays. Project 4's land use application delayed implementation impacting feasibility of commercial opportunities. Project 5's political engagements (context) affected benefit realisation and technology appropriateness (scope). It also affected the relationship between the sponsor, researchers, local administration, the users, and the project management team (good governance measures).

4.5.4 Good governance measures of performance

Interviewees contended that human resource management responsibilities were substantial. They insisted that the extent and depth of human resources management was underestimated. It is a vast responsibility that prioritises compliance to policy, regulations, and procedures while optimising performance. They suggested that policy refers to legislative and organisational aspects with the legislative aspect including compliance with occupational health and safety and human resources development prescripts. Box 4-20 illustrates the project's accounting to the committee on human resources management.

Box 4-20: An extract of minutes of a steering committee meeting



- All project Occupational Health and Safety (OSH) requirements are met
- Some of the staff are informed and involved in the business so they understand the project targets, their role in achieving these targets and they are encouraged to contribute when developing the day to day management plan.
- Training and development needs should be identified for all staff and steps taken to meet these

As mentioned previously: the People vs Production model is very important to me and I am trying to balance this at Hi Hanyile.

- The human capital is the most important asset to acknowledge and therefore develop and empower.
- Some internal training or skills transfer amongst the workers is taking place.
-

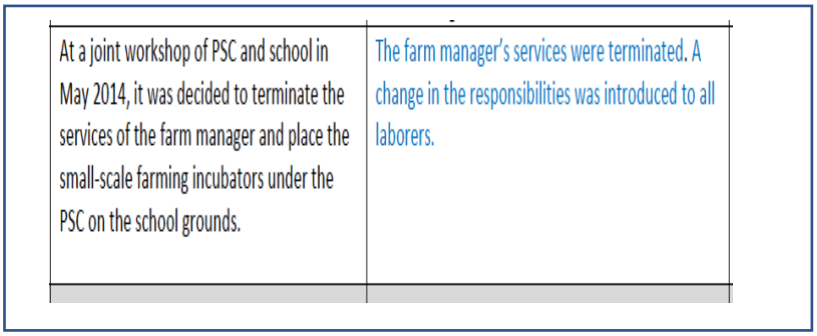
The interviewees highlighted that the temporary organisation must establish its own policies, e.g., recruitment, performance management, rewards, and governance. They insisted a multi-stakeholder organisation must create its own responsive protocols that are inclusive of diversity. Projects 1 and 2 developed governance mechanisms (steering committees) inclusive of different stakeholders.

One interviewee shared that project managers are social actors and must understand the interaction and interfaces between individual, behavioural, and organisational performance variables. They must create an enabling environment for participatory, accountable, and result-oriented project management. They need to coordinate the identification of requisite skills to successfully deliver the project.

The maturity of the project manager influenced the recruitment of requisite competencies. "*The recruitment demanded maturity and emotional intelligence as it was one of the aspects open to manipulation and interference*". Such interference might come from politicians, administrators, traditional leadership, or development partners (see Box 4-21). In Projects 1, 2, 4, and 5, the representatives of the users and local authorities were involved in the recruitment of labour. In Project 1 and 2, the

steering committees were involved in human resourcing decisions including the termination of services (see Box 4-21).

Box 4-21: An extract of minutes of a steering committee meeting



At a joint workshop of PSC and school in May 2014, it was decided to terminate the services of the farm manager and place the small-scale farming incubators under the PSC on the school grounds.	The farm manager's services were terminated. A change in the responsibilities was introduced to all laborers.

Box 4-21 shows a project steering committee resolution to terminate the services of a farm manager employed by one of the participating schools. A stakeholder contested this decision and argued that the steering committee did not have the power to terminate employment contracts.

One of the project manager's responsibilities was to oversee the capacity building of their teams. This included enhancing the ability to recognise interconnected activities and their interfaces. Inefficiency to do so was associated with failure for the temporary project organisation. The interfaces included those between the temporary organisation and its context, with the context interface including the participation of the users, their traditional leaders and political leadership in steering committees.

Project managers shared the challenges of the steering committee's involvement in recruitment. They commented that while it was desirable for ownership, it demanded tactfulness. It could influence performance due to the deployment of inappropriate personnel. The involvement set precedence for other critical decisions, e.g., scope management which is an intricate exercise manipulatable by different interests.

One project manager stated that:

> *Steering committee engagement demands emotional intelligence. The intelligence manager deciphers when and how to share or withhold power. This strategic competence influences all aspects of project management.*

Managing relationships with the steering committee and other stakeholders is time-consuming. Performance of this responsibility should be recognised and rewarded.

I concurred with the project manager and as such, included good governance measures of performance (see Figure 4-3).

The management of innovation for inclusive development projects is an emergent process. The interviewees shared its demand for flexibility, creativity, and appreciation for fluidity. The data confirmed that steering committees oversight permeated other aspects of project management. This demanded that project managers' competencies included the ability to minimise disruptive outcomes of oversight activities.

The project manager's ability to understand stakeholders is a key competence. It guides the realisation of inclusive and responsive leadership. Projects 1 and 2's managers shared how it empowered them to secure mechanisms to ensure collective accountability and consequence management. They recognised that this competence was critical to establishing fit-for-purpose governance arrangements. The differences observed amongst the steering committees' operations across the projects might be relatable to the project managers' competence.

Interviewees listed risk management as a governance matter. The most identified risks were political interference and failure of the technology to perform. Political interference affected recruitment of labour, procurement of goods and services, and increased likelihood of scope creep, among others. While most interviewees referred to risks, I noted that only two project managers mentioned undertaking a complexity assessment. They indicated that poor understanding of features of complexity might have similar results to ill-defined risk management. Inefficiency in dealing with risk and complexity might derail, delay, or lead to early termination of the project.

Interviewees also identified failure to secure additional finance as a risk to sustaining and operationalising the projects. To respond to this risk, Projects 1 to 4 developed plans to successfully operationalise the projects as financially viable enterprises.

Except for Project 3 and 5, the other projects implemented capacity building to strengthen the potential of the users to operationalise the projects.

The risks and complexity features confirm that the project organisations faced uncertainty in their operating environment and the extent to which the desired transformational change could be realised. Risk management would address uncertainty and factors that have the potential to inhibit or compromise project management. The International Centre for Complex Project Management (2011) and Transportation Research Board (2014) advocated for continuous risk management throughout the project lifecycle. I concur with this perspective as it could improve responsiveness and dynamism.

The review of the secondary data revealed an inconsistent vigour in risk management across the sampled projects. Despite its reported importance, risk management appeared reactionary and was not executed systematically. Some progress reports did not mention it. This might have compromised the extent to which project management was proactive and agile in addressing risks. The non-systematic approach to risk and complexity implied that the project managers undermined their possible impacts and value. It is also possible that project managers were not adequately skilled to execute risk and complexity management.

The unsystematic approach had dire consequences in Project 5. The sponsor, technology developer, and project manager might have overestimated the contribution of the technology to enable access to decent and dignified sanitation. The secondary data revealed that the project manager secured acceptance from users and local administration before deploying the technology. They perceived the technology as a better option than the conventional ventilated pit latrine.

The technology deployment was scheduled a few months before municipal elections. A few months following the deployment, selected users requested the municipality to remove the sanitation units. The removal of the deployed units became ‘politicised’, with the project manager claiming that “*outside influence from communities around the area stole the buy-in*”. He reported that “*it is people who have not been selected for the project create a negative perspective of solutions resembling the apartheid aligned*

bucket system". A post-implementation evaluation report highlighted that the rejection could have been due to various factors. These included (i) the lack of technical support and available materials, and (ii) the lack of training to operate and maintain the technology.

The experience in Project 5 emphasised a lesson in Project 1. The lesson was that "it is currently clear to the project team that more work will have to be done to provide guidelines to marry the aspirations of the people affected by change and technology with funder objectives and agendas. Failing to do so still seems to be one of the biggest contributors to the breakdown of technology-intensive development approaches. This can look deceptively obvious but in practice requires a major mind-shift in the NSI towards human-centred, participatory design and development" (DSI, 2014:n.p.).

Despite most interviewees acknowledging the influence of complexity on project management, there was limited documented evidence of a complexity assessment across the project sample. Project 1's systemic approach to development acknowledged features of complexity although there was no formal assessment. The complexity assessment might have empowered the identification of features of complexity and their sources. It could have enabled recognition and categorisation of interfaces and interdependencies (International Centre for Complex Project Management, 2011; Transportation Research Board, 2014).

I realised that the response to uncertainty and risk in the project sample was mainly informed by a linear probability versus impact risk assessment. The International Centre for Complex Project Management (2011) identified this approach as limited and compromised in its agility to deal with risk events. The linear approach is restrictive in recognising and responding to the fluidity and emergence features of complex projects, particularly in its context. The latter is not static. It is fluid and is subject to changes that can be chaotic and ambiguous (International Centre for Complex Project Management, 2011).

For example, while the projects in the research sample were being implemented, there were changes in political leadership at national, provincial, and local levels. Such changes were associated with certain ideologies in community development, e.g., the

community as a partner and active actor in its own development versus the community as a mere beneficiary with no agency in its own development. Such stances influenced the extent to which political leadership engaged and provided oversight in these projects through various activities such as official project site visits by the national portfolio committees.

The interviewees shared that they were expected to efficiently manage the risks and complexity. They mentioned that risk management was a time-consuming exercise with considerable consequences if not addressed. They indicated that, despite the significance of this task, it was not included in performance agreements and they were judged based on compliance to time, cost, and scope. One project manager stated that "*any other effort falls through the cracks of performance assessments*".

I noted that each project created its own formal and informal communication and knowledge management approaches. Timely and efficient knowledge management was raised as one of the neglected but important activities critical for communication, decision-making, learning, and continuous improvement of the project management process. The KPIs in this regard included regular governance meetings (steering committee), submission, review, and feedback on progress reports, information access platforms, among others.

The interviewees insisted that a clear information and knowledge management approach clarified communication lines. It clarified how the project management process engaged with its context. For example, the users led on communicating with local authorities and traditional leadership and the sponsor led on engaging with provincial and facilitated local government liaison for the project management agencies. Examples of project-specific policies and operating procedures included aspects such as demographic allocation of in-sourced labour.

All five projects prioritised youth employment in line with the national development agenda. Despite this commitment, two of the five sampled projects employed more women than youth. According to the users and local leadership, the youth had largely not shown much interest in agricultural activities and as such, sourcing them for these

agro-processing projects was not successful. These two projects crafted their policies in terms of employment demographic allocations.

The project manager has a critical role to play in ensuring that the temporary organisation has requisite and efficient communication and information management methods. This is important to enable regular appraisal of progress by the stakeholders, collective reflection on risk and complexity responses, changes, and evolution in the project context, among others. Poor communication and knowledge management can lead to mistrust within the project management team and with stakeholders in the project context.

Poor communication and knowledge management can lead to reduced support and buy-in by stakeholders due to inadequate access to information. Davis (2016) cited poor communication and knowledge management as the main reasons for failures for complex projects. While literature acknowledges it, not many frameworks incorporate communication and knowledge management as measures of performance.

Knowledge management is important for learning and continuous improvement purposes. It enables the temporary project organisation to document and reflect on lessons learnt in the project management process, like a recognised practice of some bodies of knowledge such as PRINCE2, which is critical for continuous improvement. It enables proper documentation of information and knowledge created during project management (Standard for Program Management, 2008).

Communication and knowledge management affect relationships with stakeholders. Project managers highlighted that maintaining good relationships was not conventional stakeholder engagement. Based on the interviewees, I classified this as relationship management. Relationship management within the project and its context are of strategic importance due to the influence of stakeholders. It is also key to securing and sustaining customer loyalty and future business opportunities. Efficient relationship management enables stakeholders to learn from each other. It neutralises power imbalances and enhances cohesion within the temporary organisation and its context. As such, it is critical for successful management of innovation for inclusive development projects.

Strategic relationship management is purposeful and requires creativity. It uses techniques beyond conventional stakeholder engagement tools and methods and optimises the management of conflicts associated with competing demands and expectations. The project managers appreciated the value of the ability to simultaneously manage different relationships. They harnessed this ability to navigate the multi-dimensionality of project management performance. It incorporated competency to recognise and respond to various interfaces and interactions amongst the interconnected project elements in a particular context.

Strategic relationship management is important in deploying the right resourcing at the right time when dealing with uncertainties in the project context, e.g., to prevent them from derailing the project management process. Strategic relationship management enhances customer focus and advances horizontal rather than vertical integration, advocated for by conventional techniques (Transportation Research Board, 2014; Gorod et al., 2018).

4.6 Conclusion

The iron triangle remains relevant to assess complex project management performance. Various project management bodies of knowledge and researchers maintain the iron triangle in performance assessment. Based on this research, I contend that any framework on measures of performance should attempt to be two-fold: (i) measuring whether the project management is delivering the expected output, and (ii) assessing the efficiency of project management from the aspect of the temporary organisation.

My research highlights that project management is a composite responsibility within the temporary organisation. The organisation simultaneously executes different interconnected activities through humans, finance, technology, and other resources. The activities interface in a predictable and unpredictable way, which can exacerbate risk and complexity attributes. The increased risk and complexity arise from the emergence of new behaviours. For example, I have shown how contextual factors influence decision-making within the temporary project organisation and that the

temporary organisation enables an organised response to external dynamics and fluidity of the context.

The research further shows that the social nature of project management requires clear processes, e.g. communication and knowledge management to engage internally and externally. It emphasises the influence of technical expertise and development orientation of the manager on managing innovation for inclusive development projects. It highlights that inclusivity and responsiveness are ideal in the governance of the temporary organisation The approach of the project as a temporary organisation addresses different elements of project management that might enhance flexibility and accommodate differentiation in the use of measures of performance. For example, De Witt (1988) and Dao et al. (2016) advocated for the use of differentiated performance management to accommodate evolution and changes during project management. Such changes may be due to context factors, and technology, among others.

The differentiated approach enables a two-pronged mechanism, with certain measures applied throughout project management, while others apply only at specific phases. It accommodates the application of unique measures of performance at different phases of project management.

I concur with De Witt (1988), that each phase of project management must have measures of performance related to their particular outputs. In so doing, the project management process will be flexible and not restricted by the use of uniform measures of performance across the lifecycle.

One of the objectives of this study was to propose more measures of performance to expand the iron triangle. My proposal acknowledges that, although complex projects are unique, their management exhibits common activities. These apply, regardless of the type and nature of the project. My suggested expansion (see Figure 4-3) is a practice-based proposal, based on five distinct case studies in different contexts. These cases comprised different interviewees with varied experience and expertise in the management of innovation for inclusive development projects. My proposal (see

Figure 4-3) is comprehensive and accentuates core aspects that influence the efficiency and success of project management.

CHAPTER FIVE: CONCLUSION

5.1 Summary

In this chapter, I discuss the research findings expounded in the preceding section. I have arranged my discussion according to the two research questions:

1. How does complexity influence how stakeholders organise the management of complex innovation for inclusive development projects?

2. What are the additional measures to time, cost, and scope needed to assess the performance of the management of innovation for inclusive development projects?

I began this journey out of frustration and a desperate need for a solution. I needed answers to improve the management of complex innovation for inclusive development projects. Their prominence continues to increase as organisations globally harness science, technology, and innovation to meet development priorities.

I resorted to Microbiology to dissect the problem to its simplest elements. The process led me to various articles that described the complexity of a project (International Centre for Complex Project Management, 2011; San Cristóbal, 2017; San Cristóbal et al., 2018). I perused publications describing features and sources of complexity that acknowledged that the complexity of a project affects project management. The literature recognised the impact of the complexity of the definition of project objectives and project outcomes (San Cristóbal et al., 2018). It was, however, limited to how complexity influences the organisation of project management.

The literature review confirmed the ongoing concerns with the performance of complex project management. It exposed the focus on identifying and understanding complexity and showed models to help project managers identify, classify, and manage complexity (International Centre for Complex Project Management, 2012; Shenhar & Wideman, 2002; Snowden & Boone, 2007; Turner & Cochrane, 1993;

Zimmerman, 2001). Despite this knowledge, literature provided corresponding evidence on the ongoing failures in the management of complex projects. I recognised a distinct discourse on measuring the performance of complex project management.

In dissecting the problem to its simplest form, I adopted the analogy of a complex project as a human body. Both comprise many interconnected and interdependent subsystems and parts that sometimes interact with the emergence of new behaviours. The convergence and alignment of the subsystems might appear chaotic, although there is a certain order. There is a thread of critical and compulsory activities based on guiding laws to maintain order and function. The efficient health or operation of the temporary organisation demands synergy amongst the various subsystems and parts.

The complex project reacts to internal and external changes. Project management ensures that, regardless of these changes, the project proceeds to achieve its objectives. My analogy of the project as a human body helped identify the knowledge gap which was how complexity influences project management.

My microscope unveiled the discrepancies between the definitions of a ‘conventional’ and complex project. The definitions of a conventional project limit it to a productive function. They support the notion of delivery and performance on the measures of time, cost, and scope. The definitions of a complex project mainly reflect on its features which include uncertainty, fluidity, interrelatedness, and interfaces, among others. Complex projects are temporary endeavours that create unique goods and services.

I reflected on the definitions and was less clear on how the interactions, instability, and disorder of a complex project affect its management. The literature did not help address the pain points of managing many stakeholders. It did not help me understand how the interfaces amongst subsystems affect project management. It was inadequate in assessing how the interfaces amongst governance, operations, and the context affect project management. It exposed that complex projects exhibit behaviours that make them difficult to manage and suggested different skills required to manage complex projects. It challenged assessing the performance of complex project management based on time, cost, and scope. It emphasised the influence of the

context on project management. Despite this knowledge, I was not any wiser on how complexity influences the behaviour and management of a complex project.

5.2 The Research Methodology

I acknowledged early on that my colleagues, development practitioners, and funding agencies shared my frustration. I reviewed many evaluation reports that recommended how to improve management innovation for inclusive development projects. The literature review indicated limited research on the management of these projects.

My research questions led me to select qualitative research as an approach to the study. I opted not to start with a hypothesis or theory to test. My focus was to understand how complexity influences the organisation of complex project management and the performance management thereof. The qualitative research method enabled me to engage with interviewees and gather their inputs, which demonstrated their lived experiences, on the issue of concern. I combined their inputs into addressing the two research questions.

The nature of the research questions facilitated the choice of the case study. It enabled me to understand why things happen. It empowered me to decipher how complexity influences the organisation of project management and the performance assessment thereof. It allowed me to decode patterns of behaviours in responding to complexity. The case study method privileged me to conduct my research in its natural settings.

I collected data to understand and inductively craft a theory on the issue of concern. At the onset, I rejected any approach that would lead me to test complex project management performance against an existing theory.

I learnt a few lessons in using the inductive case study method to conduct project management research. They included:

- The extent of work in collecting and categorising data from different sources is underestimated. The data exist in different formats, e.g., progress reports, minutes of steering committee meetings, and financial information, among

others. The documents do not follow identical templates, which led to inconsistencies in their format and level of information. It is particularly challenging on an issue of concern that is not well researched and documented.

- Gathering data from multiple sources creates vast information. The vast information does not imply additional insights.

- The risk of the data becoming familiar increases in some instances. Under such circumstances, I opted for more caution and active awareness to lower the risk of missing hidden concepts when dealing with the familiar.

- I consistently managed what I knew and let the data speak for itself. My knowledge could have compromised the extent to which I could find the unknown unknowns, expressed as the aggregate dimensions of the data structure (see Figure 4-2).

- Coding and classifying the data demands skill. I rearranged codes and categories many times to extract possible meanings using the Gioia approach. Transitioning from the 1st-order concepts to 2nd-order themes to construct aggregate dimensions is more dependent on the quality, rather than the quantity of data.

- There is a benefit in being selective with choosing interviewees. I am convinced that creating criteria to choose interviewees assisted me to gather relevant inputs. It provided me with data from lived experiences and not hypothetical inputs.

I assured the interviewees of their safety when participating in this research. I anonymised data collection (recorded data) as much as possible. I consistently assured them that I valued their input. I administered four individual focus groups, one for DSI project management personnel, one with a service provider and two with project users. During these sessions, I observed that some interviewees were not actively participating in the discussions. Some shared their fear of retribution or subjection to unfair labour practices if they raised contrary views to their supervisors.

Upon further engagement with the interviewees, I opted to not proceed with mixed focus group discussions, as initially planned.

All interviews, except for two focus group discussions with the users, were in English. Two of the focus group discussions were in indigenous languages, which I am not fluent in. On these two occasions, I depended on an interpreter. I recorded the interviews to double-check that I had correctly captured the inputs of the interviewees.

Charmaz (2010) stated that to ascertain the meanings that interviewees attach to things, it is ideal to study what is practically happening in a research setting. Charmaz (2010) further expanded that meanings influence actions and responses to things, i.e., actions reflect obvious or hidden meanings. It is plausible that the behaviours and observations that I made during the research manifested in actual and lived management of innovation for inclusive development projects.

I observed variation in the extent of participation of the interviewees. I sensed that limited participation might be due to the following:

- Perceived authority and legitimate or positional power amongst the interviewees: An interviewee requested me to not include him in the same focus group as his supervisor. His reason was that his contrary views with his boss "*may be career-limiting*". He explained that they disagreed on resource allocations and performance management. I agreed to the request and included him in a different focus group. In another focus group, I observed positional power at play. Some interviewees made certain gestures and 'checked' with their supervisor as they spoke.

  In another focus group, project managers debated the influence of authority and power. One of them insisted that they, as project managers, sometimes overestimated themselves in project management. He explained that "*it is not true that beneficiaries do not know what to do. They do know, just not in the way we expect them to. They know the extent of the problem as they experience it. They know it better than us. Using positional power to enforce our views and*

ways of working rob us of learning and improving how we manage these projects".

- Diversity in age and gender: In another instance, an interviewee requested a private engagement as she feared repercussions from her colleagues. She inferred the influence of gender, age, and clan in the selection of supervisors. Another interviewee expressed how patriarchy remained a challenge as it advanced the blatant disregard of their abilities and knowledge as young women. She explained that "*they expect us to be passive. How can we participate if we constantly fight over timely access to the information? I think they talk down at us instead of talking to us*".

- Cultural and language differences might have affected participation in the focus group interviews. In one instance, I observed that one individual from a different ethnic group and language did not participate. Some interviewees expressed that he did not need to be part of the group since he did not appreciate their culture, customs, and language. One interviewee claimed, "*how can he understand us when he cannot even speak our language*?" The interviewee then requested an individual engagement and excused himself. At the individual interview, he shared how differences in culture and language frustrated the execution of his duties. He explained that he was, as a supervisor, also responsible for quality assurance of the products and he was disappointed in how ethnicity was compromising performance. He shared that those other interviewees were opposed to his appointment and felt a local candidate could have been better. This example demonstrated how the external environment (context) can influence project management. This decision challenged human resources management (recruitment) and production subsystems.

5.3 Contributions to Theory and Practice

5.3.1 How does complexity influence how stakeholders organise the management of complex innovation for inclusive development projects?

The data analysis revealed that complexity influences the behaviour of collaborating stakeholders. What they view as sources and their interpretation of the nature of complexity affect their behaviour. It influences how they position and organise themselves to participate in project management. It affects how they interact with other stakeholders, and it shapes their decisions on which project management engagements to prioritise for participation.

The data (see Figures 4-1 and 4-2) revealed that, of all project management processes, complexity influences the organisation of project management as follows:

- Organising for the desired multidimensional transformative change:

  The data demonstrated that complexity affects how stakeholders organise themselves for the management of innovation for inclusive development projects. It influences how they engage with the planning phase and activities in this regard. The stakeholders acknowledge that although they might agree on the overall goal of the project, they hold individual and sometimes hidden objectives.

  They understand that project objectives inform the allocation of resources and organisation of project management. They delegate representatives to actively engage in the planning process to protect their priorities and individual objectives. They ensure that the planning stage delivers quantifiable targets aligned with their objectives.

  The interviewees consistently referred to change and a better quality of life from participating in these projects. In each project, the desired change is multidimensional and transformative which might have facilitated convergence. The multi-dimensionality emphasises that the objectives are co-dependent and

interconnected. It communicates that no objective is more important than the collective.

The inclusion of each stakeholder's objective(s) in the project management plan was critical to secure their buy-in and participation. The lack of buy-in and explicit proactive transformative change objectives might likely have limited the participation of users in Projects 3 and 5.

The literature review highlighted that disharmony of project goals and objectives is a possible factor of complexity (San Cristóbal et al., 2018). I concur with this finding and suggest that its influence on project organising is not limited to the planning stage. The stakeholders consider the implementation (when and how) of their specific objectives. It is possible for the objectives to change, as was the case in one project sampled in this research. The risk of changing objectives is a source of conflict, influenced by the power of the one proposing the change.

- Responsive and inclusive leadership

Many stakeholders with decision-making powers collaborate in these projects. Linear and non-linear interfaces amongst the stakeholders influence the efficiency of the collaboration. The number and interconnectedness of interfaces contribute to the complexity of the temporary organisation. The interfaces influence critical decisions, e.g., structuring and governance of the temporary project organisation. Stakeholders carefully position themselves in the governance of the temporary organisation. They deploy carefully considered representatives in its decision-making platforms such as the steering of any technical ad hoc committees.

The interfaces influence the pace and flow of appropriate information amongst stakeholders. The primary data conveyed that, stakeholders form strategic alliances to protect and advance their influence. The study showed that these alliances concentrate on decision-making platforms e.g., how the project steering committees are structured and functioned. Despite not demonstrating

evidence of documented terms of reference for these committees, I observed unwritten rules and terms of operation during the research.

I envisage that conflict manifests when stakeholders feel compromised or undermined. For example, a project manager who had unilaterally affected a scope change created conflict. The scope change might have been beneficial to the project. The process of making this decision was against the agreed values and as such, was fiercely rejected by the steering committee.

- Flexibility

  The influence of the project context is dependent on how each stakeholder perceives it. The context has obvious influences such as compliance with legislation and industry standards. It also has unpredictable influences, e.g., change in political leadership. Perceptions of the influence of the context influence the allocation of duties. For example, there were users delegated to manage interactions with political and traditional leadership. The project manager led engagement with regulatory bodies. The sponsor championed engagements with government and state-funded agencies.

  The stakeholders respected the urgency to be flexible in responding to the context. The pace and the quality of the response affected the extent of the impact on project management. The competencies of the project manager affected the flexibility and quality of responses. The research demonstrated the potential of transdisciplinary approaches to improve project management.

- Learning and continuous improvement

  The collaboration of the different stakeholders is a social process influenced by collective values. The values acknowledge that the stakeholders need each other to realise the project. In some instances, individual values influenced the collaboration, which was also laden with power imbalances. The alliances might have been valuable in responding to the power imbalances and other forms of illegitimate power. What the stakeholders prioritised drove their participation and interactions in the temporary organisation.

The plurality of stakeholders increased the likelihood of tensions. The stakeholders navigated them to protect their interests, amidst the uncertainty of success. The tensions motivated participatory project management, which facilitated the collective framing of the problem and its solutions. It enhanced collective accountability for success or failure. It decentralised project management and facilitated distributive and shared power amongst the stakeholders. These decisions advanced responsive and inclusive governance.

- Technology fitness-for-purpose:

  The research highlighted that various aspects are considered in the technology fitness-for-purpose. Such include the ease of understanding and operating the technology and its newness to its context. The context reflected on the readiness of the existing local value chains to maintain the technology. In the projects sampled in this research, the interviewees highlighted alignment with local value chains as critical to eliminating dependency on the technology providers, who often originate from other countries.

5.3.2 What are the additional measures to time, cost, and scope needed to assess the performance of the management of innovation for inclusive development projects?

The plurality of stakeholders involved in the management of innovation for inclusive development projects amplified contentions on performance management. I gathered how different stakeholders apply diverse measures of performance to assess project management. The sponsor's measures of performance included the generation of a knowledge product, the number of jobs created, and enterprises supported. The focus on jobs incorporated both quality and quantity. The knowledge products synthesised evidence to support policy and related decisions, e.g., resourcing.

The users were interested in jobs created, enterprises supported, capacity building, and infrastructure delivered. Their interest in jobs was mainly based on quantity and quality. The technology developers or researchers appointed as project managers prioritised technology performance. The combination of these interests implied

different measures of performance. Each measure is comprised of different KPIs. For example, the human resources measure KPIs included training attended, the achievement of targets, and quality of work. Managing diversity and culture were accounted for in the administration and governance measures of performance. The efforts on managing diversity and maintaining a positive and productive culture were not formally assessed.

In practice, the data showed that the management of complex innovation for inclusive development projects is not assessed based on the iron triangle. It demonstrated how the cost measure includes financing the sustainability and operationalisation of the projects. This aspect exceeds the management of financial resources allocated to the project. In some instances, the stakeholders regarded financing as a measure of performance. Achieving financing goals inferred success as other stakeholders, e.g., financiers and development partners would further support the projects. The support symbolised value for money for the government as the projects would essentially catalyse local economic development.

The measures I propose to expand the triple constraint have emerged from what is currently practised (see Figure 4-3). I categorised the measures to emphasise differences amongst them. My approach also highlights that the iron triangle limits project management performance to process efficiency. My research demonstrates concerted efforts on inclusive administration and governance. It highlights the relationship between the project and its context and the demand for flexibility due to the unpredictability of the outcomes of their interactions.

My proposal on measures of performance needed to expand the iron triangle departs from the systems thinking approach. It is holistic and recognises the interconnectedness and interdependency amongst the different aspects of complex project management. The practice-based proposal concurs with Utulu and Sewchurran (2016) who recognised the value of systems thinking in recognising interfaces and likely sources of social and technical complexity in the temporary project organisation.

My proposal acknowledges that process efficiency can only be achieved in an environment characterised by efficient administration and governance. Attaining process efficiency and scope measures is influenced by the context. My proposal, therefore, expands the measures and puts them into categories that attempt to align with the expanse of complex project management.

5.4 Recommendations

The real-life context of my research strengthens its contribution to complex project management theory. Its value is its practical knowledge of how complexity influences project management organisation. It contributes to theory and practice by highlighting critical aspects that influence how organisations organise for the management of complex projects. It delivers practical knowledge that can assist practitioners to plan and implement their projects. Such knowledge is key as development practitioners and different organisations, including funders, pursue innovation for inclusive development.

The research highlights the formation of a temporary multi-stakeholder organisation to manage complex innovation for inclusive development projects. It shows how the plurality of stakeholders influences the governance of the temporary multi-stakeholder organisation. It highlights a ‘power-with’ compared to a ‘power-over’ approach to project management authority and power. It supports distributive power to enable governance that is inclusive and responsive. It underscores that such are critical to achieving collective ownership and accountability for success and efficiency. It emphasises the flexibility of the stakeholders when dealing with that risk and complexity.

The research used practical information sourced from interviewees and secondary data to propose a four-dimension framework on measures of performance (see Figure 4-3). The framework expands the iron triangle and therefore might contribute to addressing its inadequacy to assess complex project management performance. The proposed framework categorises measures according to process efficiency, scope, context, and good governance.

The four-dimension framework accommodates the breadth of performance priorities assessing the performance of the management of innovation for inclusive development projects. I recommend that future research be considered to test this framework to measure project management performance.

The insights provided through the study motivate further research to expand how complexity influences project management. Further research is critical to complex project management theory. It would enhance the existing knowledge of how complexity influences project organising and performance management. It might delve deeper into alternative forms of organising and how this could affect and improve performance. It might deliver tools and knowledge to successfully deliver them. This research is critical since national and global organisations continue to invest in innovation for inclusive development projects.

REFERENCES

Andersen, E. S. (2006). Toward a project management theory for renewal projects. *Project Management Journal*, *37*(4),15-30. https://doi.org/10.1177/875697280603700403

Andrew, T. N., & Petkov, D. (2003). The need for a systems thinking approach to the planning of rural telecommunications infrastructure. *Telecommunications Policy*, *27*(1-2), 75-93. https://doi.org/10.1016/S0308-5961(02)00095-2

Atkinson, R. (1999). Project management: cost, time and quality, two best guesses and a phenomenon, it's time to accept other success criteria. *International Journal of Project Management, 17*(6), 337-342. https://doi.org/10.1016/S0263-7863(98)00069-6

Baccarini, D. (1996). The concept of project complexity – a review. *International Journal of Project Management, 14*(4), 201-204. https://doi.org/10.1016/0263-7863(95)00093-3

Bakshi, J., Ireland, V., & Gorod, A. (2016). Clarifying the complexity project construct: past, present and future. *International Journal of Project Management*, *34*, 1199-1213. https://doi.org/10.1016/j.ijproman.2016.06.002

Baxter P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *The Qualitative Report, 13*(4), 544-559. https://doi.org/10.46743/2160-3715/2008.1573

Belassi, W., & Tukel, O. I. (1996). A new framework for determining critical success/failure factors in projects. *International Journal of Project Management, 14*(3), 141-151. https://doi.org/10.1016/0263-7863(95)00064-X

Bickman, L., & Rog, D. (2009). Applied research design. In L. Bickman & D. J. Rog (Eds.), *The SAGE handbook of applied social research methods* (2nd ed.). Sage. http://dx.doi.org/10.4135/9781483348858.n1

Bjorvatn, T., & Wald, A. (2018). Project complexity and team-level absorptive capacity as drivers of project management performance. *International Journal of Project Management, 36*(6), 876-888. https://doi.org/10.1016/j.ijproman.2018.05.003

Bredillet, C. (2010). Blowing hot and cold on project management. *Project Management Journal, 41*(3), 4-20. https://doi.org/10.1002/pmj.20179

Brockman, C., & Girmsheid, G. (2007). Complexity of megaprojects. *Proceedings of CIB World Building Congress: Construction for Development, South Africa.* 14-17 May 2007. 219-230. https://doi.org/10.3929/ethz-a-005997850

Brulin, G., & Svensson, L. (2012). Sustainable change in large projects. *PM World Journal, I*(V), 1-5. *http://www.gowerpublishing.com/default.aspx?page=2063.*

Bryde, D. J. (2005). Methods for managing different perspectives of project success. *British Journal of Management, 16*(2), 119-131. https://doi.org/10.1111/j.1467-8551.2005.00438.x

Cambridge Dictionary. (2020). *Measure*. https://dictionary.cambridge.org/us/dictionary/english/measure

Charmaz, K. (2010). Premises, principles and practices in qualitative research: Revisiting the foundations. *SAGE Qualitative Research Methods, 14*(7), 976-993. http://dx.doi.org/10.1177/1049732304266795

Cicmil, S., Cooke-Davies, T., Crawford, L., & Richardson, K. A. (2009). *Exploring the complexity of projects: implications of complexity theory for project management practice*. Project Management Institute. http://site.ebrary.com/id/10461977

Cicmil, S., & Hodgson, D. (2006). New possibilities for project management theory: a critical engagement. *Project Management Journal, 37*(3), 111-122. https://doi.org/10.1177/875697280603700311

Cicmil, S., Williams, T., Thomas, J., & Hodgson, D. (2006). Rethinking project management: researching the actuality of projects. *International Journal of Project Management, 24*(8), 675-686. https://doi.org/10.1016/j.ijproman.2006.08.006

Cohen, W. M., & Levinthal, D. M. (1990). Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly*, *35*(1), 128-152. https://doi.org/10.2307/2393553

Cooke-Davis, T. (2002). The “real” success factors on projects. *International Journal of Project Management, 20*(3), 185-190. https://doi.org/10.1016/S0263-7863(01)00067-9

Crawford, L. (2000). Profiling the competent project manager. *Project Management Research at the Turn of the Millennium: Proceedings of PMI Research Conference*. 21-24 June 2000. Paris, France. 3-15. https://www.researchgate.net/publication/250837584_Profiling_the_Competent_Project_Manager

Creswell, J. W. (2013). *Qualitative inquiry and research design: choosing among five approaches* (3rd ed). Sage.

Crosby, P. (2017). Shaping complex mega-projects: Practical steps for success. *Australian Journal of Civil Engineering, 15*(1), 1-19. https://doi.org/10.1080/14488353.2017.1362806

Daniels, C., Ustyuzhantseva, O., & Yao, W. (2017). Innovation for inclusive development, public policy support and triple helix: perspectives from BRICS. *African Journal of Science, Technology, Innovation and Development, 9*(5), 513-527. https://doi.org/10.1080/20421338.2017.1327923

Daniel, P. A., & Daniel, C. (2018). Complexity, uncertainty, and mental models: from a paradigm of regulation to a paradigm of emergence in project management. *International Journal of Project Management, 36*(1), 184-197. https://doi.org/10.1016/j.ijproman.2017.07.004

Dao, B., Kermanshachi, S., Shane, J., Anderson, S., & Hare, E. (2016). Identifying and measuring project complexity. *Procedia Engineering, 145*, 476-482. https://doi.org/10.1016/j.proeng.2016.04.024

Davis, K. (2016). A method to measure success dimensions relating to individual stakeholder groups. *International Journal of Project Management, 34*(3), 480-493. https://doi.org/10.1016/j.ijproman.2015.12.009

Department of Science and Technology. (2015). *Technology for rural education and development progress report*. Government Printers.

Department of Science and Technology. (2016). *Draft Innovation for Inclusive Development Strategy.* Government Printers.

Department of Science and Technology. (2019). *Science, Technology and Innovation White Paper.* Government Printers.

De Rezende, L. B., Blackwell, P., & Gonçalves, M. (2018). Research focuses, trends, and major findings on project complexity: A bibliometric network analysis of 50 years of project complexity research. *Project Management Journal, 49*(1), 42-56. https://doi.org/10.1177/875697281804900104

De Wit, A. (1988). Measurement of project success. *International Journal of Project Management, 6*(3), 164-170. https://doi.org/10.1016/0263-7863(88)90043-9

Diallo, A., & Thuillier, D. (2004). The success dimensions of international development projects: the perceptions of African project coordinators. International *Journal of Project Management*, *22*(1), 19-31. https://doi.org/10.1016/S0263-7863(03)00008-5

Díez Silva, H. M., Pérez, M. A, Gimena, F. N., & Montes Guerra, M. I. (2013). Performance management in project management. Facultad de Ciencias Economicas y Empresariales, **13**, 33-52. http://dx.doi.org/10.15446/innovar.v25n56.48989

Discenza, R., & Forman, J. B. (2007). Seven causes of project failure: how to recognize them and how to initiate project recovery. Paper presented at *PMI® Global Congress 2007—North America, Atlanta, GA*. Newtown Square, PA: Project Management Institute. https://www.pmi.org/learning/library/seven-causes-project-failure-initiate-recovery-7195

Dombkins, D. (2009). Redefining our profession part 2: The history and future of project management. *PM World Today, XI*(II), 1-21. https://www.researchgate.net/publication/242522271_Redefining_Our_Profession_Part_2_The_History_and_Future_of_Project_Management

Dubois, A., & Gadde, L-E. (2002). Systematic combining: an abductive approach to case research. *Journal of Business Research, 55*(7), 553-560. https://doi.org/10.1016/S0148-2963(00)00195-8

Dubois, A., & Gadde, L-E. (2014). Systematic combining - a decade later. *Journal of Business Research, 67*(6), 1277-1284. https://doi.org/10.1016/j.jbusres.2013.03.036

Eisenhardt, K. M. (1989). Building theories from case study research. Academy *of Management Review, 14*(4), 532-550. https://doi.org/10.2307/258557

Eriksson, P., & Kovalainen, A. (2008). *Qualitative methods in business research*. Sage.

Eskerod, P., Huemann, M., & Savage, G. (2015). Project stakeholder management—past and present. *Project Management Journal, 46*(6), 6-14. https://doi.org/10.1002/pmj.21555

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry, 12*(2), 219-245. https://doi.org/10.1177/1077800405284363

Flyvbjerg, B., Bruzelius, N., & Rothengatter, W. (2003). *Megaprojects and risk: an anatomy of ambition*. CUP. https://doi.org/10.2307/25606171

Freeman, M., & Beale, P. (1992). Measuring project success. *Project Management Journal*, *XXIII*(1), 1-16. https://www.pmi.org/learning/library/measuring-success-business-venture-5351

Geraldi, J., & Söderlund, J. (2018). Project Studies: what it is, where it is going. *International Journal of Project Management, 36*(1), 55-70. https://doi.org/10.1016/j.ijproman.2017.06.004

Ghosh, S., Forrest, D., Thomas DiNetta, T., Wolfe, B., & Lambert, D. C. 2012. Enhance PMBOK® by comparing it with P2M, ICB, PRINCE2, APM and Scrum Project Management Standards. *PM World Journal, IV*(IX), 1-75. https://pmworldlibrary.net/wp-content/uploads/2015/09/pmwj38-Sep2015-Ghosh-Forrest-DiNetta-Wolfe-Lambert-student-paper.pdf

Gioia, D. A, Kevin G., Corley, K. G., & Hamilton, A. L. (2012). Seeking qualitative rigor in inductive research: notes on the Gioia Methodology. *Organizational Research Methods, 16*(1), 15-31. https://doi.org/10.1177/1094428112452151

Gorod, A., Hallo, L., & Nguyen, T. (2018). A systemic approach to complex project management: integration of command and-control and network governance. *Systems Research and Behavioural Science, 35*, 811-837. https://doi.org/10.1002/sres.2520

Guba, E.G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 105-117). Sage.

Gunduz, M., & Almuajebh, M. (2020). Critical success factors for sustainable construction project management. *Sustainability, 12*(5), 1-17. https://doi.org/10.3390/su12051990

Gupta, J., Pouw, N. R. M., & Ros-Tonen, M. A. F. (2015). Towards an elaborated theory of inclusive development. *European Journal of Development Research, 27*(4), 541-559. https://doi.org/10.1057/ejdr.2015.30

Hass, K. B. (2009). *Managing project complexity: A new model*. Management Concepts.

Hayfield, F. (1979). Basic factors for a successful project. *6th Internet Congress*, Garmisch-Partenkirchen FRG.

Henning, E., Van Rensburg, W., & Smit, B. (2004). *Finding your way in qualitative research*. Van Schaik Publishers.

Hodgson, D. E., & Cicmil, S. (2008). The other side of projects: the case for critical project studies. *International Journal of Managing Projects in Business, 1*(1), 142-152. https://doi.org/10.1108/17538370810846487

Hoffecker, E. (2020). Understanding inclusive innovation processes in agricultural systems: A middle-range conceptual model. *World Development, 140*(2021), 105382. https://doi.org/10.1016/j.worlddev.2020.105382

Howsawi, E., Eager, D., Bagia, R. & Niebecker, K. (2014). The four-level project success framework: application and assessment. *Organisational Project Management, 1*(1), 1-15. https://doi.org/10.5130/opm.v1i1.3865

Hyväri, I. 2006. Project management effectiveness in project-oriented business organizations. *International Journal of Project Management, 24*(3), 216-225. https://doi.org/10.1016/j.ijproman.2005.09.001

Ika, L. A., Diallo, A., & Thuillier, D. (2012). Critical success factors for World Bank projects: an empirical investigation. *International Journal of Project Management, 30*(1), 105-16. https://doi.org/10.1016/j.ijproman.2011.03.005

Ika, L.A., Söderlund, J., Munro, L.M. & Landoni, P. (2020). Cross-learning between project management and international development: Analysis and research agenda. *International Journal of Project Management, 38*(8), 548-558. https://doi.org/10.1016/j.ijproman.2020.10.005

International Centre for Complex Project Management (ICCPM). (2011). *Complex project management global perspectives and the strategic agenda to 2025*.

https://iccpm.com/wp-content/uploads/2018/09/ICCPM-Executive-Summary.pdf

International Centre for Complex Project Management (ICCPM). (2012). *Complex project manager competency standards* (Version 4.1, August 2012): *Complex project management leadership and excellence.* https://iccpm.com/wp-content/uploads/2018/09/CPM-Competency-Standard-V4.1.pdf

International Project Management Association. (2006). *ICB: IPMA competence baseline, Version 3.* International Project Management Association.

Jugdev, K., & Müller, R. (2005). A retrospective look at our evolving understanding of project success. *Project Management Journal, 36*(4), 19-31. https://doi.org/10.1177/875697280503600403

Keene, C. (2007). *Development projects that didn't work: the perils of narrow approaches to complex situations*. http://www.globalhood.org/articles/briefingnotes/Development_Projects_That_Didnt_Work.pdf

Kenny, J. (2003). Effective project management for strategic innovation and change in organizational context. *Project Management Journal, 34*(1), 43-53. https://doi.org/10.1177/875697280303400106

Kerzner, H. (2003). *Project management: A systems approach to planning, scheduling, and controlling* (8th ed.). John Wiley & Sons, Inc.

Kerzner, H. (2015). *Project management metrics, KPIs and dashboards*. International Institute of Learning.

Khang, D. B., & Moe, T. L. (2008). Success criteria and factors for international development projects: a life-cycle-based framework. *Project Management Journal, 39*(1), 72-84. https://doi.org/10.1002/pmj.20034

Khosvari, S., & Afshari, H. (2011). A success measurement model for construction projects. *International Conference on Financial Management and Economics, 11*, 186-190. http://www.ipedr.com/vol11/36-W00014.pdf

Klein, L. (2010). *Designing social complexity: towards a next practice of complex project management based on a comprehensive theory of social systems*. ICPPM Research Prize.

Koelmans, R. G. (2004). Project success and performance evaluation. *International Platinum Conference 'Platinum Adding Value'*. The South African Institute of Mining and Metallurgy. http://www.saimm.co.za/Conferences/Pt2004/229_Koelmans.pdf

Koskela, L., & Howell, G. (2002). The theory of project management: Explanation to novel methods. *Proceedings IGLC-10,* August 2002. Gramado, Brazil. https://iglcstorage.blob.core.windows.net/papers/attachment-8ef324db-750a-40c3-9c17-273db32b54e2.pdf

Kotzé, T. (2007*). Guidelines on writing a first quantitative academic article*. University of Pretoria.

Kwak, Y. H. (2002). Critical success factors in international development project management. The organization and management of construction. In B. O. Uwakweh & I. A. Minkarak (Eds.), *10th International Symposium: Construction Innovation and Global Competitiveness*. CRC Press.

Leedy, P. D., & Ormrod, J. E. (2005). *Practical research: planning and design* (8th ed.). Prentice Hall.

Leedy, P. D., & Ormrod, J. E. (2010). *Practical research: planning and design* (9th ed.). Pearson Education.

Lu, Y., Luo, L., Wang, H., Le, Y., & Shi, Q. (2015). Measurement model of project complexity for large-scale projects from task and organization perspective. *International Journal of Project Management, 33*(3), 610-622. https://doi.org/10.1016/j.ijproman.2014.12.005

Luo, L., He, Q., Jaselskis, E. J., & Xie, J. (2017). Construction project complexity: research trends and implications. *Journal of Construction Engineering and Management, 143*(7), 1-10. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001306

Mahalingam, A., & Levitt, R. E. (2007). Institutional theory as a framework for analyzing conflicts on global projects. *Journal of Construction andEngineering Management, 133*(7), 517. https://doi.org/10.1061/(ASCE)0733-9364(2007)133:7(517)

Mamédio, D. F., & Meyer V. (Jr). (2020). Managing project complexity: how to cope with multiple dimensions of complex systems. *International Journal of Managing Projects in Business, 13*(4), 727-744. https://doi.org/10.1108/IJMPB-06-2019-0147

Marnewick, C. (2012). To invest or not to invest in SADC – a project management perspective. *Journal of Contemporary Management, 9*, 341-363. https://www.semanticscholar.org/paper/To-invest-or-not-to-invest-in-SADC-a-project-Marnewick/08cf0b7076b70f68c94fafe3da36ccbf138fe78a

Mason, J. (2002). *Qualitative researching* (2nd ed.). Sage.

Mellado, F., Lou, E. C. W., & Becerra, C. L. C. (2020). Synthesising performance in the construction industry: An analysis of performance indicators to promote project improvement. *Engineering, Construction and Architectural Management, 27*(2), 579-608. https://doi.org/10.1108/ECAM-09-2018-0419

Meredith, J. R., & Mantel, S. J. (Jr). (2003). *Project management. A managerial approach*. John Wily & Sons, Inc.

Morris, P. W. G. (1988). Managing project interfaces – key points for project success. In D. I. Cleland & W. R. King (Eds.), *Project management handbook* (pp. 16-55). Van Nostrand Reinhold.

Morris, P. W. G. (2004). Why project management doesn't always make business sense. *Project Management, 1*(98), 13-16.

Müller, K., & Turner, R. (2007). The influence of project managers on project success criteria and project success by type of project. *European Management Journal, 25*(4), 298-309. https://doi.org/10.1016/j.emj.2007.06.003

Narsalay, R., Pongeluppe, L., & Light, D. (2015). The hidden pitfalls of inclusive innovation. *Stanford Social Innovation Review*, 48-53. https://doi.org/10.48558/7ajb-gc03

Neuman, W. L. (2006). *Social research methods: qualitative and quantitative approaches*. Pearson.

O'Leary, Z. (2014). *The essential guide to doing your research project* (3rd ed.). Sage.

Organisation for Economic Cooperation and Development. (2015). *Innovation policies for inclusive development: scaling-up inclusive innovations*. OECD Publications.

Osorio P. F., Quelhas O. G., & Zotes, L. P. (2014). Critical success factors in project management: an exploratory study of an energy company in Brazil, Double Blind Peer Reviewed. *International Research Journal, 14*, 39-50.

Pinto, J. K., & Slevin, D. P. (1988). Critical success factors across the project life cycle: definitions and measurement techniques. *Project Management Journal, 19*(3), 67-75. https://www.pmi.org/learning/library/critical-success-factors-project-life-cycle-2131

Page, C., & Meyer, D. (2000). *Applied research design for business and management*. Irwin/McGraw-Hill.

Project Management Institute. (2004). *A guide to the project management body of knowledge (PMBOK)*. PMI.

Project Management Institute. (2013). *A guide to the project management bdy of kowledge (PMBOK guide)* (5th ed.). Newton Square.

Project Management Institute. (2018). *Pulse of the profession. Success in disruptive times: expanding the value delivery landscape to address the high cost of low performance*. Newton Square.

Project Management Institute. (2021). *Beyond agility: Flex to the future. Pulse of the profession*. Newton Square.

Radujković, M., & Sjekavica, M. (2017). Project management success factor. *Procedia Engineering, 196*, 607-615. https://doi.org/10.1016/j.proeng.2017.08.048

Remington, K., & Pollack. J. (2007). *Tools for complex projects*. Routledge.

Remington, K., Zolin, R., & Turner, R. (2009). A model of project complexity: distinguishing dimensions of complexity from severity. Paper presented at the *Proceedings of the 9th International Research Network of Project Management Conference.*

Rozenes, S., Vitner, G., & Spraggett, S. (2006). Project control: literature review. *Project Management Journal, 37*(4), 5-14. https://doi.org/10.1177/875697280603700402

Rwelamila, P. D., & Ssegawa, J. K. (2014). The African project failure syndrome: the conundrum of project management knowledge base- the case of SADC. *Journal of African Business, 15*(3), 211-224. https://doi.org/10.1080/15228916.2014.956645

Sage, D., Dainty, A., & Brookes, N. (2014). A critical argument in favour of theoretical pluralism: project failure and the many and varied limitations of project management. *International Journal of Project Management, 32*(4), 544-555. https://doi.org/10.1016/j.ijproman.2013.08.005

San Cristóbal, J. R., Carral, L., Diaz, E., José A., Fraguela, J. A., & Iglesias, G. (2018). Complexity and project management: a general overview. *Hindawi Complexity*. https://doi.org/10.1155/2018/4891286

Sato C. E. Y., Dergint D., & Hatakeyama K. (2005). Project-based organizations as complex adaptive systems. In P. L. Alberto, L. S. de Oliveira & P. Guarnieri (Eds.), *Produção científica do PPGEP: 2004.* UTFPR.

Saunders, M., Lewis, P., & Thornhill, A. (2007). *Research methods for business students* (4th ed.). Pearson.

Saynisch, M. (2010). Mastering complexity and changes in projects, economy, and society via project management second order (PM-2). *Project Management Journal, 41*(5), 4-20. https://doi.org/10.1002/pmj.20167

Serrador, P., & Turner, R. (2014). The relationship between project success and project efficiency. *Procedia – Social and Behavioural Sciences, 119*, 75-84. https://doi:10.1016/j.sbspro.2014.03.011

Sewchurran, K., Smith, D., & Roode, D. (2010). Toward a regional ontology for information systems project management. *International Journal of Managing Projects in Business*, *3*(6), 681-692. https://doi.org/10.1108/17538371011076118

Shivambu, X., & Thwala, W. D. (2019). Assessment of the delays in the delivery of public sector projects in South Africa. In W. Karwoowski & T. Ahram (Eds.), *Intelligent human systems integration (IHSI).* https://doi.org/10.1007/978-3-030-11051-2_138

Shenhar, A. J., & Dvir, D. (2007). *Reinventing project management: the diamond approach to successful growth and innovation*. Harvard Business School Press.

Shenhar, A. J., Holzmann, V., Melamed, B., & Zhao, Y. (2016). The challenge of innovation in highly complex projects: What can we learn from Boeing's Dreamliner experience? *Project Management Journal, 47*(2), 62-78. https://doi.org/10.1002/pmj.21579

Shenhar, A. J., Poli, M., & Lechler, T. (2000). A new framework for strategic project management. In T. Khalil (Ed.), *Management of technology VIII*. University of Miami.

Shenhar, A. J., & Wideman. M. (2000). *Optimizing project success by matching PM style with project type*. http://www.pmforum.org/pmwt/papers00-11.htm

Slevin, *D. P., & Pinto*, *J. K. (1986).* The project implementation profile: new tool for project managers. *Project Management Journal*, *17*(4), 57-70. https://www.pmi.org/learning/library/project-implementation-profile-tool-project-managers-5220

Snowden, D. J., & Boone, M. E. (2007). A leader's framework for decision making. *Harvard Business Review, 85*, 68. https://hbr.org/2007/11/a-leaders-framework-for-decision-making

Stacey, R. D. (1993). *Strategic management and organisational dynamics*. Pitman.

Stacey, R. D. (1996). *Complexity and creativity in organizations*. Berrett-Koehler Publishers.

Stake, R. E. (1995). *The art of case study research*. Sage.

Struyk, R. J. (2007). Factors in successful program implementation in Russia during the transition: Pilot programs as a guide. *Public Administration and Development*, *27*, 63-3. https://doi-org.ezproxy.uct.ac.za/10.1002/pad.430

Sutrisna, M. (2009). Research methodology in doctoral research: Understanding the meaning of conducting qualitative research. *Working Paper presented in ARCOM Doctoral Workshop Liverpool John Moores University*, 12 May 2009

The Centre for Business Practices. (2005). *Measures of project management performance and value: A benchmark of current business practices*. https://www.pmsolutions.com/audio/PM_Performance_and_Value_List_of_Measures.pdf

Transportation Research Board of the National Academies. (2014). *Guide to project management strategies for complex projects*. Strategic Highway Research Program 2.

Turner, J. R., & Cochrane, R. A. (1993). Goals-and-methods matrix: coping with projects with ill-defined goals and/or methods of achieving them. *International Journal of Project Management, 11*(2), 93-102. https://doi.org/10.1016/0263-7863(93)90017-H

Turner, J. R., & Müller, R. (2003). On the nature of the project as a temporary organization. *International Journal of Project Management, 21*, 1-8. https://doi.org/10.1016/S0263-7863(02)00020-0

Turner, J. R., & Zolin, R. (2012). Forecasting success on large projects: developing reliable scales to predict multiple perspectives by multiple stakeholders over multiple timeframes. *Project Management Journal, 43*(5), 87-99. https://doi.org/10.1002/pmj.21289

Turley, F. (2013). *An introduction to PRINCE2*. https://mplaza.pm/wordpress/wp-content/uploads/2015/11/Introduction-To-PRINCE2-MP0057.pdf

United Nations. (2015). *A/RES/61/313: Addis Ababa Action Agenda of the Third International Conference on Financing for Development* (Addis Ababa Action Agenda).

Utulu, S. C. A., & Sewchurran, K. (2016). Designing e-Government platforms using systems thinking perspectives and performance measurement frameworks. In *Politics and social activism: Concepts, methodologies, tools, and applications.* https://doi.org/10.4018/978-1-4666-9461-3.ch013

Van der Waldt, G. (2007). Project management: a new service delivery. *Koers, 72*(2), 239- 260. https://reference.sabinet.co.za.nwulib.nwu.ac.za/sa_epublication/koers

Vidal, L., & Marle, F. (2008). Understanding project complexity: Implications on project management. *Kybernetes, 37*(8). https://doi.org/10.1108/03684920810884928

Whitty, S. J., & Maylor, H. (2009). And then came complex project management (revised). *International Journal of Project Management, 27*(3), 304-310. https://doi.org/10.1016/j.ijproman.2008.03.004

Wideman, R. X. (2000). *Managing the development of building projects for better results.* www.maxwideman.com

Williams, T. (2002). *Modelling complex projects*. John Wiley & Sons, Ltd.

Williams, T. (2017). The nature of risk in complex projects. *Project Management Journal, 48*(4), 55-66. https://doi.org/10.1177/875697281704800405

Winch, G. M. (2014). Three domains of project organising. *International Journal of Project Management, 32*(5), 721-731. https://doi.org/10.1016/j.ijproman.2013.10.012

Wood, H. L., & Ashton, P. (2010). Modelling project complexity. *In:* Egbu, C. (Ed) *Procs 26th Annual ARCOM Conference,* 6-8 September 2010, Leeds, UK, Association of Researchers in Construction Management, 1111-1120.

Wright, N. J. (1997). Time and budget: The twin imperatives of a project sponsor. *International Journal of Project Management, 15*, 181-186. https://doi.org/10.1016/S0263-7863(96)00059-2

Xia, B., & Chan, A. P. C. (2012). Measuring complexity for building projects: A Delphi study. *Engineering, Construction and Architectural Management, 19*(1), 7-24. https://doi.org/10.1108/09699981211192544

Yin, R. (2009). *Case study research: Design and methods* (4th ed.). Sage.

Yin, R. (2012). *Applications of case study research* (3rd ed.). Sage.

Yun, S., Choi, J., Oliveira, D. P., Mulva, S. P., & Kang, Y. (2016). Measuring project management inputs throughout capital project delivery. *International Journal of Project Management, 34*, 1167-1182. https://doi.org/10.1016/j.ijproman.2016.06.004

Zimmerman, B. J. (2001). *Ralph Stacey's agreement & certainty matrix.* York University.

APPENDICES

Appendix I: Consent Form

Informed Consent Form for Key Informants

Consent statement

CONSENT STATEMENT

My name is Nonhlanhla Patience Mkhize. I am a student and researcher the Graduate School of Business at the University of Cape Town. I am supervised by Associate Professor Kosheek Sewchurran and I am doing research for the Department of Science and Technology, who is my current employer. The intention of this research is as follows:

- To ascertain what informs the management of inclusive development projects.
- To investigate the project management process, the managing organization (DST) is obliged to follow; and the manifest disharmony regarding the use of this process and the criteria for project success.
- To explore how organizations organize and manage inclusive development projects through literature searchers.
- To identify an appropriate inclusive development project management framework that may be used and adapted for the DST, state development entities, and the non-state sector etc.
- To test the plausibility of such a framework in the context of the DST.

I am studying the views of project management personnel and beneficiaries in order to learn more about the DST's project management of inclusive development projects. Based on your area of responsibility, participation and involvement in the DST inclusive development projects, I would like to discuss the project management of inclusive development projects with you in line with the objectives of this research. All information will be kept confidential.

This research has been approved by the Commerce Faculty Ethics in Research Committee.
* Your participation in this research is voluntary. You can choose to withdraw from the research at any time. There is no penalty for not participating, and your answer will be kept confidential.
* The interviews will take approximately 90 minutes to complete. If you choose to take part you may stop at anytime, or skip any questions that you do not wish to answer without any penalty.
* You will not be requested to supply any identifiable information, ensuring anonymity of your responses.
Do you wish to proceed? *[Proceed with interview only if response is positive]*
* You will not be requested to supply any identifiable information, ensuring anonymity of your responses.
Do you wish to proceed? *[Proceed with interview only if response is positive]*

Informed Consent Form for Key Informants

Name of researcher : **Signature of researcher:**

Name of supervisor : **Signature of supervisor:**

Title of research project :

By filling out this questionnaire / answering the questions put to me:

- I understand the purpose of this research project.
- I have read this consent form and the information it contains and had the opportunity to ask questions about them.
- I understand that I was selected to participate in this study due to my [expertise/ /position] (*delete as applicable.*)
- I understand that I was selected randomly from a larger group of people [with my expertise / in my position] (*delete as applicable.*)
- I understand I have the right to withdraw from this project at any stage.
- I understand that I am under no obligation to take part in this project.
- I understand that this research might be published in a research journal or book. In the case of dissertation research, the document will be available to readers in a university library in printed form, and possibly in electronic form as well.
- I agree to my responses being used for education and research on condition my privacy is respected. I understand that my responses will be used in aggregate form only, so that I will not be personally identifiable.

	Yes	No
My name may be used in the published research		
My personal details (e.g. age, occupation, position) may be included in the published research		
My responses can only be used in a way that I cannot be personally identifiable		

Name of participant :

Signature of participant :

Date :

The researcher must supply you with an ***Information sheet*** which provides his / her contact details, outlines the nature of the research and how the information will be used and explains what your participation in the research involves (e.g. how long it will take, participants' roles and rights (including the right to skip questions or withdraw without penalty at any time), any anticipated risks/benefits which may arise as a result of participating, any costs or payment involved (even if none, these should be stated))				
Has this been provided?	**Yes**		**No**	
Have your received verbal confirmation/explanations where needed?	**Yes**		**No**	

Appendix II: 1st-Order Concepts Quotations

1st order concepts	Notable quotes
Concept 1	"although the project is for us and about us, our needs were not considered in framing it. We are happy about the jobs that the project has created but we are concerned that our expectation for sustainable business enterprises will not be met. How can they commit to doing things for us without us?" "it is naïve to think that project management personnel are impartial. I have seen how they prioritise the department over us. They don't respect and trust us as partners in this project. How can we be accountable to each other and accept responsibility for performance if we are not treated the same by the project manager?" "a complex project must deliver transformative change", which significantly alters conventional business processes and behaviours of stakeholders.
Concept 2	"*inclusion is doing things with. It is not doing things for or to*." "diversity is both an opportunity and a threat. It creates a dynamism that can either enrich the project or hamper its progress." "the sponsor and project manager could claim their commitment to inclusive development principles. They forget such during the project management process. Their actions could denounce the principle of "doing things with the users and not for the users." Practising this principle during project management promotes accountability for success or failure.

	“a community is not homogenous as it has ecosystems of the marginalised, the poor and elites.” “behavioural change *is unfortunately, a neglected aspect of project management. Stakeholders prioritise the technology and the business stuff. Their focus is on the numbers to make sense and creation of physical assets.*” "*the right behaviour characterised by appropriate intellectual; physical and metaphysical orientation.”* Another conformed to this view and explained that “*language is a power that makes or breaks cooperation. It is potent when it recognises different forms of organising in the community*”. “regardless of the collaboration, the stakeholder who “holds the purse strings” should be allowed due authority and preside over the decision-making at the steering committee meetings.” We are made to feel like spectators expected to accept the decisions of the project manager without challenging them.” *“beneficiaries do not know what to do.”* T*hey may not know in the way we expect them to, but they have knowledge of the extent of the problem in its context. Using positional power to enforce our views and ways of working rob us of learning and improving the management of these projects*.” “we must be empowered with the same information to trust and be accountable to each other.”
Concept 3	*Users form part of the project management team, which "forces the voice of the users, although they are still not heard*.”

	“the sponsor and contracted project management agencies are inefficient in understanding community dynamics. These dynamics can hamper definition of goal and objectives.” “things that are beyond our control will happen, we must adapt.” "naïve project managers underestimate the influence of politics"
Concept 4	“as the project manager, I design and lead the project. I am experienced in managing these projects and know what is best. “*the project managers whom themselves have vested interests in the projects sometimes struggle to recognise and merge the needs of the funders and users.”* *“if this was my own money, I would have made different decisions.* *“blatantly ignore our abilities and knowledge. We cannot be observers of initiatives activated by our knowledge. How can we be partners of a project if we constantly fight over timely access to the information?”* “the know it all attitude annoys me. He claims we are stakeholders and then treats us like children who must be told what to do. It is either his way or total humiliation for you.” “the technical and social maturity of the project manager is essential. It enables the collaboration of different stakeholders. It helps to maintain a governance model that is appropriate for the context” (Figure 15).
Concept 5	“whilst scientists focus on technology demonstration, we are concerned with making this project successful so that we can create businesses from it. It must be succeed so that we can take care of ourselves and our families, once the government no longer funds the project. We are committed to our development.”

	"*people in rural areas are not well trained nor educated. They are expected to operationalise projects without the necessary psychosocial support. This might be one of the reasons why projects are not operationalised successfully."* *"the technology must work for us, not the other way round"* *"how does this technology support our local businesses. Why are we selling the oil overseas when the saloons can use it as well?"*