Framework For Developing Coworking Spaces Through Sustainable Refurbishment In South Africa

by

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Declaration

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Abstract

The study was conducted as the changing nature of work, global trends and South African market conditions indicated the need for coworking spaces. The aim of the study is to assist the development manager of coworking spaces projects in the development process. A grounded theory methodology was used to develop a conceptual framework. As guideline, the Professional Consultants Services Agreement Committee (PROCSA) matrix was used to build the conceptual framework. The PROCSA matrix states the general roles and responsibilities of all parties involved in a construction project for the life-cycle of the project, including the development manager.

Requirements were added to the general roles and responsibilities of the development manager, these requirements can be divided into four main categories. **Coworking requirements** comprised of a coworking member typology matrix, general coworking characteristics and specific location selection requirements. **Refurbishment requirements** included the need for deep energy refurbishment, vacant sites, flexible refurbishment design and thorough assessment of refurbishment characteristics. **Sustainable requirements** included a minimum four star green rating according to the green building council of South Africa and several additional requirements to use the office rating tool. **Construction management requirements** included the use of an eight step method aimed at reducing waste in refurbishment projects through implementing lean construction principles.

The study was validated by conducting a theoretical case study on a coworking space completed in the second half of 2018. After the theoretical case study, subject matter experts in the industry were interviewed with the results from the case study and the conceptual framework to gather further input on the conceptual framework.

Opsomming

Die studie is uitgevoer omdat globale tendense in Suid-Afrikaanse kondisies die behoefte vir saamwerkspasies toon. Die doel van die studie is om die ontwikkelingsbestuurder van saamwerkspasies te ondersteun in die ontwikkelingsproses. 'n Gegronde-teorie metodologie is gebruik om 'n konsepsuele raamwerk te ontwikkel. Die konsepsuele raamwerk het gebruik gemaak van die Komitee vir Professionele Konsultante Ooreenkomste-matriks (KPKO) as riglyn. Die KPKO-matriks benoem die rolle en verantwoordelikhede van alle partye wat betrokke is in 'n konstruksie projek vir die lewensiklus van die projek, insluitend die ontwikkelingsbestuurder.

Vereistes is by die algemene rolle en verantwoordelikhede van die ontwikkelingsbestuurder gevoeg. Hierdie vereistes kan in vier hoofkategorie verdeel word. **Saamwerkspasie vereistes** sluit in die gebruik van 'n tipologiematriks van 'n saamwerkspasie se lede, algemene karakteristieke van 'n saamwerk spasie sowel as spesefieke vereistes vir die keuse van liggings. **Opknappingsvereistes** sluit in die toepassing van die energie opknapping, vakante geboue of dele van geboue, buigbare opknappingsontwerp sowel as 'n deeglike evaluering van die opknappingseienskappe. **Volhoubare vereistes** sluit 'n minimum vierster-groengradering volgens die groenbouraad van Suid Afrika in sowel as verskeie bykomende vereistes om die kantoorwaarderingsinstrument te gebruik. **Vereistes vir konstruksiebestuur** sluit die gebruik van 'n agt-stapmetode in wat gemik is op die vermindering van afval in opknappingsprojekte deur die toepassing van skraal konstruksiebeginsels.

Die studie is bekragtig deur 'n teoretiese gevallestudie te doen oor 'n saamwerkspasie wat in die tweede helfte van 2018 voltooi is. Na die teoretiese gevallestudie, is vakkundiges in die industrie met die resultate van die gevallestudie en die konseptuele raamwerk genader om verdere insette oor die konsepsuele raamwerk te versamel.

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Chapter 1

Introduction

1.1 Introduction

The nature of work is changing. Changes in the economy, digitalisation of the economy, generational shifts and shifts in company goals all have part in this changing nature of work. In order to build a working environment for the current and future working population, these changes in work must be considered and taken into account.

With big changes in the nature of work, it also causes the nature of firms to change. With physical presence no longer being a prerequisite to do business in a given market, expanded boundaries are created for firms to grow, but this is often met with increased concentration in the markets World Bank (2019). With changes in firms, comes changes in working environments, therefore the increase in demand for coworking spaces.

Moriset (2014) argues that the rise of coworking spaces is a result of two interlinked tendencies, the rise of the creative economy (Florida, 2014) and the digitalisation of the economy (Malecki and Moriset, 2007). In the last two decades our economy shifted from an industrial economy to a knowledge economy and the next step is a creative economy where creativity is increasingly seen as the *holy grail* in the economic world according to Malecki and Moriset (2007).

The term coworking was coined in 2005 by Neuberg. He was in a predicament where he could either have a job that gave him structure and community, or he could be a freelancer that gave him freedom and independence. He saw a golden opportunity to create a working environment where desks can be rented out to individuals or small companies to create a community of people with different jobs but who wanted to share ideas (Frost, 2008).

Since then, coworking spaces around the world increased significantly. A global coworking survey done by Deskmag in 2017 projected 18,900 coworking spaces to be in business by the end of December 2018 with more than 1.7 million people occupying the these spaces (Deskmag, 2018)

This rise in the use of coworking spaces is due to the changing nature of work driven by the creative economy and digitalisation of the economy. With generational shifts and shifts in company goals, people and companies are mobilizing to a more flexible working environment provided by coworking spaces.

Spreitzer *et al.* (2015) did a study on coworking spaces to better understand why so many people are

moving to coworking spaces. The study found three reasons for this movement.

Firstly, people thrive in the diversity created in a coworking space:

- Unlike traditional offices, people from different companies, ventures and projects work in the same space. This leads to little direct competition and internal politics; and with the different kinds of work within the coworking space, it can make ones own work seem more distinctive; and
- With the wide variety of skill sets in the coworking space, coworkers very often provide their skills to other community members, creating a sense of value within the member offering the skills.

Secondly, coworking spaces give people more control over their working hours. Since coworking spaces are normally accessible 24 hours a day to members, people can decide to put in a long day's work before a deadline or to take a long midday break to go to the gym. Members can decide where in the coworking space they want to work, a quiet space for more focused work or a more collaborative space for interaction with coworkers. People can even work from home in the case of a family emergency or scheduled appointment, but this is not encouraged since to much autonomy can cripple productivity. A good coworking space thus has a vibrant community that helps create structure and motivates each other.

Thirdly, as opposed to working from home, people pay to work in a communal space to be part of a community and to build connections with other people. It is important to note that socialising is not compulsory or forced, it is more organic and happens at members free will. A member would for instance move to the café if they are interested in networking, or they could move to a quieter place in the office to get some focused work done.

Spreitzer *et al.* (2015) states that although the coworking movement has its origins among entrepreneurs, freelancers and the tech industry, the style of working is increasingly relevant to a broader range of people and organisations. People need the freedom to craft their work in ways that give them purpose and meaning. The study suggests that it is a combination of a well-designed work environment and a well-curated work experience that lead to the effectiveness coworking spaces.

Moriset (2013) attests that coworking spaces is a growing phenomenon considering the increase in coworking spaces worldwide from 2005 to 2013. Coworking spaces is a result of hybridization between technological, economic and social categories and they are strongly anchored in the workplace landscape of big business cities.

Aurelie (2016) states that despite the unprecedented speed and scale of the rise of coworking spaces, academic research has largely ignored this phenomenon. Coworking spaces reflect the value that workers place on autonomy and empowerment and as a result have started disrupting classic models of working organisations.

Online searches conducted by Coworker (2019), indicated that South Africa also experienced the rise of coworking spaces with at least 67 known coworking spaces. With no signs of this coworking trend stopping any time soon, there is a demand to develop coworking spaces in South Africa. With development comes an obligation to be sustainable and future focused. Huang *et al.* (2018); Lei *et al.* (2019) states that construction contributes roughly 23% of global CO2 emissions annually thus making it a large contributor to global warming.

Research done by the South African Property Owners Association (SAPOA) indicated that nationally the office vacancies stood at 11.2% for the third quarter of 2018. These sticky vacancy rates slowed rental growth down to 5.3%, compared to the 6.3% in the second quarter of 2018 (SAPOA, 2018).

With sustainable development becoming a more pressing matter and the high amount of office vacancies in South Africa, the refurbishment of vacant spaces presents a solution to address both the vacancies and sustainable development matters. According to the World Green Building Council, evidence is growing that green buildings bring multiple benefits. These benefits can be categorised with in environmental, economic and social benefits WorldGBC (2019).

According to Molenbroek *et al.* (2015), global energy efficiency measures could lead to an estimated annual savings of 280 - 410 billion Euros. Building owners report that Green buildings command a 7% increase in asset value over traditional buildings whether it is new builds or retrofits Morton *et al.* (2016).

Refurbishment projects is a complex and non-continuous process that requires planning to be adjusted to fit project characteristics Lundberg and Lidelow (2016). To deal with all the added complexities these characteristics add to refurbishment projects, one would expect an advanced management approach, but studies show otherwise. A study done by Kemmer and Koskela (2013) indicated that the management tasks perceived as most difficult in managing refurbishment projects was in order forecasting and planning, analysis of project risk and uncertainty, competitive tendering, budgetary control and managing time. Despite this view from industry, the most popular planning and control techniques implemented in refurbishment projects are still bar charts, Critical Path Method (CPM), schedules, project cost-value reconciliation and labour reconciliation Lundberg and Lidelow (2016); Babangida (2014)

This thesis sets out to investigate the development of coworking spaces through sustainable refurbishment in South Africa. During research it was found that there is need for an improved construction management method among property development teams. The research objectives in Section 1.3 sets out all aspects that was investigated in this document.

1.2 Problem Statement

With the nature of work changing, the demand for a new type of working environment is growing. Coworking spaces have proven to meet this demand but are in short supply. South Africa is currently in a position where the business industry is realising the need and advantages of coworking spaces. The country also has high amounts of vacant retail space that could serve as coworking spaces through refurbishment. Lastly, the construction industry is a contributor towards global warming, therefore we have a shared responsibility to consider sustainable development.

There is an opportunity to add to the body of knowledge on coworking spaces by creating a framework that guides the development of coworking spaces through sustainable refurbishment in South Africa

The primary and secondary research objectives, as well as the research questions are detailed in Section 1.3.

1.3 Research Objectives

This research aims to develop a conceptual framework that aids the development manager in the construction of coworking spaces through the sustainable refurbishment of buildings and implementing lean construction principles to improve construction management. Table 1.1 summarises the research problem, primary and secondary objectives as well as subsequent research questions.

Chapter 2 sets out to investigate development life cycles to find a life cycle that guides the development manager best in their general roles and responsibilities. Chapter 3 gets to the central theme of this document that binds all the other topics together. The changing nature of work leads to the need for coworking spaces and thus the need to guide development managers in this process. The objective is to give the development manager a better understanding of the nature, member typology and characteristics of coworking spaces.

Chapter 4 aims to establish the benefits of refurbishment over new builds, since development is capital intensive and refurbishment offers financial and sustainable advantageous, it was deemed necessary to add this objective to the study. Chapter 5 sets out to determine the criteria to measure building sustainability. With the increasing effects of global warming and the part that construction/property development plays therein, it was deemed important to address the sustainability of new coworking spaces. The objective of Chapter 6 is to determine an improved construction management method, the need for improved construction management was discovered during the refined literature review of refurbishment.

The objective of Chapter 8 is to validate the study by receiving input for subject matter experts in the industry where the conceptual framework is intended to be used.

Table 1.1 serves as a guideline for the layout of the thesis. The objectives for each chapter will be stated at the beginning of the chapter to set the scope for the chapter. The layout of the thesis was designed in such a way that every consecutive chapter adds a piece to the final conceptual framework. It was found that this method of structuring the thesis made the chapters more streamlined and to the point, and guides the reader as the conceptual framework is built.

Problem Statement	Primary Objectives	Secondary Objectives	Research Question Structure	Doc Structure
The changing nature of work gives rise to the need for new working spaces termed coworking spaces. How does one develop a coworking space through sustainable retrofitting in South Africa	Determine what development life cycle guides the development manager best in his general roles and responsibilities	Compare relevant development life cycles	Why look at development life cycles?	2.2
			What is the criteria for selecting the best life cycle?	2.2.4
		Investigate general roles and responsibilities of development manager	What development life cycle is best for the conceptual framework?	2.2.4
			What are the roles and responsibilities of a development manager according to this development life cycle?	2.3
	Establish the nature and extent of the need for coworking space	Investigate the changing nature of work and subsequent need for coworking spaces	What are the drivers of the changing nature of work?	3.2
			What is the impact of the changing nature of work?	3.2
		Define coworking spaces	What is coworking?	3.3
		Investigate the coworking member typology	Who is working in coworking spaces and how can they be classified?	3.4.1
		Investigate common coworking space characteristics	What characteristics are shared by majority of coworking spaces?	3.5
		Determine the relevance of coworking in South Africa	Where in South Africa would coworking spaces be feasible?	3.6
	Establish the benefits of refurbishment over new builds	Compare advantages of new builds to refurbishment	What is refurbishment?	4.2
			Why is refurbishment better than new builds in the context of coworking spaces?	4.3
		Investigate refurbishment in South Africa	Why would refurbishment be a better consideration in a South African context?	4.4.1
	Determine criteria for measuring building sustainability	Determine what sustainable property development is	Why should sustainable development be considered?	5.2
			How is green buildings defined?	5.2
		Establish the benefits of sustainable property development	What are the benefits of sustainable development?	5.3
		Determine how sustainable property development is measured	How is sustainable development standardised and measured?	5.4
	Determine improved construction management method for refurbishment projects	Establish current construction management methods of refurbishment projects	Why is better construction management needed?	6.2
		Determine candidate solutions to improve management of construction	What solutions are there for current problems in construction management?	6.2.2
		Establish a new method for construction management	What management principals can be applied to improve the refurbishment process?	6.3
	Validate the study	Conduct a theoretical case study	Is the requirements in the conceptual framework realistic and applicable in industry?	8.3
		Learn from subject matter experts in the industry		
		Adjust conceptual framework	How is the conceptual framework affected after validation steps?	8.4

Table 1.1: **Research Objective Overview.**

1.3.1 Document Structure

Chapter 2 investigates property development life cycles and existing frameworks that depicts the general roles and responsibilities of a development manager. Three property development life cycles are evaluated and the PROCSA matrix is selected as the preferred development life cycle. The general roles and responsibilities of the development manager according to the PROCSA matrix is then discussed in more detail. The chapter concludes with an illustration of how the PROCSA

matrix forms the foundation of the conceptual framework developed in this study.

Chapter 3 investigates the changing nature of work. The growing popularity of coworking spaces are investigated as well as global and local trends giving rise to the need for coworking spaces. The typology of coworking members are investigated and a matrix is designed to group coworking members. Coworking spaces are then defined followed by an investigation into the characteristics of coworking spaces. The chapter is concluded with a list of requirements drawn from the research in the chapter, that is added to the already stated roles and responsibilities of the development manager in the PROCSA matrix.

Chapter 4 investigates the advantages of refurbishment over new build. The chapter presents a definition for refurbishment as well as several requirements for the refurbishment of vacant buildings/spaces to create coworking spaces. During the research a need was identified for improved construction management in refurbishment projects, this is investigated in Chapter six. Finally, Chapter four concludes with a list of requirements to be added to the already stated roles and responsibilities of the development manager in the PROCSA matrix.

Chapter 5 states the need to develop property sustainably and defines green buildings. The benefits of sustainable development is investigated as well as ways to measure the sustainability of a development. The chapter then researches the Green Building Council South Africa's (GBCSA) rating system for green buildings as it is designed for and recognised in South Africa. The chapter concludes with a list of sustainable development requirements to be added in addition to the already stated roles and responsibilities of the development manager as stated in the PROCSA matrix.

Chapter 6 investigates inefficiencies in construction management and a method to manage refurbishment projects. The method relies heavily on lean construction principles that aims to reduce waste in construction to improve project budget and schedule management. The chapter is concluded with a method for construction management for refurbishment project that is added as requirement to the roles and responsibilities of the development manager already stated in the PROCSA matrix.

Chapter 7 verifies that all the requirements produced throughout the study has been added to the conceptual framework.

Chapter 8 validates the conceptual framework. A theoretical case study is conducted on an existing coworking space in South Africa as well as interviews with subject matter experts in industry. This leads to a revised and updated version of the conceptual framework at the end of Chapter eight.

Chapter 9 concludes the study and proposes future research avenues.

1.4 Research Design

Different terms and concepts used in the development of a framework for business and management research, will be explored in this section. The aim is to better understand the building blocks of research and how to appropriately address the main objectives of this study.

According to Sutton and Staw (1995), the terms concept, theory, model, and framework are often used interchangeably in business and management research. A lack of consensus also exists on whether a theory and a conceptual framework is different or distinguishable. Saunders *et al.* (2015)

states that the terms conceptual framework, concept, model, and theory can be used interchangeably and that conceptual model/framework can refer to a theory.

The different uses of these terms can be ascribed to differences in the underlying disciplines that management research calls upon. The researcher thus needs to define the different terms to be used for clarity to the reader (Saunders *et al.*, 2015).

The following are defining characteristics of a theory Creswell and Creswell (2017); Saunders *et al.* (2015):

- Grounded in empirical evidence;
- A systematic body of knowledge;
- Changes on the basis of emerging or new observations and evidence;
- Brings together related facts and concepts that can describe and interpret;
- Explains or predicts, using a system of ideas that is based on general principles; and
- Can be contradicted or verified.

A theory is ultimately verified or contradicted by comparing the predictions the theory provides to measurements taken in practice (Saunders *et al.*, 2015).

According to Saunders *et al.* (2015), three levels of theory exist, outlined by the theory's ability to create a paradigmatic shift. The three levels are as follows:

- **Grand Theory** is a theory that is universally applicable and changes the way we think about the world, such as Einstein's theory of everything;
- **Middle-range Theory** is a type of theory is more restricted in application than a grand theory, and it's unlikely to cause a paradigm shift; and
- **Substantive Theory** provides insights into a problem within a certain context and is developed from middle-range theories. These theories are less likely than middle-range theories and have general applicability.

Substantive theories are useful for adding value to particular subjects of interest by offering guidelines for the best course of action to particular problems, thus enhancing the understanding. Substantive theories are thus often used to refine and enhance middle range theories (Saunders *et al.*, 2015).

A concept can be described as a mental image or an abstraction of a phenomenon. Alternatively, a concept can be described as the summation of ideas or observations that describe the characteristic of a phenomenon. Concepts can be combined into a conceptual model or framework. This allows the interconnectedness of concepts and information to be displayed and provides a foundation for further theory building (Imenda, 2014; Saunders *et al.*, 2015).

Further distinctions can be made between models and frameworks. A model refers to the representation of concepts and their interrelationships, whereas frameworks may be built upon one or more existing models. Frameworks also take the ontological and epistemological context into account [1]. A framework is evaluated against the data collected while studying a phenomena. Any discrepancies can then be used as justification to reference multiple theories, models or concepts to

[1]Ontology focuses on describing the phenomena and its underlying interactions (the study of reality), while epistemology focuses on describing different ways of understanding the phenomena (the study of knowledge)

explain the phenomena (Imenda, 2014; Saunders *et al.*, 2015).

Referencing multiple models is the starting point of the synthesis of a new framework, this represents the integrated and multidisciplinary approach to the research. The conceptual framework can finally replace the theoretical framework after extensive validation (Imenda, 2014; Saunders *et al.*, 2015).

Table 1.2 summarises the differences between a conceptual framework and a theoretical framework.

Variable	**Conceptual Framework**	**Theoretical Framework**
Purpose	Highlights the main variables and concepts in the research. Provides a general approach for research methodology and design. Provides guidance in the collection, interpretation and explanation of data. Provides guidance for future research.	Helps illuminate the main variables and concepts in the research. Provides a general approach for research methodology and design. Provides guidance in the collection, interpretation and explanation of data.
Genesis	Relies on a variety of conceptual and/or theoretical perspectives. Adapted from existing theoretical perspective.	Adapted from reviewed literature and gathered data.
Conceptual meaning	Synthesis of concepts that are relevant.	The partial or complete application of a theory.
Research approach	Mainly inductive, particularly where research problems cannot easily be explained by one theoretical perspective.	Mainly deductive, particularly where hypothesis testing occurs.
Methodological approach	Both quantitative and qualitative research are frequently used. Descriptive and empirical survey instruments, direct observations and interviews are used. Strong emphasis on the context.	Mainly quantitative research. Experimental designs, tests and empirical surveys are used. Attempts to standardise context.
Scope of application	Limited to the context of the specific research problem.	Wider application beyond the current context and research problem.

Table 1.2: **Conceptual Framework vs. Theoretical Framework.**

(Reproduced from Imenda (2014))

Based on this summary from Imenda (2014) and the research objectives from Section 1.3, this study will develop a conceptual framework.

To better understand conceptual frameworks, Jabareen (2009) gives the main features of a conceptual framework as follows:

- A conceptual framework is not merely a collection of concepts, rather, the concepts play an integral role in the construct. A conceptual framework would state all the key factors, constructs and variables and then give the relationship among them;
- A conceptual framework does not only provide a casual/analytical setting, but gives an interpretative approach to social reality;
- Rather than just offering a theoretical explanation like a quantitative model, conceptual frameworks provide understanding;
- A conceptual framework provides soft interpretations of intentions, rather than knowledge of hard facts;
- Conceptual frameworks do not enable us to predict and outcome, they are indeterministic in nature; and
- Qualitative analysis can be used to develop conceptual frameworks.

1.4.1 Building A Conceptual Framework

Jabareen (2009) proposes a method of building conceptual frameworks from existent multidisciplinary literature through a process of theorization, which uses grounded theory methodology rather than a description of the data and the targeted phenomenon.
Strauss and Corbin (1990) gives two main points related to the difference between theory and descriptions:

- Theory uses concepts where similar data are grouped together and given conceptual labels, thus placing interpretations on data; and
- Concepts are related by means of statements of relationships. Data may be organised according to themes, but these themes are more likely to be summaries of words taken from the data with little interpretation of the data.

Jabareen (2009) further states that qualitative studies ultimately aim at describing and explaining, patterns and relationships and that this can only be done with a set of conceptually specified categories. Methods such as content analysis, thematic analysis, conceptual analysis and metaphor analysis, all aim, in principle, to assess the occurrence of certain words, phrases and themes within a given text. These methods of analysis are therefore good for providing descriptions, but not for generating theorisation. On this basis, Jabareen (2009) holds that grounded theory method is extremely useful for building conceptual framework from multidisciplinary texts.

Grounded theory is also adequate for conceptual framework building due to other characteristics:

- The research method aim at the discovery of theory from systematically obtained data; and
- It's an inductive, theory discovery methodology.

Grounded theory is a widely used, qualitative interpretive framework, in social science today, mainly because it uses methods that conforms to the good science model (Jabareen, 2009).

1.4.2 Conceptual Framework Analysis Technique

Both Myers (2019) and Jabareen (2009) propose techniques to analyse conceptual frameworks, but for the purpose of this study, the work from Jabareen (2009) was found to be more applicable.

Jabareen (2009) proposes a new technique which he refers to as conceptual framework analysis, as a grounded theory technique. This technique aims to generate, identify, and trace a phenomenon's major concepts, which together compose its theoretical framework. At the heart of this methodology is an interplay between induction, derivation of concepts from data, and deduction aimed at hypothesising the relationship between concepts.

The data selected for the conceptual framework analysis should be effective in representing the relevant social, political, cultural, and environmental phenomenon, and the multidisciplinary literature that focuses on the phenomenon of the study in question. It is important that the data also represent practices that are related to the phenomenon. Data should thus be gathered from a variety of sources such as books, articles, interviews and practices. Most data represents theories that belong to a specific discipline. When embarking on a multidisciplinary approach, these discipline-orientated theories will become empirical data for the conceptual framework analysis (Jabareen, 2009).

Jabareen (2009) states that the process of conceptual framework analysis is both iterative and comparative. It requires a steady movement between concepts and data as well as a constant

comparison across evidence to control the scope of the emerging theory.

Jabareen (2009) proposed a methodology that consists of the following main phases:

Phase 1: Mapping the selected data sources
The first step is to map the spectrum of multidisciplinary literature regarding the topic. This is done by an extensive review of multidisciplinary texts. The data collection should be comprehensive and complete to facilitate a holistic mapping that ensures validity.

Phase 2: Extensive reading and categorising of the selected data
This phase is where the researcher reads the selected data and categorises it by discipline, scale of importance and representative power within each discipline. Following this process will maximise the effectiveness of the inquiry and ensure effective representation of each discipline.

Phase 3: Identifying and naming concepts
The aim of this phase is to read and reread the selected data in order to discover the concepts. The final result is a list of concepts that are competing and sometimes contradicting.

Phase 4: Deconstructing and categorising the concepts
The aim of this phase is to deconstruct the concepts discovered in phase three. In the process of deconstruction, it is important to identify the main attributes, characteristics, assumptions and role of the concepts. The concepts can then be categorised according to their features and, ontological, epistemological, and methodological roles.

Phase 5: Integrating concepts
In this phase, concepts with similarities are grouped together to reduce the number of concepts to a reasonable amount.

Phase 6: Synthesis, re-synthesis, and making it all make sense
The researcher now synthesises the concepts into a theoretical framework. This will require the researcher to be open, tolerant and flexible with theorisation as the iterative process of synthesis and re-synthesis continues until a general theoretical framework makes sense.

Phase 7: Validating the conceptual framework
The researcher must validate the conceptual framework by seeking feedback from subject matter experts. The question is whether the framework and concepts make sense to other scholars and practitioners.

Phase 8: Rethink the conceptual framework
Since the theoretical framework will always be dynamic, it may be revised according to new insights, comments, literature, and so on.

This analysis method follows a logical order and was thus used by the researcher. More on the implementation of this method in Section 1.5.

1.4.3 Validation

Denzin (2012) advocates an approach where multiple data collection methods are used to validate a

study. He describes this as triangulation and states that this approach leads to greater validity and reliability than a single data collection methodology. As a result of this, a theoretical case study as well as expert opinions through interviews were used to validate this study.

The theoretical case study was based on a coworking space construction project completed in the past. Information on the construction project was obtained from industry. After the theoretical case study, the conceptual framework as well as the theoretical implementation thereof was presented to industry experts, specifically the experts that sourced the information for the theoretical case study.

The knowledge gained from the expert interviews and theoretical case study was used to reassess the conceptual framework and improve it where necessary. Caution was taken not to adapt the framework to something so radical that it requires a second validation phase.

1.5 Research Methodology

The research conducted in this study is qualitative of nature and the methodology used was, grounded theory based Conceptual Framework Analysis (CFA), as proposed by Jabareen (2009). The eight phases in the CFA process was adapted and divided into three parts as shown in Figure 1.1. Each of these parts are discussed in more detail in Sections 1.5.1, 1.5.2 and 1.5.3.

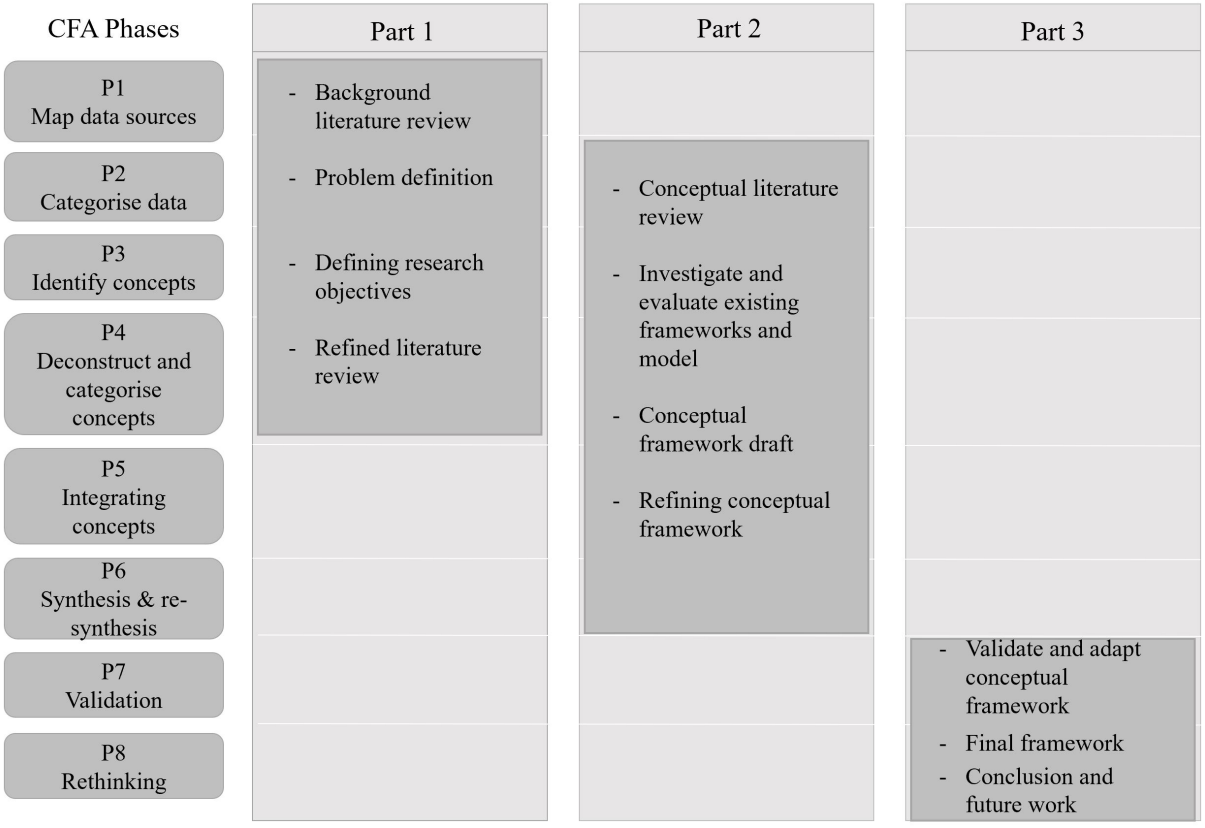

Figure 1.1: **Research Methodology Overview.**

1.5.1 Part 1: Making Sense Of Literature And Research Aims

The first part of the research focused on getting a broader understanding of the literature landscape and fields surrounding the central theme that is coworking spaces. Part one thus consists of defining the problem and research objectives, as well as an overview of literature. The first aim was to identify concepts related to the development of coworking spaces. The second aim was to aid the development manager in the process of developing coworking spaces, thus grounding the concepts of the first aim on the relevance it has for the development manager.

1.5.2 Part 2: Formulating The Preliminary Framework

This part of the research focused on a more in-depth investigation of literature and the development of a preliminary framework. The literature investigations were based on the knowledge gained in part one of the research. From this in depth investigation of current models and frameworks, a preliminary framework was developed for further review and validation.

Due to the scope of this thesis, a secondary research approach was followed. Primary research is a direct approach where information is gathered specifically for one's research, and includes surveys, direct observations and interviews. This type of research gives control of the questions one asks and the information one gathers. It can be extremely valuable but also very costly and time consuming. The alternative is secondary research that relies on the gathering and analysis of existing information. This information can be obtained from the internet, existing market research results, government agencies or industry bodies. The second method is much cheaper and faster, but it can be challenging to find relevant information (Sapsford and Jupp, 1996).

1.5.3 Part 3: Validating And Refining Framework

The aim of the validation was to prove the accuracy of the framework as well as to test how applicable and valuable the framework is within its context. After the validation, the knowledge gained from the theoretical case study and the industry expert interviews were used to update and refine the framework.

1.6 Scope And Limitations

During the initial phases of the research (Part one of the research methodology), numerous topics were investigated but could not be included in the scope of the study. The following topics were identified and evaluated, but not included in the final scope:

- Mixed use development;
- Operation and management of a coworking space;
- Financial structure and revenue model of a coworking space;
- Smart technology in the office; and
- Analysing the flow of people in a coworking space to improve coworking space layouts.

Chapter 2

Property Development Life Cycle

2.1 Introduction

The primary objective of this chapter is to determine which development life cycle serves as best guideline for the development manager. Thus, this chapter investigates different property development life cycles and existing frameworks that depicts the general roles and responsibilities of a development manager. Three property development life cycles are evaluated and the PROCSA matrix is selected as the preferred development life cycle, based on criteria set out in this chapter. The general roles and responsibilities of the development manager according to the PROCSA matrix is then discussed in more detail. The chapter concludes with an illustration of how the PROCSA matrix forms the foundation of the conceptual framework developed in this study. Figure 2.1 displays the objectives of the chapter as stated in Section 1.3.

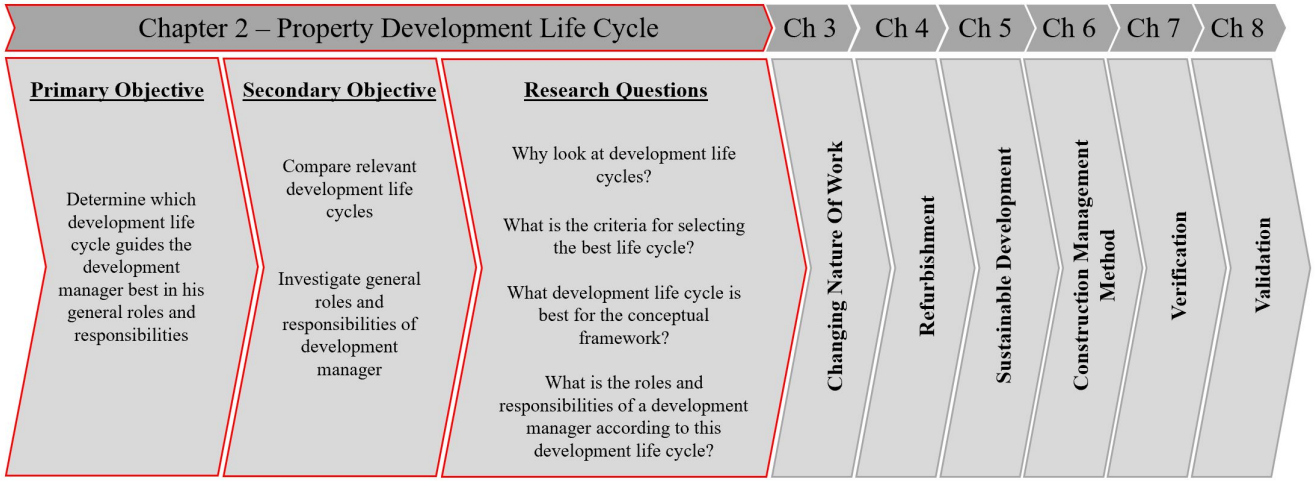

Figure 2.1: **Chapter Two Objectives.**

2.2 Investigating Property Development Life Cycle

In the mid to late 1900's, Emmerson and Emmerson (1962); Latham (1994); Hardcastle *et al.* (2008) documented that there is a clear need in the construction industry to improve the conventional design and construction process. This need for improvement is fundamentally related to poor performance measured in cost, time and/or quality.

Kagioglou *et al.* (1998) describes five principles that can be used as foundation for the development of an improved process:

Principle 1: Whole project view
Pre- and post-construction jobs are often sidelined and rushed to move on to new projects, resulting in poor client requirements identification.

Principle 2: A consistent process
Little consistency exist between subcontractors in a construction project, resulting in a compounding effect of problems encountered in the environment, mainly due to poor communication and lack of understanding roles and responsibilities.

Principle 3: Co-ordination
Construction projects traditionally performs poorly in the area of co-ordination. This is something that needs to be facilitated and managed by the development manager in a process where all information related to the project passes through him.

Principle 4: Stakeholder involvement and teamwork
Conventionally construction projects consist of a team of participants, each selected to facilitate a specific aspect of the project. Project teams rarely work together on more than one project and with a new participants for every project, this can adversely affect the teams performance.

Principle 5: Feedback
With the continual break-up and formation of project teams, the ability to learn from past failures and successes is severely hampered.

These principles have been used by researchers and the property development industry, to create frameworks that addresses the roles and responsibilities or the role players in the property development process.

Section 2.2.1, 2.2.2 and 2.2.3 investigates three frameworks that attempts to break the development process into stages and create a guideline for industry practitioners. These studies are based on cumulative knowledge and improvements on previous frameworks since the late 1900's. One of these frameworks will be used as a base for the conceptual framework to be developed in this study. Section 1.3 states that the aim of the study is to aid the development manager in their roles and responsibilities during the property development life cycle. The aim of this section is thus to find a framework that sets out the roles and responsibilities of a development manager in a general property development life cycle.

2.2.1 Generic Design And Construction Process

Kagioglou *et al.* (1998) developed a Process Protocol that breaks down the design and construction process into ten distinct phases. These ten phases are grouped into four broad stages. The stages are as follows:

Pre-Project stage

This stage relates to the strategic business considerations of a potential project and aims to address the client's needs. The aim of this stage is to determine the need for a construction project solution and to secure outline financial authority to proceed to the next stage (Pre-Construction stage).

Pre-Construction stage
In this stage the client's needs are developed through a logical sequence into an appropriate design solution. This stage also allows for a review process at the end of each phase to allow for improved communication and coordination between project participants.

Construction stage
This stage solely focuses on the production of the project solution. Here the full benefits can be seen of the co-ordination and communication in earlier stages.

Post-Construction stage
Phases in this stage aims to continually monitor and manage the maintenance needs of the constructed facility.

The framework is good in the sense that it gives a good holistic view of the property development life cycle and who all the role players are in the process, but it lacks the detailed roles and responsibilities of the role players involved. The study lead to a framework as shown in Appendix A.1.

2.2.2 Integrated Framework For Concurrent Life Cycle Design And Construction

Evbuomwan and Anumba (1998) developed a life cycle design and construction framework. The framework is divided into three levels as follows:

Design Stages
The first level consists of six different stages and acts as an overarching structure over supporting design tools and associated knowledge databases also developed by Evbuomwan and Anumba (1998). The six stages are:

- Client requirements processing;
- Preliminary conceptual design;
- Design of schematics;
- Analysis and detailed design;
- Design documentation; and
- Construction planning.

Design tools and techniques
The second level represents computer-aided design tools and techniques. All practices and industry standards that can be used in design activities are included here.

Knowledge databases
Level three consists of the necessary databases that augment the design tools of level two. They act as a cache for design codes and standards, information on construction materials, standard construction components, processes and operations, construction techniques as well as the evolving

project model.

The framework is slightly limited by the fact that it does not cover the physical construction of a project but only considers the design and construction planning phases. The framework also does not state whose responsibility it is to complete the tasks indicated. The developed framework is displayed in Appendix A.2.

2.2.3 PROCSA Matrix

The Professional Consultants Service Agreement Committee (PROCSA) developed a client/consultant Professional Service Agreement to regulate the terms of engagement between the client and the consultant in the interest of standardisation and good practice in the construction industry. Along with these service agreement documents, PROCSA developed a matrix that sets out the roles and responsibilities of all parties involved in property development process and divided the process into 7 stages. The PROCSA committee is based in South Africa and their service agreements are widely used in the South African industry. Table 2.1 summarises the seven steps given in the PROCSA Matrix.

Stage 0 Project Initiation & Briefing	**Stage 1** Inception	**Stage 2** Concept & Viability	**Stage 3** Design & Development	**Stage 4** Documentation & Procurement	**Stage 5** Construction	**Stage 6** Close-out
Establishing the need, desirability and viability of undertaking a property development together with securing the appropriate land and rights to undertake such a development.	Establish the client requirements and preferences, assess user needs and options, appointment of necessary consultants, establish the project brief including project objectives, priorities, constraints, assumptions, aspirations and strategies.	Prepare and finalise the project concept in accordance with the brief including the scope, scale, character, form, function and preliminary programme and viability of the project.	Develop the approved concept to finalise the design, outline specifications, cost plan, financial viability and programme for the project.	Prepare the construction and procurement documentation, confirm and implement the procurement strategies and procedures for effective and timeous procurement of necessary resources for the execution of the project.	Management, administer and monitor the contracts and processes, including the preparation and co-ordination of the procedures and documentation to facilitate practical completion of the works.	Fulfil and complete the project close-out including the preparation of the necessary documentation to facilitate effective completion, handover and operation of the project.

Table 2.1: **PROCSA Matrix Summary.**

(Reproduced from PROCSA (2019))

For each of these seven stages, the PROCSA Matrix addresses in detail the roles and responsibilities of the Development Manager, Project Manager, Architect, Quantity Surveyor, Structural Engineer, Civil Engineer, Electrical Engineer and the Mechanical Engineer. The roles and responsibilities of the development manager is examined in Section 2.3. The full matrix can be seen in Appendix A.3.

2.2.4 Comparison Of Property Development Life Cycles

From the research in Sections 2.2.1, 2.2.2 and 2.2.3, the PROCSA matrix was chosen as the foundation for the conceptual framework to be developed in this study. The criteria for determining which framework is the best were based on the following:

- Does the framework have a holistic view of the development life cycle or is it focused on only a section thereof?
- Are all the role players involved in the development life cycle considered?
- Are specific roles and responsibilities allocated to specific role players?
- How relevant is the framework to South Africa?

Based on these questions, the three frameworks were compared as shown in Table 2.2.

Criteria	**Life Cycle**		
	Generic design and construction process (Section 2.2.1)	Integrated framework for life cycle design and construction (Section 2.2.2)	PROCSA Matrix (Section 2.2.3)
Good holistic view of the property development life cycle		X	X
Detailed layout of all the role players involved in the life cycle		X	X
Detailed roles and responsabilities of role players			X
Relevant to South africa			X

Table 2.2: **Comparison Of Life Cycles.**

The PROCSA matrix:

- Has the best holistic view of the design and development process, from inception to close-out;
- Shows in detail, all the key role players in the design and development process;
- Has the most detailed roles and responsibilities of the development manager and other role players; and
- Is most relevant to the South African industry.

2.3 PROCSA Matrix As Framework Foundation

Using the PROCSA matrix as foundation for the conceptual framework adds to the mission of the Professional Consultants Service Agreement Committee to introduce some standards into the industry.
For the purpose of this thesis and developing a conceptual framework to guide the development manager in the development of coworking spaces, only the roles and responsibilities of the development manager is of interest. Tables 2.3 and 2.4 states the roles and responsibilities of the development manager according to the PROCSA matrix.

Stage	Roles and Responsibilities
Stage 0 Project Initiation & Briefing	• Establish project need and desirability • Prepare a First Business Case • Formalise Client's Vision • Source Appropriate Land • Manage procurement of land rights including necessary zoning, environmental, infrastructural/external services, legal requirements, etc. in relation to such land rights • Procure market research to assist in confirming the appropriate product and income stream • Appoint necessary Consultants • Process Payments to all project creditors
Stage 1 Inception	• Formalise project brief • Facilitate preliminary site assessment • Prepare a preliminary desk top project viability • Appoint necessary appropriate consultants • Establish project procurement policy
Stage 2 Concept & Viability	• Provide consultants with all supplementary information and constraints necessary to execute their respective obligations • Define format and procedures for reports, presentations and communications by all members of the project team • Review and comment on proposals and reports prepared and presented by consultants including design concepts, costings and the like • Prepare "bankable business plan" including but not limited to a viability study, market research, end-user commitments, operating agreements, marketing strategy and the like, for purposes of procuring finance for the project • Manage procurement of project finance
Stage 3 Design & Develop	• Appoint balance of the consultants including the clear definition of their roles, responsibilities and liabilities • Review and approve formal and informal communication structure, processes and procedures for the design development of the project • Review and approve detailed design and documentation programme, based on an updated indicative construction programme, with all consultants • Obtain and timeously provide all operating end user requirements to the design team • Procure appropriate health and safety representative and advice • Facilitate the timeous submission by the design team of all plans and documentation to obtain the necessary statutory approvals • Provide design and cost decisions timeously in relation to the design development process • Receive, review and agree estimates, budgets and cost reports in relation to the final capital cost of the project • Establish, monitor and manage cash flow requirements of the project • Review and approve designs by consultants • Review facilities management requirements and establish facilities management policy • Monitor implementation of the marketing strategy • Procure and approve the marketing documentation • Manage achievement of the business plan income stream requirements • Procure achievement of all project finance preconditions

Table 2.3: **Development Manager Roles And Responsibilities, Stage 0-3.**

(Reproduced from PROCSA (2019))

Stage	Roles and Responsibilities
Stage 4 Documentation & Procurement	• Review and approve procurement strategy for contractors, subcontractors and suppliers • Review and approve project procurement program and proposed tenderer • Receive and review the environmental management plan • Provide all necessary, project-specific tender conditions including but not limited to, amendments and additions to the preliminaries, empowerment policies, insurance and payment conditions and the like to incorporation in the tender documentation • Review health and safety specification for the project • Review adjudication of tenders and instructions to the principal agent to appoint the appropriate contractors • Sign all principal and direct contract appointment on project • Place the necessary insurance for the project including contractor insurance and appropriate development risk insurance • Review reconciliation by quantity surveyor of the tender prices with project budget • Agree on format and procedures for monitoring and control by quantity surveyor of cost of the scope of works • Monitor leasing/sales performance relative to project feasibility • Procure and manage legal advice in relation to project leasing, sales, etc. • Formalise all service agreements with the appropriate authorities including the payment of all necessary deposits
Stage 5 Construction	• Manage ongoing projects insurance requirements (including resolution of all insurance claims) • Formalise and facilitate the occupation of site by contractor, including but not limited to termination of existing leases and the like • Review formal and informal communication structure and procedures for construction process • Regularly attend site meetings and inspections • Receive and review contractors' health and safety plan • Review and approve "end-user" specific construction details, documentation, and materials timeously • Review and approve all scope and cost variations • Arbitrate acceptable standards of quality when required to do so • Review and process monthly progress payments • Receive, review and approve recommendations for settlement of contractual claims as prepared by the principal-agent • Receive and review monthly cost reports • Formalise management of all direct contractors and suppliers • Receive and review all project reports and present same at client review meetings • Provide operator input for any necessary early testing and commissioning by consultants and contractors
Stage 6 Close-out	• Accept works completion certificate • Receive and distribute all as-built drawings and design documentation, to appropriate parties • Receive and distribute, all operating and maintenance manuals, as well as all warranties and guarantees, to appropriate parties • Receive and distribute, all statutory compliance certificates and documentation, to appropriate parties • Receive and handover health and safety files to the client • Monitor rectification of defects during the defects liability period • Monitor preparation and agreement of the final accounts • Procure and distribute end-users latent final completion defects list for inclusion in project final completion latent defects list • Receive and review and present project close-out report to the client • Assist the client in procuring appropriate facilities management resources

Table 2.4: **Development Manager Roles And Responsibilities, Stage 4-6.**

(Reproduced from PROCSA (2019))

Tables 2.3 and 2.4 indicates that the roles and responsibilities of the project manager as set out by the PROCSA matrix revolves around requesting and reviewing all proposals, documents and plans related to the development. The matrix does not mention requirements for specific type of development such as offices or industrial, it refers to general roles and responsibilities that forms part of all construction

projects. For this reason, the PROCSA matrix forms a good base for the development of the conceptual framework since it does not limit the type of development project. This allows requirements to be added for the specific development of coworking spaces through sustainable refurbishment.

2.4 Chapter Conclusion

This chapter first investigated a few development life cycles and then found that the PROCSA matrix is best suited for the objectives set out in Section 1.3. Since the PROCSA matrix is a well known framework in the South African industry, it can be assumed that all practising development managers are aware of the roles and responsibilities stated in the matrix and that they know what it entails. The roles and responsibilities was thus mentioned in this chapter, but not explained in detail.

This matrix now serves as a foundation for building the conceptual framework. As explained in section 1.3, each consecutive chapter will conclude with a set of requirements that will be integrated with the roles and responsibilities stated in the PROCSA matrix.

Figure 2.2 thus represents how the PROCSA matrix is the foundation of the conceptual framework to be developed. The following chapters will explore requirements that will be added in addition to the roles and responsibilities of the development managers already stated in the PROCSA matrix.

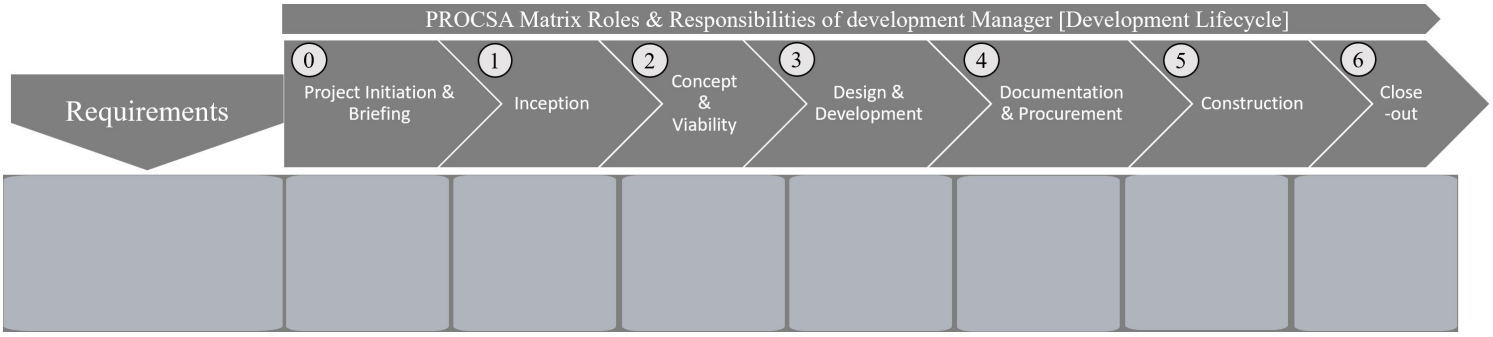

Figure 2.2: **Conceptual Framework Update.**

Chapter 3

The Changing Nature Of Work

3.1 Introduction

The primary objective of this chapter is to establish the nature and extent of the need for coworking spaces. Thus, this chapter starts by investigating the changing nature of work in more detail. The growing popularity of coworking spaces are investigated, as well as global and local trends giving rise to the need for coworking spaces. Coworking spaces are then defined followed by the development of a coworking member typology matrix, to better understand coworking member needs. Finally, the characteristics of coworking spaces are investigated, as well as the relevance of coworking in South Africa. The chapter is concluded with a list of requirements drawn from the research in the chapter, that is added to the already stated roles and responsibilities of the development manager in the PROCSA matrix. Figure 3.1 summarises the objectives and research questions for the chapter.

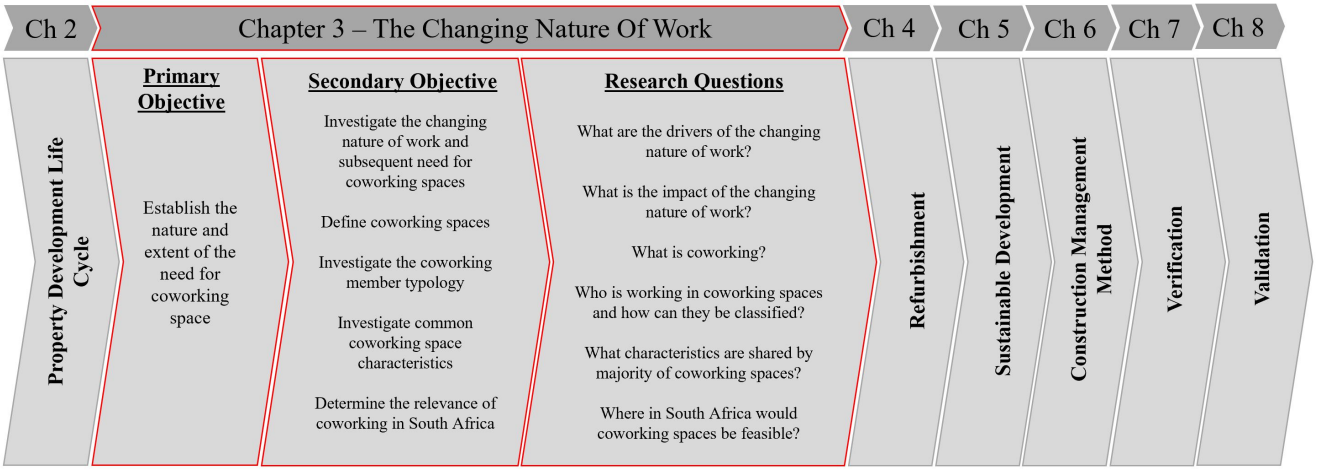

Figure 3.1: **Chapter Three Objectives.**

3.2 Global Trends Giving Rise To The Need For Coworking Spaces

The nature of work is changing. Changes in the economy, digitalisation of the economy, generational shifts and shifts in company goals all have part in this changing nature of work. In order to build a working environment for the current and future working population, these changes in work must be considered and taken into account.

Moriset (2014) argues that the rise of coworking spaces is a result of two interlinked tendencies, the rise of the creative economy (Florida, 2014) and the digitalisation of the economy (Malecki and Moriset, 2007). In the last two decades our economy shifted from an industrial economy to a knowledge economy and the next step is a creative economy where creativity is increasingly seen as the *holy grail* in the economic world according to Malecki and Moriset (2007).

Florida (2014) in his book, *The Rise of the Creative Class* states that a new creative class of innovative workers creating content ranging from art to artificial intelligence, has emerged as the most important part of the post-industrial workforce. Florida describes a creative class that stemmed from the western economies and the need for constant innovation and creativity. The writer attests that the word class in the traditional Marxist view is outdated and argues that the creative class is more defined by its consumption patterns and lifestyle and that its power is derived from the ability to innovate rather than accumulating by means of production. With this theory, Florida also acknowledges the growing economic gap between workers that serves meals and cleans clothes and the high-wage knowledge workers.

Gandini (2015) is of the opinion that Micro, Small and Medium-sized Enterprises (SMEs) is an important vehicle for the development of an industrial country's economy. These enterprises play a big role in employment creation and innovation and is becoming more prominent with the digitalisation of the economy. In traditional economies, low cost manufacturing and economies of scale were the main operating principles while the new economy favours customer-focused service, relationships, knowledge workers and an unprecedented level of connections among entities.

Although computers have permeated the value chain of most business sectors and transformed organisations radically, there are two uniquely human attributes that the digitalisation of the economy cannot replace- creativity and innovation. The term creatives describes people with some artistic skill in content creation according to Florida (2014). He gives a list of various crafts and professions including but not limited to music, arts, architecture, design, media, fashion, software professionals, engineers, lawyers and consultants.

The nature of work globally is changing, with the rapid growth in application of technology, a lot of people are being displaced from their workplace. Allahar (2014) did a study on the changing nature of work and jobs of the future where he mentioned seven mega-trends that are impacting the changing workplace. These trends are:

- Declining birth rates;
- Rise of exponential industries;
- Expanding individual awareness;
- Increasing individual fragility;
- Individual empowerment;
- An overprotected generation; and
- Labour shortages.

Wright (2013) noted that the organisations that are going to succeed are the ones that are nimble. He highlights five trends, displayed in Table 3.1, that are driving the changing nature of work .

Trend	Description
Technology	With the continuous connectivity experienced through smart devices, the lines between work and personal life gets blurred. HR is not prepared for the issues surrounding constant connectivity and work/life balance although they have made some progress through initiatives like telecommuting and flexible hours.
Outsourcing	In an attempt to streamline business and projects, companies have identified which work is critical and which work is not. The non-critical or non-core competence work would be outsourced to free agents with specific expertise in solving the outsourced problem. These free agents would jump between projects and organisations, solving problems requiring their specific expertise. The problem for HR arises in developing a strategy for how work in the organisation gets done and by whom.
Changing worker attitudes and values	According to the Bureau of Labour Statistics, a worker in America has an organisational life expectancy of three and a half years. This creates significant challenges for HR regarding the way in which they engage with workers. The engagement is being done in whichever way they want at the organisation, even with knowing they have interests outside the workplace.
Demographics and diversity	With increased life expectancy, for the first time ever, there will be five generations in the workplace. On the one side a generation that entered the workplace before technology revolutionised it and on the other a generation what grew up with technology, understands it and knows how to leverage it to their advantage. This creates challenges for HR in structuring things like training and development in an organisation.
Globalisation	Companies that expand over international boarders can get 24 hours of work time. This dispersion of work geographically is the best possible way that work can get done. HR should align their strategy according to the organisation's goals and objectives.

Table 3.1: **Trends Changing The Nature Of Work.**

(Reproduced from (Wright, 2013))

These drivers, as mentioned by Wright (2013) and Allahar (2014), have certain impacts on the way in which companies are structured and operate. Technology and globalisation allows for employees to be scattered worldwide and still communicate effectively while outsourcing allows for the freelancing economy to thrive.

Pucher (2010) did a study on how the future of work is going to change given all the trends that we are experiencing. He states that due to different environments and cultures, work will evolve into a mix of many styles. Ten key ways in which the world of work is changing were identified, some are near-term trends while others are more long-term, see Table 3.2.

Trend	Description
De-routinisation of work	Due to automation of industries, the value that people add does not lie in a process that can be optimised, instead it lies in uniquely human contributions, interactive or analytical. These contributions often relate to innovation, leading, teaming, discovery, selling and learning.
Swarms	Solo performances will not be valued highly. Instead, teamwork will be rewarded and occur more frequently. Swarming is a bit different from teamwork seeing as it is characterised as a flurry of collective activity from everyone available and able to add value.
Weak links	This is described as knowing someone just barely or by picking up weak cues from others that know the people you have to work with. Strong links on the other hand are well established relationships with people. Navigating these strong and weak links in one's own personal, professional and social networks is crucial to surviving and succeeding with swarms.
Working with collectives	Collectives are characterised as informal groups that are beyond the control of organisations and bound by common interest. Collectives and impact organisations' success or failure, thus smart business executives will understand what collectives can influence their organisation and know the key people in these external groups.
Spontaneous work	Reactivity will be trumped by spontaneity meaning growth in proactive work, such as seeking out new opportunities and creating new designs and models will be favoured and rewarded.
Simulation and experimentation	Drilling into cells in spreadsheets will be replaced by active engagement with simulated environments.
Pattern sensitivity	Significant growth in groups tasked with detecting divergent patterns, evaluating them and developing scenarios for how these disruptive patterns might play out, are expected.
Hyper-connected	As a result of our hyper-connectedness via technological devices and platforms, work will ultimately cross company borders in both formal and informal relationships. This has implications for how people work and how IT supports that work.
My place	With meetings occurring across time zones and between organisations with participants who barely know each other, it is evident that the workplace is becoming more virtual. Despite this, employees will still have a "place" of work although it might not be a company-provided physical office or desk. Work will increasingly happen 24 hours a day, seven days a week and in this environment, the lines between social, personal and professional family matters, will disappear.

Table 3.2: **How The Future Of Work Is Going To Change.**

(Reproduced from Pucher (2010))

These changes in work as described by Pucher (2010) favours the use of coworking spaces over traditional offices. De-routinisation of work and Swarms aligns with the changing nature of work and need for coworking spaces as described by Moriset (2014).

Heerwagen (2016) states that although various factors contribute to the changing patterns of work, the two biggest impacts are:

- An increased pressure on organisations to be more customer focused, competitive and agile; and
- Breakthroughs in communication and information technology, especially mobile and internet technologies, allows work to be separated from space and time.

Table 3.3 highlights the key impacts, solutions and potential issues raised by the solutions for the changing workplace.

IMPACTS	WORKPLACE AND TECHNOLOGY SOLUTION	ISSUES AND CONCERNS
Increased use of teams and cross unit work; more pressure for communication and information flow.	• More meeting space • Greater variety of meeting spaces (open & enclosed, large & small) • Smaller individual workspaces • More open individual workspaces • Unassigned workspaces • Greater interior visibility to support awareness • Mobile supports (phones, laptops, PDAs, wireless) • Personal video, instant messaging, desktop team software • More use of project rooms • Displayed information and work progress • Small rooms for individual focus • Lockers for personal belongings	• Increased noise • Increased distractions and interruptions • Potential for ”over communicating” • Cultural barriers to behavioural change • Individuals working longer hours to compensate for lack of time to do individual tasks • Expectations that workers are always available
Greater use of dispersed work groups- often global.	• Increased use of video conferencing, computer-based team tools • More reliance on conference calls • Greater need for mobile technological supports for meeting rooms • Use of facilities beyond normal working hours	• Expansion of the workday to accommodate geographically dispersed team meetings • Loss of opportunity to develop trust through face to face interaction • More difficulty managing and coordinating • Very high dependence on technological reliability
Continual reorganisation and restructuring.	• Flexible infrastructure to support rapid reconfiguration • Mobile furnishings	• Acoustical problems with loss of good enclosure • Potential for reduced ergonomic effectiveness
Reduced costs/more efficient space use.	• Shared or unassigned workspaces • Centralized filing system • Reduced workstation size and increased overall densities • Greater overall spatial variety to enable different kinds of work to be accommodated at same time	• Increased distractions and interruptions • Increased noise • May meet with employee resistance • More difficult for paper intensive work
Improved quality of work life and attraction of new workers.	• More equitable access to daylight, views, and other amenities • More equitable spatial allocation and workspace features • Amenities for stress reduction and quiet relaxation	• Resistance from those who support hierarchical space allocation

Table 3.3: **Impacts, Solutions, And Issues For The Changing Workplace.**

(Reproduced from (Heerwagen, 2016))

These drivers and impacts do not only affect the nature of work, it also causes the nature of firms to change. With physical presence no longer being a prerequisite to do business in a given market, expanded boundaries are created for firms to grow, but this is often met with increased concentration in the markets according to World Bank (2019). Van den Bergh and De Wulf (2017) approaches the topic of the changing nature of firms from a different perspective, looking at the millennial generation, typically born between 1980 and 1996. Millennials influence the working environment by being:

- More individually empowered: Raised and educated with a less hierarchical parental and educational approach, they embrace an entrepreneurial mindset and desire ownership of their work and careers;
- More collaboration-orientated: Although they are individually empowered, they are not individualistic. Using a cooperative learning style in school, this generation is team-orientated, often bonding together to socialize in groups. The millennials believe that as a team they can accomplish more and create better than an individual; and

- More purpose-driven: Millennials are in search of additional meaning and feel that a personal life full of exploration, experiences and meaning is more valuable than participating in the career rat race. That is why they are looking for a sense of meaning in their work and a healthy work-life balance.

In addition to these traits of millennials, research done by World Bank (2019) states that in many developing countries, the demand for high-skill[1] workers is increasing and that the demand for middle-[2] and low-skill[3] jobs in developing countries are driven by competing forces of automation and globalization. As a result, the low- and middle-skilled jobs of developed countries are moving to some developing countries. Depending on the speed of these forces, some developing countries experience an increase in middle-skill jobs and other a decrease, these trends are visually represented in Figure 3.2.

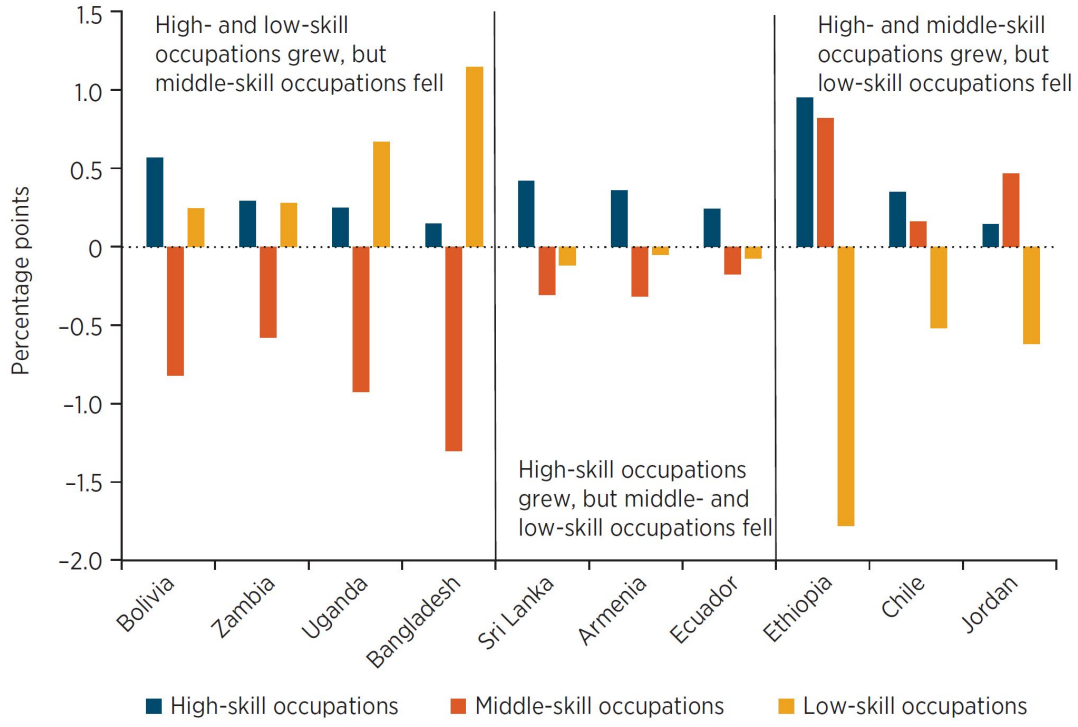

Figure 3.2: **Annual Average Change In Employment, By Occupation Skill Level (2000 - 2015).**

(Reproduced World Bank (2019))

All these factors, the changing nature of work, its drivers and impacts, the changing nature of firms, millennial worker traits and the increasing demand for high-skill jobs creates the opportunity for a new type of working environment termed coworking spaces. Coworking spaces will be defined in Section 3.3

[1]High-skill occupations: managers, professionals, technicians, and associate professionals.

[2]Middle-skill occupations: clerical support workers; sales and services workers; craft and related trades workers; skilled agricultural, forestry, and fishery workers; plant and machine operators and assemblers.

[3]Low-skill occupations: elementary occupations such as cleaners and helpers; labourers in agriculture, forestry, and fisheries; labourers in mining, construction, manufacturing, and transport; food preparation assistants; street and related sales and services workers.

3.3 Coworking: Towards A Definition

Coworking has been a subject of increasing attention around the world in recent years but sparse literature revolves around the concept, specifically defining the concept. The term **coworking** is not recognised by the Oxford or Cambridge dictionary. The Oxford dictionary does however describe the term **co-working** as:

> *The use of an office or other working environment by people who are self-employed or working for different employers, typically so as to share equipment, ideas, and knowledge.*

In contrast to this, the Oxford dictionary describes the term co-worker as:

> *A person with whom one works, typically someone in a similar role or at a similar level within an organization.*

In 2018, the Associated Press updated their stylebook to replace the hyphenated version **co-working** with **coworking**, describing the term as (Associated Press, 2018):

> *Sharing workspace and amenities, such as Wi-Fi, printers, photocopiers and the like, when people don't actually work for the same company but instead are self-employed or remote workers. No hyphen for this use.*

For the sake of consistency, this document uses the term **coworker** to refer to a working individual and **coworking space** to refer to the environment/building that coworkers work in.

Despite the term **coworking** being agreed upon by the majority of the parties using these working spaces, there are still some discrepancies about the definition of the term. Pohler (2011) argues that one cannot define a coworking space based on the characteristics it has. Just because a workspace does not measure up to certain organisational or spatial characteristics, does not disqualify it from being a coworking space. The following are examples of coworking spaces characteristics that do not hold for all coworking spaces:

- Coworking spaces combine the best elements of coffee shops and workspaces and are founded by like-minded people (not all of them);
- Only independent freelancers use coworking spaces (not exclusively);
- The members of coworking spaces work in different industries (not all of them);
- Coworking spaces are designed with big shared working spaces, compared to several small offices (not all of them);
- A coworking space has hot-desking (not necessarily);
- Coworking spaces offer variable memberships (although this is very common, it is not universal);
- Coworking spaces have room for drop ins and visitors (not always); and
- Events are hosted in coworking spaces for members and other people (not all of them).

To define a coworking space based on these organisational and spatial characteristics, one can create a list of clearly defined properties and use the same method medical practitioners use to diagnose illnesses. If a working space has x% of the defined properties, then it qualifies as a coworking space. This method, however, overlooks the biggest reason why coworking spaces started in the first place. Coworking spaces resulted in a quest to find strategies to deal with new, flexible types of work, addressing the changes stated in Table 3.3. A more fitting and elegant definition was developed by Pohler (2011) where she describes a coworking space as:

> *Every workspace with flexible structures that is designed for and by people with atypical, new types of work - that is not exclusively for people from one certain company.*

In a theoretical examination of coworking, Uda (2013) compared several definitions from pioneers in the coworking industry, irrespective of their standpoints such as practitioner, supporter or investigator. All definitions made reference to ”individuals who work” and ”places” that are shared by these individuals with differing attributes. An amalgamation of literature lead to the following definition for a coworking space:

> *A way of working in which working individuals gather in a place to create value while sharing information and wisdom by means of communication and cooperating under the conditions of their choices*.

For the purpose of this paper, a coworking space is defined as follows:

> ***A way of working in which people, not exclusively from a single company, gather in a place to create value while sharing information and wisdom by means of communication and cooperation under the conditions of their choices.***

Although the latter will be used as the working definition for coworking spaces in this study, one has to give consideration to the different organisational and spatial characteristics of coworking spaces. A coworking space without the basic office amenities like a printer and boardroom might not make sense, but can still be classified as a coworking space. Section 3.5 considers the global trend for required characteristics in a coworking space.

3.4 Understanding Coworking

This section aims to give the reader a better understanding of coworking space by investigating the target market of coworking spaces, as well as ideal locations for coworking spaces.

3.4.1 Coworking Member Typology

McBride (2018) reports that within certain fields, coworking has been popular from the start, but in the last five years the concept has taken hold across industries. The coworking industry is growing at an exceptional rate as more entrepreneurs, consultants and corporate organisations re-think the value of collaborative work and the overhead costs in their businesses. Coworking spaces are becoming more intentional, they are designed to truly meet the needs of the diverse group of professionals they serve. With coworking spaces being so technologically-advanced and architecturally interesting, there truly is a place for everyone at a coworking space.

Pinto (2018) agrees that coworking spaces originated with freelancers, entrepreneurs and start-ups in mind. It is ideal since it creates a feeling of community for those who would otherwise be forced to work alone at home or in a coffee shop. Coworking spaces provide the ideal setup for start-ups with the low cost of leases and flexibility in the period of a lease, they also provide the opportunity for small teams to interact and exchange ideas.

Hamraoui (2018) states that Small to Medium Enterprises (SME’s) are flocking to coworking spaces for the ease of access to office spaces and the networking opportunities. Khan (2018) states that coworking spaces owners also prefer SME’s to freelancers since they are more consistent clients.

Another market for coworking spaces is big corporations. Broadbent (2018) states that big media conglomerates and tech giants have been moving their employees to coworking and incubator spaces. For the big companies this hold several advantages like, less admin to manage office spaces and overhead costs, and having better access to innovators, innovations and talent.

The 2017 Global Coworking Survey conducted by Deskmag published some statistics about the members of coworking spaces, the current average age for members of coworking spaces is just over 36 years. The oldest members are entrepreneurs at age 40 years, who are employing staff, followed by freelancers at age 38 years. The survey also found that the average age is lower in bigger cities. Cities with more than a million inhabitants show an average age of 34.5 years, while in cities with less than 100 000 inhabitants, the average age of coworking members rise to 38.5 years. As coworking spaces grow in capacity, they start to provide more offices for companies and private persons, resulting in only 30% of coworkers in spaces with 100 or more workstations being freelancers. However, an overall 41% of all coworking space members are still freelancers, suggesting that freelancers are more concentrated in smaller coworking spaces (Foertsch, 2017).

The dominating industries in coworking spaces are IT (20%), PR marketing & Sales (14%) and Finance (10%), while consultants, on the other hand, has dropped significantly from 11% to 6%. Another important aspect to take note of is the high level of education among coworkers, where around 85% of them have finished an academic degree. A bachelor's degree is held by 41%, while another 41% holds a master's degree and 4% have already received their doctorate (Foertsch, 2017).

From the research done in this section a coworking typology matrix can be constructed indicating the size of the entity working in the coworking space and their respective industry. The size of the entity can be classified as either freelancer (this incorporates entrepreneurs), SME's or big corporate companies. From Deskmag's surveys, the biggest industries among coworking members are Tech, PR and Sales, Consulting and Finance. The typology matrix can be seen in Table 3.4.

Size	**Industry**			
	Tech	PR & Sales	Consulting	Finance
Freelancer				
SME				
Big corporates				

Table 3.4: **Coworking Member Typology.**

This matrix is intended to aid the development manager in better understanding the demographic of members the coworking space is designed for. This is a tool to be used in stage 0 of the development life cycle according to the PROCSA matrix where market research is to be conducted. This is needed since the type member and industry they operate in will have an influence on the characteristics of a coworking space is designed with. Coworking space characteristics will be discussed in Section 3.5.

3.4.2 Ideal Location

Location is one of the most important aspects for the success of a coworking space. WeWork[4] states that the biggest blocker to their ability to expand is simply how many leases they can sign. Aaron

[4]WeWork is one of the most prominent role players in coworking with 790 locations globally and a valuation of $47 billion (Herbert Lash, 2019).

Fritsch, Product Director at WeWork, states that WeWork passes on two to five leases for every one they sign. To speed up the process of eliminating the locations that are not suitable for coworking spaces, WeWork developed software that uses data regression analysis to identified amenities that were close to existing thriving WeWork locations. They then use geographical data to plot maps indicating these amenities within a certain radius of new location of interest. The relevant amenity categories include coffee shops, restaurants, fitness and night-life. The real estate team can now use this software to visualise the density of each amenity within a given radius of the geographical location. A radius of 350 meters is used as a maximum walking distance for the amenity search (Belanger, 2017).

This technique is helpful to narrow down possible locations. Belanger (2017) states that although this tool is good to narrow down locations, it is still important to visit the location in person.

> *There is no substitute for seeing in person, talking to people face to face and your gut feel from being there yourself.*
>
> Jeff Lessard

Things to take into consideration when looking at possible locations for a coworking space are:

- Be close to amenities such as a coffee bar, restaurants, gyms, night clubs or social gathering spots;
- Be centrally located; this might be more expensive but will attract more customers;
- Have easy access to the location; traffic and parking needs to be considered, especially in South Africa where public transport is not readily available; and
- Visit the location and nearby coffee shops to establish if entrepreneurs and freelancers utilise the coffee shops as work space. This will give a good indication of the demand for a coworking space in the area.

3.5 Coworking Space Characteristics

Due to the diversity of coworking spaces, it is difficult to ascribe a single set of characteristics to all coworking spaces. As stated in Section 3.4.1, the characteristics of a coworking space will differ based on the members of the coworking space and the industry they work in. In the development of a coworking space, one should first assess the coworking member typology (Table 3.4) and then design the coworking characteristics based on the need of the members. This section investigates the characteristics most commonly shared by coworking spaces.

A quick comparison of the South African and global coworking market was conducted using the filter provided by Coworker. Coworker is essentially a database of coworking spaces worldwide. It gives the user the ability to search for coworking spaces based on location, workspace required, membership duration and various filters. There are 83 filters to choose from in the search for a coworking space. These filters were applied individually to determine the percentage of coworking spaces complying to the selected filter. The results turned out to be fairly similar for the South African and Global coworking market, with some filters, namely wheelchair accessibility, 24-hour member access, standing desks, outdoor terrace, kitchen and on-site cafés, showing a greater availability in the South African market. The following characteristics were found to be most popular among global coworking spaces with a rate of 60% or higher:

- High Speed Wi-Fi;
- Air Conditioning;
- Events;
- Printers / Scanners / Copiers;
- Lounge / Relaxation-Area;
- Kitchen;
- Free Drinking Water;
- Free Coffee; and
- No Deposit Required.

Research done by van de Koevering (2017) investigated what the typical characteristics of coworking spaces are, as well as what the user preferences are for coworking space characteristics. These typical characteristics are shown in Table 3.5.

Characteristic	**Description**
Location	The location is very accessible, not only with regards to the mode of transport (public or private), but also the time it takes to get to the location.
Office exterior and division	Offices are designed in such a way that it utilises maximum natural light and office spaces are open, rather than closed cubicles.
Office decor	Office decor and appearance is aesthetically pleasing, often utilising colour that boost creativity and incorporating natural element such as wood and plants in the office.
Facilities and services	Facilities often offered by coworking spaces include a booking system for spaces and work spots, canteen/restaurant, cleaning services, coffee and tea vending machine, coworking host (community manager), opening hours (24 hours access) and a reception and help desk.
Collaboration and openness	Coworking spaces boast with collaborative spaces, event spaces, informal areas with sofas and couches, kitchen areas, conference rooms and even quite spaces.
Community and sustainability	Coworking spaces offer more than just a place to work, it also offers a social network, training events and workshops, a virtual organisational platform and social events.
Accessibility	Coworking spaces have a diversity of tenants and lease contracts that is affordable and can space short periods of time.

Table 3.5: **Typical Characteristics Of Coworking Spaces.**

(Reproduced from van de Koevering (2017))

According to a survey study conducted by van de Koevering (2017), the user preference for coworking space characteristics are as shown in Table 3.6.

Characteristic	Description
Type of lease contract	Tenants significantly prefer no lease contract or shorter contracts of a day, week or month, over longer contracts like a year or longer.
Accessibility	Coworkers prefer a coworking place that is both accessible by public transport and by car.
Coworking layout	Tenants prefer a half-open layout over an open layout and closed layout. Thus, there has to be a balance between open spaces and concentration rooms, or places where more focused work can be done without the distraction of other coworkers collaborating.
Diversity	A coworking space is a community-driven environment where individuals from different business fields can meet, collaborate and exchange ideas and services.
Reception and hospitality	Tenants prefer a working environment that has a reception and a host, sometimes even for the host to connect coworkers to each other.
Events	Not as an important characteristics of coworking spaces, tenants state that they prefer events sometimes in the coworking space while other tenants attach no value to events.
Atmosphere and interior aesthetics	Surprisingly, tenants do not value the atmosphere and interior aesthetics as highly.

Table 3.6: **User Preference Of Coworking Space Characteristics.**

(Reproduced from van de Koevering (2017))

When comparing the characteristics obtained from literature to the data from Coworker, it is clear that both sources favour the same characteristics. The results from literature placed more emphasis on the atmosphere in a coworking space where as Coworker has no measurement for the atmosphere in a coworking space, thus the data focused more on physical characteristics of coworking spaces.

These characteristics can now be compiled into a list with an importance rating of 1 - 5. This is not an exhaustive list and can be used during market research in Stage 0 of the PROCSA matrix to determine the desired coworking characteristics of the member typology as explained in Section 3.4.1. The coworking spaces characteristics desired by members should be incorporated in the design and development in Stage 3 of the PROCSA matrix. The coworking characteristic rating form is shown in Table 3.7.

Characteristic	Importance
Location	1 2 3 4 5
Accessibility	1 2 3 4 5
Type of lease contract	1 2 3 4 5
Coworking layout	1 2 3 4 5
Reception and hospitality	1 2 3 4 5
Atmosphere and interior aesthetics/Office decor	1 2 3 4 5
Collaboration and openness	1 2 3 4 5
Office exterior and division	1 2 3 4 5
High speed Wi-Fi	1 2 3 4 5
Air conditioning	1 2 3 4 5
Printers / Scanners / Copiers	1 2 3 4 5
Lounge / Relaxation-area	1 2 3 4 5
Kitchen	1 2 3 4 5
Free drinking water and coffee	1 2 3 4 5

Table 3.7: **Coworking Characteristic Rating Form.**

3.6 South African Realities Giving Rise To The Need For Coworking Spaces

After profiling the target market in Section 3.4.1, the demographic of the target market in South Africa can be discussed. Since coworking spaces serve mostly the IT, business, finance and creative sector, a location where those sectors thrive would be ideal for a coworking space. According to Stats SA (2018), the top three provinces with the biggest contribution to South Africa's GDP is Gauteng, KwaZulu-Natal and Western Cape. The contributions from KwaZulu-Natal is largely due to manufacturing and transport from all the imports and exports at the Durban harbour and Richards Bay coal terminal. The biggest contributors in Gauteng and the Western Cape is Finance, Real Estate and the business service sector, these are concentrated in Johannesburg, Pretoria, Cape Town and Cape winelands.

The financial service group Alexander Forbes did a study on municipal areas that could help unlock South Africa's growth potential. The indicators that were used to determine the attractiveness of possible investment were:

- Market size (GDP per capita);
- Agglomeration of people;
- Agglomeration of economic activity;
- Openness of the local economy;
- Cost of labour; and
- Quality of labour and local stability.

Out of the six municipalities identified, only three shows big potential growth in business services namely City of uMhlanhuze Local Municipality, Emfuleni Local Municipality and Stellenbosch local municipality (Business Tech, 2018).

In addition to these South African cities consisting of the right makeup regarding potential for business growth and dominant industries, there are other realities in South Africa that favour the development of coworking spaces. These realities include the rising office vacancy rates and heavy traffic congestion in major cities.

3.6.1 Vacant Retail Space

The retail and office space industry in South Africa is under pressure. Research done by the South African Property Owners Association (SAPOA) indicated that nationally the office vacancies stood at 11.2% for the third quarter of 2018, which is a result of low economic growth in the county. Small to medium sized companies cannot afford the overhead and operational costs of offices anymore and are moving their employees over to remote working locations. This creates ideal opportunities to refurbish the vacant office and retail space in the county, and in return create the remote working environments sought after by small to medium sized companies. These office vacancies lead to the refurbishment component of the conceptual framework developed in this document. Refurbishment will be investigated in Chapter 4.

3.6.2 Traffic Congestion

South Africa's highway congestion is at an all time high. According to data released by TomTom in 2018, the country has an overall congestion rate of 21%. TomTom calculates these traffic congestion percentages by measuring the amount of extra travel time experienced by drivers across the entire year and comparing it to a baseline travel time during free flow conditions. Thus, a congestion level of 21% means that the projected travel time is 21% more than an average trip would take during uncongested/free flow conditions. The data showed that congestion on secondary roads are worse than main roads with commuters spending an average of ten working days a year stuck in traffic. South Africa has approximately 8.5 million employed workers earning an average of R14 911 per month, equating to roughly R710 per person per day and an astounding R60.35 billion lost annually to the economy in productivity due to the highly congested roads Business Tech (2014).
Cape Town and Johannesburg are the two most congested cities in the country with 35% and 30% congestion respectively, East London and Pretoria follows in third and fourth place with 29% and 26% respectively (TomTom, 2019).

Coworking spaces offer a solution to the traffic congestion experienced by creating nodes of coworking spaces closer to residential areas, and companies can be drawn away from the Central Business District (CBD) and alleviate traffic.

3.7 Chapter Conclusion

This chapter started by investigating the changing nature of work and identified some drivers and impacts of this change. Secondly, coworking was defined after which the typology of coworking members was investigated. The common characteristics of coworking spaces was investigated and a coworking characteristic rating form was developed. Lastly, the relevance of coworking in South Africa was discussed .

From this chapter several requirements can be added to the roles and responsibilities of the development manager already stated in the PROCSA matrix.

Firstly, the use of the typology matrix developed in Section 3.4.1. This matrix should be populated during the market research conducted in Stage 0 of the PROCSA matrix. This will give the development manager and design team a good idea of the target market and their needs.

Secondly, the use of the coworking characteristic rating form. This is to be used in Stage 0, after the completion of the typology matrix, in order to determine the desired coworking characteristics of the members that will use the coworking space. These characteristics then has to be incorporated in the design and development in Stage 3 of the PROCSA matrix.

Lastly, three aspects the development manager must consider when sourcing a location in Stage 0 of the PROCSA matrix are:

- Traffic congestion has to be considered as explained in Section 3.6.2; and
- Ideal location close to services and community as mentioned in Section 3.4.2 has to be considered.

The requirements from this section can then be summarised as seen in Table 3.8 and incorporated in the PROCSA matrix as illustrated in Figure 3.3.

	Requirement
R3.1	Use of the typology matrix
R3.2	Use of the coworking characteristic rating form
R3.3	Consider locations that alleviate traffic congestion
R3.4	Location in close proximity to services and community

Table 3.8: **Chapter Requirements Summary.**

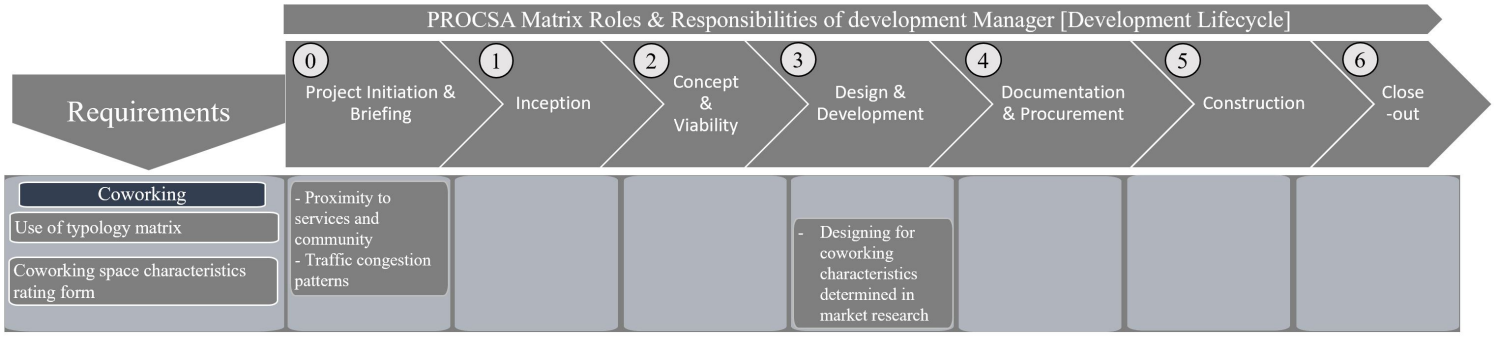

Figure 3.3: **Conceptual Framework Update.**

Chapter 4

Refurbishment

4.1 Introduction

The primary objective of this chapter is to establish the benefits of refurbishment over new builds. This chapter investigates the advantages of refurbishment over new build and presents a definition for refurbishment. Several requirements for the refurbishment of coworking spaces are also investigated. During the research, a need was identified for improved construction management in refurbishment projects, this is investigated in Chapter six. Finally, Chapter four concludes with a list of requirements to be added to the already stated roles and responsibilities of the development manager in the PROCSA matrix. Figure 4.1 displays the objectives of the chapter as stated in Section 1.3.

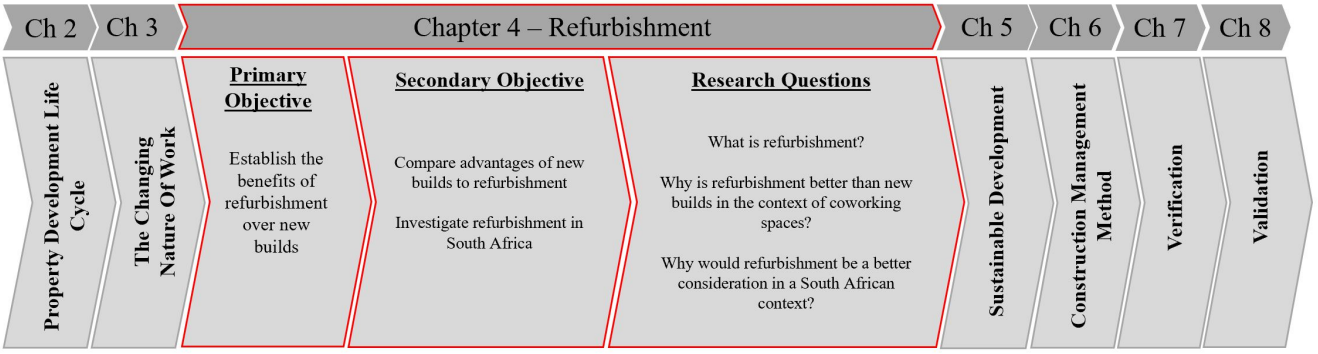

Figure 4.1: **Chapter Four Objectives.**

4.2 Towards Defining Refurbishment

For the purpose of this thesis, refurbishment is defined according to the interpretation of Egbu *et al.* (1998) stating that:

> *Refurbishment refers to such works as improvements, adaption, upgrading, rehabilitation, restoration, modernisation, conversion, retrofit, and repair which are carried out on existing buildings for a variety of reasons. This definition, however, excludes such work as cleaning, decorating, and emergency maintenance work.*

This definition was found during research on construction management techniques, this will be discussed in more detail in Chapter 5. It was cited by Kemmer (2018) as the most developed

definition and the author of this thesis agrees.

For a long time the terms retrofit and refurbishment was used interchangeably, but according to Dixon (2014), based on 37 in-depth interviews with key players, a distinction can be made between the two terms. Retrofit refers to buildings being refitted with relatively light touch energy efficiency measures, for example, while tenants are still in occupation of the space. Refurbishment would refer to a much deeper level of refit where changes to the internal and external fabric of the building is made.

4.3 Advantages Of New Builds

The argument for building new rather than refurbishing include (Power, 2008):

- Building new allows you complete freedom in the design and layout of the space;
- The latest technologies can be incorporated from design phase to allow for maximum energy efficiency and operational cost savings; and
- Since you design the building, you do not have to deal with unforeseen challenges of refurbishing a building where no or limited blueprints of the building is available.

4.4 Advantages Of Refurbishment

The argument for refurbishment rather than new build :

- Commercial refurbishment of existing spaces usually have a much shorter project duration than new builds;
- Refurbishment is more environmentally friendly than building new buildings according to Power (2010), more on this in subsection 4.4.2 and chapter 5;
- Refurbishment is a lot cheaper than new build, some argue that refurbishment cannot reach the same level of energy efficiency as new build because of construction restrictions, but according to Liu *et al.* (2018) similar energy efficiency levels can be achieved;
- Refurbishment has a high uncertainty and therefore a high risk, but with the model presented in chapter 6, uncertainty risks can be mitigated; and
- In practice, most coworking spaces are operated by a company that does not own the property they operate in. For such a company, it could be financially strenuous to build a new building, but with the right agreement with the landlord, refurbishment is very plausible.

4.4.1 Vacant Retail Spaces In South Africa

The retail and office space industry in South Africa is under pressure. Research done by the South African Property Owners Association (SAPOA) indicated that nationally the office vacancies stood at 11.2% for the third quarter of 2018. These sticky vacancy rates slowed rental growth down to 5.3%, compared to the 6.3% in the second quarter of 2018. Overall, the office sector is still in its recovery phase and vacancy rates are moving sideways, this is as result of the low economic growth in the country. For the 33 quarters since the fourth quarter of 2010, the office space industry in South Africa has only seen six quarters of improving occupancy rates.

SAPOA's quarterly report also indicated that Cape Town still has the lowest overall vacancy rates while Johannesburg had the highest vacancy rate at 12.8%. The report also analysed vacancy rates

by building size and found that vacancy rate is the lowest in office buildings smaller than 1000 m^2 and buildings larger than 20000 m^2, but significantly higher in the middle tiers. Development activity, expressed as a percentage of existing market stock, is at 2.9% compared to the 6.6% high in 2007, this is as result of many development schemes scaling down building activity, only phasing development on a tenant driven basis (SAPOA, 2018).

4.4.2 Sustainability

According to a study done by Preservation Green Lab, it is unequivocally greener to retrofit an old building with green technologies, than to construct a new green building. For a long time, the thought was that to build green you had to build new, but the numbers don't add up that way according to Elizabeth Heider, chair of the board of directors at the United States Green Building Council (USGBC) (Hughes, 2012; Power, 2010).

The research shows that if the negative climate change impacts of re-use and new construction are compared, the re-use dominates with 4% to 46%. In the study a new construction and a retrofit in seven different categories were compared, these categories include commercial office, mixed-use, elementary school, single-family home, multifamily, warehouse-to-office conversion and warehouse-to-multifamily conversion. For commercial offices, a baseline retrofit has 20% less of an environmental impact compared to a new construction (Hughes, 2012).

4.4.3 Financial Advantages

Not only is retrofit a more environmentally friendly option than new construction, the Return On Investment (ROI) is also far greater. Green retrofits are able to yield a ROI of up to 19.2% while newly built green buildings trend around an ROI of 9.9% (Shipley *et al.*, 2006; Harvey *et al.*, 2013).

Over six months, ended in June 2018, the retail and office space industry saw very little change in the cost of occupancy. The retail sector's gross cost to income stands a 36.5% while the office sector's ratio stands at 31.5%. From all the property operating costs, the municipal charges are the highest, constituting a portion of 63.9% of the overall operating costs. These municipal charges include rates & taxes, water and other metered utility charges such as electricity. The overall operating cost per month increased by R5.74/m^2, the biggest driver in this increase being the municipal charges, contributing R3.47/m^2.
According to the South African Property Owners Association (SAPOA), prime offices remain well placed with an operating cost as a percentage to gross income at 30.2% while secondary offices sit at 30.7%. The secondary-quality office segment was one of the segments with the highest level of transaction activity, this is typical for this phase of the property cycle (SAPOA, 2018).

4.5 Refurbishment And Coworking Spaces

The following subsections constitute the requirements for refurbishment.

4.5.1 Location

As mentioned in subsection 3.4.2, it is crucial to get a good location for the coworking space. More often than not a good location would be in a well developed business district of a city. Finding space to build a new building here would be difficult and costly, but refurbishing a floor or a section of an

existing building provides an ideal solution.

According to Zhai *et al.* (2011), deep energy refurbishment can yield energy savings of at least 50%, and this is most economical when applied to buildings with low energy efficiency. Conventional retrofits will achieve annual energy savings of 15-25%. This results in isolated construction projects like upgrading HVAC (heating, ventilation and air conditioning) component and/or lighting. Deep energy refurbishment is recommended for optimal operational cost reduction.

Thus, things to consider when scouting for a location for a new coworking space include:

- Can the building be refurbished, or is a light retrofit the most viable option in terms of energy components?
- What is the zoning of the property, i.e. is it maybe a heritage site, and will this allow deep refurbishment?

4.5.2 Modular Design

Since coworking operates on a very short membership contract basis, tenants and tenant needs can change relatively quickly that will in turn effect the use of the office space. Thus, in planning for the future and possibly changing the layout of the coworking space for future demands, it is good to design the coworking space to be modular/flexible.

Briitain *et al.* (2004) states that flexible buildings need to accommodate the following types of change:

- Relocation of desks;
- Relocation of partitioning and shifts between cellular and open plan;
- Intensification of space use, moving more people into a work area will increase loads on building services;
- Changes in the office equipment loads;
- Changes in office hours- for example to 24 hour shifts; and
- Changes in sub-division to different tenants.

Not considering a flexible design can lead to increased operating costs as a result of office churn and occupant discomfort when problems in modifying the building is experienced.

4.5.3 Refurbishment Characteristics

Refurbishment projects are complex and non-continuous, much more so than new build projects. This often requires planning to be adjusted to fit the project characteristics. Table 4.1 lists the typical characteristics of refurbishment projects. These characteristics need to be assessed and kept in mind before any decision it might influence is made.
Chapter 6 looks more in detail at how these characteristics influence the management of the construction project.

Management issues	Refurbishment features
Additional level of variability and uncertainty	• Unforeseen conditions like problems are not revealed until dismantling and stripping work has started • As-built drawings are often unavailable and inaccurate if available • Project scope can be unclear due to limited information about the existing building • Unforeseen conditions are continually discovered during the construction phase
Distinct health and safety concerns	• Hazardous material might be encountered in the existing building • Safety issues due to the interface of workers with existing operations in the building and involvement of building users who may include the public • Demolition and structural instability causes dangerous working environments
Particular management challenges	• Refurbishments involve a high number of constraints such as space limitations (e.g. storage, new equipment), restricted access, etc. • Time is usually constrained in refurbishment projects due to interference with building occupation and operation • Refurbishments might happen in an occupied building, hence temporary structures may be necessary to safeguard users and operations in the existing building • Operational constraints related to the existing facility, hence greater need to interface with the existing operations in the building, tenants, neighbours, maintenance and construction personnel • Small labour-intensive operations spread out in the existing building, which is commonly occupied

Table 4.1: **Typical Characteristics Of Refurbishment Projects.**

(Reproduced from Kemmer (2018))

As mentioned in Table 4.1, refurbishment adds various levels of restraints to construction projects. Unforeseen conditions uncovered during stripping of the building like features not marked on old building plans or hazardous materials can add time constraints on construction projects. Refurbishment projects also leads to various management challenges related to time, storage and restricted access as a result of existing infrastructure and facilities on site.. Kemmer (2018) developed a method for the construction management of refurbishment projects, originating from lean manufacturing principles. This method is discussed in Chapter 6.

4.6 Chapter Conclusion

This chapter first defined refurbishment for use in this research. Secondly, the advantages of both new builds and refurbishment were investigated, after which the requirements of refurbishment to be incorporated with the PROCSA matrix was discussed.

The requirements from this chapter can be added to the PROCSA matrix as follows:

- Subsection 4.5.1 states that the location must preferably be suited for deep energy refurbishment. This needs to be considered in Stage 0 when the appropriate property is sourced;
- South Africa has market conditions that make the refurbishment of empty/vacant retail and other spaces a viable and preferred solution as stated in subsection 4.4.1. This also has to be considered in Stage 0 of the PROCSA matrix;
- Subsection 4.5.2 requires refurbishment to be flexible. This is not directly influenced by the development manager, but is a requirement when the development manager reviews and approves the designs by consultants in Stage 3 of the PROCSA matrix; and
- Refurbishment projects have a lot of uncertainty, which requires characteristics of the specific refurbishment project (subsection 4.5.3) to be determined and considered before decision making. Determining refurbishment characteristics would take place in Stage 1 of the PROCSA matrix and considered for the rest of the project life cycle. This aspect is also discussed in Chapter 6 and tied into the construction management principles.

Figure 4.2 gives an update of the conceptual framework and how the requirements from this chapter, as summarised in Table 4.2, fit into the framework.

	Requirement
R4.1	Location must be suited for deep energy refurbishment
R4.2	Site must be vacant
R4.3	Refurbishment design must be flexible for future change
R4.4	Assess refurbishment characteristics to prevent unforeseen circumstances

Table 4.2: **Chapter Requirements Summary.**

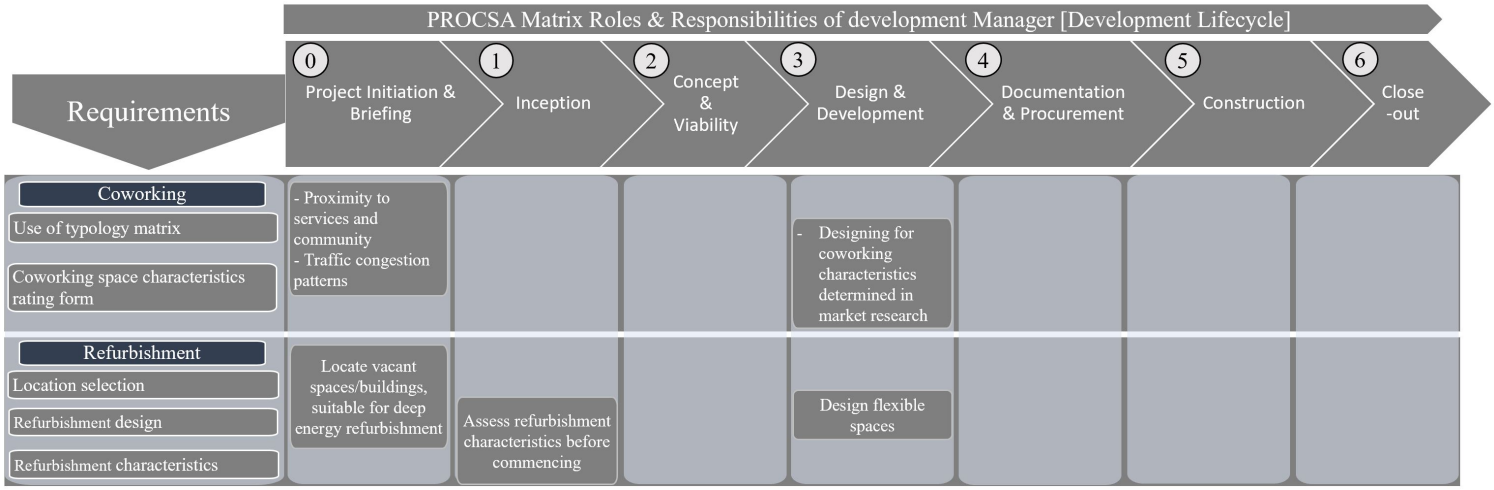

Figure 4.2: **Conceptual framework update.**

Chapter 5

Sustainable Development

5.1 Introduction

The primary objective of this chapter is to determine a set criteria to measure the sustainability of buildings. This chapter states the need to develop property sustainably and defines green buildings. As mentioned in Chapter 4, refurbishment is more environmentally friendly/sustainable than new builds. The benefits of sustainable development is investigated, as well as ways to measure the sustainability of a development. The chapter then researches the Green Building Council South Africa's (GBCSA) rating system for green buildings as it is designed for and recognised in South Africa. The chapter concludes with a list of sustainable development requirements to be added in addition to the already stated roles and responsibilities of the development manager as stated in the PROCSA matrix. Figure 5.1 displays the objectives of the chapter as stated in Section 1.3.

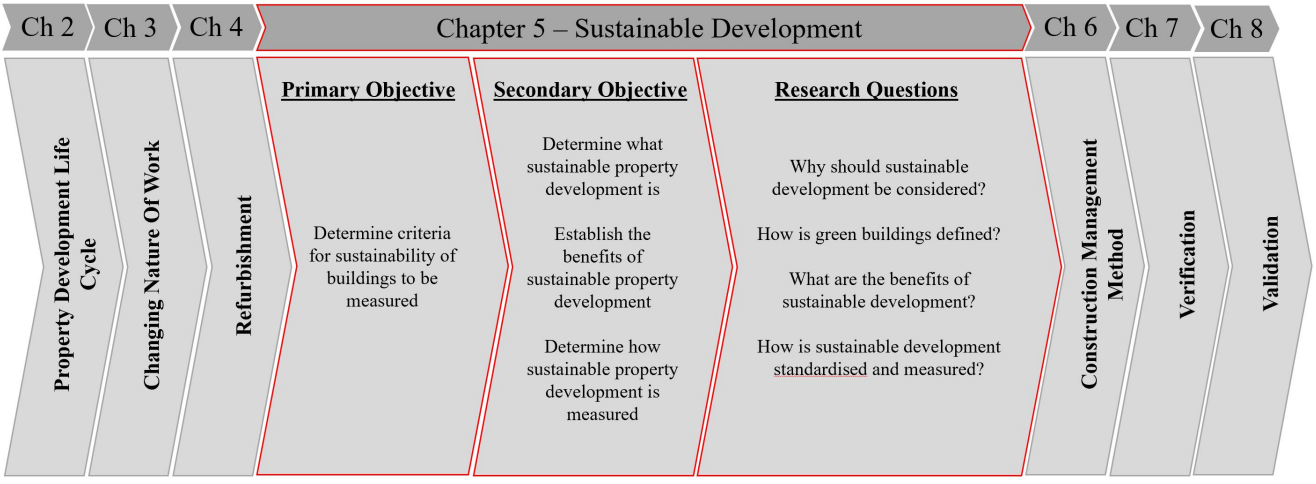

Figure 5.1: **Chapter Five Objectives.**

5.2 Towards Defining Green Buildings

Global warming is a widely known occurrence and its effects are well known. The influence of the construction industry on global warming, however, is not as widely known. According to Laurencine (2015), 19% of annual global greenhouse gasses are produced by the construction industry. This takes into account the gasses released by the materials such as concrete and steel used for construction, as well as the machinery used in construction. Despite the negative effects of global

warming, it is still a mystery why people are not embracing the implementation of green building readily. This chapter will explore the benefits of green buildings and why people are still hesitant to build green. Green buildings standards and rating systems in South Africa will be investigated, as well as governmental policies on green developments.

WorldGBC (2019) defines a green building as a building that in its design, construction and operation, reduces or eliminates negative impacts, and creates positive impacts on the climate and natural environment. Kolev (2009) states that green buildings are designed and constructed in a way that is measurably less harmful to the environment than traditional buildings. For the purpose of this study, these two definitions will be blended to define green buildings as follows:

> *Buildings that are designed, constructed, and operated to not only reduce or eliminate negative impacts, but to create positive impacts on the climate and natural environment in a measurable way.*

A green building can directly translate to being a sustainable development project, thus by defining what a green building is and applying that to the refurbishment and construction of coworking spaces, the coworking space in question would be a sustainable development.

5.3 Benefits Of Sustainable Development

According to the World Green Building Council, evidence is growing that green buildings bring multiple benefits. These benefits can be categorised into environmental, economic and social benefits (WorldGBC, 2019).

Environmental
The biggest benefit green buildings offer is to our natural environment and climate. Not only can they reduce or eliminate the negative impacts on our environment by using less water and energy, but in many cases they have a positive impact, generating their own energy and increasing biodiversity (Olsen and Fenhann, 2008).

On a global level, the building industry has the largest potential for reducing greenhouse gas emissions compared to other major emitting sectors. As much as 50% or more energy savings can be achieved by 2050 in support of limiting global temperature rises to 2°C (Dean *et al.*, 2016).
Green buildings in South Africa achieving a Green Star certification have shown to save between 30 - 40% energy and carbon emissions annually, one between 20 - 30% potable water annually, when compared to industry norm.

Economic
Green buildings offer a number of economic benefits including cost savings on utility bills (through energy and water efficiency); lower construction costs and higher property value; increased occupancy rates; and job creation.

According to Molenbroek *et al.* (2015), global energy efficiency measures could lead to an estimated annual savings of 280 - 410 billion Euros. Building owners report that Green buildings command a 7% increase in asset value over traditional buildings whether it is new builds or retrofits (Morton *et al.*, 2016; Eichholtz *et al.*, 2013).

Social

Many of the social benefits of Green buildings are around the health and well-being of the people working in green offices or living in green homes. According to MacNaughton *et al.* (2016), workers in green, well-ventilated offices record a 26.4% increase in cognitive scores. Employees in offices that utilise more natural light slept an average of 46 minutes more per night Boubekri *et al.* (2014).

Windapo (2014) conducted a study to determine the main drivers for green buildings in South Africa. The study concluded that the main drivers for green buildings in South Africa are firstly economic and secondly, in a far lesser extent, environmental factors. Interviews with industry leaders at the time revealed the following:

- The green building industry is at a premature stage in South Africa with little interest shown from the government and public;
- The rise in energy costs (financial aspect) and an industry rating system (Green star SA) are the main drivers of green buildings;
- The rating system (Green star SA) seems to be reasonably developed from a professional perspective;
- Operational cost savings, marketing potential and the ability to charge higher rents, are all considered important benefits, whereas the indoor environmental quality is almost unanimously considered unimportant;
- The most expensive part of green buildings is the ventilation system; and
- Green features can easily be incorporated in buildings and this is mainly driven by increase rebates/subsidies from green investments.

Saad (2016) did a study on the impediments to implementation of green buildings in South Africa. A qualitative research method was adopted where five construction professionals (Three Architects and two Quantity Surveyors) were interviewed to uncover facts pertaining to the Green Building Industry in South Africa. These construction professionals were registered with their respective professional bodies and had at least 20 years experience in their field and Green Buildings, they were also from different companies.

The interviews revealed several factors from the transcripts that were identified as impediments to the growth of the green building industry. The themes and constructs are listed below and ranked according to frequency percentages Saad (2016):

- Green Buildings are to costly (100%);
- Lack of proper knowledge of the advantages of Green Buildings (100%);
- Developers build to maximise profit only, not for users' comfort (100%);
- Lack of team integration within stakeholders (75%);
- Use of expensive technologies (75%);
- Lack of proper communication strategies (50%);
- No effective enforcement by professionals and government by-laws (50%); and
- Lack of stakeholders buy-in to the technology (50%).

The latest information on the condition of the green building industry in South Africa indicates that about 41% of all building projects are green buildings, compared to the global average of 24%. In 2018, 61% of building projects were expected to be green building projects Morton *et al.* (2016). Along with this, GBCSA (2019) released data from a study indicating that green buildings sell at a premium of 1.1% to 5%. In conclusion, the green building industry in South Africa seems to be growing rapidly and awareness with developers and other stakeholders are increasing.

5.4 Green Building Rating Systems

In the 1990s the push towards sustainable design increased. This lead to the first green building rating system, Building Research Establishment's Environmental Assessment Method (BREEAM), being developed in the U.K. in 2000. The U.S. Green Building Council then followed with their rating system aimed at improving environmental performance with their Leadership in Energy and Environmental Design (LEED) system for new construction. Since then various rating systems have been developed by various countries and institutions, most of which will be reviewed later in this section.

Green rating codes come in two basic formats, prescriptive and performance, with a third developing option known as outcome-based. The Perspective path is a definitive and conservative approach to code compliance and often the fastest. It requires that equipment and materials meet certain levels of stringency which are quantified in tables. Performance-based codes, on the other hand, are designed to achieve certain results rather than meeting a list of requirements for individual components. Outcome-based codes are very similar to performance-based codes, but it considers the whole building as a system and not individual components. These codes would set target levels to be achieved and then provide measurement and reporting tools to ensure that the completed building performs at the established levels. These target levels can be for aspects such as energy usage, indoor environmental quality and various others.

Certifying a building or a product is the confirmation that it meets the defined requirements of a standard. According to the International Standards Organisation (ISO), certification is defined as: *Any activity concerned with determining directly or indirectly that relevant requirements are fulfilled.*
Product certification is intended to ensure that a product meets a particular standard and offers environmental benefit. Most certification programs certifies products based on life-cycle parameters including energy use, recycled content, air and water emissions from manufacturing, disposal and use. Programs such as this would be considered multi-attribute programs where as single-attribute programs would only consider a single attribute such as water, energy, or chemical emissions that directly impact Indoor Environmental Quality (IEQ).

Some green product certifications include Energy Star, WaterSense, Green Seal, Cradle to Cradle, GREENGUARD and Green Squared. Although these product certifications will not be investigated, it is important to note that green product certifications are on the rise as market conditions change and demand for greener products continues to increase. Having products certified offers greater assurance to designers and consumers and product certifications will often be recognised by comprehensive green building rating systems.

Green building rating or certifications goes beyond just considering the products, but considers the project as a whole. These rating systems require an integrated design process to ensure that projects are environmentally responsible and resource-efficient throughout a building's life-cycle, from sitting to design, construction, operation, maintenance, renovation and demolition. Just as with product certification, green building certifications are most respected when an independent third party is responsible for conducting the rating of the building. Some of the big rating systems in the world are investigated in Table 5.1 and 5.2 with a focus on the Green Star rating system used in South Africa.

BUILDING RATING OR CERTIFI-CATION SYSTEM	SINGLE- OR MULTI-ATTRIBUTE	TYPE OF STANDARD OR CERTIFICATION	MANAGING ORGANIZATION	ISSUES / AREAS OF FOCUS
Green Star SA (South Africa)	Multi-Attribute	Green building rating system for: Office Retail Multi-unit residential	Green Building Council of South Africa administers program Independent assessors to assess and score projects	Categories assessed in: Management Indoor Environmental Quality Energy Transport Water Materials Land Use & Ecology Emissions Innovation
LEED (Worldwide)	Multi-Attribute	Green building rating and certification system through independent third-party verification for: New Construction (NC) Existing Buildings, Operations & Maintenance (EB O&M) Commercial Interiors (CI) Core & Shell (CS) Schools (SCH) Retail Healthcare (HC) Homes Neighbourhood Development (ND)	U.S. Green Building Council	Performance in: Sustainable Sites Water Efficiency Energy & Atmosphere Materials & Resources Indoor Environmental Quality Locations & Linkages Awareness & Education Innovation in Design Regional Priority through a set of prerequisites and credits
Living Building Challenge (International /USA)	Multi-Attribute	Performance-based standard, and certification program for: Landscape and infrastructure projects Partial renovations and complete building renewals New building construction Neighbourhood, campus and community design	International Living Future Institute	Performance areas include: Site Water Energy Materials Health Equity Beauty All areas are requirements.
WELL Building Standard (USA)	Multi-Attribute	Performance based standard and certification program for New and Existing Buildings New and Existing Interiors Core and Shell Retail Education Facilities Restaurant Commercial Kitchen Multifamily Residential	Administered by the International WELL Building Institute (IWBI)	Measures attributes of buildings that impact occupant health by looking at seven factors: Air, Water, Nourishment, Light, Fitness, Comfort, Mind

Table 5.1: **Global Green Building Rating Systems.**

(Reproduced from GBCSA (2019))

BREEAM (UK, EU, EFTA member states, EU candidates, as well as the Persian Gulf)	Multi-Attribute	Certification system is a multi-tiered process with pre-assessment, third-party consultant guidance through an assessment organization for: New Construction Communities In Use Buildings and EcoHomes	BRE Global	Assessment uses recognized measures of performance, which are set against established benchmarks in: Energy and water use Internal environment (health and well-being) Pollution Transport Materials Waste Ecology and Management processes
CASBEE (Japan)	Multi-Attribute	Building assessment tools for Pre-design New Construction Existing Building and Renovation	JSBC (Japan Sustainable Building Consortium) and its affiliated sub-committees	Assessment areas include: Energy efficiency Resource efficiency Local environment, and Indoor environment
Pearl Rating System for Estidama (UAE)	Multi-Attribute	Green building rating system for: Community Buildings Villas Temporary Villas and Buildings	Abu Dhabi Urban Planning Council	Assessment of performance in: Integrated Development Process Natural Systems Livable Communities Precious Water Resourceful Energy Stewarding Materials Innovating Practice
EDGE (Worldwide)	Multi-Attribute	A universal standard and a certification system for residential and commercial structures.	International Finance Corporation (IFC), a member of the World Bank Group	Assessment areas include: Energy Water Materials
Beam (Hong Kong)	Multi-Attribute	Comprehensive standard and supporting process covering all building types, including mixed use complexes, both new and existing to assess, improve, certify, and label the environmental performance of buildings	Business Environment Council	Performance and assessment in: Site aspects Material aspects Water use Energy use Indoor environmental quality Innovations and additions
BCA Green Mark Scheme (Singapore)	Multi-Attribute	Benchmarking scheme that aims to achieve a sustainable built environment by incorporating best practices in environmental design and construction, and the adoption of green building technologies.	Building and Construction Authority (BCA)	Rates buildings according to five key criteria: Energy efficiency Water efficiency Environmental protection Indoor environmental quality, and Other green and innovative features that contribute to better building performance.

Table 5.2: **Global Green Building Rating Systems.**

(Reproduced from GBCSA (2019))

When comparing green rating systems, it is important to consider the areas of focus. From all the green rating systems mentioned in Table 5.1 and 5.2, the following four areas of focus are most common:

- Water efficiency;
- Energy efficiency;
- Environmental protection; and
- Indoor environmental quality.

Considering the more established green rating systems like LEED and BREEAM, areas of focus also include pollution, transport, waste, materials, innovation and design, as well as awareness and education. Similar areas of focus are found in the Green Star rating system implemented in South Africa. For this study, the requirements as stated by the Green Star rating system will be used as guidelines for sustainability since this is the rating system recognised by the government. The areas of focus of the Green Star rating system is as follows:

- Management;
- Indoor environmental quality;
- Energy;
- Transport;
- Water;
- Materials;
- Land use & ecology;
- Emissions; and
- Innovation.

The requirements of the Green Star rating system for refurbishment projects are discussed in Section 5.4.1.

5.4.1 Green Star Rating System

The green rating system awards points across nine categories. Each category has a number of credits that addresses specific green building aspects and actions. Each credit has points associated with it and at the end of a project, credits would be assessed and a weighting factor that is specific to the tool is applied before a final score is calculated. Several rating tools are available, namely GBCSA (2019):

- New buildings and major refurbishments;
- Existing building performance;
- Interior fit-outs; and
- Sustainable precincts.

The tools most commonly used in this framework for developing coworking spaces, would be the **major refurbishment tool** and the **interior fit-out tool** in the cases where only a part of a existing building is being refurbished for a coworking space. It is important to note that the greater the refurbishment, the greater the benefits derived from refurbishing would be. There are four tools for rating major refurbishments across South Africa namely, office tool, retail tool, public & education (PEB) tool and multi-unit residential (MUR) tool. This research focuses on the office tool.

The GBCSA only recognises a 1, 2 and 3 star rating for existing building performance only. Other tools start at a 4-star rating minimum. This is done to set a higher standard for any new developments in South Africa and to encourage more sustainable development. For the major refurbishment and interior fit-out tools, the following certifications are available GBCSA (2014):

- **4 Star rating**: A weighted score of 45-59 recognises *Best Practice*;
- **5 Star rating**: A weighted score of 60-74 recognises *South Africa Excellence*; and
- **6 Star rating**: A weighted score of 75-100 recognises *World Leadership*.

Thus, the minimum requirement that can be placed on any new coworking space development, given that the development will go through certification, is a 4 Star Green rating.

The scorecard for rating major refurbishment of office buildings indicates categories and respective credits as shown in Table 5.3.

Category	**Max Credits**
Management	14
Indoor Environmental Quality	24
Energy	30
Transport	14
Water	15
Materials	21
Land Use and Energy	9
Emissions	17
Innovation	10

Table 5.3: **Office Building Green Star SA Rating Scorecard.**

(Reproduced from GBCSA (2019))

The detailed scorecard can be seen in Appendix AA.

Before this tool can be used to rate te building or office spaces, there are some eligibility criteria that needs to be met by the building. These criteria are GBCSA (2010):

Spatial Differentiation
The project must be visually distinct and recognisable from any surrounding buildings or structures that it is connected to. The reasoning is that for Green Star SA rating to provide a meaningful result, it has to send a clear message to the market place.

Space use
Office buildings will only be eligible for certification if at least 80% of the gross floor area comprise of commercial office space.

Conditional Requirements
The building will not be eligible for Green Star SA rating unless the conditional requirements have been met. For office buildings there are conditional requirements on energy usage and land and ecology of the site.

Timing of certification
Certification for either 'Design' or 'As built' has to be achieved within two years (24 months) of practical completion of the project.

5.5 Chapter Conclusion

As stated in the beginning of this chapter, green buildings offer various benefits. The aim of developing green coworking spaces would be to maximise the economic benefits for the operator of the coworking space, to maximise social benefits for the occupants of the coworking space, and to minimise the impact of the building on the environment.

In order to achieve this, the conceptual framework being developed in this study requires the minimum Green Star rating of four stars. The requirements of the scorecard in Appendix 5.3 is of the nature that it has to be consulted during every stage of the PROCSA matrix. Thus, the 4 Star Green rating is relevant for Stages 0 to 6 of the PROCSA matrix. Besides this requirement, the basic eligibility criteria to use the major office refurbishment tool applies. Spatial differentiation and space use becomes relevant in Stage 1 (establishing the client requirements) and Stage 3 (review and approve designs by consultants) of the PROCSA matrix. Conditional requirements is relevant in Stage 0 of the PROCSA matrix where the selected site has to comply to the land and ecology requirements and Stage 3 where the energy usage has to comply to given requirements. Timing of certification is only applicable in Stage 6 where the building/site has to be certified within 24 months of practical completion.

Finally, two other requirements are imposed namely, a minimum score of 18/24 (75%) for Indoor Environmental Quality and a minimum rating of 23/30 (76%) for Energy category on the scorecard of the major office refurbishment tool. These scores are the minimum required to obtain a six star rating. These requirements are introduced for the social and economic benefits it will bring as discussed in section 5.3. Same as the 4 Star Green rating, these requirements are also applicable for Stages 0 to 6 in the PROCSA matrix.

Figure 5.2 gives an update of the conceptual framework and how the requirements from this chapter fits into the framework, the requirements are summarised in Table 5.4.

	Requirement
R5.1	Four Star Green rating for the refurbishment project
R5.2	The project must be visually distinct from surrounding buildings
R5.3	80% of the gross floor area must be commercial office space
R5.4	Additional energy usage and land ecology requirements have to be met
R5.5	Building must be certified within two years of practical completion
R5.6	Indoor environmental quality requires a rating of 18/24 or greater
R5.7	Energy rating of 23/30 or greater is required

Table 5.4: **Chapter Requirements Summary.**

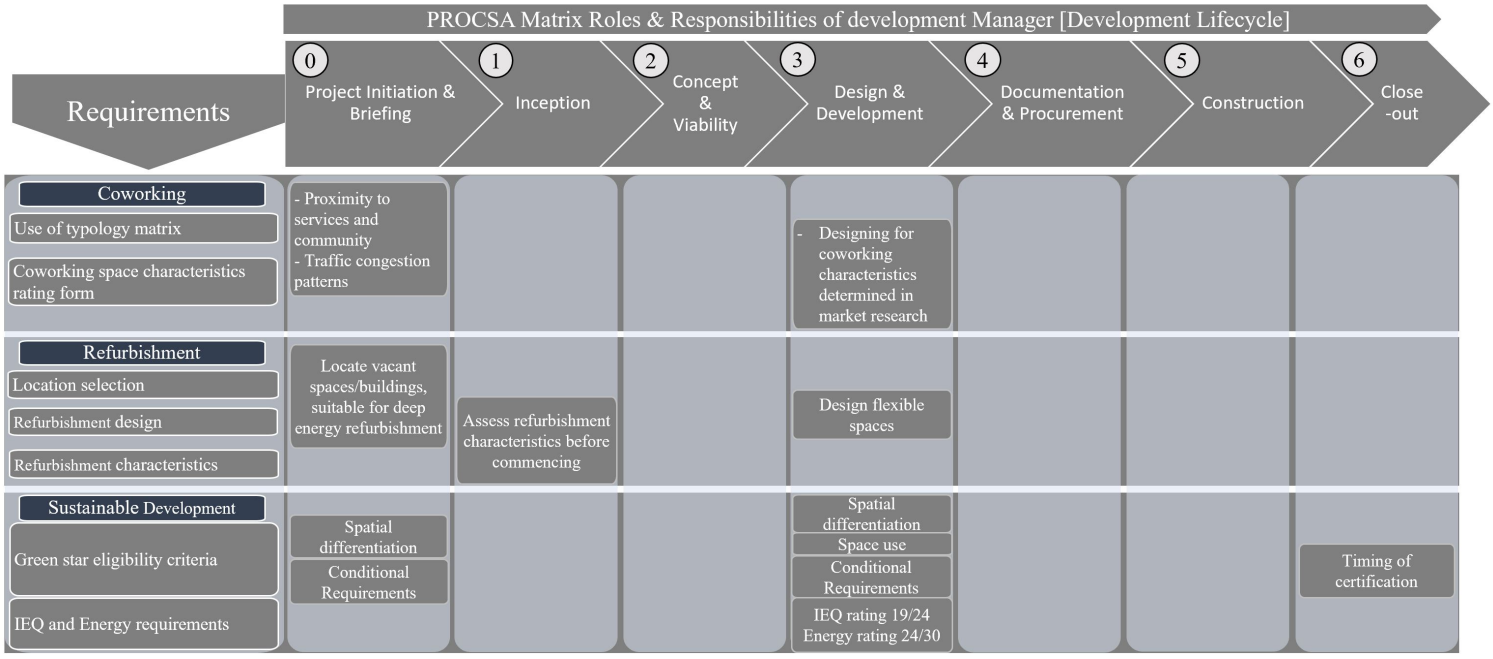

Figure 5.2: **Conceptual Framework Update.**

Chapter 6

Construction Management Of Refurbishment Projects

6.1 Introduction

The primary objective of this chapter is to research an improved construction management method for refurbishment projects. The first part of this chapter delves into the history of construction management, looking at why current methods are ineffective. The first section ends with a list of proposed management solutions that can improve construction management. The second section in this chapter explores a method for construction management of refurbishment projects developed by Kemmer (2018). This method incorporates the managerial solutions from the first section. The method from Kemmer (2018) along with the managerial solutions will serve as requirements to be implemented in the building life cycle of coworking spaces which is the PROCSA matrix for this study. Figure 6.1 displays the objectives of the chapter as stated in Section 1.3.

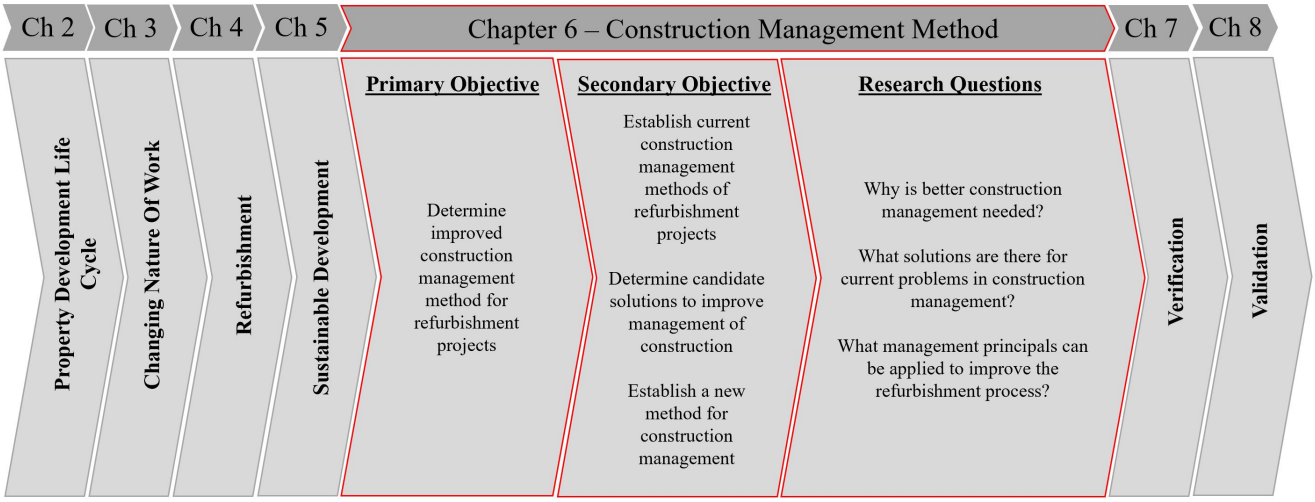

Figure 6.1: **Chapter Six Objectives.**

6.2 Current Construction Management Of Refurbishment Projects

Before delving into the traditional approach used by construction companies to manage refurbishment projects, it should be noted that the same definition for refurbishment as stated in Chapter 3 is used in this chapter. The definition follows the interpretation of Egbu *et al.* (1998), stating that "refurbishment refers to such works as improvements, adaption, upgrading, rehabilitation, restoration, modernisation, conversion, retrofit, and repair which are carried out on existing buildings for a variety of reasons. This definition, however, excludes such works as cleaning, decorating, and emergency maintenance work."

Refurbishment projects is a complex and non-continuous process that requires planning to be adjusted to fit project characteristics Lundberg and Lidelow (2016). Some typical characteristics of refurbishment projects are listed in Table 4.1. To deal with all the added complexities these characteristics add to refurbishment projects, one would expect industry to implement a management approach that caters for these added complexities, but studies show otherwise. A study done by Kemmer and Koskela (2013) indicated that the management tasks perceived as most difficult in managing refurbishment projects was in order forecasting and planning, analysis of project risk and uncertainty, competitive tendering, budgetary control and managing time. Despite this view from industry, the most popular planning and control techniques implemented in refurbishment projects are still bar charts, Critical Path Method (CPM), schedules, project cost-value reconciliation and labour reconciliation Lundberg and Lidelow (2016); Egbu *et al.* (1996); Babangida (2014); McKim *et al.* (2000) .

Some would say that the management of refurbishment works have improved and that the aforementioned principals are no longer in use. However, a study conducted by Henrich and Others (2010) shows that managerial practices for refurbishment projects remains inappropriate. The study shows that there is no involvement of stakeholders such as subcontractors in the creation of plans and the Critical Path Method (CPM) is still the main method of production planning. Managers use pre-estimated plans to push activities to production and communication between planning and production is done in a one-way fashion. Action is only taken when variance against standard performance is identified and there is no evidence of continuous improvement in the program implemented on site. The study went on to identify several types of waste within refurbishment projects namely, waiting time, the use of wrong equipment, unnecessary transport, rework, double handling and space conflicts between materials. These wastes are likely to result in project delays, cost overruns, low productivity and tenant's annoyance. Kemmer (2018) developed a method for construction management in refurbishment projects and pointed out the lack of research in the field and confirmed that the aforementioned management principals are still widely in use.

There is thus a clear emphasis on managing tasks on site by implementing scheduling, particularly Critical Path Method (CPM). It is worth mentioning that the use of CPM for construction control have been criticised for a long time. Dave (2013); Wandahl and Skovbogaard (2017) argues that plans are quickly out of use and this requires permanent and time-consuming adjustments of the plan to real situations. It is also argued that CPM does not create satisfactory results as it is not compatible with the essence of construction processes. Johnston and Brennan (1996) states that this management style based on planning refers to a style called management-as-planning. This management style has an underlying assumption that projects can be successfully managed by the production and implementation of plans. While effective for simpler projects, this management style

is not capable of dealing with the complexities and level of uncertainty in refurbishment projects.

Koskela (2000) investigated the theoretical foundation of traditional construction management projects. He states that the traditional approach is essentially based on the transformation theory of production- a reductionist view that is incapable of coping with the complexities found in the construction sector. His conclusion was that construction project management needs a more powerful theoretical basis of production capable of dealing with intrinsic construction peculiarities. The functions of a theory of production are summarised as follows Koskela (2000):

- Explanation - a theory provides an explanation of observed behaviour, and contributes to understanding;
- Prediction - a theory provides a prediction of future behaviour; in the case of production, especially of the contribution of action to goals;
- Direction - a theory identifies the sources of further progress;
- Testing - when stated clearly, it is possible to constantly test the theory to prove its validity;
- Tools for decision and control - on the basis of a theory, tools for designing, analysing, and controlling production can be built;
- Communication - a theory, when shared, provides a common language or framework, through which the co-operation of people in collective undertakings, like a project or firm is facilitated an enabled;
- Learning - a theory can be seen as a condensed piece of knowledge: it empowers novices to do things that formerly only experts could do; and
- Transfer - innovative practices can be transferred to other settings by first abstracting a theory from that practice and then applying it in the desired setting.

An investigation on existing theories of production carried out by Koskela (2000) resulted in three main approaches proposed throughout the 20th century, namely, the Walrasian production model, the Factory Physics model, and the product realisation model. These three theories' conceptualisation of production is transformation, flow, and value respectively. It was proposed that production could be conceptualised by using these three theories simultaneously giving rise to the Transformation (T), Flow (F), and Value (V) or TFV theory of production.

The integrated TFV view on production is summarised in Table 6.1. The transformation view is focused on transforming inputs into outputs and efficient production through work breakdown structures and organisational charts. In the construction of coworking spaces through refurbishment, this view would correspond to planning and executing tasks to complete the project as soon as possible. The flow view focuses on the movement of components with the aim to limit waste and reduce the amount of unnecessary tasks. In the construction of a coworking space, this would correspond to the strategic movement and ordering of materials on site to reduce waste in time and damaged materials. The value generation view focuses on accurate requirement capturing and quality end products to ensure that best possible value is delivered to the client.

	Transformation view	**Flow view**	**Value generation view**
Conceptualisation of production	As a transformation of inputs into outputs	As a flow of material, composed of transformation, inspection, moving, and waiting	As a process where value for the customer is created through fulfilment of his requirements
Main principles	Getting production realised efficiently	Elimination of waste (non-value-adding activities)	Elimination of value loss (achieved value in relation to best possible value)
Practical contribution	Taking care of things to be done	Taking care that what is unnecessary is done as little as possible	Taking care that customer requirements are met in the best possible manner
Methods and practices (examples)	Work breakdown structure, MRP, Organisational charts	Continuous flow, pull production control, continuous improvement	Methods for requirements capture, Quality Function Deployment
Suggested name for practical application of the view	Task management	Flow management	Value management

Table 6.1: **Integrated TFV View On Production.**

(Reproduced from Koskela (2000))

The transformation view is what traditional construction management is based on and it is very helpful for specific purposes like determining which tasks are needed in a project. The downside of this view is that it does not take into account other non-value adding production activities such as moving, waiting and inspection. It also fails to acknowledge that value in production is having the outputs conform to the clients needs and not just transforming inputs into outputs.

The flow concept emerged as a criticism to the transformation view. Koskela *et al.* (2002) recognises the existence of two types of activities namely, value-adding or transformation activities and non-value-adding or non-transformation (waste) activities. This distinction becomes important when looking at the core of the flow view of production. In the flow view of production, time is seen as an attribute (or resource) of production and reducing the use of this resource is a major goal. The main principle of the flow view is to reduce non-value-adding activities, directly translating to reducing time wastes and compressing lead times. The following flow concept-related principles are central to the development of lean construction management solutions developed later in this chapter (Koskela, 2000):

- Reduce the share of non-value adding activities (waste);
- Compress lead time;
- Reduce variability;
- Simplify (by minimising the number of steps, parts, and linkages);
- Increase transparency; and
- Increase flexibility.

The value view of production aims to produce the best value from the perspective of the customer. The main difference to the transformation view is that the value view takes into consideration the customer in the conceptualisation of production and it is focused on the interaction between customer and supplier (producer). Improvement of customer value is the main principle and the

process of capturing customer requirements, translating it into design solutions and then producing it accordingly is vital (Koskela *et al.*, 2002).

The reason for bringing three theories together to create the TFV theory is that production has to be managed from all three viewpoints simultaneously Koskela (2000). Thus, it is important that managers have a balanced approach regarding each perspective of production. The TFV theory has also been called ”lean construction theory” in the research community on construction management due to its emphasis on principles derived from lean production. This integrated view of production will from now on be described with the term ”lean”.

While lean theory has been well tested in new construction projects, the same can not be said for refurbishment projects. Due to the added complexities of refurbishment projects, not all lean principals are easily implementable in refurbishment projects. Kemmer and Koskela (2012) reports that lean theory can be applied to improve the management and performance of refurbishment projects. These include benefits, for example, reliable workflow on site, improved logistics, optimised design process, enhanced integration and coordination between project participants, and increased productivity. A proper understanding of the refurbishment context is also vital to compose appropriate solutions for each particular project environment (Vrijhoef, 2016).

6.2.1 Lean Solutions

A list of candidate solutions for production management in refurbishment projects can be drafted from the work done by Bryde and Schulmeister (2012); Kemmer (2018) as indicated in Table 6.2. These managerial tools and techniques are based on further development of the work done by Kemmer *et al.* (2013); Koskela *et al.* (2002). The correlation between the lean solutions and the concepts and principles of the TFV theory of production (Koskela, 2000), are also indicated in the table. According to Kemmer (2018) these lean solutions are theoretical in nature and their practical application is not widely used or known in the construction industry, however, cases of implementation records great improvement over traditional solutions. Alarcón *et al.* (2008) states that performance improvements between 7% and 48% can be expected with the implementation of lean construction principles.

Lean solutions	TFV Concept	TFV Principles
Production System Design	Transformation	Decompose the production tasks
		Reduce share of non-value adding activities
	Flow	Simplify
		Reduce variability
	Value	Ensure that all requirements are captured
Line of Balance	Transformation	Decompose the production tasks
		Reduce the amount of non-value adding activities
	Flow	Reduce variability
		Compress lead time
Last Planner System	Transformation	Decompose the production tasks
		Reduce the amount of non-value adding activities
	Flow	Reduce variability
		Compress lead time
	Value	Ensure that all requirements are captured
		Ensure the flow down of customer requirements
Prefabrication / Standardisation	Flow	Reduce non-value adding activities
		Compress lead time
		Increase flexibility
	Value	Improve customer value
Mass Customisation	Flow	Increase flexibility
	Value	Improve customer value
Cellular Manufacturing/ Multiskilling	Transformation	Realise value-adding activities efficiently
	Flow	Reduce non-value adding activities
		Compress lead time

Table 6.2: **Lean Solutions And The TFV Theory Of Production.**

(Reproduced from Bryde and Schulmeister (2012); Kemmer (2018))

6.2.1.1 Production System Design

This is the first task of a productive endeavour, and it extends from global organisation to design of operation. The production system design focuses on addressing the three main objectives of production systems, i.e. do the job, maximise value, and minimise waste (Espinosa-Garza *et al.*, 2017).

Slack argues that the production system design sets out to debate and convert the planned production strategy into a set of decisions that will serve as guidance for the management of different activities. These decisions that act as a guide refers to defining the project execution strategy, studying workflows, identifying and designing critical processes, as well as defining the capability of production resources (Sacks and Goldin, 2007).

Completing the production system design can help to cope with the uncertainty inherent to refurbishment projects. More information on this system is available in Ballard *et al.* (2001); Tsao *et al.* (2004); Tsao (2005); Schramm *et al.* (2004, 2006).

6.2.1.2 Line Of Balance

This tool is used to project planning and control that provides great visibility for the flow of work on a construction site. The line of balance provides information related to where, when and what tasks are done at any time, as well as task size, pace, and buffers between different crews.

In addition to making workflows more transparent to the managers of the project, line of balance serves as a means to simulate and discuss different strategies and alternatives to sequence activities in the long run. More information on the structuring and implementation of this tool can be found in Soini *et al.* (2004); Seppänen and Alto (2005); Kemmer *et al.* (2008); Kenley and Seppänen (2010).

6.2.1.3 Last Planner System (LPS)

This tool was designed to produce reliable workflow and stable projects. The LPS is a philosophy, rules and procedures, and a set of tools that facilitate the implementation of procedures (Ballard, 2000). The five main elements of LPS is as follows Koladiya (2017):

- **Master Plan** - this is a general plan that identifies all the work packages for the project identifying their main activities, duration and sequence;
- **Phase Plan** - this divides the master plan into phases aimed at developing a more detailed work plans, it also provides goals that can be considered targets by the project team. The phase plan is a bridge between the master plan and the look ahead plan;
- **Look Ahead Plan** - this focuses managements attention on what is supposed to happen in the future and encourage present actions to lead toward the desired future;
- **Weekly Work Plan** - the weekly work plan covers the production tasks for the next day or week via weekly meetings. This helps to plan work for the next week, bearing in mind the work that is currently being done and the knowledge of the work that is ready to be done. Weekly meetings usually cover work plans, safety issues, quality issues, resources and construction methods; and
- **Percent Plan Complete (PPC)** - this element focuses on improving project planning through continual assessment of project tasks and learning from failure. PPC is essentially a percentage representation of the promises made that are delivered on time.

The last planner system is seen as an appropriate tool for managing refurbishment projects as it is better equipped to deal with uncertainty inherent to refurbishment projects. The gradual detailing of plans, removal of constraints before work on site starts, the use of short control and learning cycles, high involvement of project participants when creating plans, and learning from mistakes, makes this system suitable for refurbishments. More information on the last planner system can be found in Ballard (2000, 1997); Ballard and Howell (2003).

6.2.1.4 Prefabrication/Standardisation

This is already a widely used method in the construction industry and it is well known that prefabrication and standardisation leads to increased quality and a reduction of cost and time (Goodier and Gibb, 2007). Vrijhoef (2016) states that using prefabricated and standardised building elements will improve a labour team's productivity in refurbishment projects.
More information on prefabrication and standardisation is available in Hook *et al.* (2005); Höök (2006).

6.2.1.5 Mass Customisation

This technique has two main objectives, to offer product variety while maintaining process efficiency. Mass customisation consists of management methods and tools that allow companies to produce customised, affordable, high-quality goods and services with shorter cycle times and lower costs than what was historical possible with mass production and standardisation (Hora *et al.*, 2016).

Mass customisation can be a good approach for the refurbishment sector since the unpredictability

associated with refurbishment projects can lead to project environments akin to that of a customisation process. More information on how mass customisation can be applied in construction projects can be found in Kemmer *et al.* (2010); Lu *et al.* (2011); da Rocha (2011); da Rocha *et al.* (2013).

6.2.1.6 Cellular Manufacturing

This technique is largely used in the manufacturing industry, but it is applicable in the refurbishment sector in the sense that it groups tasks with the same processing requirements together to be completed with increase flow and improved efficiency (Shafer and Rogers, 1991). Hyer and Brown (1999) defines cellular manufacturing as ”dedicating equipment, and materials to a family of parts or products with similar processing requirements by creating a workflow where tasks and those who perform them are closely connected in term of time, space, and information” (Hyer and Brown, 1999, p. 560).
Multiskilling, small transfer batch size, and reduced set-up times support the establishment of production cells. Benefits from using production cells include productivity increase, shorter set-up times, high quality, in-process inventory, and cost savings. Further information is available in Mariz *et al.* (2011); Santos *et al.* (2002).

6.2.1.7 Multiskilling

This refers to the use of workers with several skills that allow them to execute different tasks. This strategy is effective for both construction companies and workers since it increases productivity, quality, and continuity of work. It also reduces skill shortages through an effective utilisation of the current labour force (Wang *et al.*, 2009). In refurbishment projects, where the environment is characterised by different small labour operations, using multi-skilled teams can reduce disruptions and compress project lead time.
More information on multiskilling can be found in Cuperus *et al.* (2010); Sacks and Goldin (2007); Maturana *et al.* (2003).

6.2.2 Candidate Solutions For Production Management

Kemmer *et al.* (2010); Neve and Wandahl (2018); Kemmer (2018) conducted research on applicable solutions for production management of refurbishment projects. The research proposed the following solutions.

Guidelines from literature:

- Foster collaboration, engagement, and early involvement;
- Safeguard users and existing operations in the building;
- Reduce uncertainty;
- Use appropriate contract strategies, procurement routes, and management systems;
- Provide contingencies; and
- Work with skilled people in refurbishment projects.

Empirical studies:

- Standardisation of design features;
- Integration of internal clients during the design development;
- Early identification of project constraints;

- Collaborative site pre-inspections;
- Visual controls;
- Prototyping;
- Daily site visits;
- Structured and collaborative preplanning process;
- Effective and constant communication with users of the building;
- Maintenance of essential services in the existing building;
- Long-term relationship with people skilled in refurbishment projects;
- Use of visual aids to improve communication and decision making; and
- Standardisation of materials' specification.

Lean solutions:

- Production System Design;
- Last Planner System;
- Line of Balance;
- Visual Management;
- Cellular Manufacturing;
- Multiskilling;
- Prefabrication/Standardisation; and
- Benchmarking.

6.3 Method For Construction Management Of Refurbishment Projects

Kemmer (2018) developed a method for managing construction of refurbishment projects. The method was developed through literature reviews, practical implementation and focus group discussions. Kemmer (2018) states that the method proved to reduce wastes in construction projects and is helpful in creating awareness about the importance of integrating the three elements discussed in Section 6.3.1.1.

The method consists of two distinct implementation stages as per the nature of the activities carried out in the respective stages. There is a planning and a implementation and improving stage in the model. Figure below depicts the conceptual model of refurbishment projects.

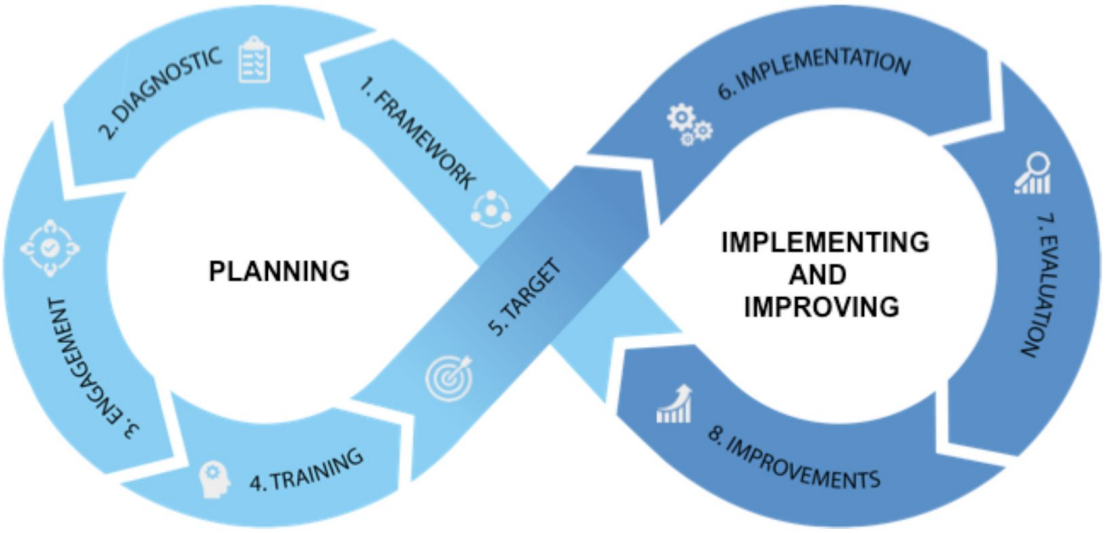

Figure 6.2: **Method For Construction Management In Refurbishment Projects.**

(Reproduced from Kemmer (2018))

6.3.1 Planning Stage

The first five steps of the method forms the planning stage. Stages two to five are likely to be carried out several times to catch up to the changes that might occur in the project environment.

6.3.1.1 Step 1 - Framework

Refurbishment projects comprise of and can be conceptualised in three main parts namely, the existing assets, the construction tasks, and the operations in the existing building. These three elements affect and interact with one another in significant ways and it is important to integrate and consider these three parts equally for effective construction management. The relationship between these three parts can be conceptualised as depicted in Figure 6.3.

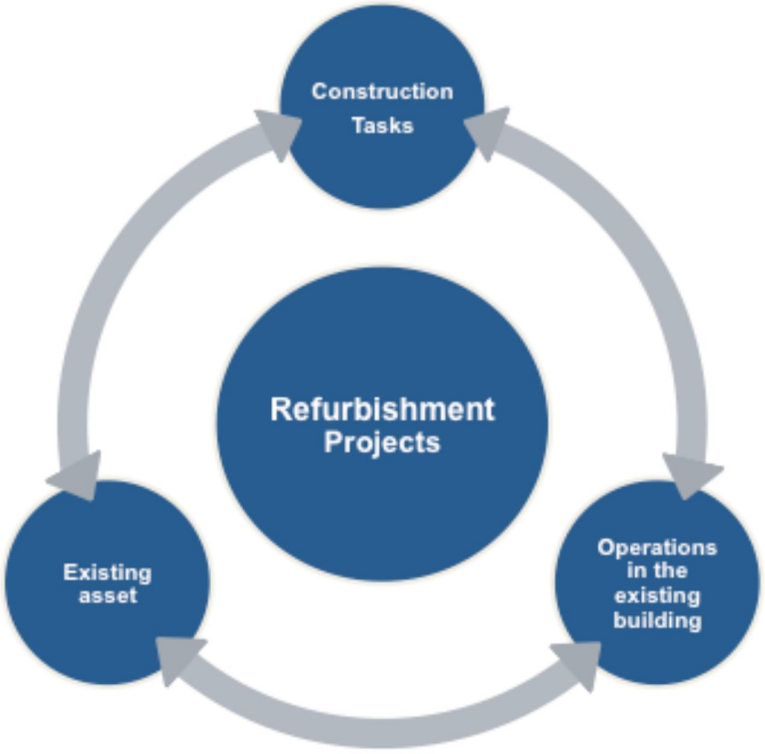

Figure 6.3: **Conceptual Model Of Refurbishment Projects.**

(Reproduced from Kemmer (2018))

Knowledge of existing assets and understanding the current operations in the building are essential for improved performance in the execution of construction tasks. Failing to understand and integrate these three parts can cause design related rework, disruptions in on site workflow, and ultimately schedule and cost overruns. Construction tasks can also cause disturbances to users in the building if existing assets are not assessed properly, this in turn could cause disruptions in the operations in the building (Kemmer, 2018).

6.3.1.2 Step 2 - Diagnostic

It is essential to understand the project environment to effectively manage complexities and uncertainties inherent to refurbishment projects. This step relies on the framework for characterisation of refurbishment projects (Figure 6.4) and the collaboration of every organisation involved to ensure that all dimensions are addressed and different perspectives considered.

Project Characteristics	Industry Sector
	Project
Design intent	
Project driver	
Budget	
Client	
Scope of work	
Typical problems	
Root causes	
Health and safety	
Sequence of works on site	
Organisational structure	
Building information	
Building occupation	

Figure 6.4: **Framework For Characterisation Of Refurbishments.**

(Reproduced from Kemmer (2018))

This step is key in the method as it provides information to managers to decide on which production management approach to follow (Kemmer, 2018).

6.3.1.3 Step 3 - Engagement

The aim of this step is to decide on which managerial solutions to implement. Ideally all project participants partake in these discussions after the information collected from the diagnostics has been validated to ensure that decisions are based on accurate data.
Kemmer (2018) designed several tables (See Tables 6.5, 6.6 and 6.7) and frameworks to be used as supporting materials during this stage as they illustrate the connection between the refurbishment context, and production control approaches deemed appropriate for the particular setting. The aim is to ensure that the management approach applied in the project addresses the three parts of refurbishment mentioned in Step 1 and that the primary focus is on lead time compression and variability reduction principles.

Table 6.5 illustrates the root cause of typical problems in refurbishment projects and its corresponding basic element as stated in Step 1 with Figure 6.3. This table depicts common problems like late discovery of pre existing conditions and attributes this to a root cause, in this case inappropriate managerial practices and poor building surveying. Table 6.7 refers a countermeasure from a lean perspective to each of the root causes. The countermeasure to inappropriate managerial practices would be to reduce variability. Table 6.6 then links the countermeasure to a lean solution. In the case of reducing variability, production system design, last planner system and prefabrication/standardisation can be implemented to ultimately address the root cause of problems encountered in refurbishment projects.

Refurbishment basic elements	Problems	Root causes
Existing Asset	Lack of an appropriate understanding of the existing building Late discovery of pre-existing conditions (after design decisions had been made), therefore causing negative design iterations and rework Hazardous material (e.g. asbestos) might be encountered in the existing building Project scope can be unclear due to limited information about the existing asset	Use of inappropriate managerial practices (i.e. poor building surveying) and lack of understanding regarding the nature of refurbishment projects (i.e. poor building surveying is detrimental to production performance)
	Late involvement of stakeholders (i.e. no input of contractors and subcontractors in the building surveying), hence causing design-related rework. As-built drawings are often unavailable and when they are available, usually they are inaccurate	Use of inappropriate managerial practices (e.g. lack of integration of production teams in the building surveying process, poor practice regarding as-built drawings)
Construction Tasks	Wastes in production (e.g. waiting time, disruptions in the workflow, rework, downtime, high level of work in progress, unnecessary transport, etc.) Inefficient communication, coordination, and collaboration among the project team Difficulty to synchronise crews on site Delays in material delivery Poor performance in terms of cost, schedule, and quality in comparison with new building projects	Use of inappropriate managerial practices (e.g. highly detailed CPM plans, no contractor input on planning, thermostat model of control, etc.)
	Variability (unforeseen works and variation in the quantity of works, variation in the lead time) Unknowns on site more prominent. Discovery of unforeseen conditions continue to happen during the construction phase	Use of inappropriate managerial practices (e.g. poor building surveying) / typical features of refurbishment projects
	Short construction timeframes due to interference with building occupation and operation High number of project's constraints such as space limitations (e.g. storage, new equipment, construction), restricted access, uncertainties on the condition of the existing asset, pollution control, etc.	Typical features of refurbishment projects
Operations in the existing building	Lack of integration between design, construction, and operations	Use of inappropriate managerial practices (e.g. no input from production and facilities management teams in the design stage)
	Operational constraints related to the existing facility. Need to interface with users of the building Dangerous work (e.g. project involving demolition). Safety issues due to the interface of workers with existing operations in the building and users Tenants (lack of compliance to agreed dates, late design change requests)	Typical features of refurbishment projects

Figure 6.5: **Root Cause Of Typical Problems In Refurbishment Projects.**

(Reproduced from Kemmer (2018))

Flow principle	Associated principle	Guidelines	Best Practices	Tools and techniques
Reduce the share of non-value adding activities (waste)	Compress lead time	Work with people skilled in refurbishments	Structured and collaborative preplanning process	Production System Design
	Increase transparency	Foster collaboration, engagement, and early involvement	Integration of internal clients during the design development	Last Planner System
			Effective and constant communication with the users of the building	Visual Management (e.g. flowchart processes)
				Multiskilling
				Cellular Manufacturing
Compress lead time	Reduce the share of non-value adding activities	Work with people skilled in refurbishments	Long term relationship with people skilled in refurbishments	Last Planner System
	Reduce variability	Foster collaboration, engagement, and early involvement	Maintenance of essential services in the existing building	Line of balance
				Benchmarking
Reduce variability	Simplify	Reduce uncertainty	Collaborative site pre-inspections	Production System Design
	Increase transparency	Provide contingencies	Early identification of project constraints	Last Planner System
		Safeguard users and operations in the existing building	Daily site visits	Prefabrication / Standardisation
			Prototyping	
Simplify	Reduce the share of non-value adding activities	Work with people skilled in refurbishments	Standardisation of design features	Production System Design
		Foster collaboration, engagement, and early involvement	Standardisation of material specifications	Prefabrication / Standardisation
				Multiskilling
				Cellular Manufacturing
Increase transparency			Use of visual aids to improve communication and decision-making	Visual management
			Visual controls	5S
Increase flexibility	Compress lead time			Modularisation
	Increase transparency			Mass customisation
	Simplify			Multiskilling

Figure 6.6: **Connection Between Conceptual And Practical Solutions.**

(Reproduced from Kemmer (2018))

Refurbishment	Root causes of typical problems in refurbishments	Countermeasures from a lean perspective
Existing asset	Use of inappropriate managerial practices (e.g. poor building surveying) Lack of understanding on the nature of refurbishment projects (e.g. uncertainty and variability is neglected by managers)	Reduce variability
Construction Tasks	Use of inappropriate managerial practices (e.g. use of highly detailed CPM schedules) Typical features of refurbishment projects (e.g. high uncertainty and variability, short timeframes)	Compress lead time and reduce variability
Operations in the existing building	Use of inappropriate managerial practices (e.g. lack of integration of production teams in design stage) Typical features of refurbishment projects (e.g. high number of constraints)	Compress lead time and reduce variability

Figure 6.7: **Countermeasures To Address Typical Problems In Refurbishment Projects.**

(Reproduced from Kemmer (2018))

6.3.1.4 Step 4 - Training Sessions

After the managerial solutions are selected (Step 3), it is important to build the capabilities of project participants to enable appropriate implementation of the solutions. It is advised that a gradual approach is followed in the delivery of the sessions since people not familiar with lean theory, tools, and techniques may find an information overload demotivating (Kemmer, 2018).

6.3.1.5 Step 5 - Target

It is recommended that performance at process and project level is measured through the use of key performance indicators (KPI). These indicators should be set for the three parts of refurbishment as described in Step 1 and be aligned with the flow-concept related principles of production management. The characterisation of the refurbishment project conducted in the diagnostics step should serve as supporting document for defining the KPIs. These KPIs will be beneficial in step 7 when the performance of the managerial solutions are evaluated. Project participants should be part of setting the KPIs to ensure that they are aware and committed to the targets set (Kemmer, 2018).

6.3.2 Implementation And Improving Stage

This stage comprises of the implementation of the managerial practices selected in the planning stage. Evaluation and improvement are the last steps but it should be mentioned that it is not necessary to wait until the end of the project to evaluate and improve the process.

6.3.2.1 Step 6 - Implementation

In the implementation of the managerial solutions, the roles and responsibilities of project participants should be clearly defined. It is necessary that the person responsible for leading the implementation of this method is familiar with and has knowledge of lean construction. In a traditional sense, this would be the project manager (Kemmer, 2018).

6.3.2.2 Step 7 - Evaluation

All managerial solutions implemented should be evaluated against the targets set in step 5 and its utility for improving production management and enhancing project results.The aim is to assess the applicability of lean principles in the context of refurbishments and to better understand the benefits and implementation issues of lean methods.

6.3.2.3 Step 8 - Improvements

This last step aims at improving the production management approach in a given refurbishment project. Meetings with project participants should be promoted to discuss the improvement of project management. Evaluations from the previous step will be central to these meetings. Adaptions to managerial tools is appropriate if it enhances project performance (Kemmer, 2018).

6.4 Chapter Conclusion

This chapter briefly investigated the history of construction management and why better construction management is needed. Then candidate solutions to improve the management of construction was investigated, as well as a method that can be implemented to improve the refurbishment process. It is anticipated that the method for construction management of refurbishment projects can be implemented with similar success as recorded by Kemmer (2018), in the development of coworking spaces.

The research from this chapter resulted in an eight step method for construction management in refurbishment projects. For the development of the conceptual framework in this study, the use of this eight step method is a requirement. This method will be integrated with the PROCSA matrix from Chapter 2. Figure 5.2 shows how the method for construction management can be integrated with the PROCSA matrix, indicating the step in the method and to what stage in the PROCSA matrix it corresponds with.
Table 6.3 summarises the requirements from this chapter.

	Requirement
R6.1	Refurbishment project Framework
R6.2	Project Diagnostics
R6.3	Project Engagement and managerial solution selection
R6.4	Training session and equipping participants
R6.5	Setting Targets and key performance indicators
R6.6	Implementing managerial solutions
R6.7	Evaluating managerial solutions and performance
R6.8	Improvements

Table 6.3: **Chapter Requirements Summary.**

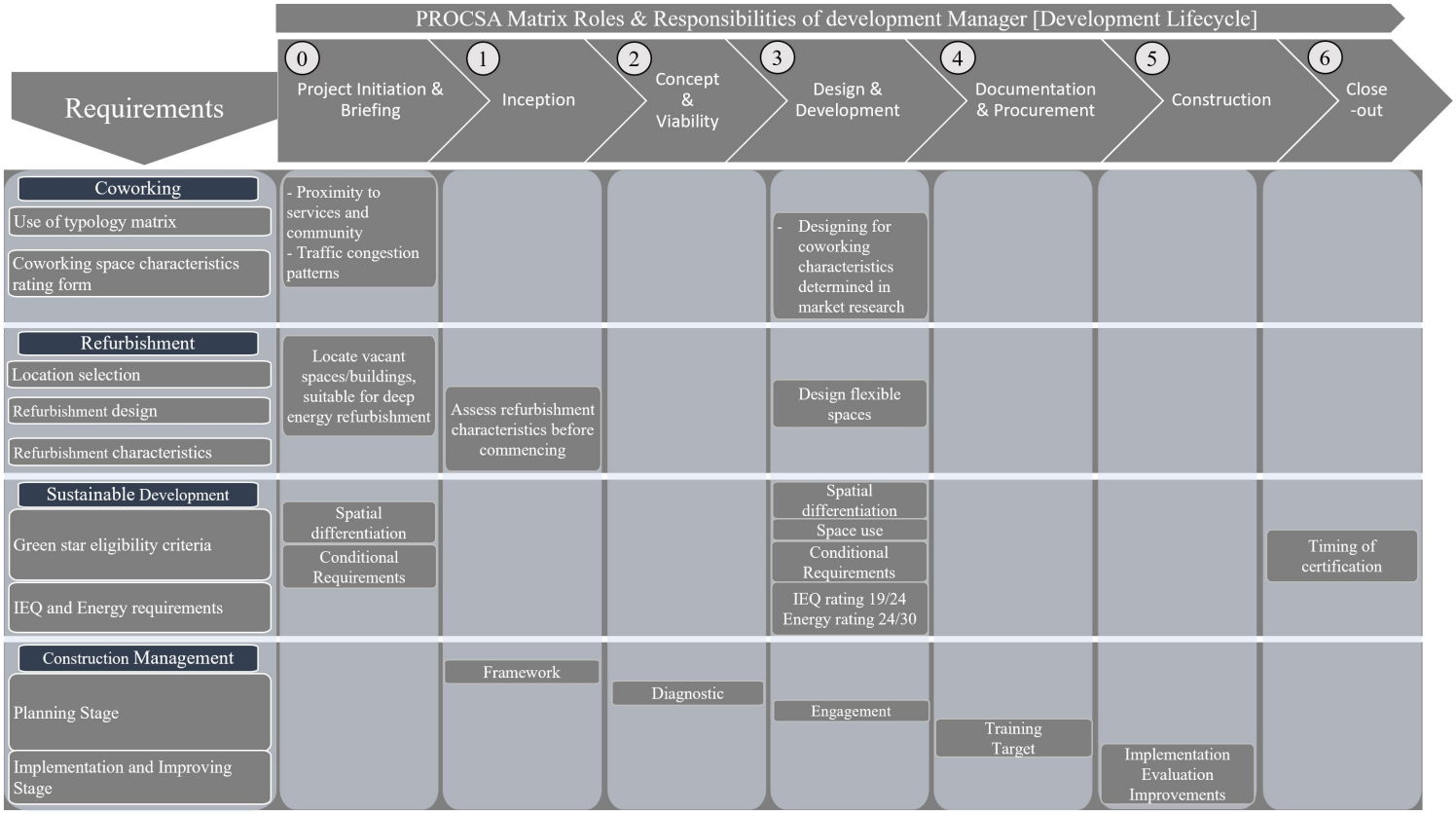

Figure 6.8: **Conceptual Framework Update.**

Chapter 7

Verification

The objective of this chapter is to verify that the intended research set out in Section 1.3 has been achieved by assessing the requirements from each chapter and its correspondence to the conceptual framework. The requirements from Chapter 3 to 6 can be summarised as seen in Table 7.1 .

	Requirement	Section	Comments
R3.1	Use of the typology matrix	3.4.1	Stage 0 of PROCSA matrix
R3.2	Use of the coworking characteristic rating form	3.5	Stage 0 and 3 of PROCSA matrix
R3.3	Consider locations that alleviate traffic congestion	3.6.2	Stage 0 of PROCSA matrix
R3.4	Location in close proximity to services and community	3.4.2	Stage 0 of PROCSA matrix
R4.1	Location must be suited for deep energy refurbishment	4.5.1	Stage 0 of PROCSA matrix
R4.2	Site must be vacant	4.4.1	Stage 0 of PROCSA matrix
R4.3	Refurbishment design must be flexible for future change	4.5.2	Stage 3 of PROCSA matrix
R4.4	Assess refurbishment characteristics to prevent unforeseen circumstances	4.5.3	Stage 1 of PROCSA matrix
R5.1	Four star Green Rating for the refurbishment project	5.4.1	Stage 0 through 6 of PROCSA matrix
R5.2	The project must be visually distinct from surrounding buildings	5.4.1	Stage 0 and 3 of PROCSA matrix
R5.3	80% of the gross floor area must be commercial office space	5.4.1	Stage 3 of PROCSA matrix
R5.4	Additional energy usage and land ecology requirements have to be met	5.4.1	Stage 0 and 3 of PROCSA matrix
R5.5	Building must be certified within two years of practical completion	5.4.1	Stage 6 of PROCSA matrix
R5.6	Indoor environmental quality requires a rating of 18/24 or greater	5.3	Stage 0 through 6 of PROCSA matrix
R5.7	Energy rating of 23/30 or greater is required	5.3	Stage 0 through 6 of PROCSA matrix
R6.1	Refurbishment project Framework	6.3.1.1	Stage 1 of PROCSA matrix
R6.2	Project Diagnostics	6.3.1.2	Stage 2 of PROCSA matrix
R6.3	Project Engagement and managerial solution selection	6.3.1.3	Stage 3 of PROCSA matrix
R6.4	Training session and equipping participants	6.3.1.4	Stage 4 of PROCSA matrix
R6.5	Setting Targets and key performance indicators	6.3.1.5	Stage 4 of PROCSA matrix
R6.6	Implementing managerial solutions	6.3.2.1	Stage 5 of PROCSA matrix
R6.7	Evaluating managerial solutions and performance	6.3.2.2	Stage 5 of PROCSA matrix
R6.8	Improvements	6.3.2.3	Stage 5 of PROCSA matrix

Table 7.1: **Conceptual Framework Requirements.**

These requirements were incorporated into the conceptual framework as shown by Figure 7.1.

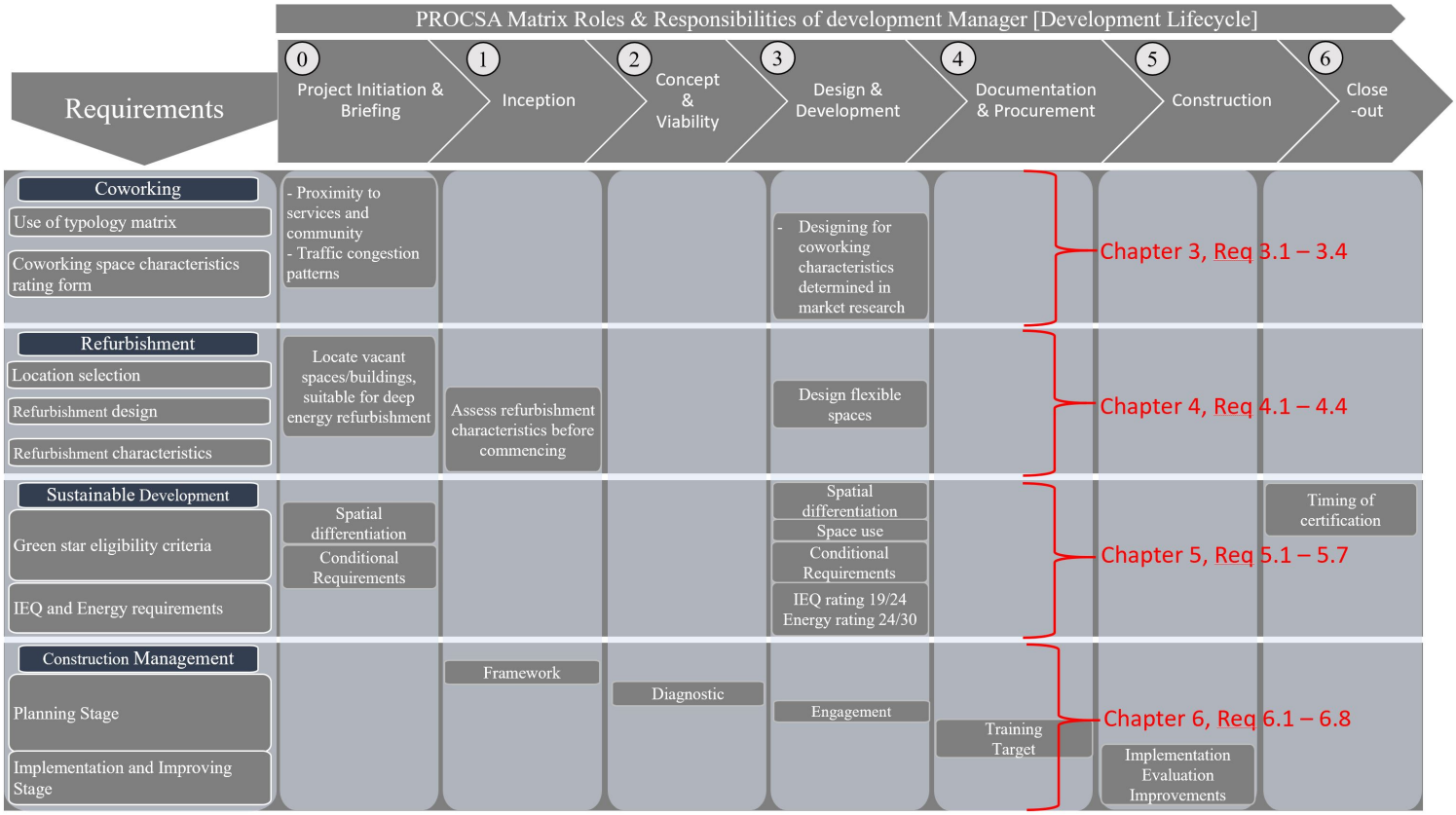

Figure 7.1: **Conceptual Framework Verification.**

Comparing Table 7.1 and Figure 7.1, it can be concluded that the intended objectives to develop a conceptual framework as described in Section 1.3 has been achieved.

Chapter 8

Validation

This chapter aims to validate the study through a theoretical case study and expert interviews. This chapter will first discuss validation methodology and philosophy where the validation process will be developed. Then the results from the validation process, theoretical case study and expert interviews will be documented. Finally, the conceptual framework will be updated with all the knowledge gained through the validation process. The objectives of this chapter is summarised in Figure 8.1.

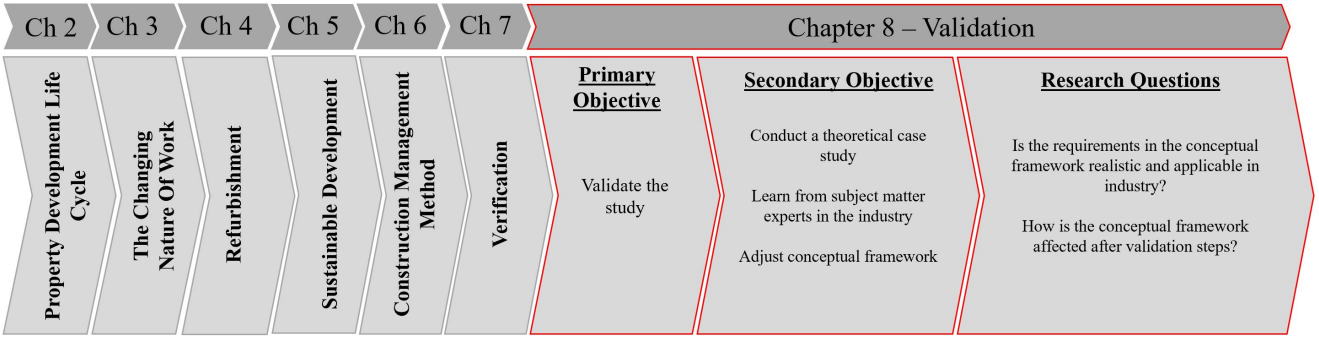

Figure 8.1: **Chapter Eight Objectives.**

8.1 Validation Design: Philosophy And Methodology

Validating new methods and conceptual frameworks are important for the advancement of both theory and industry practice. Validation adds to the integrity of the research conclusion and strengthens the link between the conclusion and research purpose (Bryman and Bell, 2014).

According to Gaber and Gaber (2010), validation is a process of testing research findings against existing knowledge. This process provides no absolute assessments, but are context-specific. Validation thus improves the confidence that the developed framework is able to address the identified problem.

Validating a framework as developed in this study, can be viewed as a specialised topic in the epistemology of research. Frey and Dym (2006) states that there are four different views on the sources and justification of knowledge, they are summarised as follows:

- **Foundationalism** - The instances of knowledge are basic and can be validated by relating new instances to basic beliefs;

- **Naturalistic epistemology** - The empirical study of how subjects convert data into theories;
- **Relativism** - Knowledge cannot be validated in an objective way, rather subjective preferences must be considered as part of the validation process; and
- **Epistemology of practice** - This view relies on knowledge of skilled practitioners, that cannot be easily codified, to validate new models and frameworks.

This study will rely on validation methodologies used as part of the epistemology of practice. The details on the development and roots of epistemology of practice is outside the scope of this study. Argyris (1977) suggested some validation principles, methodologies and requirements that are considered specifically:

- New framework or theory testability:
  - The specific situation where a theory or framework can be implemented needs to be specified. This implies that the environment that is conducive to validation needs to be established;
  - The desired results of the application of the framework can be defined; and
  - The way in which the application of the framework will be evaluated, can be described.
- Internal consistency of the framework or theory;
- Harmony between the new framework or theory and accompanying theory; and
- Effectiveness of the new framework or theory, thus when validation will be successful.

With epistemology of practice, it is often required that the researcher validates the framework or theory in the context of a single environment. Therefore, it is also important to consider the principles and practices involved in case study research as part of the validation design. Yin (2017) identified the following characteristics:

- The aim of the research is not only to explore a certain phenomenon, but also to understand it within a certain context or environment;
- Research typically does not start with a list of limitations within which the research will take place; and
- The research uses various methods of data collection which may include qualitative and quantitative measures. Thus, case study research often combines multiple data collection methods which is described as triangulation by Denzin (2012). He states that this use of different data collection methods would lead to grater validity and reliability, if the conclusions are the same, than a single data collection.

8.2 Theoretical Case Study

The objective of the theoretical case study is to determine how the use of the conceptual framework would change the outcome of coworking spaces that are currently in operation. To achieve this, interviews with the project manager and site inspections of the coworking space under investigation, were conducted. This was done to investigate how the construction process and current characteristics of the coworking space would differ if the conceptual framework was implemented in the development process.

As a result, the theoretical case study was conducted per section of the conceptual framework as

shown in Figure 8.2. The requirements, as set out by conceptual framework, were compared to the development process of the coworking space, as recalled by the project manager.

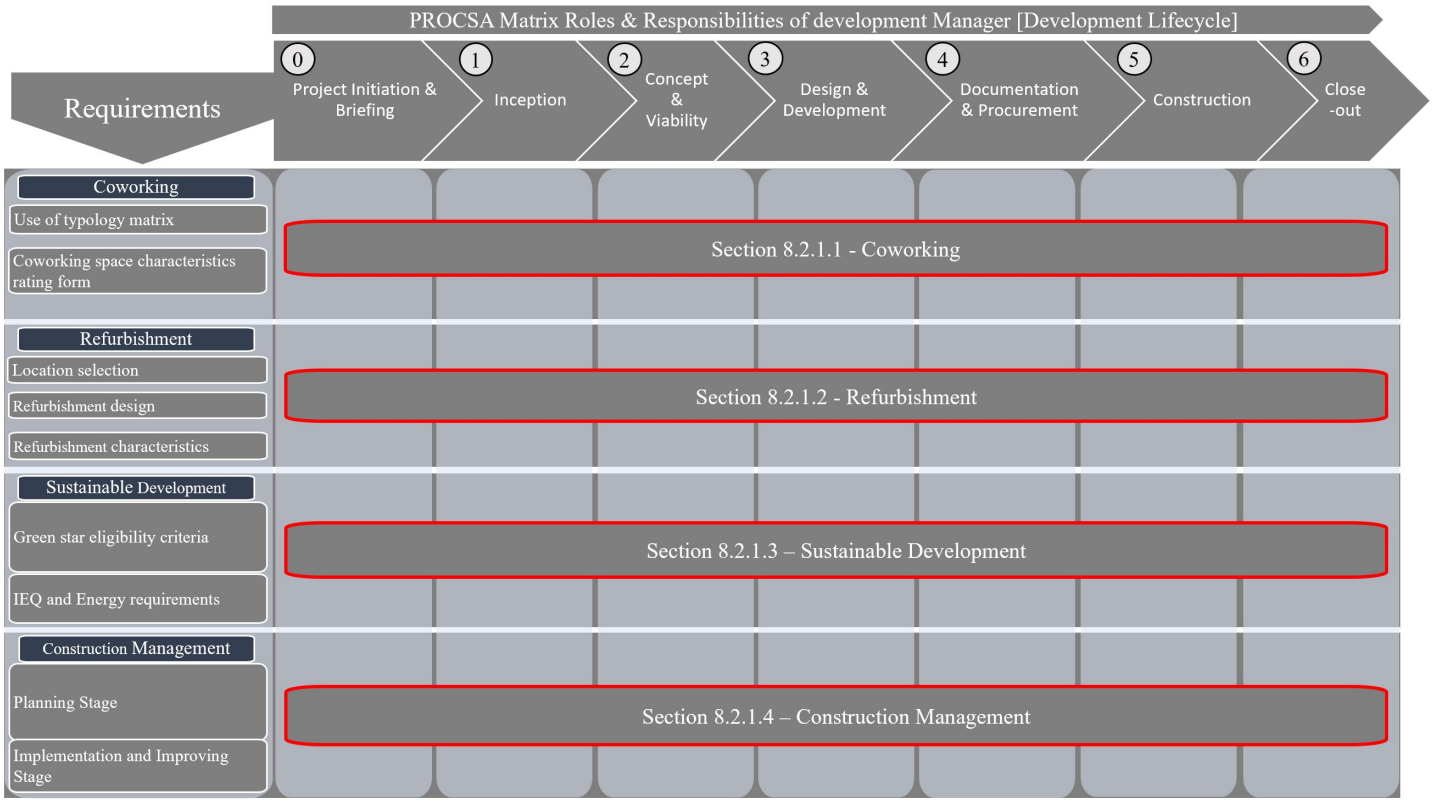

Figure 8.2: **Theoretical Case Study OF Framework.**

8.2.1 Workshop 17

This theoretical case study was conducted on a Workshop 17 location at 32 Kloof Street, Cape Town. Workshop 17 operates in collaboration with Growthpoint (a silent partner owning 50% of Workshop 17) and the coworking space in question was one of seven Workshop 17 locations in South Africa. This was a good location to test the framework since it was a refurbishment project and it was a historical site. An interview and site inspection were conducted with the project manager who also formed part of the design team of Workshop 17.

The case study started with the investigation of the company structure and how projects are managed. According to the project manager, the PROCSA matrix is used for the majority of appointments, but the roles and responsibilities are very much overlapped. Based on the role players recognised in the PROCSA matrix, Workshop 17 outsources work as follows:

- Development Manager: In-house (usually the directors of the company);
- Project Manager: In-house;
- Architect: In-house;
- Quantity surveyor: Outsourced;
- Structural Engineer: Outsourced;
- Civil Engineer: Outsourced;
- Electrical Engineer: Outsourced; and

- Mechanical Engineer: Outsourced.

The management of new development is spread out between the in-house design and architecture team and the directors of the company. Thus, all the participants proposed by the PROCSA matrix is not assigned and the roles and responsibilities are divided on an ad hoc basis. This makes for some inefficiencies and sometimes confusion as the project manager, also a the interior designer, interviewed stated that: "*if you see something that needs to be done, you just pick it up and do it*".

The first section of the theoretical case study was conducted on the coworking requirements as stated in the conceptual framework. This is discussed in Section 8.2.1.1.

8.2.1.1 Coworking

Workshop 17 on Kloof meets all the requirements for coworking spaces identified by the conceptual framework. The location in close proximity to various restaurants and shopping locations, the notorious nightlife activities of Long street is a comfortable 10 minute walk away and tenants have various options for health and fitness.

The traffic in the area is quite congested especially during rush hours and as a result parking can be hard to find since it is quite limited in the area. Public transport in the form of "My city bus" has a stop right in front of the workshop, making it a lot more accessible to the public. They also offer bicycle storage for tenants. The project manager on the project stated that a new trend in the city is for people to Uber everywhere since parking is limited and can be more expensive.

Lastly, the characteristics of the coworking space meet all the minimum requirements. Workshop 17 is a brand name with several coworking spaces throughout South Africa and is known for their pristine working environments and top class service they offer to customers.

The next section of the theoretical case study was conducted on the refurbishment requirements as stated in the conceptual framework. This is discussed in Section 8.2.1.2.

8.2.1.2 Refurbishment

The refurbishment requirements are mostly met for this site. The location is suited for deep energy refurbishment even though it is a heritage site, however, this does not mean that a deep energy refurbishment was done. This will be discussed in more detail in the next subsection. The building was vacant before the refurbishment started.

Workshop 17 tries to implement flexible refurbishments with all their sites, but with refurbishments comes certain limitations restricting the flexibility of the office space. The design of the office space was as flexible as the building would allow, with overhead ventilation being the biggest restriction to flexibility.

The characteristics of refurbishment projects were not given enough consideration. When construction started and the back side of the structure was excavated to open up the basement, granite was discovered that delayed the excavation significantly. If the framework was followed, a lot of the delays could have been predicted and measures could have been put in place to work around it- this could have resulted in earlier project completion.

The next section of the theoretical case study was conducted on the sustainable development requirements as stated in the conceptual framework. This is discussed in Section 8.2.1.3.

8.2.1.3 Sustainable Development

The site does not meet the requirements for sustainable development. The building is not certified and would not meet the necessary standards to get a four star Green Rating. It also does not meet the indoor environmental quality or energy requirements set by the framework. The reason for this is explained in Section 8.3 were feedback from expert interviews are given.

Although the building does not meet the necessary requirement for a four star rating, features like solar panels on the roof and motion censors to control lights and ventilation, are implemented. Not all glass panels are replaced with double glazed glass panels, but in areas/rooms with a lot of glass towards the exterior, double glazed glass will be installed to control temperatures. Other sustainable elements implemented include, LED lights, recycling and low Volatile Organic Compound (VOC) paints.

The final section of the theoretical case study was conducted on the construction management requirements as stated in the conceptual framework. This is discussed in Section 8.2.1.4.

8.2.1.4 Construction Management

Lean construction principles were not applied in the construction of the coworking space. As stated in Chapter six, lean construction is unfamiliar to the South African construction industry and therefore none of the proposed lean principles were implemented.

The method discussed in Section 6.3 is still relevant, although it was not implemented. During construction, a few weeks before the site was set to launch, a fire sprinkler on the top floor malfunctioned, soaking half of the building and setting the project back three months. Whether it was a malfunction or negligence has not been determined yet, but this could have been prevented if it was indeed negligence and the construction management method was implemented.

8.3 Expert Interviews: Critical Observations

This sections covers the main points from interviews with experts in the industry. Interviews were not transcribed but an interview protocol was set up for meetings, see Appendix AB. A list of the industry experts interviewed and their experience is provided in Table 8.1. Pseudonyms were used to portray the people interviewed since commercially sensitive information was disclosed.

The amount of interviews needed before completion of validation was determined by the researcher. Baker and Edwards (2012) did a study on 'how many qualitative interviews is enough?'. The study interviewed 14 established academics and posed them the question 'how many' and all responded 'it depends'. The study concluded that nature and field of the research will sometimes require more and sometimes less interviews to reach saturation, in this case saturation refers to the point where experts start repeating what was already discovered by the researcher, this conclusion is supported by Charmaz (2014).

This study is focused on a very specific field and saturation was reached after three interviews. None

the less, experts were interviewed on related fields to give input on specific sections of the conceptual framework. Three experts on the development of coworking spaces were interviewed to give feedback on the whole framework. A specialist in sustainable development and member of GBCSA were interviewed to give specific input on the sustainable development section of the framework and lastly, experts in construction and development management were interviewed to give input on the refurbishment and construction management aspects of the framework. In total four experts were interviewed and their significant comments/contributions were recorded and is summarised below.

Name	**Position**	**Field of expertise**	**Experience**
John Wick	Project Manager	Design & development; Coworking spaces	Interior designer (3 years) Workshop 17 Project Manager (5 years)
James Bond	Director	Business management	Workshop 17 Director (7 years)
Jason Bourne	CEO	Property Development	Proproyale Development CEO (10 years)
Ethan Hunt	Programme Manager	Architect, Sustainability	GBCSA Program manager (7 years)

Table 8.1: **Industry Expert List.**

Since the conceptual framework incorporates sections from different backgrounds, finding industry experts with expertise in all the aspects of the conceptual framework would be difficult. Thus, the expert interviews were set up in such a way that experts on every section of the conceptual framework were interviewed. Figure 8.3 shows that the experts from Table 8.1 have expertise in different fields and in different stages of the property development life cycle.

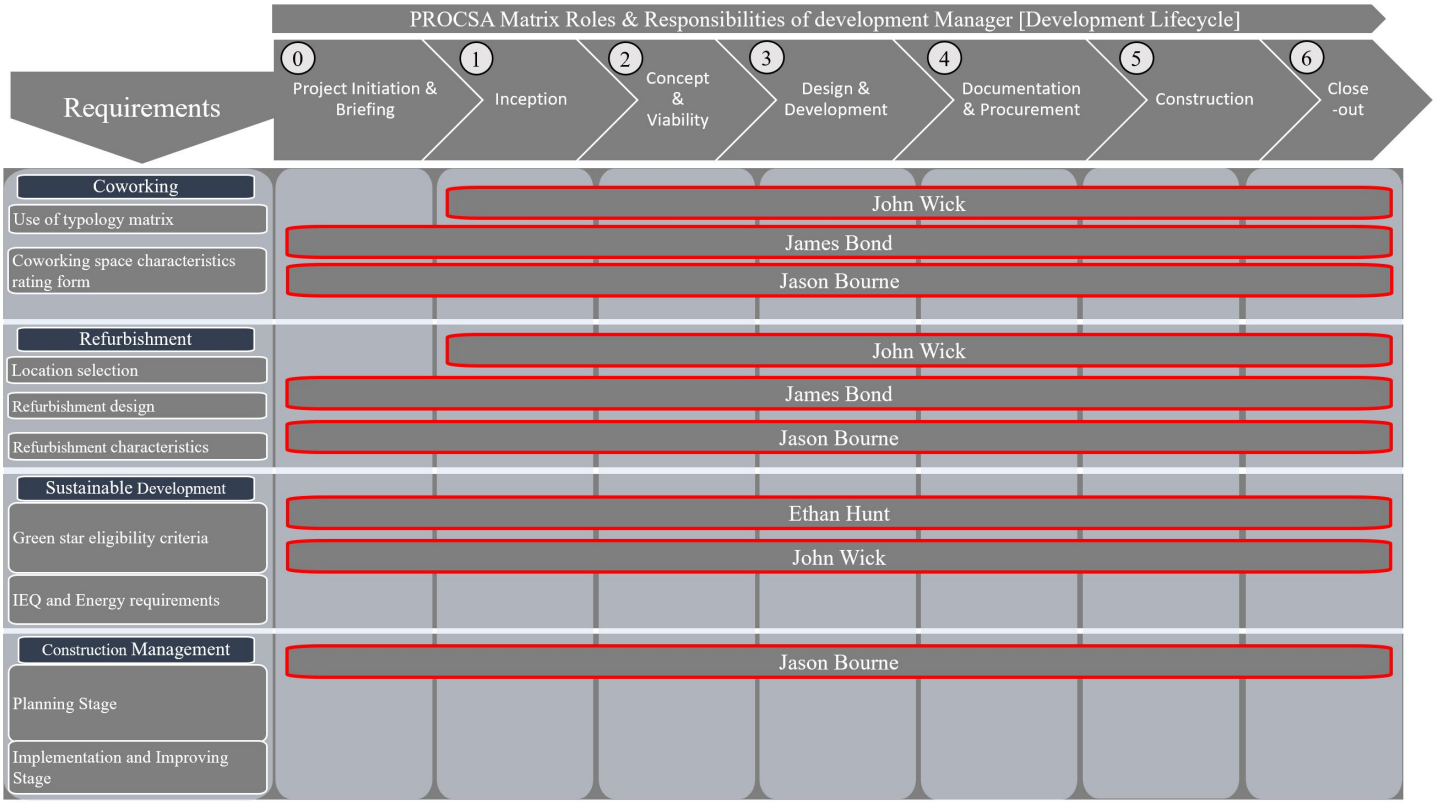

Figure 8.3: **Interviewees Expertise.**

8.3.1 Coworking

A big part of location scouting is negotiating a fit-out budget with the landlord. The bigger their budget per square meter, the better the financial feasibility of your coworking space. They rarely pay for green technology and sustainable retrofits, since finance is their biggest concern.

> *... if it is a really old building and the Heating Ventilation and Air Conditioning (HVAC) system is older than six years, you have to replace it otherwise you won't meet the necessary health and safety requirements. It is important to negotiate with the landlord a fit-out budget and to include the cost of things like old HVAC systems to make it financially feasible for you.*
>
> John Wick

Workshop 17, similar to WeWork, is moving more in the direction of serviced office space, they still have an element of coworking inside them, but it is mostly serviced offices.

> *Operating a coworking space is much harder than a services office space since the tenants of coworking spaces demand a lot more attention and effort from operators and managers than tenets in serviced offices.*
>
> James Bond

The income from serviced offices are also more than from coworking tenants. The current ratio for Workshop 17 is 60/40 serviced office space to coworking space, this ratio will change soon to 70/30.

In South Africa, the need for office space will always lead to serviced office rather than coworking spaces. More important than this is the peripheral services attached to the office space which is dedicated to creating a connected people environment rather than a connected technology environment. Serviced office in itself is not a big profit business, the real money comes from all the added services (i.e. a venture capitalist firm that has access to a coworking/serviced office network to source possible businesses to fund- the operator of the office space would take a finders fee).

> *Site selection should be data driven.*
>
> James Bond

Workshop 17 has a location matrix that rates a location based on certain features and a weight attached to each feature. The score for each feature has to be assessed objectively by preferably more than one person to ensure consistency. The features rate is the product of its allocated score and the weight for that feature. The total rate of all locations under consideration will then be compared to decide on the best suited location. The location matrix is shown in Table 8.2.

Sub-Location:				*eg. 32 Kloof Street, Cape Town*
Feature	**Description**	**Score**	**Weight**	**Rate**
Access	Ease of access, brand alignment of entrance		8	
Access to public transport	Walking distance from major transport nodes		9	
Access to other amenities	Residential and entertainment, recreational facilities		4	
Access to parking	Guest parking, public parking and building parking		8	
Access to shopping	Shops and restaurants within walking distance		4	
Awareness & Visibility	Street visibility & knowledge of the location		7	
Ease to create Workshop 17 look and feel	High ceiling, exposed soft, natural light		8	
Ease to create Workshop 17 space layout	This is the grid - pillars vs efficiencies of space		8	
Ease to create public café	Self explanatory		7	
Eventing possibility	Suitability for eventing, meeting space		6	
Impact of operational expenses	Energy efficiency, operating costs		5	
Outside space	Rooftops, balconies, courtyards		6	
Views	Scenic & surrounding buildings		5	
Total				

Table 8.2: **Workshop 17 Location Matrix.**

8.3.2 Refurbishment

Location:

Refurbishment is definitely something you want to do since it is significantly cheaper than new builds giving almost a 100% cost reduction per square meter construction cost.

James Bond

Although deep energy refurbishment is ideal, refurbishment buildings are just not geared for alternative energy, grey water recycling or even water harvesting. Refurbishing buildings to meet all these demands will still be cheaper than building new, but financially it does not make sense. The benefits and long-term cost savings do not justify the capital expense.
Often with refurbishment, the building would be a heritage site that limits the changes you can make to the outside of the building. This is problematic especially if you are on ground level since you ideally want to be visible from the outside (i.e. big glass windows to see what is happening on the inside), but with older buildings, the windows are usually smaller and far apart.

You need permeability to intrigue pedestrians with what is happening in your building

Jason Bourne

Flexible Refurbishment:
According to Wick, it is ideal to have as much flexibility as possible, but it is limited by refurbishment.

As soon as you want to move an office or enclose a space, your ventilation and cooling regulations change, often resulting in changes to ventilation systems, which is very costly.

John Wick

In new builds can accommodate all the utilities under the floor, which makes for much easier and cheaper office layout changes later.

> *We would always design our office spaces for two or three possible permutations, this way you know that you can get four or five more offices at relatively low cost and short time frame.*
>
> James Bond

Refurbishment Characteristics:
This is crucial, every industry expert the researcher spoke to that has done a refurbishment project in the past, ran into some problem that delayed the project and increased cost. Things to pay special attention to is the layout and age of HVAC and electrical systems, as well as the contractors you bring in on the project- carefully look at cost cutting versus value cutting. Contractors that charge you less but do work that requires rework will cost you more in the end in time and money.

8.3.3 Sustainable Development

A joint research venture by the GBCSA and MSCI indicates that the return on investment of buildings with a green certification is higher than for buildings without a Green Star rating. This research was based on new builds and not refurbishments and fit-outs, research on this is still being conducted. It was suggested that if a coworking operator wants to certify the fit-out or refurbishment, it is very helpful to use the green lease tool created by GBCSA and SAPOA. Green leases set out the shared responsibilities of landlords and tenants, provide a platform for sharing the benefits of the enhanced performance of the building and it balances the respective costs between the two parties.

> *Getting the green certification might be a bit more costly, but with a green lease and savings on utilities, costs can be mitigated and green certification can add a good distinguishing feature to a coworking brand in the current economic climate of South Africa.*
>
> Ethan Hunt

4-star rating:

> *This will only see the light of day once the government mandates it or creates significant tax benefits for sustainable development.*
>
> James Bond

Workshop 17 does not certify their office spaces, even though a lot of sustainable practices are implemented. The project manager and designer states that sustainable design and development should be implemented regardless of the building being certified or not. Green star certification is a big cost and time expense and does not translate to any monetary value for the operator of the coworking space. There are also no current benefits besides bragging right to do this, thus it is not implemented.

> *This is not a selling point to clients, as clients consider most importantly price and if they get value for what they pay through added extras like boardrooms, creator spaces and added benefits. Other attractions include current occupants of the space. If you attract some big venture capitalists or entrepreneurs to the space, other people would want to be there for the opportunity to network and to build contacts.*

James Bond

IEQ rating:
All the benefits from improved indoor environmental quality is not a priority for coworking spaces, since any potential increase in worker efficiency will not raise the monthly membership fee. In the scenario of a company like Allen Gray building new offices, they want the sustainability and indoor environmental quality to be as good as possible since any increase in productivity of their workers will lead to a direct financial gain for them.

Energy rating:
This is something to really look into and is good to add to the framework, since the current climate in South Africa makes for very uncertain power supply. In addition to this, government has approved the national power supplier, Eskom to increase electricity tariffs by 9.4% and 8.1% in 2019 and 2020 respectively.

> *With so much uncertainty about the power supply of the future, it is also crucial to consider backup power supplies for your coworking spaces*

John Wick

8.3.4 Construction Management

According to Bond, the biggest challenge in South Africa is the lack of skilled artisans and hard working labour force. This poses big problems for the implementation of lean construction principles as one can almost expect contractors to underperform. Another big problem and mistake from industry is that they rely too heavily on the ability of a quantity surveyor to comprehend cost.

> *Quantity surveyors often use invoices from previous projects to estimate costs and then just add a ten percent contingency cost to the project that almost always gets absorbed in the project cost.*

James Bond

> *A big problem for us was having a contractor and architect from Durban working on a project in Cape town.*

Jason Bourne

8.4 Adjusting The Conceptual Framework

From the interviews with industry experts, a few changes can be made with regard to the research in the thesis and the conceptual framework. This section summarises the changes to research done and assumptions made in the thesis, as well as changes to the conceptual framework.

Use of PROCSA matrix:
Initially the conceptual framework was developed to aid the development manager in the construction of coworking spaces, but from the interviews with industry experts it was learned that projects in industry seldom follow the PROCSA matrix. Projects often have less role players than suggested by the PROCSA matrix and roles and responsibilities are divided between project

participants. Thus, the framework developed in this study is applicable to both the development manager and project managers since these roles often overlap in industry. From expert interviews it was also gathered that the projects, where no individual was assigned to oversee the development and project management, had avoidable problems that a dedicated development/project manager could have prevented. Thus, it is highly recommended that future development projects have a dedicated development or project manager that oversees the process and uses the developed framework to aid in the process.

Definition of coworking:
In Chapter 3.3, coworking was defined as follows:

> *A way of working in which people, not exclusively from a single company, gather in a place to create value while sharing information and wisdom by means of communication and cooperating under the conditions of their choices*.

After the industry expert interviews, it was deemed necessary to review this definition. Industry experts revealed that coworking spaces consist more of serviced office spaces than open collaborative working environments. Thus, the definition can be refined to better explain the status of coworking in South Africa. As mentioned by interviewee James Bond, leading working spaces like WeWork and Workshop 17 provide 80% serviced office space and 20% open collaborative spaces, but never one in isolation, thus the definition of coworking can be changed to the following:

> *A way of working in which people, not exclusively from a single company, gather in a place to create value while sharing information and wisdom by means of communication and cooperating under the conditions of their choice in spaces that offer both open collaborative environments and serviced office spaces* .

Ideal location:
More than just the amenities close to the location 3.4.2, the access to the location and the physical condition of the building that influences location selection. Since the location matrix of Workshop 17 already includes features related to access to amenities and public spaces, the requirement regarding access to amenities from Section 3.4.2 can be replaced by the use of the location matrix. This just serves as guideline for the development manager, the weights and features can be amended, but it serves as a tested matrix already implemented in industry.

The following changes were made to improve the conceptual framework:

- A location matrix used by Workshop 17 can be added to the coworking requirements to further aid the development manager in procuring a good site. This will be relevant in Stage 0 of the PROCSA matrix;
- As derived from interviews with industry experts, requirements for deep energy refurbishment and flexible office design is not always possible. It is recommended that energy costs and cost of making the building energy efficient, be considered in the financial feasibility to determine if it makes financial sense. It is also recommended that the layout of the coworking space be designed for two or three possible permutations for future change in the layout, specifically considering HVAC, electric wiring and health and safety regulations;
- The section on sustainable development will no longer be a requirement but will be kept as an highly recommended extra- the reason for this is:

  - The financial burden currently outweighs the benefits of green certification. The demand for green working environments by coworking members are not high enough to justify the financial expense; and
  - If the market becomes more competitive and tenants are spoiled for choice, this might add a unique selling point for a coworking space, but it will come at a price.

- One addition to the sustainable development section is the green lease, and this was advised by industry experts to share responsibilities between the landlord and tenants.

With these adjustments to the conceptual framework, the final framework for the development of coworking spaces through sustainable refurbishment can be seen in Figure 8.4.

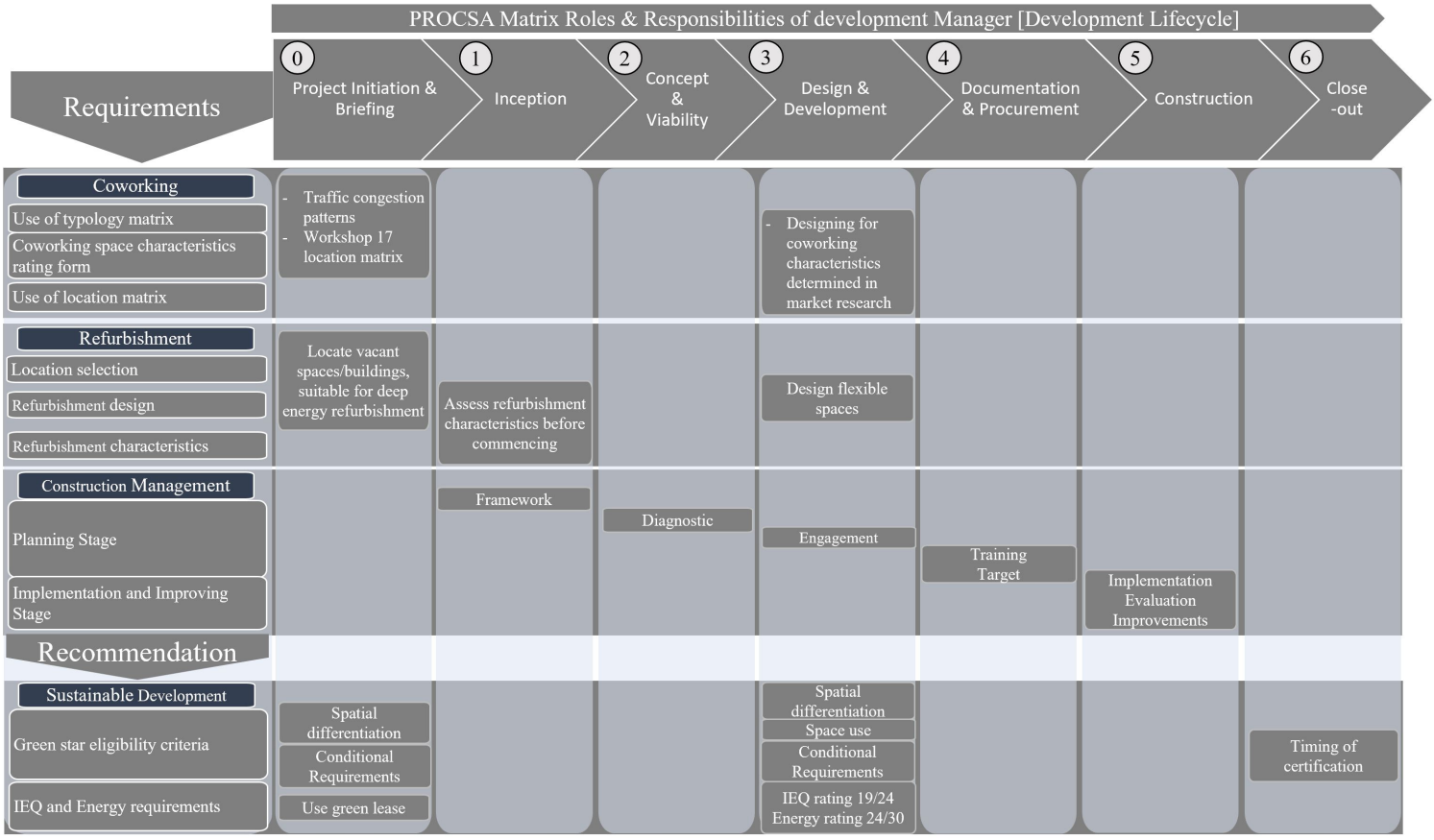

Figure 8.4: **Adjusted Conceptual Framework.**

Chapter 9

Conclusion And Recommendations

This chapter concludes the study. First the method used to conduct the research will be reviewed after which it will be shown that the initial objectives were achieved. Secondly, the lessons learned in this study is summarised followed by possible future research avenues.

9.1 Methodology Review

The grounded theory methodology used in this study and the eight conceptual framework analysis phases proposed by Jabareen (2009), guided the study to reach the desired outcome. The method was helpful in identifying and categorising concepts in ’n structured manner as depicted by phases 1-4. Phase 4 was particularly helpful since it motivated the investigation into construction management methods, resulting in the requirements added in Chapter six. Phase 6 was crucial as the conceptual framework went through several iterations to display the requirements in a visually pleasing and logical manner. Finally, the study was grounded by validating the conceptual framework through a theoretical case study and subject matter interviews. After the validation, the conceptual framework was adjusted as suggested in phase eight. Thus, for this study the grounded theory methodology was suited to achieve the objectives stated in Section 1.3.

The method applied in writing up the research consisted of building the conceptual framework over several chapters. Chapter two investigated the PROCSA matrix that set the foundation of the artefact. Each consecutive chapter after this added a set of requirements to the roles and responsibilities of the development manager, as stated in the PROCSA matrix. Figure 9.1 shows the flow of chapters.

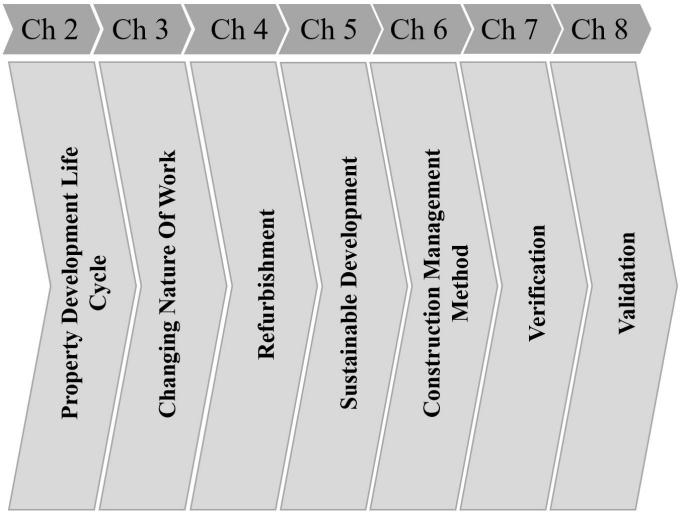

Figure 9.1: **Chapter Overview.**

Each chapter consisted of an introduction, body and conclusion.

- **Introduction:** here the primary objectives, secondary objectives and research questions were clearly defined. Figure 9.2 was expanded to reveal the objectives and research questions for the relevant chapter, as shown in Figure 9.2;
- **Body:** here literature was reviewed to answer the research questions and in doing so, the secondary and primary objectives were achieved; and
- **Conclusion:** here the knowledge gained from the chapter was summarised and a set of requirements were compiled and added to the conceptual framework.

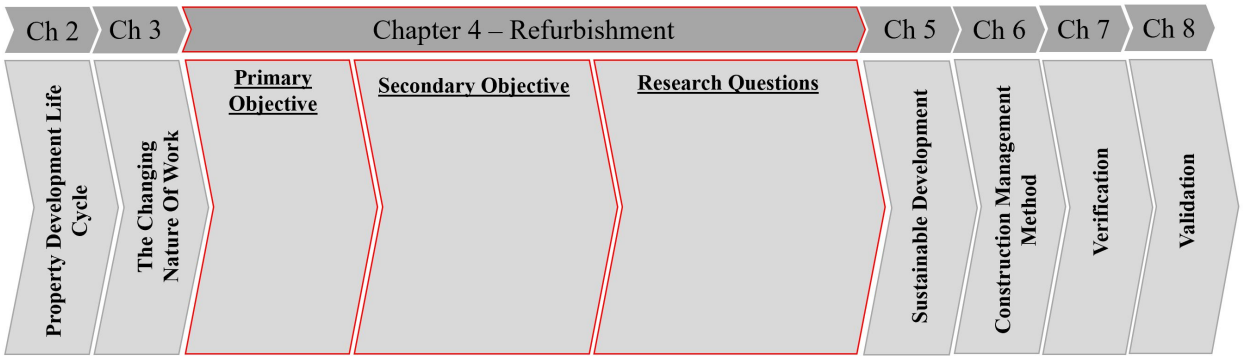

Figure 9.2: **Chapter Overview Expanded.**

Structuring the objectives as shown in Table 1.1 and using the layout shown in Figure 9.2 to introduce the objectives of each chapter, made the structure of each chapter logical and easy to follow. Each chapter was structured to answer the research questions as presented in the expanded overview, and in doing this the secondary and primary objectives were achieved. This method of structuring research objectives, with primary objectives leading to secondary objectives and then a set of research questions, was efficient and is advised for future research.

9.2 Artefact And Research Objectives Review

Reviewing the artefact as shown in Figure 8.4, it can be seen that the artefact flows from the completion of the objectives. This study had one primary objective and five secondary objectives. The achievement of the primary objective was dependant on the achievement of the secondary objectives. The objectives are set out in Table 1.1 but for ease of reference, the objectives are summarised in Table 9.1.

Chapter	No.	Objective
		Primary Objectives
Two	1	Compare relevant property development life cycles to investigate the roles and responsibilities of the development manager.
Three	2	Investigate the changing nature of work, the subsequent need for coworking spaces and define coworking spaces. Investigate coworking member typology and common coworking space characteristics, as well as the relevance of coworking in South Africa.
Four	3	Compare advantages of new build to refurbishment of properties and investigate refurbishment in South Africa.
Five	4	Determine what sustainable property development is and the benefits thereof. Determine how this sustainability is measured.
Six	5	Establish current construction management methods and candidate solutions to improve the management of construction. Establish a new method for construction management.
		Thesis Objective
Eight	6	Develop a framework to guide the development manager in the sustainable refurbishment of coworking spaces in South Africa.

Table 9.1: **Summary Of Research Objectives.**

Objective 1: Compare relevant property development life cycles to investigate the roles and responsibilities of the development manager.

Evidence:

Chapter 2 looked at different development life cycles and why this was of interest for this study (Section 2.2). Based on the criteria given in Section 2.2.4, the PROCSA matrix was selected as the preferred development life cycle. The PROCSA matrix served as base for the conceptual framework, not only dividing the development and construction process into seven stages, but also providing the general roles and responsibilities of the development manager as discussed in Section 2.3.

Status: Achieved.

Objective 2: Investigate the changing nature of work, the subsequent need for coworking spaces and define coworking spaces. Investigate coworking member typology and common coworking space characteristics, as well as the relevance of coworking in South Africa.

Evidence:

Chapter 3.2 investigated global trends causing a change in the nature of work and how this creates the need for coworking spaces. Coworking spaces were defined in Section 3.3. Coworking member typology was investigated in Section 3.4.1, the result was a typology matrix (Table 3.4) to be used by

the development manager. Common coworking space characteristics were investigated in Section 3.5 and finally the relevance of coworking in South Africa was discussed in Section 3.6.

Status: Achieved.

Objective 3: Compare advantageous of new build to refurbishment of properties and investigate refurbishment in South Africa.

Evidence:

Chapter 4 investigates the focus on refurbishment as a result of the retail vacancies in South Africa. Refurbishment was defined in Section 4.2. The advantages of both new build and refurbishment were compared in Sections 4.3 and 4.4 and the advantages of refurbishment over new build in a South Africa context was stated in Section 4.4.1. Aspects regarding the refurbishment of coworking spaces was discussed in Section 4.5 resulting in the need for Objective 5. Section 4.5.3 states how important the consideration of refurbishment characteristics is to the successful completion of projects with such nature.

Status: Achieved.

Objective 4: Determine what sustainable property development is and the benefits thereof. Determine how this sustainability is measured.

Evidence:

Chapter 5 discussed the development of sustainable buildings, this is an important topic especially considering the dangers of global warming. A definition for green buildings was reached in Section 5.2 and the benefits of such development was discussed in Section 5.3. Green buildings can be a broad term, but several bodies worldwide have set up some rating systems to standardise green buildings, these rating systems were briefly investigated in Section 5.4. Finally, the green rating system used as requirement in the framework was the Green Star rating system of South Africa, discussed in detail in Section 5.4.1.

Status: Achieved.

Objective 5: Establish current construction management methods and candidate solutions to improve the management of construction. Establish a new method for construction management.

Evidence:

This objective was added as result of research conducted on refurbishment in Section 4.5.3. Chapter 6 investigated the current management of construction projects and how it can be improved. Section 6.2 investigated the principles that current construction management is based on and suggested some principles (Section 6.2.1) that can lead to improved time and cost management. This created an understanding of why better construction management is needed. In Section 6.3, a method for the construction management of refurbishment projects was investigated and added as requirement to the conceptual framework.

Status: Achieved.

Objective 6: Develop a framework to guide the development manager in the sustainable refurbishment of coworking spaces in South Africa.

Evidence:
The primary objective was completed throughout the document as the secondary objectives were completed. Figure 6.8 shows the culmination of all the requirements of the secondary objectives into the conceptual framework. In Chapter 8 the conceptual framework was validated through a theoretical case study and subject matter experts in industry, some adjustments were made to the conceptual framework and the final framework to be presented to the development manager is shown in Figure 8.4.

Status: Achieved.

9.3 Limitations

With any scientific research, some form of limitation exists. It is important to acknowledge these limitations since they can restrict and influence the research outcomes. This study had the following limitations:

- The available resources such as time and finance did not allow for a practical case study, thus the conceptual framework was tested in theory but practical application will undoubtedly reveal unforeseen challenges and problems in the conceptual framework; and
- The scope of the study excluded the financial model of a coworking space, which limited the depth of research done on coworking characteristics and features. From the validation it became apparent that everything in construction is determined by cost, as a result, aspects such as sustainable development are often overlooked to save cost.

It was also found that a lot of what is stated in the framework is already known in the industry. Some of these aspects are being implemented and some not due to financial reasons. The developed framework would work well for smaller, local companies looking to open 2 to 5 coworking spaces in their region or country. Bigger coworking companies such as WeWork operates on a bigger scale and have teams dedicated to developing new coworking spaces.

This framework would be useful for smaller coworking space operators, just to guide them through the development process, but individual coworking spaces usually offer a lot less in terms of amenities and utilities. As mentioned in Chapter 8, coworking spaces in its own right does not make a lot of money, it's all the peripheral services (multiple location access, large network, angel investment opportunities etc.) that make coworking spaces lucrative. Because of this and single coworking spaces often not having large financial backing, their fit-out cost is even less, resulting in limited amenities and utilities. The conclusion is that coworking is most successfully operated when managed as a brand with multiple locations and various peripheral services like those offered by WeWork or Workshop 17.

9.4 Recommendations For Possible Future Research

This section proposes future research avenues. These avenues were either excluded from the scope of the study or discovered during research. Possible future research include:

- **A financial model for developing coworking spaces.**
  During validation it became apparent that the outcome of all decisions in the development of a

coworking space is determined by the financial feasibility of its implementation. This is why the sustainability requirements were changed to recommendations in Figure 8.4. A model that investigates the financial impact of decisions and its influence on the return on investment would be a valuable addition to the framework developed in this document. Since the financial aspect of a coworking space is so big, it can be divided onto smaller sections:

  - Lease agreement, condition of the site and how much would be needed to refurbish the site;
  - Characteristics of the coworking space and how much extra is incorporated; and
  - Membership fee structure of the coworking space.

- **How to de-risk a coworking space.**
  This was a proposition from a subject matter expert during validation. With the nature of work changing and more entrants in the coworking industry, how do you de-risk your coworking space to ensure attraction of coworking member, but also be financially profitable. What are additional uses for the space?

- **How to offer and monetize peripheral services as a small/single coworking space operator.**
  Industry leaders like WeWork have over a thousand industry partners. Small/single coworking spaces will not be able to partner as easily with big corporates and other industries. Thus, the problem arises where small coworking spaces are sometimes isolated and struggle to offer peripheral services to its members, thus also struggling to be financially sustainable. This makes it difficult for small coworking spaces to enter the market without being dominated by bigger competitors prices and additional service.

- **Smart technology in coworking space**
  With the digitalisation of industries, numerous smart building technologies have entered the market that are pioneering the way in which people interact with and use indoor spaces. The best example to date is the *The Edge*, head offices of Deloitte in Amsterdam.

End.

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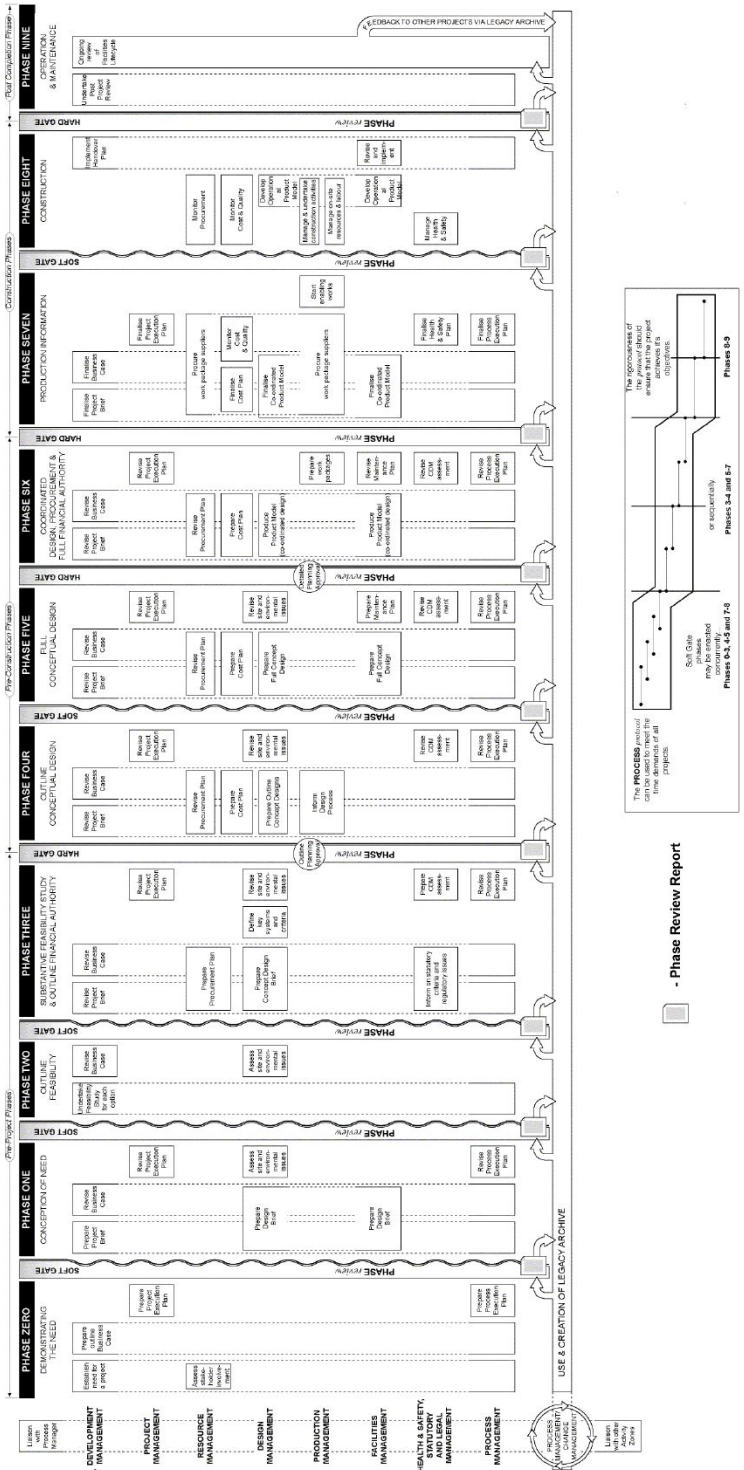
Appendices

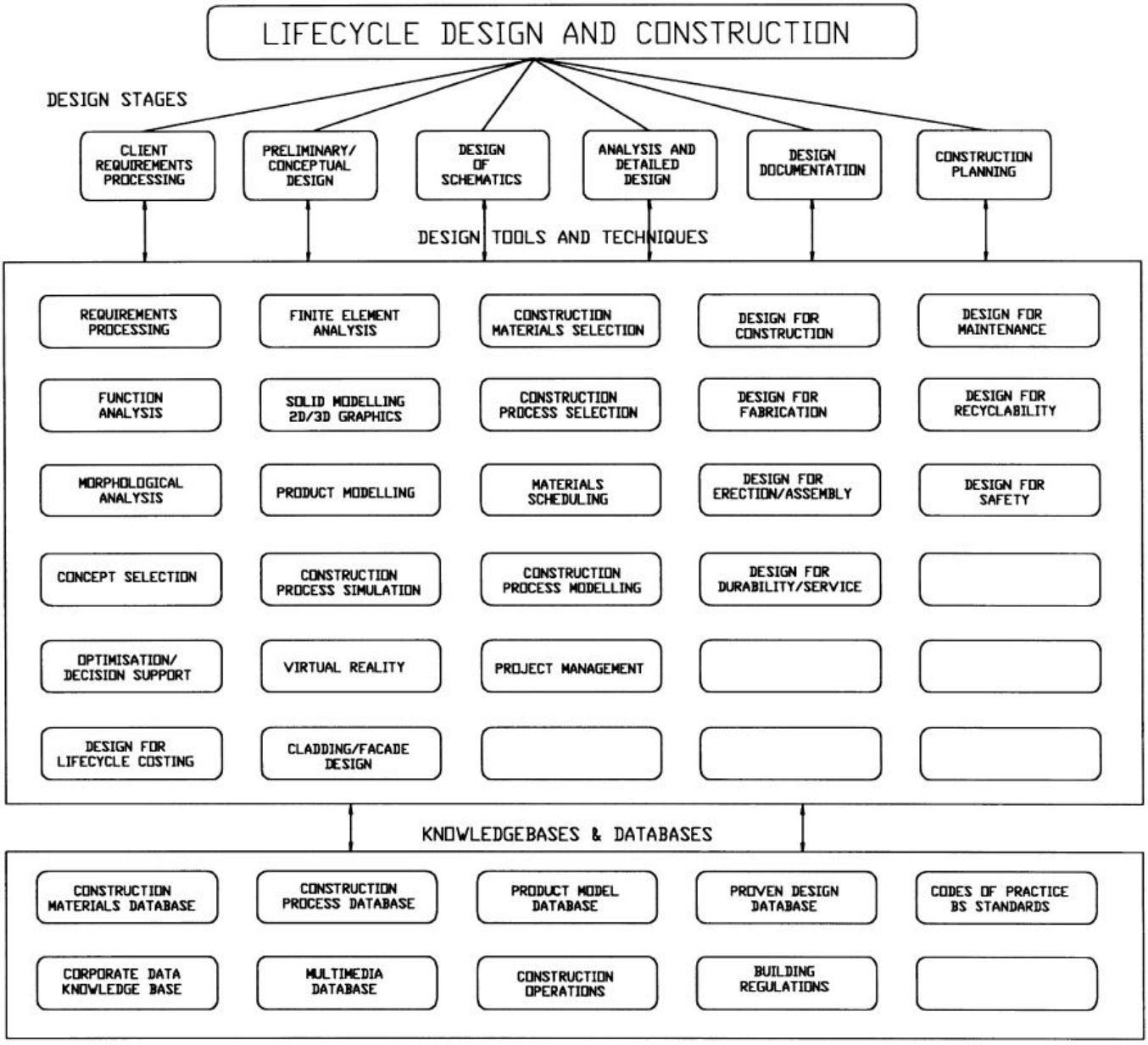
Appendix AA

Property Development Life Cycles

A.1 Generic design and construction process



A.2 Integrated framework for concurrent life cycle design and construction



A.3 PROCSA Matrix

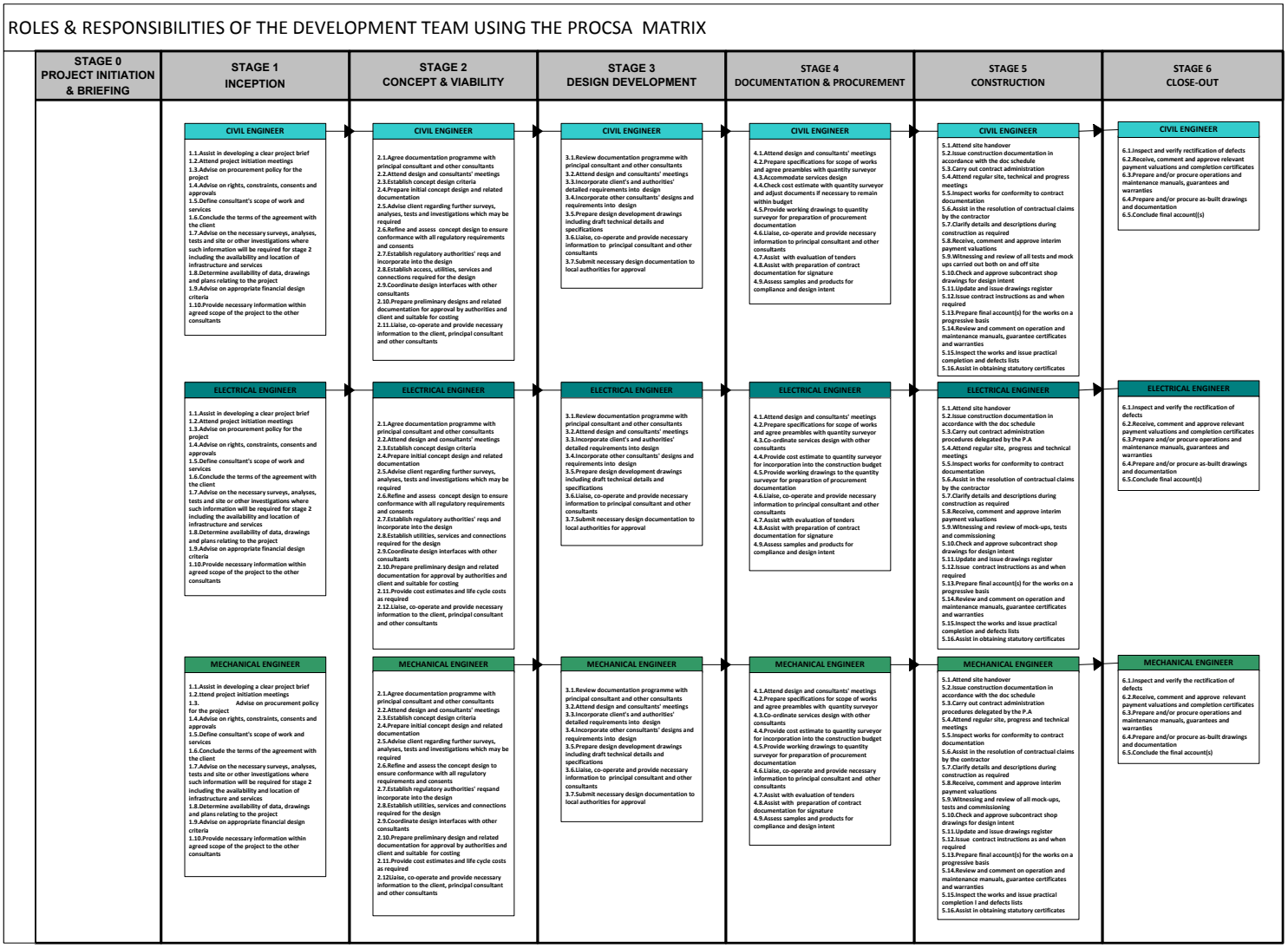
ROLES & RESPONSIBILITIES OF THE DEVELOPMENT TEAM USING THE PROCSA MATRIX

STAGE 0 PROJECT INITIATION & BRIEFING	STAGE 1 INCEPTION	STAGE 2 CONCEPT & VIABILITY	STAGE 3 DESIGN DEVELOPMENT	STAGE 4 DOCUMENTATION & PROCUREMENT	STAGE 5 CONSTRUCTION	STAGE 6 CLOSE-OUT
Establishing the need, desirability and viability of undertaking a property development together with securing the appropriate land and rights to undertake such a development	Establish the client requirements and preferences, assess user needs and options, appointment of necessary consultants, establish the project brief including project objectives, priorities, constraints, assumptions, aspirations and strategies.	Prepare and finalise the project concept in accordance with the brief including the scope, scale, character, form, function and preliminary programme and viability of the project	Develop the approved concept to finalise the design, outline specifications, cost plan, financial viability and programme for the project	Prepare the construction and procurement documentation, confirm and implement the procurement strategies and procedures for effective and timeous procurement of necessary resources for the execution of the project	Management, administer and monitor the contracts and processes, including the preparation and co-ordination of the procedures and documentation to facilitate practical completion of the works	Fulfill and complete the project close-out including the preparation of the necessary documentation to facilitate effective completion, handover and operation of the project
DEVELOPMENT MANAGER 0.1.Establish project need and desirability 0.2.Prepare a First Business Case 0.3.Formalise Client's Vision 0.4.Source Appropriate Land 0.5.Manage procurement of land rights including necessary zoning, environmental, infrastructural / external services, legal requirements etc. in relation to such land rights 0.6.Procure market research to assist in confirming the appropriate product and income stream 0.7.Appoint necessary Consultants 0.8.Process Payments to all project creditors	**DEVELOPMENT MANAGER** 1.1.Formalise project brief 1.2.Facilitate preliminary site assessment 1.3.Prepare a preliminary desk top project viability 1.4.Appoint necessary appropriate consultants 1.5.Establish project procurement policy	**DEVELOPMENT MANAGER** 2.1.Provide consultants with all supplementary information and constraints necessary to execute their respective obligations 2.2.Define format and procedures for reports, presentations and communications by all members of the project team 2.3.Review and comment on proposals and reports prepared and presented by consultants including design concepts, costings and the like 2.4.Prepare "bankable business plan" including but not limited to a viability study, market research, end user commitments, operating agreements, marketing strategy and the like, for purposes of procuring finance for the project 2.5.Manage procurement of project finance	**DEVELOPMENT MANAGER** 3.1.Appoint balance of the consultants including the clear definition of their roles, responsibilities and liabilities 3.2.Review and approve formal and informal communication structure, processes and procedures for the design development of the project 3.3.Review and approve detailed design and documentation Programme, based on an updated indicative construction programme, with all consultants 3.4.Obtain and timeously provide all operating end user requirements to the design team 3.5.Procure appropriate health and safety representative and advice 3.6.Facilitate the timeous submission by the design team of all plans and documentation to obtain the necessary statutory approvals 3.7.Provide design and cost decisions timeously in relation to the design development process 3.8.Receive, review and agree estimates, budgets and cost reports in relation to the final capital cost of the project 3.9.Establish, monitor and manage cash flow requirements of the project 3.10.Review and approve designs by consultants 3.11.Review facilities management requirements and establish facilities management policy 3.12.Monitor implementation of the marketing strategy 3.13.Procure and approve the marketing documentation 3.14.Manage achievement of the business plan income stream requirements 3.15.Procure achievement of all project finance preconditions	**DEVELOPMENT MANAGER** 4.1.Review and approve procurement strategy for contractors, subcontractors and suppliers 4.2.Review and approve project procurement programme and proposed tenderers 4.3.Receive and review environmental management plan 4.4.Provide all necessary, project specific tender conditions including but not limited to, amendments and additions to the preliminaries, empowerment policies, insurance and payment conditions and the like to incorporation in the tender documentation 4.5.Review health and safety specification for the project 4.6.Review adjudication of tenders and instructions to the principal agent to appoint the appropriate contractors 4.7.Sign all principal and direct contract appointment on project 4.8.Place the necessary insurance for project including contractor insurance and appropriate development risk insurance 4.9.Review reconciliation by quantity surveyor of the tender prices with project budget 4.10.Agree format and procedures for monitoring and control by quantity surveyor of cost of the scope of works 4.11.Monitor leasing / sales performance relative to project feasibility 4.12.Procure and manage legal advice in relation to project leasing, sales,etc 4.13.Formalise all service agreements with the appropriate authorities including the payment of all necessary deposits	**DEVELOPMENT MANAGER** 5.1.Manage ongoing projects insurance requirements (including resolution of all insurance claims) 5.2.Formalise and facilitate occupation of site by contractor, including but not limited to termination of existing leases and the like 5.3.Review formal and informal communication structure and procedures for construction process 5.4.Regularly attend site meetings and inspections 5.5.Receive and review contractors' health and safety plan 5.6.Review and approve "end user" specific construction details, documentation, and materials timeously 5.7.Review and approve all scope and cost variations 5.8.Arbitrate acceptable standards of quality when required to do so 5.9.Review and process monthly progress payments 5.10.Receive, review and approve recommendations for settlement of contractual claims as prepared by the principal agent 5.11.Receive and review monthly cost reports 5.12.Formalise management of all direct contractors and suppliers 5.13.Receive and review all project reports and present same at client review meetings 5.14.Provide operator input for any necessary early testing and commissioning by consultants and contractors	**DEVELOPMENT MANAGER** 6.1.Accept works completion certificate 6.2.Receive and distribute all as-built drawings and design documentation, to appropriate parties 6.3.Receive and distribute, all operating and maintenance manuals as well as all warrantees and guarantees, to appropriate parties 6.4.Receive and distribute, all statutory compliance certificates and documentation, to appropriate parties 6.5.Receive and handover health and safety files to client 6.6.Monitor rectification of defects during defects liability period 6.7.Monitor preparation and agreement of the final accounts 6.8.Procure and distribute end users latent final completion defects list for inclusion in project final completion latent defects list 6.9.Receive and review and present project closeout report to client 6.10.Assist the client in procuring appropriate facilities management resources
	PROJECT MANAGER 1.1.Facilitate development of a clear project brief 1.2.Establish procurement policy for the project 1.3.Assist the client in the procurement of necessary and appropriate other consultants including the clear definition of their roles and responsibilities 1.4.Establish in conjunction with the client, other consultants and all relevant authorities, the site characteristics, rights and constraints for the proper design of the intended project 1.5.Define the consultant's scope of work and services 1.6.Conclude the terms of the agreement with the client 1.7.Facilitate a schedule of the required consents and approvals 1.8.Prepare, co-ordinate and monitor a project initiation programme 1.9.Facilitate client approval of all stage 1 documentation	**PROJECT MANAGER** 2.1.Assist the client in procurement of the other consultants 2.2.Advise the client on the requirement to appoint a health and safety consultant 2.3.Communicate the project brief to the other consultants and monitor the development of the concept and viability 2.4.Agree format and procedures for cost control and reporting by the other consultants 2.5.Prepare a documentation programme and indicative construction programme 2.6.Co-ordinate concept and viability documentation for presentation to the client for approval 2.7.Facilitate approval of the concept and viability by the client 2.8.Facilitate approval of the concept and viability by statutory authorities	**PROJECT MANAGER** 3.1.Agree and implement communication processes and procedures for the design development of the project 3.2.Assist the client in the procurement of the necessary other consultants including the clear definition of their roles and responsibilities 3.3.Prepare, co-ordinate, agree and monitor a detailed design and documentation program 3.4.Conduct and record consultants' and management meetings 3.5.Facilitate input required by health and safety consultant 3.6.Facilitate design reviews for compliance and cost control 3.7.Facilitate timeous technical co-ordination 3.8.Facilitate client approval of all stage 3 documentation	**PROJECT MANAGER** 4.1.Recommend and agree procurement strategy for contractors, subcontractors and suppliers with the client and the other consultants 4.2.Prepare and agree the procurement programme 4.3.Advise the client, in conjunction with the other consultants on the appropriate insurances 4.4.Co-ordinate and monitor preparation of procurement documentation by consultants in accordance with the project procurement programme 4.5.Manage procurement process and recommended contractors for approval by the client 4.6.Agree the format and procedures for monitoring and control by the quantity surveyor of the cost of the works 4.7.Co-ordinate and assemble the contract documentation for signature	**PROJECT MANAGER** 5.1.Arrange site handover to the cntractor 5.2.Establish construction documentation issue process 5.3.Agree and monitor issue and distribution of construction docs 5.4.Instruct the contractor on behalf of the client to appoint subcontractors 5.5.Conduct and record site meetings 5.6.Monitor, review and approve the preparation of the construction programme by the contractor 5.7.Regularly monitor performance of the contractor against the programme 5.8.Adjudicate entitlements that arise from changes required to the construction programme 5.9.Receive, co-ordinate and monitor approval of all contract documentation provided by contractor(s) 5.10.Agree quality assurance procedures and monitor implementation thereof by the other consultants and the contractors 5.11.Monitor preparation and auditing of the contractor's health and safety plan and approval thereof by the H&S consultant 5.12.Monitor preparation of the environmental management plan by the environmental consultant 5.13.Establish procedures for monitoring scope and cost variations 5.14.Monitor, review, approve and issue certificates 5.15.Receive, review and adjudicate any contractual claims 5.16.Monitor preparation of financial control reports by the other consultants 5.17.Prepare and submit progress reports 5.18.Coordinate, monitor and issue practical completion lists and the certificate of practical completion	**PROJECT MANAGER** 6.1.Co-ordinate and monitor rectification of defects 6.2.Manage procurement of operations and maintenance manuals, guarantees and warranties 6.3.Manage preparation of as-built drawings and documentation 6.4.Manage procurement of outstanding statutory certificates 6.5.Monitor, review and issue payment certificates 6.6.Issue completion certificates 6.7.Manage agreement of final account(s) 6.8.Prepare and present the project close-out report

ROLES & RESPONSIBILITIES OF THE DEVELOPMENT TEAM USING THE PROCSA MATRIX

STAGE 0 PROJECT INITIATION & BRIEFING	STAGE 1 INCEPTION	STAGE 2 CONCEPT & VIABILITY	STAGE 3 DESIGN DEVELOPMENT	STAGE 4 DOCUMENTATION & PROCUREMENT	STAGE 5 CONSTRUCTION	STAGE 6 CLOSE-OUT
	ARCHITECT 1.1.Assist in developing a clear project brief 1.2.Attend project initiation meetings 1.3.Advise on the procurement policy for the project 1.4.Advise on rights, constraints, consents and approvals 1.5.Advise on the other consultants and services required 1.6.Define the consultant's scope of work and services 1.7.Determine availability of data, drawings and plans relating to the project 1.8.Provide necessary information within the agreed scope of the project to the other consultants	**ARCHITECT** 2.1.Agree the documentation programme with the principal consultant and the other consultants 2.2.Attend design and consultants' meetings 2.3.Prepare concept design based on the client's brief 2.4.Consult with the other consultants and incorporate their input 2.5.Discuss design concept with local authorities 2.6.Clarify and confirm the project space norms to optimise functional and operational efficiency in terms of scale and relationships of areas 2.7.Co-ordinate design interfaces with the other consultants 2.8.Select general construction materials and intended finishes 2.9.Provide information to the quantity surveyor for suitable estimates of constuction costs 2.10.Prepare and submit presentation of the design concept to the client for approval 2.11.Prepare and submit the site development plan to the local authority for approval where applicable 2.12.Liaise, co-operate and provide necessary information to the client, principal consultant and other consultants	**ARCHITECT** 3.1. Review the documentation programme with the principal consultant and the other consultants 3.2.Attend design and consultants' meetings 3.3.Incorporate the client's detailed requirements into building design 3.4.Incorporate and co-ordinate the other consultants' designs into building design 3.5.Prepare design development drawings including draft technical details and outline specifications 3.6.Review budget in conjunction with the quantity surveyor 3.7.Liaise, co-operate and provide necessary information to the client, principal consultant and other consultants 3.8.Submit drawings to local authorities for approval	**ARCHITECT** 4.1.Attend design and consultants meetings 4.2.Prepare specifications for the works and agree preambles with the quantity surveyor 4.3.Co-ordinate services and prepare necessary services co-ordination drawings 4.4.Check cost estimate with the quantity surveyor and adjust documents if necessary to remain within budget 4.5.Provide working drawings to the quantity surveyor for preparation of procurement documentation 4.6.Liaise, co-operate and provide necessary information to the principal consultant and the other consultants 4.7.Assist with evaluation of tenders 4.8.Assist with the preparation of contract documentation for signature 4.9.Assess samples and products for compliance and design intent	**ARCHITECT** 5.1.Attend the site handover 5.2.Issue construction documentation in accordance with the documentation programme 5.3.Carry out contract administration procedures delegated by the principal agent in terms of the contract 5.4.Attend regular site, technical and progress meetings 5.5.Inspect the works for conformity to contract documentation 5.6.Clarify details and descriptions during construction as required 5.7.Receive, comment and approve interim payment valuations 5.8.Witness and review all tests and mock-ups carried out both on and off site 5.9.Check and approve subcontract shop drawings for design intent 5.10.Update and issue the drawings register 5.11.Issue contract instructions as and when required 5.12.Review and comment on operations and maintenance manuals, guarantees, certificates and warranties 5.13.Inspect the works and issue practical completion and defects lists 5.14.Assist in obtaining statutory certificates	**ARCHITECT** 6.1.Inspect and verify rectification of defects 6.2.Receive, comment and approve relevant payment valuations and completion certificates 6.3.Prepare and/or procure operations and maintenance manuals, guarantees and warranties 6.4.Prepare and/or procure as-built drawings and documentation
	QUANTITY SURVEYOR 1.1.Assist in developing a clear project brief 1.2.Attend project initiation meetings 1.3.Advise on procurement policy for the project 1.4.Advise on other consultants and services required 1.5.Define the consultant's scope of work and services 1.6.Conclude the terms of the agreement with the client 1.7.Advise on economic factors affecting the project 1.8.Advise on appropriate financial design criteria 1.9.Provide necessary information within the agreed scope of the project to the other consultants	**QUANTITY SURVEYOR** 2.1.Agree the documentation programme with the principal consultant and other consultants 2.2.Attend design and consultants' meetings 2.3.Review and evaluate design concepts and advise on viability in conjunction with the other consultants 2.4.Receive relevant data and cost estimates from the other consultants 2.5.Prepare preliminary and elemental or equivalent estimates of construction cost 2.6.Assist the client in preparing a financial viability report 2.7.Audit space allocation against the initial brief 2.8.Liaise, co-operate and provide necessary information to the client, principal consultant and other consultants	**QUANTITY SURVEYOR** 3.1.Review the documentation programme with the principal consultant and other consultants 3.2.Attend design and consultants' meetings 3.3 Review and evaluate design and outline specifications and exercise cost control in conjunction with the other consultants 3.4.Receive relevant data and cost estimates from the other consultants 3.5.Prepare detailed estimates of construction cost 3.6.Assist the client in reviewing the financial viability report 3.7.Comment on space and accommodation allowances and prepare an area schedule 3.8.Liaise, co-operate and provide necessary information to the client, principal consultant and other consultants	**QUANTITY SURVEYOR** 4.1.Attend design and consultants' meetings 4.2.Assist the principal consultant in the formulation of the procurement strategy for contractors, subcontractors and suppliers 4.3.Review working drawings for compliance with the approved budget of construction cost and/or financial viability 4.4.Prepare documentation for both principal and subcontract procurement 4.5.Assist the principal consultant with calling of tenders and / or negotiation of prices 4.6.Assist with financial evaluation of tenders 4.7.Assist with the preparation of contract documentation for signature	**QUANTITY SURVEYOR** 5.1.Attend the site handover 5.2.Prepare schedules of predicted cash flow 5.3.Prepare pro-active estimates for proposed variations for client decision-making 5.4.Attend regular site, technical and progress meetings 5.5.Adjudicate and resolve financial claims by the contractor(s) 5.6.Assist in the resolution of contractual claims by the contractor(s) 5.7.Establish and maintain a financial control system 5.8.Prepare valuations for payment certificates to be issued by the principal agent 5.9.Prepare final account(s) for the works on a progressive basis	**QUANTITY SURVEYOR** 6.1.Prepare valuations for payment certificates to be issued by the principal agent 6.2.Conclude final account(s)
	STRUCTURAL ENGINEER 1.1.Assist in developing a clear project brief 1.2.Attend project initiation meetings 1.3.Advise on procurement policy for the project 1.4.Advise on rights, constraints, consents and approvals 1.5.Define the consultant's scope of work and services 1.6.Conclude the terms of the agreement with the client 1.7.Advise on the necessary surveys, analyses, tests and site or other investigations where such information will be required for stage 2 including the availability and location of infrastructure and services 1.8.Determine availability of data, drawings and plans relating to the project 1.9.Advise on appropriate financial design criteria 1.10.Provide necessary information within agreed scope of the project to the other consultants	**STRUCTURAL ENGINEER** 2.1.Agree the documentation programme with the principal consultant and the other consultants 2.2.Attend design and consultants' meetings 2.3.Establish concept design criteria 2.4.Prepare initial concept design and related documentation 2.5.Advise the client regarding further surveys, analyses, tests and investigations which may be required 2.6.Refine and assess concept design to ensure conformance with all regulatory requirements and consents 2.7.Establish regulatory authorities' requirements and incorporate into the design 2.8.Establish access, utilities, services and connections required for the design 2.9.Co-ordinate design interfaces with other consultants 2.10.Prepare preliminary designs and related documentation for approval by authorities and the client and suitable for estimates of construction cost 2.11.Liaise, co-operate and provide necessary information to the client, principal consultant and other consultants	**STRUCTURAL ENGINEER** 3.1.Review the documentation programme with the principal consultant and the other consultants 3.2.Attend design and consultants' meetings 3.3.Incorporate the client's and authorities' detailed requirements into the design 3.4.Incorporate the other consultants' designs and requirements into the design 3.5.Prepare design development drawings including draft technical details and specifications 3.6.Liaise, co-operate and provide necessary information to the client, principal consultant and other consultants 3.7.Submit necessary design documentation to local authorities for approval	**STRUCTURAL ENGINEER** 4.1.Attend design and consultants' meetings. 4.2.Prepare specifications for the works and agree preambles with the quantity surveyor 4.3.Accommodate services design 4.4.Check cost estimate with the quantity surveyor and adjust documents if necessary to remain within budget 4.5.Provide working drawings to the quantity surveyor for preparation of procurement documentation 4.6.Liaise, co-operate and provide necessary information to the principal consultant and the other consultants 4.7.Assist with evaluation of tenders 4.8.Assist with preparation of contract documentation for signature 4.9.Assess samples and products for compliance and design intent	**STRUCTURAL ENGINEER** 5.1.Attend the site handover 5.2.Issue construction documentation in accordance with the documentation programme 5.3.Carry out contract administration procedures delegated by the principal agent in terms of the contract 5.4.Attend regular site, technical and progress meetings 5.5.Inspect the works for conformity to contract documentation 5.6.Assist in the resolution of contractual claims by the contractor 5.7.Clarify details and descriptions during construction as required 5.8.Receive, comment and approve interim payment valuations 5.9.Witness and review of all tests and mock-ups carried out both on and off the site 5.10.Check and approve subcontract shop drawings for design intent 5.11.Update and issue drawings register 5.12.Issue contract instructions as and when required 5.13.Review and comment on operation and maintenance manuals, guarantees, certificates and warranties 5.14.Inspect the works and issue practical completion and defects lists 5.15.Assist in obtaining statutory certificates	**STRUCTURAL ENGINEER** 6.1.Inspect and verify rectification of defects 6.2.Receive, comment and approve relevant payment valuations and completion certificates 6.3.Prepare and/or procure operations and maintenance manuals, guarantees and warranties 6.4.Prepare and/or procure as-built drawings and documentation

ROLES & RESPONSIBILITIES OF THE DEVELOPMENT TEAM USING THE PROCSA MATRIX



Appendix AA

Green Star SA Major Office Refurbishment Scorecard

Green Star SA - OFFICE v1.1

Credit	Credit Name	Aim of Credit	Points Available
Management Category			
OB-Man-1	Green Star SA Accredited Professional	To encourage and recognise the engagement of professionals who can assist the project team with the integration of Green Star SA aims and processes throughout all stages of a fitout's design and construction phases.	2
OB-Man-2	Commissioning Clauses	To encourage and recognise commissioning and handover initiatives that ensure all building services can operate to optimal design potential.	2
OB-Man-3	Building Tuning	To encourage and recognise commissioning initiatives that ensure optimum occupant comfort and energy efficient services performance throughout the year.	2
OB-Man-4	Independent Commissioning Agent	To ensure buildings are designed with regard to future maintenance and are correctly commissioned before handover.	1
OB-Man-5	Building Users' Guide	To encourage and recognise information management that enables building users to optimise the buildingís environmental performance.	1
OB-Man-6	Environmental Management	To encourage and recognise the adoption of a formal environmental management system in line with established guidelines during construction.	2
OB-Man-7	Waste Management	To encourage and recognise management practices that minimise the amount of construction waste going to disposal.	3
OB-Man-8	Airtightness Testing	To encourage and recognise management systems and building infrastructure that facilitates the reduction of the overall operational waste generation and disposal.	1
Management credits			**14**
Indoor Environmental Quality Category			
OB-IEQ-1	Ventilation Rates	To encourage and recognise designs that provide ample amounts of outside air to counteract build-up of indoor pollutants.	2
OB-IEQ-3	Carbon Dioxide Monitoring and Control	To encourage and recognise the provision of response monitoring of Carbon Dioxide levels to ensure delivery of optimum quantities of outside air.	1
OB-IEQ-4	Daylight	To encourage and recognise designs that provide good levels of daylight for building users.	3
OB-IEQ-5	Daylight Glare Control	To encourage and recognise buildings that are designed to reduce the discomfort of glare from natural light.	1
OB-IEQ-7	Electric Lighting Levels	To encourage and recognise base building provided office lighting that is not over designed.	1
OB-IEQ-8	External Views	To encourage and recognise designs that provide occupants with a visual connection to the external environment.	2
OB-IEQ-9	Thermal Comfort	To encourage and recognise buildings that achieve a high level of thermal comfort.	2
OB-IEQ-10	Individual Comfort Control	To encourage and recognise designs that facilitate individual control of thermal comfort.	2
OB-IEQ-11	Hazardous Materials	To encourage and recognise actions taken to reduce health risks to occupants from the presence of hazardous materials.	1
OB-IEQ-12	Internal Noise Levels	To encourage and recognise buildings that are designed to maintain internal noise levels at an appropriate level.	2
OB-IEQ-13	Volatile Organic Compounds	To encourage and recognise specification of interior finishes that minimise the contribution and levels of Volatile Organic Compounds in buildings.	3
OB-IEQ-14	Formaldehyde Minimisation	To encourage and recognise the specification of products with low formaldehyde emission levels.	1
OB-IEQ-15	Mould Prevention	To encourage and recognise the design of services that eliminate the risk of mould growth and its associated detrimental impact on occupant health.	1

OB-IEQ-16	**Tenant Exhaust Riser**	To encourage and recognise the design of buildings with a general exhaust riser that can be used by tenants to remove indoor pollutants from printing and photocopy areas.	1
OB-IEQ-17	**Environmental Tobacco Smoke (ETS) Avoidance**	To encourage and recognize the air quality benefits to occupants by prohibiting smoking inside the building.	1
Indoor Environmental Quality credits			**24**
Energy Category			
OB-Ene-0	**Conditional Requirement**	To encourage and recognise designs that minimise the greenhouse gas emissions associated with operational energy consumption, and maximise potential operational energy efficiency of the base building.	0
OB-Ene-1	**Greenhouse Gas Emissions**	To encourage and recognise designs that minimise greenhouse gas emissions associated with operational energy consumption.	20
OB-Ene-2	**Energy Sub-metering**	To encourage and recognise the installation of energy sub-metering to facilitate ongoing management of energy consumption.	2
OB-Ene-3	**Lighting Power Density**	To encourage and recognise designs that provide artificial lighting with minimal energy consumption.	4
OB-Ene-4	**Lighting Zoning**	To encourage and recognise lighting design practices that offer greater flexibility for light switching, making it easier to light only occupied areas.	2
OB-Ene-5	**Peak Energy Demand Reduction**	To encourage and recognise designs that reduce peak demand on energy supply infrastructure.	2
Energy credits			**30**
Transport Category			
OB-Tra-1	**Provision of Car Parking**	To encourage and recognise developments that facilitate the use of alternative modes of transportation for commuting to work.	2
OB-Tra-2	**Fuel-Efficient Transport**	To encourage and recognise developments that facilitate the use of more fuel efficient vehicles for work commuting.	2
OB-Tra-3	**Cyclist Facilities**	To encourage and recognise developments that facilitates the use of bicycles by occupants and customers.	3
OB-Tra-4	**Commuting Mass Transport**	To encourage and recognise developments that facilitate the use of mass transport for work commuting.	5
OB-Tra-5	**Trip Reduction - Mixed-Use**	To encourage and recognise retail centres that are built in mixed use areas in order to reduce the overall number of car trips taken by patrons.	2
Transport credits			**14**
Water Category			
OB-Wat-1	**Occupant Amenity Water**	To encourage and recognise designs that reduce potable water consumption by building occupants.	5
OB-Wat-2	**Water Meters**	To encourage and recognise the design of systems that both monitor and facilitate management of water consumption.	2
OB-Wat-3	**Landscape Irrigation**	To encourage and recognise the design of systems that aim to reduce the consumption of potable water for landscape irrigation.	3
OB-Wat-4	**Heat Rejection Water**	To encourage and recognise design that reduces potable water consumption from heat rejection systems.	4
OB-Wat-5	**Fire System Water Consumption**	To encourage and recognise building design that reduces consumption of potable water used for the building's fire protection and essential water storage systems.	1
Water credits			**15**
Materials Category			
OB-Mat-1	**Recycling Waste Storage**	To encourage and recognise the inclusion of storage space that facilitates the recycling of resources used within buildings to reduce waste going to disposal.	2
OB-Mat-2	**Building Reuse**	To encourage and recognise developments that reuse existing buildings to minimise materials consumption.	5

OB-Mat-3	**Reused Materials**	To encourage and recognise designs that prolong the useful life of existing products and materials.	1
OB-Mat-4	**Shell and Core or Integrated Fit-out**	To encourage and recognise base building delivery mechanisms that eliminate the need for immediate tenant refits.	1
OB-Mat-5	**Concrete**	To encourage and recognise the reduction of embodied energy and resource depletion occurring through use of concrete.	3
OB-Mat-6	**Steel**	To encourage and recognise the reduction in embodied energy and resource depletion associated with reduced use of virgin steel.	3
OB-Mat-8	**Sustainable Timber**	To encourage and recognise the specification of reused timber products or timber that has certified environmentally-responsible forest management practices.	2
OB-Mat-9	**Design for Disassembly**	To encourage and recognise designs that minimise the embodied energy and resources associated with demolition.	1
OB-Mat-10	**Dematerialisation**	To encourage and recognise designs that produce a net reduction in the total amount of material used.	1
OB-Mat-11	**Local sourcing**	To encourage and recognise the environmental advantages gained, in the form of reduced transportation emissions, by using materials and products that are sourced within close proximity to the site.	2
Materials credits			**21**
Land Use and Ecology Category			
OB-Eco-0	**Conditional Requirement**	To encourage and recognise development on land that has limited ecological value and to discourage development on ecologically valuable sites.	0
OB-Eco-1	**Topsoil**	To encourage and recognise construction practices that preserve the ecological integrity of topsoil.	1
OB-Eco-2	**Reuse of Land**	To encourage and recognise the reuse of land that has previously been developed and where the site is within an existing municipally approved urban edge.	2
OB-Eco-3	**Reclaimed Contaminated Land**	To encourage and recognise developments that reclaim contaminated land that otherwise would not have been developed.	2
OB-Eco-4	**Change of Ecological Value**	To encourage and recognise developments that maintains or enhances the ecological value of their sites.	4
Land use and Ecology credits			**9**
Emissions Category			
OB-Emi-1	**Refrigerant / Gaseous ODP**	To encourage and recognise the selection of refrigerants and other gases that do not contribute to long-term damage to the Earthís stratospheric ozone layer.	1
OB-Emi-2	**Refrigerant GWP**	To encourage and recognise the selection of refrigerants that reduce the potential for increased global warming from the emission of refrigerants to the atmosphere.	2
OB-Emi-3	**Refrigerant Leaks**	To encourage and recognise building systems design that minimises environmental damage from refrigerant leaks.	2
OB-Emi-4	**Insulant ODP**	To encourage and recognise the selection of insulants that do not contribute to long-term damage to the Earthís stratospheric ozone layer.	1
OB-Emi-5	**Watercourse Pollution**	To encourage and recognise developments that minimise stormwater run-off to, and the pollution of, the natural watercourses.	3
OB-Emi-6	**Discharge to Sewer**	To encourage and recognise developments that minimise discharge to the municipal sewerage system.	5
OB-Emi-7	**Light Pollution**	To encourage and recognise developments that minimise light pollution into the night sky.	1
OB-Emi-8	**Legionella**	To encourage and recognise building systems designed to eliminate the risk of Legionnairesí disease (Legionellosis), as far as reasonably practicable.	1
OB-Emi-9	**Boiler and Generator Emissions**	To encourage and recognise the use of boilers and generators that minimise harmful emissions	1

Appendix AB

Validation documents

Interview Protocol

Background:

- Get some background on the interviewee, their past projects and experiences, etc.

Introduce Conceptual framework:

- Explain the conceptual framework, how it was developed and how it works.
- Ask experts to confirm that the requirements is included at the correct stage according to their knowledge and experience.

Open conversation about framework:

1. Roles of development manager vs. project manager. Is it necessary to have delineation or can it all be done by one person?
2. What part of this framework is applicable/relates to your job?
3. Will this help you in any way?
4. Could this be applicable in any other scenarios outside coworking maybe?
5. What can you immediately see will/will not work?
6. What would you add to this framework to improve it? (General section like sustainability or refurbishment)

Section specific questions:

Coworking:

1. Is the background information on proximation to services enough to scout a location for a coworking space?
2. How do you select your sites?
3. This framework does not consider finances, how big is the effect of capex on coworking characteristics and the desired look and feel you want to create in a coworking space?

Refurbishment:

1. Do you agree that refurbishment offers an ideal solution for developing coworking space?
2. Is it realistic to look for sites that is suitable for deep energy refurbishment? It's mostly old buildings that can be very limiting in this regard, reducing your location pool considerably.

3. On the finance of refurbishment, how flexible can you make a refurbishment? Meaning, is it realistic to aim for high flexibility in refurbishment projects, or is it only really achievable in new builds?

Sustainable Development:

1. What is the current opinion in industry regarding green buildings?
2. Specifically, for coworking spaces, does tenants care about green ratings?

Construction management:

1. This is an ideal but is it feasible in South Africa given the labour market conditions, economic circumstances and skill of labourers and artisans?
2. Have you come across someone in South Africa that knows how to implement this? Does South Africa have this expertise?