

**A Conceptual Framework for the Commercial Readiness
Index: Start-Up Enterprises**

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Declaration

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Abstract

The unemployment rate in South Africa currently ranges from 27.5% to even higher when considering youth unemployment. It has become more imperative than ever before for new job opportunities to be created. The creation of a start-up enterprise is however not an easy task, with less than 30% of start-ups surviving longer than 42 months. Companies are finding it extremely hard to commercialise their products or services in a sustainable manner.

The concept of commercial readiness was explored by [ARENA \(2014a\)](#) and [Bezuidenhout \(2017\)](#), and applied to the renewable-energy and additive-manufacturing sector respectively. This study looks at the potential of applying the commercial readiness index (CRI) to the start-up domain, and in particular the technology sector. This framework was adapted to incorporate existing tools and literature that monitor specific areas of a start-up enterprise's progression. Through the consultation of 17 different experts the framework currently describing CRI was evaluated and deliberated. Through an iterative approach, a methodology was derived to determine the key concepts that need to be considered when trying to monitor the position of a start-up within the CRI framework.

The purpose of the research revolved around deriving a framework that assists an enterprise from conception to commercialisation. By incorporating the operational and strategic aspects of various models and frameworks, and comparing them in a systematic method to various categories and indicators, a better understanding of the enterprise can be derived. The framework gives guidance to the various stakeholders of the enterprise, as to what questions need to be asked, where the development needs to be accelerated, and where the prioritisation of the enterprise should be taking

place. In essence this looks at: Where the enterprise is now (As-Is status), where it needs to be (To-Be status), and how this will be achieved.

The phases of the CRI framework were adapted to suit the start-up domain, and the methodology for determining the current As-Is state and potential To-Be state was derived. These three phases are the following: *Phase 1* – Viable proposition and establishing enterprise, fundamentally considered a startup; *Phase 2* – Strategically aligned enterprise, with established foundations; *Phase 3* – Commercially scalable and competitive enterprise. These phases are guided by 11 indicators, encapsulating all the different pillars of an enterprise. These independent indicators were used in a comparative matrix with 12 categories to get an estimation of the current As-Is state.

Three companies were surveyed in different case studies in an attempt to plot their current As-Is state, and test whether the tools derived within this study could monitor the current As-Is state of each start-up within the CRI. These case studies, along with the literature and experts, serves as validation for this study. Monitoring the progress of start-ups more accurately and in more depth could lead to a greater success rate for start-ups within South Africa and globally. This study concludes that the CRI can be expanded and elaborated on in the start-up domain.

Opsomming

Die werkloosheidsyfer in Suid-Afrika is in die omgewing van 27.5%, selfs hoër wanneer daar na werkloosheid onder die jeug verwys word. Dit is nou uiters belangrik om nuwe werksgeleenthede te skep. Dit moet egter uitgewys word dat dit nie 'n eenvoudige taak is nie. Maatskappye vind dit moeilik om hulle produk of diens op 'n volhoubare manier te kommersialiseer. Nuut gestigte besighede staan slegs 'n 30%-kans om langer as 42 maande te oorleef.

Die konsep van kommersiële gereedheid is deur [ARENA \(2014a\)](#) en [Bezuidenhout \(2017\)](#) ondersoek, en is onderskeidelik op die hernubare-energie- en toevoegingvervaardigingindustrie toegepas. Hierdie studie kyk na die moontlikheid om die kommersiële gereedheidindeks (KGI) op nuut gestigte ondernemings binne die tegnologiese sektor te toets. Hierdie raamwerk word aangepas om bestaande hulpbronne en literatuur te inkorporeer wat spesifieke areas van 'n beginbesigheid se vordering monitor. Deur raadpleging van 17 verskillende kundiges is die raamwerk wat KGI huidig beskryf, geëvalueer en in oorweging gebring. Deur middel van 'n iteratiewe benadering is 'n metodiek afgelei om die sleutelkonsepte te bepaal wat oorweeg moet word wanneer daar probeer word om die posisie van 'n beginbesigheid binne die KGI-raamwerk te monitor.

Die doel van die navorsing is daarop gerig om 'n raamwerk te ontwikkel wat entrepreneurs kan help om hul onderneming van konseptualisering tot kommersialisering te neem. Dit sluit die inkorporasie van operasionele en strategiese komponente van die verskeie raamwerke in.

Deur hulle sistematies met mekaar teen verskeie kategorieë en aanwysers te vergelyk, kan die onderneming beter verstaan word. Die raamwerk gee leiding aan die verskeie belanghebbendes oor wat die prioriteite van die onderneming moet wees, help dat die regte vrae gevra word, en laat die ontwikkeling van 'n beter begrip van die maatskappy toe. Dit stel dus die

volgende vrae: Waar is die onderneming nou? Waar moet dit wees? Hoe kom dit daar?

Die fases van die KGI-raamwerk word aangepas om by die domein van die beginbesigheid te pas, en die metodiek word afgelei om die huidige toestand van die onderneming sowel as die potensiële vooruitsigte daarvan te bepaal. Die drie fases is: fase 1 – Die operasionele aspekte en vestiging van 'n nuwe onderneming; fase 2 – Strategiese belyning van die maatskappy, met gevestigde fondasies; fase 3 – Kommersieel skaalbare en mededingende onderneming. Hierdie fases word gerig deur 11 indikatore wat al die verskillende pilare van 'n onderneming uitmaak. Hierdie onafhanklike indikatore word gebruik in 'n matriks met 12 kategorieë om 'n aanduiding te kry van hoe die onderneming op daardie betrokke tyd presteer.

Drie maatskappye is in drie verskillende gevallestudies ondersoek in 'n poging om die huidige toestand van die maatskappy te bepaal, asook om te toets of die hulpbronne wat in hierdie studie afgelei is die huidige toestand van elke onderneming in die KGI kan monitor. Hierdie gevallestudies, tesame met die literatuur en kundiges, dien as bekragtiging van hierdie studie. Deur die vordering van beginbesighede noukeuriger en meer diepliggend te monitor, kan tot 'n groter sukses vir beginbesighede in Suid-Afrika en wêreldwyd lei. Hierdie studie kom tot die gevolgtrekking dat die KGI in die domein van die beginbesigheid uitgebrei kan word.

Dedication

Dedicated to my Mom and Dad, Benita and Jannie: Thank you for the continuous investment in my success, you have supported me throughout my journey. Your love is unconditional, and support unwavering. You have set me up for an amazing road ahead, and always went the extra mile in ensuring that I have every opportunity possible. I will be forever grateful for what you have done for our family. You are an example to follow and a benchmark to strive for. Thank you.

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Contents

Declaration	i
Abstract	ii
Opsomming	iv
Dedication	vi
Acknowledgement	vii
List of Figures	xi
List of Tables	xiv
Nomenclature	xv
1 Introduction	1
1.1 Overview of Commercialization	1
1.2 Description of the Problem	4
1.2.1 Research Problem	4
1.2.2 Scope of Problem	5
1.2.3 Aim and Objectives of Research	6
1.3 Thesis and Literature Methodology	9
1.4 Research Design	10
1.4.1 Case Study: Industries Assessed	10
1.4.2 Delphi Technique Methodology	10
1.5 Project Roadmap	11
1.6 Conclusion	12

CONTENTS

2	Start-up Enterprises	14
2.1	South African Entrepreneurial Ecosystem	15
2.1.1	Start-ups and Success	15
2.1.2	The South African Entrepreneurial Ecosystem	16
2.1.3	Monitoring the Start-up Domain	19
2.2	Models and Frameworks Engaged with for Start-up Enterprises	21
2.2.1	Technology Readiness Levels	21
2.2.2	Global Entrepreneurship and Development Institute (GEDI) Model	23
2.2.3	Business Model Canvas	26
2.2.4	Commercial Readiness Index (CRI) Model	29
2.2.5	Deming Cycle	31
2.2.6	Venture Capitalists Checklist	33
2.2.7	Enterprise Engineering Process	34
2.2.8	Incubators and Accelerators	35
2.2.9	Conclusion on Models	37
2.3	Consolidating the Various Methods	39
2.4	Validation of Chapter 2.	40
2.5	Chapter Summary	40
3	CRI Indicators for Start-up Enterprises	42
3.1	Introduction Into the Indicators, Categories and Phases	42
3.2	Defining the Indicators and Categories	43
3.2.1	Indicators	43
3.2.2	Proposed Categories	46
3.3	Phases Outline	50
3.3.1	Phase 1	54
3.3.2	Phase 2	55
3.3.3	Phase 3	56
3.3.4	The Link Between Phases	57
3.4	Validation of Chapter 3.	59
3.5	Chapter Summary	59

4	Conceptualising and Validating the Framework	61
4.1	Purpose of the Framework	61
4.1.1	Methodology Employed	62
4.1.2	What the Framework Entails	64
4.2	Implementation and Tools of the Framework	66
4.2.1	Phase 1 Check-list	67
4.2.2	Perceived Priority of Framework	70
4.2.3	As-Is to To-Be Analyses and Risk Management of Framework	70
4.3	Framework Outline and Implementation	73
4.3.1	Phase 1 Outline	73
4.3.2	Phase 2 Outline	75
4.3.3	Phase 3 Outline	77
4.3.4	As-Is to To-Be Conceptualisation	79
4.4	Parameters of Framework	81
4.5	Testing of Framework Outline	82
4.6	Validation of Chapter 4.	83
4.7	Chapter Summary	83
5	Case Studies	85
5.1	Overview of Implementation	85
5.2	Assumptions on Case Studies	87
5.3	Validity Risks	88
5.4	Criteria of Companies Selected	90
5.5	Company A	90
5.5.1	Case Study Company A	91
5.5.2	Reflection of Framework on Company A	94
5.6	Company B	95
5.6.1	Case Study of Company B	95
5.6.2	Reflection of Framework on Company B	99
5.7	Company C	100
5.7.1	Case Study of Company C	100
5.7.2	Reflection of Framework on Company C	104
5.8	Conclusion of Company Analysis	105

CONTENTS

5.9 Chapter Summary	107
6 Findings and Recommendations	109
6.1 Findings of Framework	109
6.2 Conclusion of Findings	111
6.3 Future Work and Recommendations	112
6.4 Reflection	113
References	118
A The Commercial Readiness Levels Described by ARENA	119
B GEDI Matrix	121
C Proposed Categories and Sub-Categories	123
C.1 Categories and Sub-Categories	123
D Chapter 3 Validation	136
E Chapter 4 Validation	140
F Company A	144
G Company B	149
H Company C	154

List of Figures

1.1	Research Methodology	7
1.2	Roadmap of Project	12
2.1	Technology Readiness Levels and Definitions of Levels	22
2.2	GEDI Rating Compared to Three Other Countries.	24
2.3	Business Model Canvas	26
2.4	TRL and CRI Technology Development Chain	29
2.5	CRI Levels in Comparison to TRL	31
2.6	The Deming Cycle	32
2.7	Venture Capitalist Categories	33
2.8	Enterprise Engineering Process	35
2.9	High Performing vs Low Performing Programs	36
2.10	Summary of Methods Used	38
3.1	Proposed Indicators	44
3.2	Commercial Readiness Phases	53
3.3	Link Between Phases	58
3.4	Consolidation of Indicators, Categories and Phases	60
4.1	Process Mapping of Framework	63
4.2	Sequential Phase Map	65
4.3	Prioritisation of Categories	71
4.4	Risk Categorisation and State Monitoring	72
4.5	Phase 1 Process Mapping	74
4.6	Phase 2 Process Mapping	76
4.7	Phase 3 Process Mapping	78

LIST OF FIGURES

4.8	As-Is to To-Be Analysis Plotting	80
5.1	Company A Category Prioritisation	91
5.2	Company A As-Is Status and Risk Profile	93
5.3	Company B Category Prioritisation	96
5.4	Company B As-Is Status and Risk Profile	98
5.5	Company C Category Prioritisation	101
5.6	Company C As-Is Status and Risk Profile	103
5.7	Company A Hypothetical To-Be State	106
B.1	GEDI Comparative Matrix on South African Ranking	121
B.2	Quantitative Change Required to Affect South African Entrepreneurial Ecosystem.	122
D.1	Validation of Chapter 3A	137
D.2	Validation of Chapter 3B	138
D.3	Validation of Chapter 3C	139
E.1	Validation of Chapter 4A	141
E.2	Validation of Chapter 4B	142
E.3	Validation of Chapter 4C	143
F.1	Company A Regulatory Environment and Stakeholder Acceptance Indi- cators	146
F.2	Company A Technical Performance and Financial Proposition - Cost, Indicators	146
F.3	Company A Financial Proposition - Revenue, and Supply Chain & Skills, Indicators	147
F.4	Company A Market Opportunities and Company Maturity Indicators	147
F.5	Company A Entrepreneur Capability Indicator	148
G.1	Company B Regulatory Environment and Stakeholder Acceptance Indi- cators	151
G.2	Company B Technical Performance and Financial Proposition - Cost, Indicators	151

LIST OF FIGURES

G.3	Company B Financial Proposition - Revenue, and Funding Indicators	152
G.4	Company B Supply Chain & Skills, and Market Opportunities Indicators	152
G.5	Company B, Company Maturity and Entrepreneur Capability Indicator	153
H.1	Company C Regulatory Environment and Stakeholder Acceptance Indicators	156
H.2	Company C Technical Performance and Financial Proposition - Cost, Indicators	156
H.3	Company C Financial Proposition - Revenue, and Supply Chain & Skills, Indicators	157
H.4	Company C Market Opportunities and Company Maturity Indicators	157
H.5	Company C Entrepreneur Capability Indicator	158

List of Tables

4.1	Derived Check-List from Venture Capitalists.	69
A.1	CRI Levels Definitions ARENA (2014a)	120
F.1	Company A: X-axis and Y-axis Coordinates for Each Indicator.	145
G.1	Company B: X-axis and Y-axis Coordinates for Each Indicator.	150
H.1	Company C: X-axis and Y-axis Coordinates for Each Indicator.	155

Nomenclature

Acronyms

ARENA	Australian Renewable Energy Agency
BMC	Business Model Canvas
BRICS	Brazil, Russia, India, China, South Africa
CRI	Commercial Readiness Index - A framework designed to indicate the level a company needs to successfully commercialise the product/company
GEDI	Global Entrepreneurship and Development Institute
GEI	Global Entrepreneurship Index
IDC	Industrial Development Corporation
IPO	Initial Public Offering
N/A	Not Applicable
NASA	National Aeronautics and Space Administration
SMME	Small, Medium, and Micro Enterprises
TRL	Technology Readiness Level - An indicator used to determine the readiness level of the investigated company
BEP Analyses	Break-Even Point refers to the point where the fixed cost, and costs to produce the product, equals the income generated from sales. Thus, the point where the enterprise breaks-even.

Chapter 1

Introduction

Chapter 1 explores what this research paper will entail. The chapter considers the background of the literature used and why this study will be value adding for industry. It further defines the problem and sets the objectives for this research. The research methodology is established through Figure 1.1 and the research methods are elaborated.

1.1 Overview of Commercialization

Companies come and go, and industries change fluidly with the development of technology. This has led to the question by start-up enterprises and venture capitalists (VC) alike, as to how does one effectively monitor the commercial readiness of such a new enterprise. This commercial readiness implies that the enterprise can effectively function and survive past the state of being a start-up.

There are various misconceptions regarding start-up enterprises, as highlighted by [Deutsch \(2017\)](#). Contrary to popular belief, more than one out of ten start-up companies actually succeed. When reviewing companies starting in 2005, [Deutsch \(2017\)](#) found that survival rates of various industries ranged from 36% to 51% across the respective industries. Keeping in mind that this happened right after a recession, this is quite a remarkable statistic. [Deutsch \(2017\)](#) also shows that retail and service industries with low entry barriers fared better in terms of their survival rate. It is important to note, that dependent on the source, these statistics alter significantly. [Cusumano \(2009\)](#) emphasises this, when highlighting that different strictness variables, alter the percentage of what is perceived as successful start-ups.

1.1 Overview of Commercialization

It is an interesting discovery, and shows why it is important to note the fact that different studies often give different results in terms of the survival rate of the enterprises. Hence, it is difficult to establish the exact statistics of the success rates of start-up enterprises, especially since the criteria and parameters consistently differ in various studies. This leads to a question on what it is that creates an environment that stimulates these success rates. Some of the terms often associated with these questions are in particular, **commercially sustainable** and **venture capitalists**. Commercially sustainable refers to a company that is able to manage on a business basis for profit for a long period of time, usually more than three years, in a manner that can be sustained over the long term (Merriam-Webster, 2017). Venture capitalists also have a vested interest in start-up enterprises, which refers to the capital that is invested or available for investment in the ownership of a new enterprise (Merriam-Webster, 2018b). These two elements have become crucial to the success of new small, medium and micro enterprises (SMME's) and creating a system to understand the most value-adding aspects of a new enterprise is fundamental to the success of these two concepts. An argument can be made that it has become more important, now more than ever, for investors and entrepreneurs to understand the market they wish to penetrate. With Parasuraman & Colby (2015) stating that in 2013, 2.7 billion people had access to internet and the global penetration grew from a mere 7% in 2000 to 39% in 2013. Parasuraman & Colby (2015) continue by identifying the growth in use of online services. The market for technical start-ups have thus grown significantly. In the financial service category, the amount of people using online banking or checking their balances online (of individuals who have access to internet), grew from 30% to 51% to 76%, over the period of 1999, 2004, and 2012, respectively (Parasuraman & Colby, 2015).

With an increasing competitive nature, thanks to globalisation, tools such as commercial readiness have started to develop. A less traditional, and new one for commercialisation was created by ARENA (2014b) where the Commercialisation Readiness Indicators (CRI) were created as an analytic test and framework for the renewable energy industry. This has however not been tested on all industries. Bezuidenhout (2017) tested this framework on the additive manufacturing industry with great success, but further studies on other industries are still required. Various platforms like crowd funding have been established, but offers little to no knowledge on the commercially sustainable potential of the enterprise (Mollick, 2014). Crowd funding is described as

1.1 Overview of Commercialization

a novel method of investment with the levels of success ranging from particularly successful, to extremely unsuccessful (Mollick, 2014). Similar to various other investment methods, crowd funding is still a field that requires more research. Thus, exemplifying the need to create a framework to better understand the commercial sustainability of an enterprise in various industries.

De Jager (2017) highlights this with his hypothesis of, *"the CRI could be used by policy-makers to identify interventions that can help address the market barriers preventing renewable energy technology commercialisation"*, and this could be applicable to other industries as well. He further highlights the challenges faced by the industry by not being able to measure the commercial sustainability of the enterprise which includes:

- High up-front capital requirements;
- the long payback periods;
- the regulatory uncertainty; and
- the perceived risks of new solutions.

This is yet again applicable to other industries. By using the framework developed by ARENA (2014b), it is possible to mitigate some of these drawbacks and establish a credible way to evaluate the commercial readiness of various start-up SMME's.

As previously described, a framework has been developed by ARENA (2014b) to describe the correlation between the Technology Readiness Level (TRL) and the Commercial Readiness Index (CRI) of a company. ARENA (2014b) developed this framework to establish the current as-is state of the renewable energy sector, as to better understand what the requirements for a to-be state would be. Through this process a reflection of the current commercial readiness of the renewable energy sector was obtained.

Further research was conducted by Bezuidenhout (2017), into the TRL and CRI of the additive manufacturing industry, where she found that some indicators (namely funding and clinical performance) were missing from the framework, and needed to be added in order to accurately reflect the CRI level required for the industry. Further noteworthy discoveries from Bezuidenhout (2017) was that the a company can reach

1.2 Description of the Problem

adequate TRL levels without having the required CRI level. Thus, the two are not necessarily correlated and the TRL can take place with the absence of CRI. However CRI cannot take place in the absence of an adequate TRL. From her research it is evident that further research is required into different industries, to see if the framework designed by ARENA (2014b) is applicable to a different range of industries other than the additive manufacturing or renewable energy industries. This thesis aims to build on this research, and seeks to adapt this framework to be used as a fourth industrial revolution benchmark within the start-up domain.

The field being researched is still relatively new. With ARENA (2014a) only introducing the CRI framework in 2014, and Bezuidenhout (2017) following up on this research in 2017. The field is thus still quite new and there is a clear link to Industry 4.0. The field of study is also developing at this early stage of development, and this quite evident when looking at the two studies by Schumacher *et al.* (2016) and Schumacher *et al.* (2019). Within two years, quite big changes were still being considered to their maturity model for assessing Industry 4.0 readiness. These two studies, highlight the continuous development of this field of study, and how the research is still being shaped. This shows that even renowned publication platforms such as CIRP¹, have not established what exactly the benchmark parameters should be in analysing commercialisation. This research thesis, aims to contribute to this continuously changing research environment and to add value to the particular knowledge domain.

1.2 Description of the Problem

1.2.1 Research Problem

As shown by Bezuidenhout (2017)'s research, doubt is cast on whether or not the framework described by ARENA (2014a), can be adapted into other industries, and whether it is industry specific. This leads to the purpose of this research thesis. As we are entering the fourth industrial revolution, time has become a precious commodity which is closely associated with resources. The importance of pursuing industries that have the potential to be commercially viable has become a priority for investors.

¹College International pour la Recherche en Productique, and includes more than 600 members from 50 countries.

1.2 Description of the Problem

The CRI framework previously described, can have the possibility of becoming the required framework to measure this feasibility. It is however unclear how effective the current CRI framework by ARENA (2014a) will be when introduced to the start-up domain, particularly the tech-environment, and how it compares to more traditional tools currently used by start-ups.

Furthermore, to take the current framework of CRI, and deliberate the applicability of the indicators and phases when trying to determine the current as-is state of a company. It is also unclear if the CRI framework needs to be customised for each company, or if a generic methodology can be followed. Currently a disproportionate number of enterprises are not surviving past the 42 month mark stipulated as the commercially sustainable benchmark.

This leads to the research problem at hand. Determining how the framework described by ARENA (2014a) can be adapted to serve as a monitoring framework for tech-start-ups and if it is a feasible methodology in assisting start-ups to determine their current as-is status within the described framework.

For this research problem to be addressed, the CRI framework needs to be tested and deliberated, and through an iterative process, adapted for the start-up domain. Various literature needs to be considered, industry experts are to be consulted, and the practicality of the framework needs to be tested for validation of this thesis.

1.2.2 Scope of Problem

This framework has is yet to be tested on specific companies in technical industries, apart from additive manufacturing and renewable energy. It is unknown whether the framework is applicable to tech-start-ups to determine their commercialisation feasibility. The scope of this research thesis will thus use the existing framework and assess the CRI levels of companies currently enlisted at LaunchLab¹, other incubating organisations, and direct surveying. The research will:

- Make use of existing frameworks to **determine** what components need to be incorporated in the developed framework.
- **Conduct** a literature review of the existing tools and frameworks predominantly used in industry to monitor the progress and growth of start-up enterprises and

¹The incubator for research and development at Stellenbosch University

1.2 Description of the Problem

to **evaluate** if all indicators applicable are covered in the framework proposed by this study.

- By using the CRI framework developed by [ARENA \(2014a\)](#), **develop** an applicable framework and associated tools that can be used to monitor the current as-is state of a start-up. In particular tech related start-ups.
- **Test** the proposed tools to existing enterprises, to determine any value adding contribution by the proposed framework.
- **Analyse** the results of the framework and determine the relevance to the start-up domain, and whether it does indeed monitor the commercial readiness of enterprises.

By using a qualitative analysis on a spectrum of different companies in technical domains, the validity of the framework on several industries can be considered. The framework will aim to test start-up enterprises within the technology domain, the obvious criteria is thus that the company is required to be in a technological associated field. This includes enterprises who consult on technology, apply technology, or whose core business practices are directly related to technology. This criteria will assist in narrowing down the field of choice.

Furthermore, using experts from industry to give contributions via the Delphi technique¹ and do a validating exercise on the findings, the framework will be validated. It should be noted that the scope of this research is limited to the testing of the framework, and not the quantitative gathering of data on it. Even though data is gathered through the means of case studies from South African tech-start-ups, it does not extend to the comparison of this framework against other frameworks.

1.2.3 Aim and Objectives of Research

The aim of this research is to determine if the CRI framework, developed by [ARENA \(2014b\)](#), is applicable to the start-up environment, and adapting the framework to fully function in the domain of start-up enterprises. Furthermore, a more in depth review of the CRI indicators, and levels will be conducted, to determine whether they cover the

¹A technique to obtain information from a panel of experts in an iterative method ([Botterill & Platenkamp, 2014](#)).

1.2 Description of the Problem

needs of each company and their potential to be commercially ready. These aims will be met by following the methodology described in Figure 1.1.

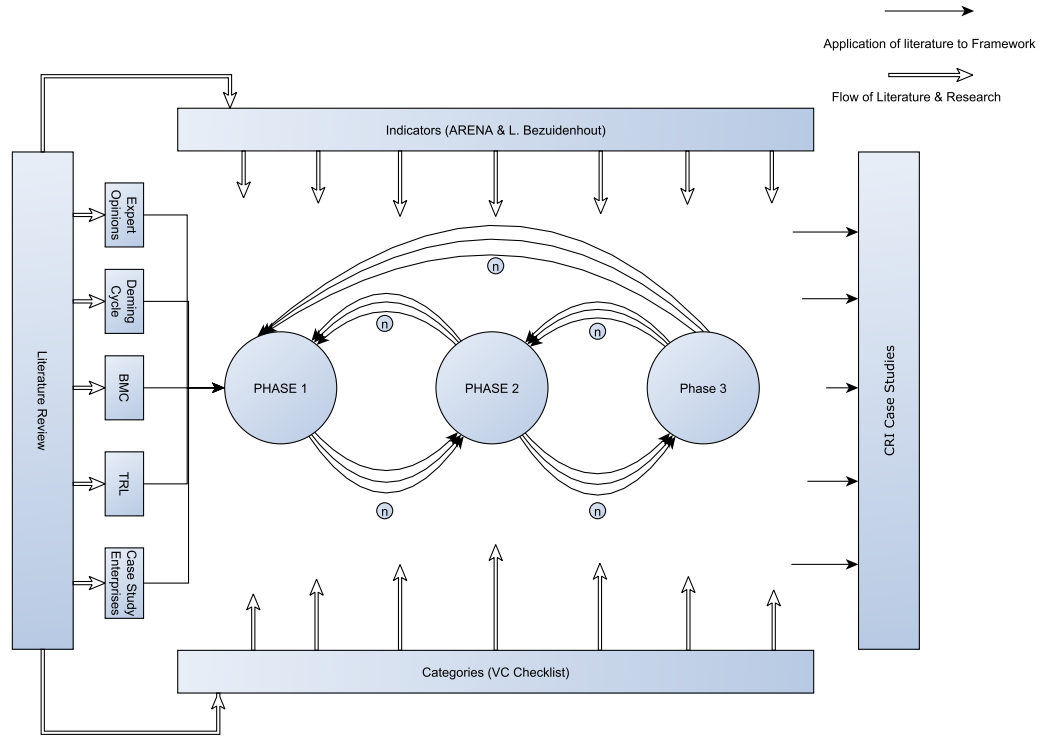


Figure 1.1: Research Methodology

From Figure 1.1, the methodology for this research is derived. Literature is gathered and investigated regarding the start-up domain. From Figure 1.1, the various models, frameworks and tools will be researched to gather the appropriate methodologies required to supplement and investigate the Commercial Readiness Index(CRI). The two main contributors of research in this field, [Bezuidenhout \(2017\)](#) and [ARENA \(2014a\)](#), influences the inputs in deriving the structure of the framework. Methodologically, this research builds on [ARENA \(2014a\)](#) framework design. This can be seen in Chapter 3.

The main body of the framework, is then derived in the Phases, where experts are consulted to assist in the iteration of the framework into the final product that is tested against the case studies at the end of this research. The direct consultation with literature is indicated with '*The Flow of Literature & Research*', and the application of research and experts are indicated with the solid black lines, as '*Application of*

1.2 Description of the Problem

literature to Framework', as seen in Figure 1.1¹. By following this methodology the following objectives are established:

Objective 1: How can existing tools and frameworks be applied to the start-up domain.

Perform a literature review on CRI and other relevant tools and frameworks, whilst **reviewing** possible shortcomings of some of the indicators. This literature review will be conducted with a broad view of CRI, with the goal of understanding what has been achieved in this field and how value can be added to the field. Literature will be **investigated** to establish the applicable concepts to perform the functions showcased in Figure 1.1. The eventual goal should be to generate a methodology for a framework to incorporate with CRI.

Objective 2: Conceptualising a framework that can be evaluated against expert opinions and refined through various iterations.

Experts in the tech start-up domain, need to be consulted to determine where the value adding prospect of the framework is and its shortcomings. By way of these various **iterations** an argument can be formulated to describe the framework, which should be capable of objectively monitoring the current status of an enterprise. By benchmarking the methods and opinions of experts and incubators using the Delphi technique, and working on an iterative methodology, a framework can be conceptualised through the literature.

Objective 3: Verifying the framework through various case studies, to increase the value adding capability.

Document the:

- The **starting point** of each company.
- The **As-Is state** of the company.
- The **To-Be State** of the company. A proposition of a progressed future state.

These three measured states will be compared to the commercialization indicators, through gathering the data on the enterprise, and consulting with an industry expert on the findings. By reviewing these different stages and the risks associated with the

¹Figure 1.1 is introduced in Chapter 1, to give the reader an insight into the methodology of the study.

1.3 Thesis and Literature Methodology

start-up life cycle of each company, and obtaining feedback from experts during the three part iteration process described in Figure 1.1, a greater understanding of the validity of the indicators can be obtained.

Measure the validity of the indicators and if these indicators truly encapsulate the commercialization potential of the company and in particular, their current as-is state. Industry experts play a pivotal role in validating these measurements. Thereafter, **provide** validation on the effectiveness of the framework and its portrayal of the current situation of the enterprise, whilst also assessing the value that could potentially be obtained from exploring the future to-be state. Therefore, only determining the potential of incorporating a to-be state in this framework.

By using the framework provided by ARENA (2014b), the validity of the proposed framework can be evaluated. Missing links can be discovered and value adding contributions to this field of study can be obtained. In this situation the Delphi technique will be imperative in acquiring industry expert validation throughout the process.

1.3 Thesis and Literature Methodology

A clear systematic approach for this research is established. By reference to Figure 1.1, an approach is followed that gathers qualitative data through literature, expert opinions and case studies. By reviewing literature ranging from 1980 to the present, a clear understanding of previous work will be established to use existing knowledge and tools to add value to the findings of this paper.

As shown in Figure 1.1, a range of literature will influence the methodology employed during the case studies, along the derived indicators and categories that constitute the framework. This literature will be used to help validate the results that the CRI framework offers for each individual case study. Thus, a qualitative approach will be employed on each company.

As indicated with the various objectives in Subsection 1.2.3, an iterative approach with the Delphi technique, and a qualitative approach will be employed in the case of each company as seen in Figure 1.1. Thus, a systematic approach to each objective will be developed to substantiate results in a value adding aspect, to show the positives and negatives of the CRI framework, and also to determine if it adequately reflects the desired objectives.

1.4 Research Design

The research is derived from literature, expert interviews via the Delphi technique and case studies. Being a qualitative study, whilst applying the Delphi technique, the research design is further developed as information is gathered. As the various data is gathered and individuals consulted, the research design is developed. Furthermore, correlations between other frameworks and the CRI framework will be dissected to determine the elements that can be improved to determine the commercial readiness of the enterprise. Figure 1.1 shows a good summary of the process to be followed.

1.4.1 Case Study: Industries Assessed

Three case studies are conducted in this research. The data for the case studies are gathered through the means of semi-structured interviews with three different start-up enterprises situated in the technology domain. The entrepreneurs in the various enterprises are presented with a summary of the study, and a background into the tools they will use.

The entrepreneurs, with the guidance of the interviewee are each consulted in a facilitated interview where the various parts of their enterprise is investigated¹. Validation of results is then conducted with the incubator in which these enterprises reside. One of the enterprises is no longer in an incubator and validation of results is done through external consultation.

1.4.2 Delphi Technique Methodology

When considering this research thesis, the written knowledge domain to date is quite limited. This creates a situation where the industry has surpassed literature and ideas have developed faster than the documentation of them. When considering the CRI framework, the two literature pieces directly addressing this topic are ARENA (2014a) and Bezuidenhout (2017). Thus, experts are required to assist in the development and validation of this study. The Delphi technique is identified as a possible solution.

Throughout the study 15 different experts are interviewed, and an additional five individuals from the technology domain are interviewed in their capacity as executives of their respective start-ups. The experts interviewed (duration of around 60 minutes

¹This will be covered in depth in Chapter 5

1.5 Project Roadmap

per interview) were presented with the research to date, documented in this study, and presented with pre-defined open ended questions. The background of each expert is considered, where they are either successful entrepreneurs - ranging from multi-million Rand enterprises to newly funded enterprises, experts heading incubator centres, experts with particular knowledge in the domain of developing frameworks, or venture capitalists who have a background in vetting start-ups.

Experts are individually consulted throughout the writing of the thesis. In particular Chapter 3 to Chapter 5, experts are used to consult on the development of the framework, the validation of the changes recommended to the CRI framework, the incorporation of models, frameworks and tools used in other start-up environments, the refinement in the methodology to conduct case studies, and finally on the case studies themselves. Experts are provided with the literature beforehand, and the proposed framework to the point of interview. The actual contribution of each expert can be seen in the validation summaries in Appendix D and Appendix E.

Finally, as the experts are almost all from different geographical locations, the interview process made use of telephonic, or online conversations. Interviews lasted for approximately an hour each, where the various concepts and ideas were deliberated. This requires the experts to be informed of the study beforehand. The case studies are conducted by executives within the start-ups, and then validated with the incubator in which they currently reside.

1.5 Project Roadmap

Indicated in Figure 1.2, a systematic approach will be used to conduct the research. Following Chapter 1 with its review of the background, objectives, methodology and roadmap. Chapter 2, through Objective 1, provides a more expansive view of the start-up ecosystem. Conducting a thorough literature review, whilst completing Objective 2 (as seen in Subsection 1.2.3) Chapter 3 considers the literature of the CRI framework designed by ARENA (2014a), along with models used by VC's, and the literature in Chapter 2 to investigate the indicators, categories and phases that can be utilised during the case studies, in completion of Objective 2, as seen in Section 1.2.3. Chapter 4 is then initiated, with the view of developing and refining the framework, and defining

the practical aspects of the framework. This chapter strengthens the argument on Objective 1 and 2 respectively.

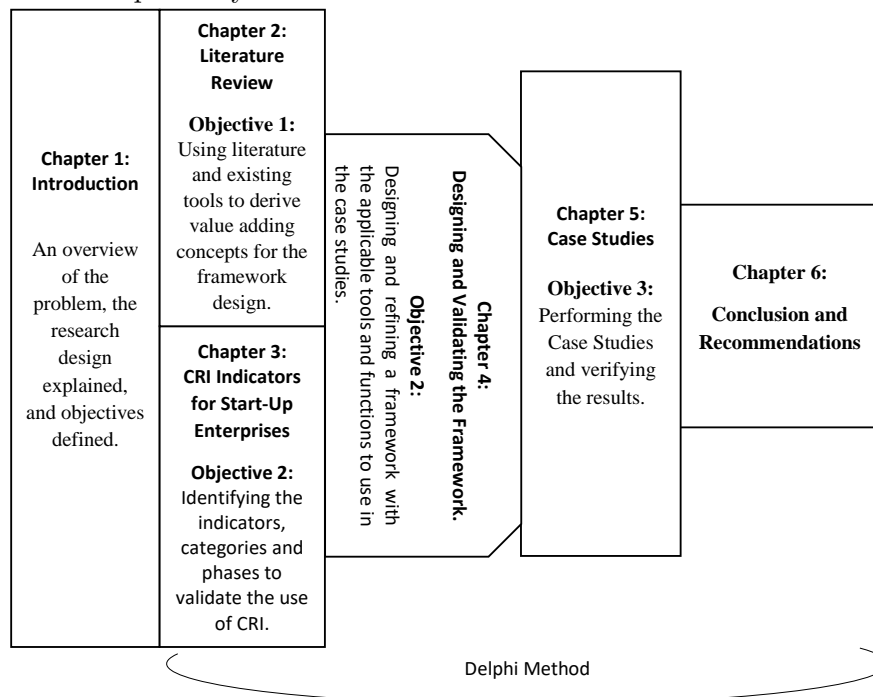


Figure 1.2: Roadmap of Project

Chapter 5 is then conducted to implement and perform the cases studies. Data will be gathered and analysed, and later validated in completion of Objective 3, as described in Section 1.2.3. Finally, Chapter 6 is the conclusion and recommendation for future research.

1.6 Conclusion

The research question is framed around the adaptation of the existing framework described by the research of ARENA (2014a), and whether this framework can be utilised by start-ups in the technology sector to guide and monitor them in the commercialisation process. By using tools applicable to the start-up environment, can the current as-is state be determined to further monitor the enterprise? Three objectives were identified to answer this research question:

1.6 Conclusion

- **Objective 1:** Can existing tools and frameworks be applied to the start-up domain.
- **Objective 2:** Conceptualising a framework that can be evaluated against expert opinions and refined by applying various iterations.
- **Objective 3:** Verifying the framework through various case studies, to increase the value adding capability.

The methodology employed will use available literature, and the Delphi Technique to capture the expert opinions, in an attempt to understand CRI in the context of the start-up domain. Each chapter aims to cover the previously mentioned objectives, and aims to answer the research question. Chapter 1 refers to the roadmap that will be followed throughout the research and sets the objective and research question for the research. Objective 1 is however addressed in Chapter 2 and Chapter 3, where existing tools and frameworks for the start-up domain is investigated. Furthermore, the various definitions are defined to avoid any ambiguity when discussing the concepts.

Objective 2 is addressed partly in Chapter 3 and completely in Chapter 4. The framework is **conceptualised, designed** and **refined** through various iterations via the Delphi Technique. The definitions of the phases are conceptualised and the process flow of the implementation along with its various tools are explained. Finally, objective 3 is addressed in Chapter 5, where three companies are used in a case study to determine their current as-is state. All case studies have a common denominator of the technology sector, and the concept by ARENA (2014a) will be explored outside its previously tested industries.

Chapter 2

Start-up Enterprises

This chapter will consist of a literature review expanding on the ecosystem of the South African entrepreneurial environment and the various methods and frameworks that will be reviewed to build this study's framework. The aspects that constitute this framework are given as conclusion at the end of the chapter.

The objective of this chapter is to gather literature evidence to support the arguments explored in Chapter 3 and Chapter 4. The various existing methods of assisting or guiding start-up enterprises will be explored and be used to derive a framework that specifically fits into the technology start-up domain. The methodology employed whilst gathering the literature was centred on its applicability to this research problem. This included the relevance of the research of the technology sector, the start-up sector and in particular, applicability to the CRI framework developed by ARENA (2014a), as this research builds on the work done by them. Even though not all models, frameworks and tools are included in this literature review, the most popular ones used by incubators such as LaunchLab are.

This chapter explores how the South African entrepreneurial ecosystem fits into the current literature available that is suited to start-ups in the technology domain. At the end of the chapter a conclusion will be drawn on the various methods used, and what aspects of each will be used in the development of the framework. It is also important to note that there is no particular weight associated to any of the frameworks, and they are thus independent of one another. With each method contributing a different value to the framework developed.

2.1 South African Entrepreneurial Ecosystem

2.1 South African Entrepreneurial Ecosystem

When discussing the current state of the South African entrepreneurial environment, it is important to start with the facts. This is due to the discrepancies in definitions of what is required for a start-up and the various myths about it circulating in the South African entrepreneurial ecosystem. It is important to look at the ecosystem holistically and evaluate what its current situation is. This section will explore:

- The definition of a start-up and their supposed success rate;
- The start-up environment of South Africa; and
- The method of monitoring success in start-up enterprises

This will provide clarity of what is meant when discussing the South African entrepreneurial ecosystem and what this thesis is trying to achieve by investigating into the commercialisation of start-up enterprises.

2.1.1 Start-ups and Success

Start-up enterprises are often considered the building blocks of an economy (Kennon, 2017). One of the biggest questions that always reappear with start-up enterprises and entrepreneurs - what can be defined as a start-up and an entrepreneur. According to Ncube (2006) an entrepreneur and a start-up can be defined as, *"anyone who is either starting a business that he or she will wholly own or someone who is managing a business that he or she wholly owns that is less than three and a half years old. The business can be in any economic sector, can be any size and can be formal or informal"*. This simplifies two contentious terms dramatically.

As mentioned, the measured success rates of start-ups differ from study to study, dependent on the source used. According to Merriam-Webster (2018a) a start-up is defined as a fledging business enterprise. However, this is a somewhat vague description and leaves too much room for self-interpretation, which is often the problem when defining the parameters of measuring success. In essence, a start-up is a SMME waiting to be established. A study was conducted by Kennon (2017) where a comprehensive compilation of the various definitions and aspects of SMME's were collected and interpreted. According to Kennon (2017) and Herrington & Kew (2013) less than 75%

2.1 South African Entrepreneurial Ecosystem

of SMME's become established. Defining this is whether they survive the 42-month mark of existence, this links in well with the definition previously provided by [Ncube \(2006\)](#). This described scenario of 42-months, is also the definition used throughout this study when considering what is a start-up. [Small-Enterprise-Development-Agency \(2018\)](#) similarly states that the most important time for a start-up SMME is during the first two to three years of its existence.

This is also emphasised by [Cusumano \(2009\)](#), who uses MIT as an example. Their current alumni base had more than 26 000 active enterprises that generate a revenue upwards of \$2 trillion as of 2006. However only 30% of the enterprises started actually succeeded (more than 66 000 failed) ([Cusumano, 2009](#)). Furthermore, [Cusumano \(2009\)](#) says that according to the National Venture Capital Association more than 75% of start-ups succeed. [Cusumano \(2009\)](#) however points out that when stricter evaluations are used, as with a recent Harvard Business School study, the figures are in the range of 25%, and when even stricter definitions on return on capital are used it can be anything between 1-5%. [Albats & Fiegenbaum \(2016\)](#) states that only one in ten enterprises actually make it. The majority of figures, and with stricter definitions range between 10-25% success rate. This shows the inconsistencies in different sources when it comes to evaluating successful start-up ventures. The definitions become really important.

Various other factors contribute to probability of the start-up eventually succeeding or not. For example, it is clear that there are major risks when moving from the idea to production or service ([Kassicieh & Walsh, 2004](#)). These types of risks need to be mitigated through novel ideas. [Kassicieh & Walsh \(2004\)](#) also refers to the impact disruptive technologies have on the start-up environment and how they influence price and even the 'need' of the industry. The key element to take from this is to ensure that the risks are properly managed to ensure a higher probability of success for a start-up enterprise. It is also interesting to note that according to [Roberts *et al.* \(2016\)](#), when considering successful and less successful incubators, the more successful start-ups are more than 25% more likely to talk about the effects of good mentorship and guidance.

2.1.2 The South African Entrepreneurial Ecosystem

The need to cultivate and assist the environment for start-ups to be successful has never been as urgent as it is now. According to [Statistics South Africa \(2016\)](#) the unemployment rate for the South African population ranges around 27.5% and increasing. What

2.1 South African Entrepreneurial Ecosystem

makes this even more troublesome is the fact that the absorption rate of the work force has remained consistent at 43.1%, which means that the South African labour market is not compensating to take these unemployed individuals into market. [Statistics South Africa \(2016\)](#) shows that the situation is even more dire when considering youth. With youth considered between the ages of 15-34 years of age, 39% of the youth are currently not involved in employment, education or training. This means more than one in three young South Africans are currently disengaged with the economy. It is also suggested that more than 50% of youth in South Africa will find difficulty entering the labour market. It has never been more important to cultivate employers rather than just employees. [GEDI \(2017\)](#) refers to this, and states that more South Africans need to be incorporated into the formal economy to ensure sustainable economic growth. Not only this, but [GEDI \(2017\)](#) particularly referred not to just creating more entrepreneurs, but rather cultivating existing entrepreneurs to be more innovative and growth-orientated.

[Small-Enterprise-Development-Agency \(2018\)](#) makes these statistics even more worrisome, with SMME's contracting by more than 15% in recent years. If SMME's are the building blocks of the economy, such a reduction during high unemployment figures is problematic for the South African economy. The [Small-Enterprise-Development-Agency \(2018\)](#) also showed that the number of individuals starting new enterprises, who had no education (or less than primary education) has increased sharply over the past year. This is a good indicator to state that more emphasis needs to be put on creating the conditions where more entrepreneurs can succeed regardless of previous education.

According to [GEDI \(2017\)](#) entrepreneurship is the key driver to economic growth. This is further explained by [Kenyon \(2017\)](#) where it is shown that SMME's contribute upwards of 45% to the annual GDP of the country. It is thus pivotal that this sector succeeds and grow significantly. [GEDI \(2017\)](#) states that their research on the South African entrepreneurial ecosystem aims to achieve:

- To build on work and research already employed and strive to increase the start-ups entrepreneurial skills and identify the regulations hindering that progress.
- Looking for methods to reform the financing of start-ups and ensure policy change to increase the probability of the entrepreneur being funded.

2.1 South African Entrepreneurial Ecosystem

- Building a global brand around the South African entrepreneurial ecosystem to increase digital access for all.

From these, the first and second items are important for this study. Continuously building on existing research and combining various existing methods and frameworks to increase the probability of success for the start-up enterprise. And increasing the probability of receiving funding or generating the funds themselves.

McKinsey (2016) highlights the intense predicted growth that Africa will experience leading up to 2025. With the current projected growth rate, the continent of Africa will have business opportunities to the value \$5.6 trillion (McKinsey, 2016). This is exciting news for entrepreneurs, especially considering McKinsey (2016) stating that new businesses need to be established for the sustainability of this growth. McKinsey (2016) further explores the fact that based on current predicted growth rate, North Africa and South Africa will collectively spend an additional \$174 billion per year by 2025. This showcases the vast opportunities for entrepreneurs in the current African market.

Even though various barriers exist for start-ups, there are a number of methods for start-up enterprises to participate in the SMME's economy. South Africa has hundreds of incubators looking to assist acceleration of the start-up enterprise, various mentorship programmes for start-ups, and various government and private funding agencies. One example is the Industrial Development Corporation (2018), which funded approximately R16.7 billion in 2018. By linking start-up enterprises to these type of agencies, the probability of success can drastically increase.

Campos & Gassier (2017) analysed specific policies that could also pose as barriers to entry for entrepreneurs. According to Campos & Gassier (2017) B-BBEE sometimes does have the effect in South Africa of not creating the incentive for corporate employees to create their own businesses and move into the job creation domain, rather than employed. Campos & Gassier (2017) further states that B-BBEE legislation is not entrepreneur orientated, but rather created the scenario where; "90% of South African would prefer to have a steady job rather than start their own company". This creates a significant barrier to entry for cultivating more entrepreneurs through policy design.

McKinsey (2016) also identifies six different government priorities in Africa to drive economic growth,

2.1 South African Entrepreneurial Ecosystem

- Mobilise domestic resources;
- Aggressively diversify economies;
- Accelerate infrastructure development;
- Deepen regional development;
- **Create tomorrow's talent**; and
- Ensure healthy urbanisation.

From these six priorities identified by [McKinsey \(2016\)](#), this thesis will particularly focus on "Create tomorrow's talent", as this speaks directly into assisting entrepreneurs in finding success. That said, to achieve the other five priorities, entrepreneurship will be at the core of this effort.

2.1.3 Monitoring the Start-up Domain

Monitoring the success of start-ups is a fundamental aspect of improving the condition in which they operate. According to [Cusumano \(2009\)](#) there are eight things to consider when evaluating whether an enterprise is a good investment or not. These include ([Cusumano, 2009](#)):

1. **A strong management team** - One of the primary reasons individuals invest in entrepreneurs is the people. This was also re-iterated by industry expert C. van Schalkwyk (*C. van Schalkwyk, personal communication, June 02, 2018*), where he states that people invest in people rather than ideas.
2. **An attractive market** - The market size should be adequately large enough for the start-up to be sustainable and the barriers to entry should be large enough to prevent other competitors from entering.
3. **A compelling new product or service** - Being able to provide quantitative and qualitative data reflecting the need and demand for the product or service.
4. **Strong evidence of customer interest** - Being able to showcase that actual customers want the product or service and their desire or need for it.

2.1 South African Entrepreneurial Ecosystem

5. **Overcoming the credibility gap** - One of the most common reasons for failure under start-ups. Customers need to be convinced of the credibility of the enterprise to deliver consistently and accurately as possible.
6. **Demonstrating early growth and profit potential** - To showcase that there is money to be made. In trying to avoid extensive research and development costs the enterprise can quell the fears of investors and partners.
7. **Flexibility in strategy and technology** - The desired result is usually not the initially planned one. Thus, start-ups need to be able to pivot strategy and technology through trial and error, with better results each time.
8. **Potential for a large investor pay-off** - Investors need to see real return on investment, and this needs to be reflected in the business plan.

These aspects identified by [Cusumano \(2009\)](#) are important to enter the market and need to be explored in unison with other methodologies. [Albats & Fiegenbaum \(2016\)](#) divides the manner of assessing a start-up enterprises funding roadmap into different phases. These different phases include ([Albats & Fiegenbaum, 2016](#)):

1. Self-evaluation of idea.
2. Co-founder - when the entrepreneur is stuck, the individual should be the first external view on the idea.
3. Family and Friends - possibility of assisting with needed resources.
4. Angel Investors - makes an estimation of what the company is worth and invests accordingly.
5. VC stage - the first prototype is ready. Product or service is ready for roll out or acceleration.
6. Post start-up - the enterprise lands Initial Public Offering (IPO).

The first five phases of [Albats & Fiegenbaum \(2016\)](#) is the investigated area that will be considered in this thesis. These ideas will be **considered** (along with the following chapter where literature is investigated) in the creation of the framework for this thesis.

2.2 Models and Frameworks Engaged with for Start-up Enterprises

2.2 Models and Frameworks Engaged with for Start-up Enterprises

This section will explore various models and frameworks that play a fundamental role in assisting start-up enterprises in understanding their various functions, and systematically improving their probability of achieving success. The various methodologies and frameworks will be discussed and reviewed to establish how they will be used in this thesis.

2.2.1 Technology Readiness Levels

Technology readiness levels (TRL) is not a new concept and has been used globally all the way back to the moon landing in 1974 (ARENA, 2014a). It has become evident however that even though a company is TRL ready, it does not necessarily mean that they are commercially ready (Bezuidenhout, 2017). It however remains important to still understand and utilise this concept to ensure that the technology aspect of a start-up enterprise is on the desired level to be commercialised. This section will therefore explore TRL and investigate how it should be incorporated into a CRI framework.

TRL is defined by ARENA (2014b) as, *"TRL is a globally accepted benchmarking tool for tracking progress and supporting development of a specific technology through the early stages of the technology development chain"*. Mankins (1995) has a similar definition, *"TRLs are a systematic metric/measurement system that supports assessments of the maturity of a particular technology and the consistent comparison of maturity between different types of technology."* The definitions remain consistent throughout, and the variations in wording is no longer disputed. Since it is measured in the early stages of development, it can be considered as the fundamental building blocks of an enterprise.

To give context of the origin of TRL, Mankins (2009) provides a good historical summary of how it originated. He explains how in the mid 1970's the National Aeronautics and Space Administration (NASA) introduced the TRL concept in an attempt to *"allow more effective assessment of, and communication regarding the maturity of new technologies"*. This later became mainstream practice when evaluating and monitoring the maturity of a technology.

2.2 Models and Frameworks Engaged with for Start-up Enterprises

The different levels of TRL are now established and agreed on globally. It consists of nine levels, with Mankins (1995) and ARENA (2014a) used to explain the concept, as seen in Figure 2.1. These nine levels are important to note when analysing any new or emerging technologies, as it assists the technology developer to determine the as-is state and the desired to-be state and can be viewed in the context of Figure 2.1. According to Mankins (2009) this also lends great assistance in determining the point of the life cycle in which the technology currently resides.

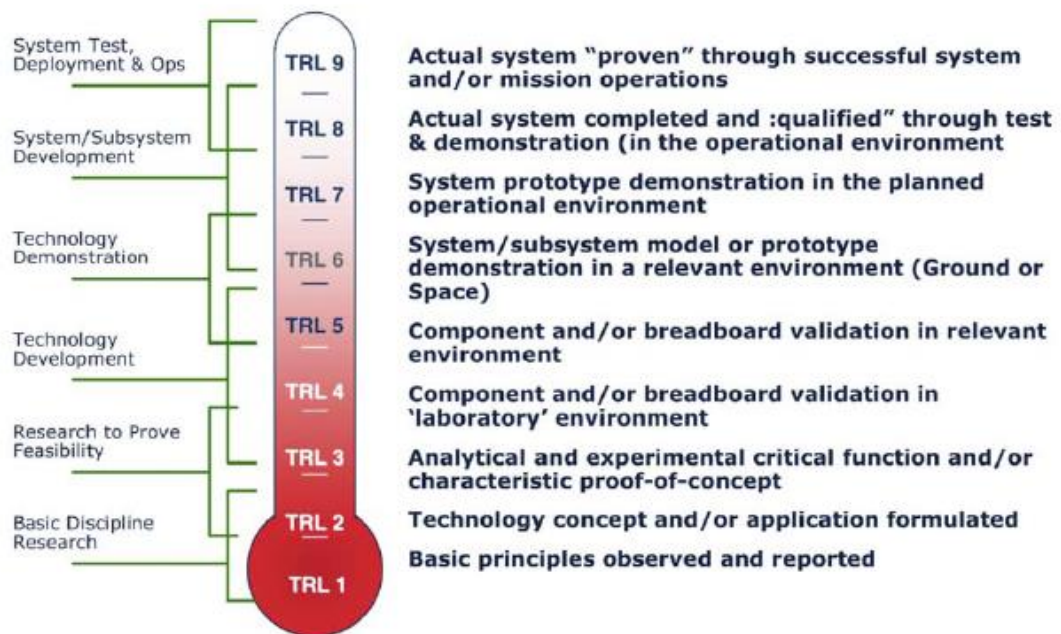


Figure 2.1: The various levels of TRL and the definitions accompanied by them (Mankins, 2009).

According to US department of Defence (2011) there are limitations when using TRL. This is also explained by Bezuidenhout (2017), where she states that by simply 'ticking' the boxes of being TRL ready, the technology will not necessarily succeed in commercialisation. There is however a correlation which can be deduced, that the more ready a technology is, the likelier the probability that the technology will be implementable on a commercial level (US department of Defence, 2011). This does however not necessarily mean that the technology will succeed commercially if it is TRL ready, as organisations like NASA are usually technologically ahead of industry, the early adopters on a technology acceptance scale could still not be ready for the com-

2.2 Models and Frameworks Engaged with for Start-up Enterprises

mercial use of the particular technology. This could lead to low market penetration, or marginal proposed market share of the industry (Lu *et al.*, 2005). Saying this, the importance of understanding TRL, remains a crucial component of moving to commercial readiness. This study is however not focussed on TRL, and this section is merely provided to give context to the principles of TRL and how it affects the thought process when considering commercial readiness.

2.2.2 Global Entrepreneurship and Development Institute (GEDI) Model

When looking at the South African entrepreneurial ecosystem it is promising to see that as far as the African continent is concerned South Africa ranks second only to Botswana in the Global Entrepreneurship Index (GEI). However, we rank a mere 57th worldwide (GEDI, 2017). The GEDI (2019) tool shows how the South African entrepreneurial ecosystem compares to Botswana, the top ranked GEI country in Africa, the USA who is renowned for its entrepreneurial drive, and China, another member of the BRICS nations and also at the forefront of the entrepreneurial drive. This can be seen in Figure 2.2 where the comparison between the four countries is outlined. The 14 different indicators can also be seen in Figure 2.2. This figure helps one to understand where the shortcomings are in the South African entrepreneurial ecosystem.

As seen with the *green* the United States is competitive in the entrepreneurial domain, with Networking the only lacking indicator - the United States has a GEI rating of 83.6. That is the highest figure globally. With the colour *black* Botswana is the highest ranked African country with a GEI ranking of 34.9 and China, with the colour *orange* has a ranking of 41.1. South Africa, with the colour *blue* has a GEI ranking of 32.9. This shows the growth that South Africa still requires to cultivate an environment where start-ups can be successful. From Figure 2.2 some of the more important areas that need improvement in the South African ecosystem can be identified and explained.

1. **Start-up skills** - This indicates that South Africa has a lack of 'know how' when it comes to starting up new ventures. Significant effort need to be concentrated on cultivating the environment where start-ups can thrive and be equipped with the necessary skills to be successful. From GEDI (2017) one can see that this

2.2 Models and Frameworks Engaged with for Start-up Enterprises

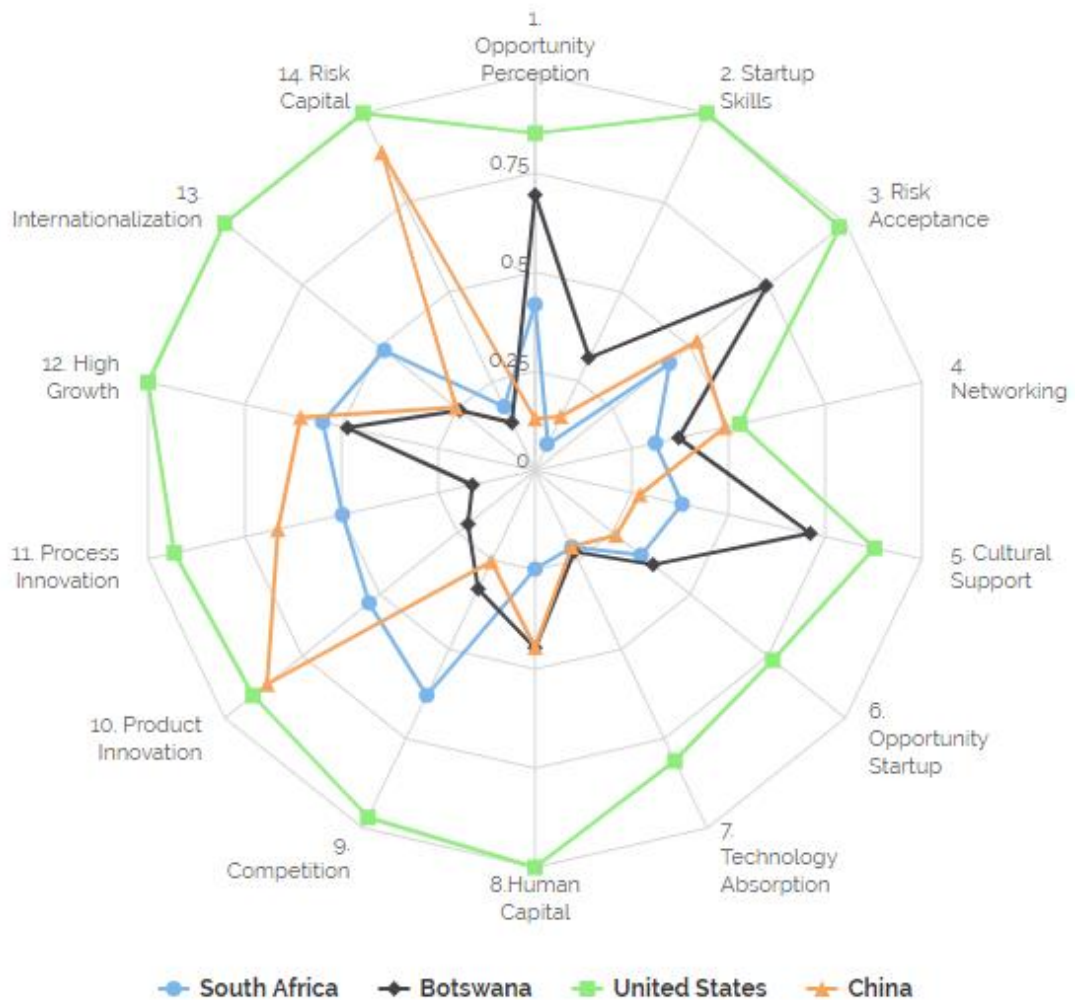


Figure 2.2: GEDI rating of entrepreneurial ecosystem compared to industry standards (GEDI, 2019).

score is made up out of a 0.2 rating for education and a 0.49 for skill perception (out of 1.0). This gives a combined score of 0.07 for achievement in start-up skills.

- 2. Technology absorption** - Even though this is similar to China and Botswana, it is unusually low compared to the average of the GEDI listed countries. This indicates that South Africa has a low capability of incorporating or adapting technologies from the global technology pool. According to GEDI (2017) the weakness from this indicator is more on an individual level than an institutional level. The rating for technology absorption is 0.22.

2.2 Models and Frameworks Engaged with for Start-up Enterprises

3. **Human Capital** - this refers to the below average skills, knowledge and experience that the normal South African entrepreneur has and offers to the enterprise. According to **GEDI (2017)** this is another good method to understand if the entrepreneur has the skills and education to initiate a start-up. The weakest aspect of this indicator is staff training. Human capital has a rating of 0.23.

4. **Risk Capital** - When consulting industry experts, it is evident that the perception is that South Africans are really risk-averse investors (*D. Strauss, personal communication, June 09, 2018*). This is further shown by Figure 2.2, where risk capital is extremely low. From **GEDI (2017)** it is seen that risk capital is compiled from a rating of 0.86 for depth of capital market and an extremely low score of 0.33 for informal investment. This derives to a score of 0.21 for risk capital. China on the other hand scores really high on two aspects, namely risk capital and product innovation. The idea can be explored that more risk capital leads to more product innovation. Taking it back to the South African context, more risk capital will be required to ensure greater innovation and more innovative results to product development.

This can be further elaborated on, and the full analysis can be seen in Appendix B in Figure B.1, where the matrix comparison is shown for each individual indicator and analysed via specific colours. With **red** representing a dire need for change, **yellow** representing room for improvement, and **blue** representing the acceptable and excellent indicators.

In Figure B.2, also Appendix B, the indicators that need significant improvement are identified. The percentages are normalised relative figures to the global average. The three big areas include (**GEDI, 2019**):

- **Start-up Skills** - Needs an improvement in effort of 63%.
- **Technology Absorption** - Needs an improvement in effort of 11%.
- **Risk Capital** - Needs an improvement in effort of 26%.

It is not all doom and gloom however. From the results of the study conducted by **GEDI (2017)** various indicators of the South African entrepreneurial economy is doing rather well in comparison with the rest of the world. The country is doing particularly

2.2 Models and Frameworks Engaged with for Start-up Enterprises

well in entrepreneurial aspirations, high growth, innovation, and internationalisation (GEDI, 2017). Our depth of capital markets, new products, and new technologies are all in the top 20% of all countries ranked. Since our GEI (Global Entrepreneurship Index) ranking is an average 0.33, (GEDI, 2017) states that South African Institutions are the biggest hurdle for entrepreneurs, since there are not enough adequate incentives created for entrepreneurship. GEDI (2017) further recommends that should South Africa improve their education system, it would impact the entrepreneurial ecosystem dramatically. As South Africans are able to innovate and create high-growth businesses, they have certain fundamentals already in place GEDI (2017).

2.2.3 Business Model Canvas

The Business Model Canvas (BMC) is one of the most utilised and recommended tools for start-up enterprises. This model was originally designed by Osterwalder (Enkel, 2013). The BMC can be seen in Figure 2.3.

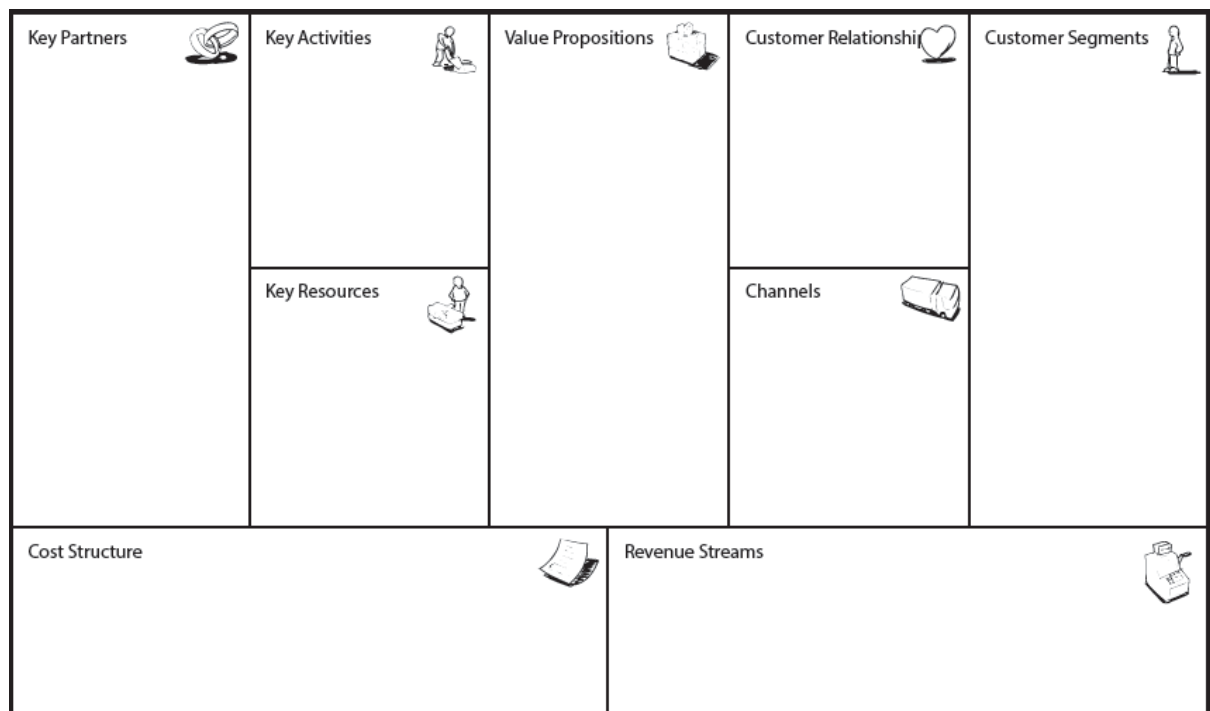


Figure 2.3: Business Model Canvas Example (Cowan, 2019).

The BMC has three priorities (Cowan, 2019):

2.2 Models and Frameworks Engaged with for Start-up Enterprises

- **Focus** - Simplifying the way in which the business is portrayed, and how the individual using the tool can analyse their business.
- **Flexibility** - Because it is a one-page exercise it is relatively easy to adjust the model and make it work as required.
- **Transparency** - It simplifies the way in which others in the organisation understand the enterprise and how to communicate the core business functions.

The BMC itself is divided into nine segments that are approached sequentially with the goal of better understanding and analysing the enterprise (Cowan, 2019). The right side of the tool in Figure 2.3 (right of *value proposition*) refers to the product offering and customer segments of the enterprise (Cowan, 2019). The left side of the tool seen in Figure 2.3 (left of *value proposition*) refers to the infrastructure segments of the enterprise. All these segments include (Cowan, 2019):

1. **Customer Segments** - This addresses the question of who the customers are. How do they perceive the service or product, how they feel, and how they react. This consists of three components. Understanding the *segment dimensions* and how the market looks, Understanding the *segment composition* of the customers on a macro- and micro-level, and finally the customer *problems, needs, and possible alternatives* to your industry.
2. **Value Propositions** - The compelling aspect of the enterprises' service or goods. Why do customers purchase this product? By identifying the greatest value proposition to the customer, the enterprise can directly address a specific need. These value propositions can be linked directly to the customer segments.
3. **Channels** - How is the value proposition promoted, moved, and sold? This is the logistical arm of the BMC, and should indicate how the different supply chains interact with one another.
4. **Customer Relationships** - How does the enterprise interact with its customers? This includes all the questions that have an effect on how the enterprise interacts and deals with customers. How problems are solved and what services or products are offered to improve customer experience.

2.2 Models and Frameworks Engaged with for Start-up Enterprises

5. **Revenue Streams** - How the business earns revenue from its value proposition. This should indicate the direct link of how revenue is generated by the value proposition and customers.
6. **Key Activities** - What are the unique things that the enterprise does to deliver its proposed proposition? These include all activities the enterprise partakes in to ensure that the value proposition can be delivered. It is important to link these activities to the respective value propositions.
7. **Key Resources** - The strategic assets the enterprise requires to ensure competitiveness. There are three categories for key resources that need to be considered in the BMC: *product* differentiated product of some sorts, *scope* - creation of some synergy around a specific customer segment, and *infrastructure* achieving economies of scale in a specific, highly repeatable area. Dependent on the type of enterprise, one of these should be adopted.
8. **Key Partnerships** - Identifying partnerships with beneficial value to the enterprise. Ensuring that key partnerships are linked directly to key activities.
9. **Cost Structure** - Identifying the major cost drivers to the enterprise and their link with revenue generation. It needs to be ensured that these costs are contributing to the value proposition, and identifying the fixed and variable costs of the enterprise.

The BMC is an easy tool utilised by millions of entrepreneurs world-wide. There are however limitations with the BMC, including the extreme emphasis on value proposition, and lack of problem identification (King, 2017). The BMC does play a significant role in assisting entrepreneurs in understanding their enterprises, but lacks the depth to develop more intricate business models. Also, without proper guidance the BMC can prove detrimental to a start-up enterprise as it is a linear problem solving method and does not compensate for the iterative nature of the technology start-up domain. This is re-iterated by Keane *et al.* (2018), who has identified that the linear nature of the BMC could prove challenging along with cognitive biases of the entrepreneur using the BMC. That said, this study will explore methods of incorporating the BMC into a more in depth iterative process which functions are more multi-dimensional.

2.2 Models and Frameworks Engaged with for Start-up Enterprises

2.2.4 Commercial Readiness Index (CRI) Model

This section will investigate what CRI is, and why it was developed. A brief look at why this framework is applicable to this study will briefly be discussed, but an elaboration of this will be covered in Chapter 3. The CRI framework was developed by the Australian Renewable Energy Agency (ARENA) that aimed to complement the existing TRL's by assessing the commercial maturity over the specific indicators developed by ARENA (De Jager, 2017). The original model developed by ARENA (2014a) was specifically designed to assist with identifying the commercial readiness of the renewable energy sector. It has since been adapted for the additive manufacturing industry by Bezuidenhout (2017). This study will further explore if this framework can be adapted to the technology start-up environment.

From De Jager (2017), it was identified that CRI could be used to influence policy-makers in breaking down barriers that prevented renewable energy technologies from being commercialised. De Jager (2017) further states that "CRI moves beyond the proof-of-function measured by the TRLs towards an evaluation of the commercial readiness". The difference between where TRL and CRI functions on the technology development roadmap can be seen in Figure 2.4.

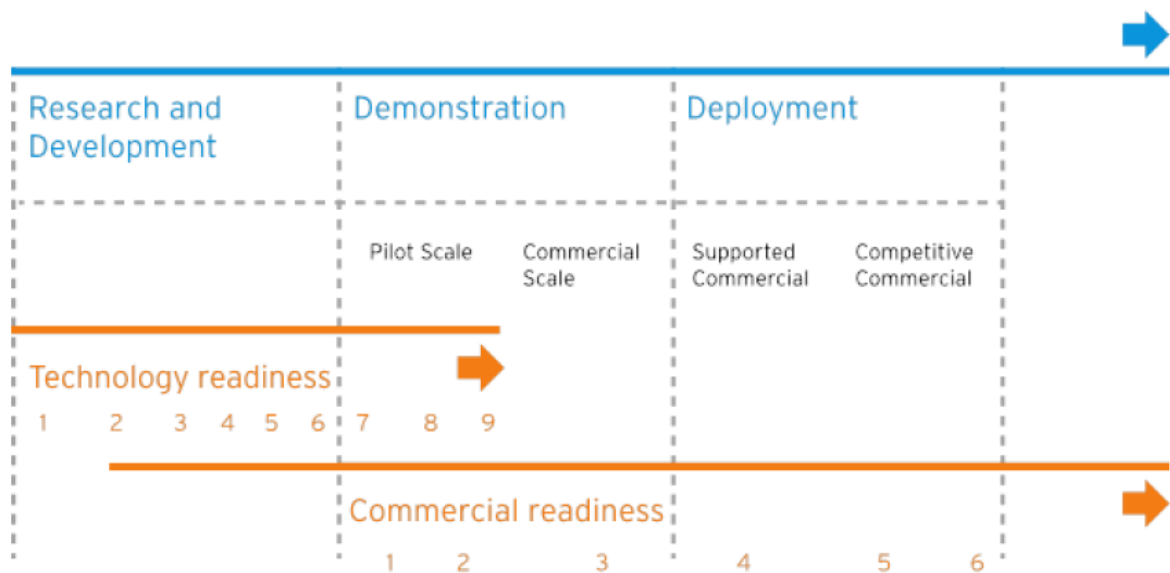


Figure 2.4: TRL and CRI mapped on the technology development chain (ARENA, 2014a).

2.2 Models and Frameworks Engaged with for Start-up Enterprises

These findings are divided into various levels and the definitions can be found in Table A.1 in Appendix A. These definitions have been adapted to suit a more global understanding of CRI and be equipped to function in an industry outside of the renewable energy one. Furthermore, a visual representation of how CRI digs deeper into the commercial viability of a technology than TRL can, can be seen in Figure 2.5. From Figure 2.5 it can be seen that there are limitations to TRL when considering the commercial readiness of the technology developed. Just because something is a novel or unique product or service, does not necessarily mean that it is a commercially viable product or service that can be utilised with the idea of making a sustainable enterprise. From Figure 2.5 it is seen that the first two levels of commercial readiness covers the entirety of the TRL levels. This leads to the question of the adequacy of TRL to assist the user with the tool to determine the viability of the technology developed and its maturity. However, this does not discount the importance of TRL, but rather states the importance of a supplementing tool and framework that can assist the user to get a more in depth analysis of their industry (De Jager, 2017).

De Jager (2017) identifies certain advantages that the CRI model brings as a tool. These include:

- The CRI recognises the need for considering different factors that influence the commercial readiness and market readiness.
- The CRI assists the user in identifying the main barriers that need to be addressed.
- The CRI can assist the user with the scaling process.

De Jager (2017) however does identify the shortcomings of CRI, of which includes the prioritisation of key areas and ensuring that key aspects are addressed. Bezuidenhout (2017) also came to the conclusion of adding additional indicators, with more specifically identifying the importance of *Funding* and *Clinical Performance* (in the medical industry). This leads to the question of which other indicators might be missing and could potentially add value to the user of the tool and framework. It also shows that CRI is still a new and developing technique in industry assessment. From

2.2 Models and Frameworks Engaged with for Start-up Enterprises

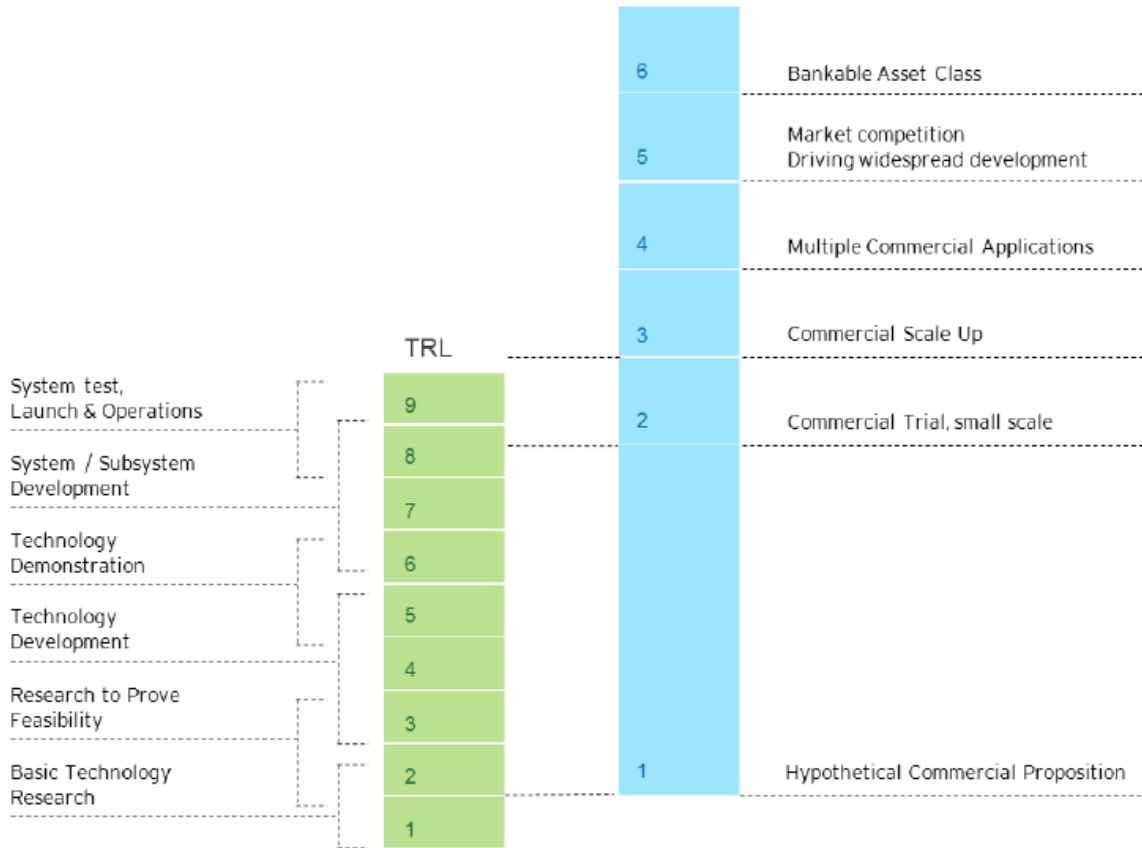


Figure 2.5: A visual depiction of the CRI levels in comparison to the TRL levels (ARENA, 2014a)

ARENA (2014a), it is evident that this technique needs to be adapted to suit the various industries in the technology sector. Chapter 3 will investigate how this can be achieved.

2.2.5 Deming Cycle

The importance of continuous improvement is consistently re-iterated throughout industrial engineering practices. Various tools are used to assist in this process, with the Deming Cycle being one such tool. From ISIXSIGMA (2019), the Deming Cycle is defined as, "a continuous quality improvement model consisting out of a logical sequence of four repetitive steps for continuous improvement and learning: Plan, Do, Check (Study) and Act". Business processes should be measured and analysed to minimise variations in the required product an enterprise wants to deliver to customers

2.2 Models and Frameworks Engaged with for Start-up Enterprises

(Balanced Scorecard Institute, 2019). By placing business processes in a continuous feedback loop, managers can identify and change parts of the process that need improvements (Balanced Scorecard Institute, 2019). The four elements of this feedback loop are *Plan*, *Do*, *Study*, and *Act* (Henshall, 2017). These elements are defined as (ISIXSIGMA, 2019):

- **Plan** - Planning for possible changes, and analyse and predict the results.
- **Do** - Execute the plan, take small steps with controlled circumstances.
- **Study** - Check and study the results.
- **Act** - Take the necessary actions to standardise or improve results.

The important aspect of this methodology is to ensure a systematic approach to continuous improvement, and provide structure to an iterative process. When designing this framework, it is important to adopt a calculated approach to iterations. The Deming Cycle is an easy way to approach these iterations and can be seen in Figure 2.6.

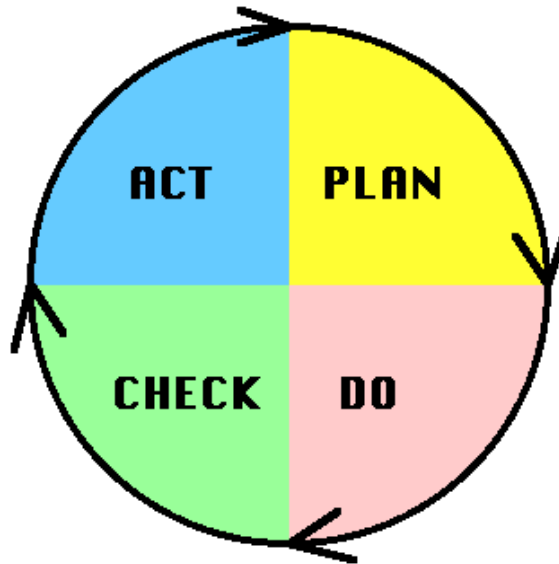


Figure 2.6: The Deming Cycle methodology for the iteration process for continuous improvement (Balanced Scorecard Institute, 2019).

There are various advantages in using the Deming Cycle as a method for continuous improvement. With the problem-solving process, project management, and continuous

2.2 Models and Frameworks Engaged with for Start-up Enterprises

development being cited as some of the most crucial benefits for using this continuous improvement method (ISIXSIGMA, 2019).

2.2.6 Venture Capitalists Checklist

It has become standard practice for venture capitalist firms to have a process in place to perform the due diligence required to ensure the risk of investment is properly managed. Venture capitalism has become an important industry in assisting and accelerating start-up industries in the modern era. The process of performing due diligence for a potential investment candidate is however a time-consuming activity, with an estimated fifty hours spent on due diligence before an investment decision is made (Smart *et al.*, 2000). The type of individual working for a venture capitalist company also varies significantly, with the majority of the senior management having nearly a decade of industry experience before pursuing such a career (Smart *et al.*, 2000).

Background & Ownership	Strategy	Product & Technical
Operations	Marketing	Sales
Finances	Human Resources	Leadership & Soft Skills
Legal	Intellectual Property	Environmental, Social, & Governance

Figure 2.7: A list of categories derived by VC's when performing their due diligence (LaunchLab, 2018).

Smart *et al.* (2000) also indicates how diverse the selection criteria is for VC's, and how subjective each decision is based on their own preferences. From Enkel (2013) the

2.2 Models and Frameworks Engaged with for Start-up Enterprises

due diligence process is broken down into seven categories; *Team, Technology, Finance, Legal, Tax, and Business Model*. From this it is evident that it can become a lengthy process, especially if some of these categories are not yet documented or identified by the entrepreneur (Enkel, 2013). It is important to note that even though South Africa is considered to have a risk averse investment culture (seen in Subsection 2.2.2), various private and public institutions do have funds available for investment - the Industrial Development Corporation (2018) had distributed R15.4 billion in funding.

When surveying the web or approaching VC's on their specific criteria for investing or not investing in an enterprise, one is nearly always referred to the VC check list. The VC check list is a document containing various categories as to what industry experts believe to be the necessities to even consider an enterprise. Various check lists were considered during this study, including those from: Ansarada (2019), Fintelligent (2019), LaunchLab (2018), and NRI Investment Platform (2019). All these sources were considered and a summary of the various categories can be seen in Figure 2.7, various sub-categories are also mentioned, although these will only be explored in Chapter 3. These various VC check lists are a good indication to the important core elements monitored by investors and should be thoroughly explored.

2.2.7 Enterprise Engineering Process

There are various methods of designing or starting new enterprises, with one such method the *enterprise engineering process*. According to du Preez *et al.* (2015) there are two types of design issues that can be encountered by an enterprise engineer; the Greenfield design and re-design. The Greenfield design pertains to the entire new design of an enterprise and re-design pertains to parts of an enterprise that needs to be re-engineered (du Preez *et al.*, 2015). These are the two scenarios one would expect to encounter when it comes to a start-up enterprise, and will be explored in more depth.

The basic principle of the enterprise engineering process is to take an enterprise **from point A to point B**. Where **point A** is the current As-Is state, and **point B** represents the desired To-Be state (du Preez *et al.*, 2015). This systematic thought process allows the user to define the three different phases of the enterprise and assists them on how to determine the move from the current As-Is to To-Be state and the thought process (paired with strategies) on how to get there (du Preez *et al.*, 2015). The importance of the systematic approach is further exemplified by Fossland

2.2 Models and Frameworks Engaged with for Start-up Enterprises

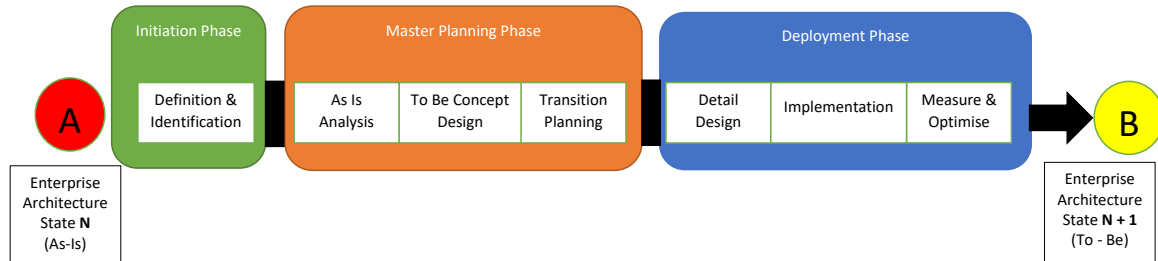


Figure 2.8: A typical enterprise engineering process for designing or re-designing an enterprise (du Preez *et al.*, 2015).

& Krogstie (2015), where they emphasise how this practise simplifies the understanding of enterprise engineering and how it assists the thought process of developing strategies to achieve the To-Be state. From Figure 2.8, the three phases of enterprise engineering can be observed. These phases are described as (du Preez *et al.*, 2015):

- **Phase 1 - Initiation Phase.** Where the conceptualisation of the enterprise and the operational aspects are developed. This highlights the fundamental problems and opportunities of the enterprise and strive to establish the value proposition.
- **Phase 2 - Master Planning Phase.** The enterprise strives to develop potential solutions for the various problems and opportunities and establish strategy for the enterprise. The focus is on establishing the As-Is state and the ideal To-Be state of the enterprise, with the idea of developing the core strategies to move the enterprise in that direction.
- **Phase 3 - Deployment Phase.** The focus is on implementing the proposed solutions recommended and eventually achieving the ideal To-Be state proposed.

The principles discussed above are a key component in the development of an enterprise, and shares similarities to the method described by ARENA (2014a) in Subsection 2.2.4. These similarities need to be further explored to understand the sequential nature of starting an enterprise.

2.2.8 Incubators and Accelerators

Incubators or accelerators are now a mainstream activity across South Africa and globally. With the idea of these types of organisations made famous by areas like Silicon

2.2 Models and Frameworks Engaged with for Start-up Enterprises

Valley. All of these institutions, be it incubators or accelerators have a varying success factor in terms of results with their start-up enterprises (Roberts *et al.*, 2016). These differences can be seen in Figure 2.9.

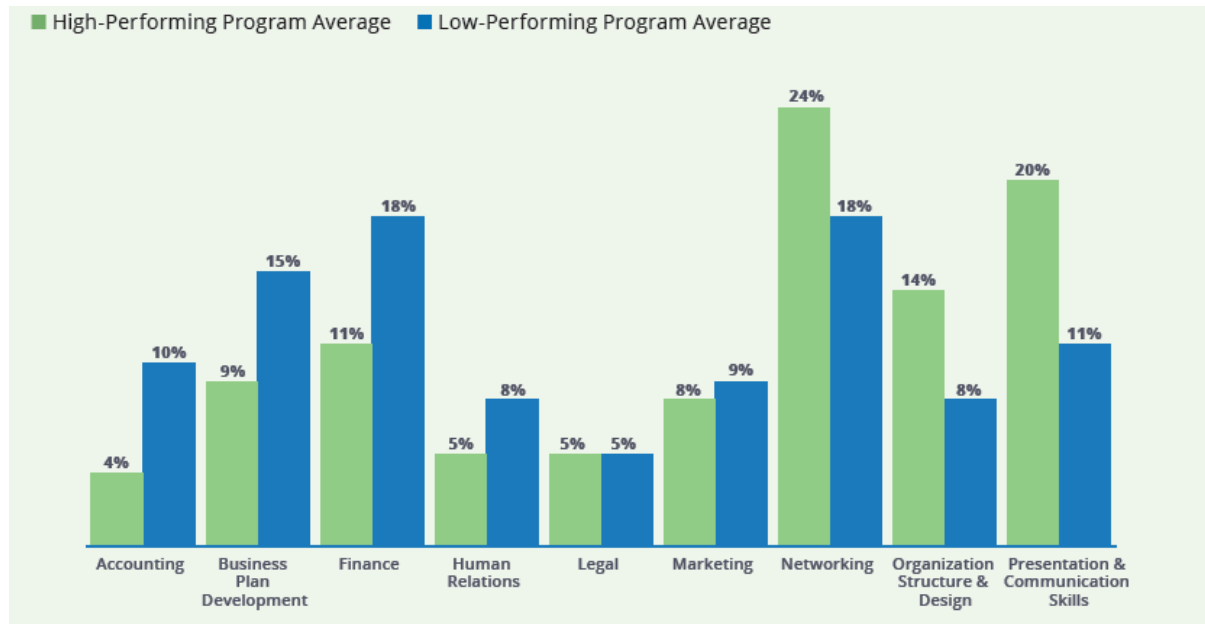


Figure 2.9: Percent of emphasis placed on different program topics (Roberts *et al.*, 2016).

From Figure 2.9 it can be derived that the incubators that have a focus on Networking, Organisation Structure and Design, and Presentation and Communication Skills, have a higher success rate than those focussing on Accounting, Business Plan Development, and Finance (Roberts *et al.*, 2016). This is interesting when it comes to considering the prioritisation of activities the enterprise spends their time on. From Roberts *et al.* (2016) it is also evident that mentorship has a significant effect on the performance of the entrepreneur. With high performing programs citing the mentor being named in 50% of cases relating to interviews, and low performing programs only 25% of the time (Roberts *et al.*, 2016).

Hasenauer *et al.* (2016) puts particular emphasis on the difference of incubators being considered 'closed' and 'open' incubators. With 'open incubators', an incubator that has a digital introduction and also a "Start-up Camp", they are thus a cooperative incubator with particular emphasis on sharing information (Hasenauer *et al.*, 2016). A

2.2 Models and Frameworks Engaged with for Start-up Enterprises

'closed incubator' is nearly the complete opposite, with a focus on internal development (Hasenauer *et al.*, 2016). From Hasenauer *et al.* (2016) it can be seen that 'open incubators' generally out perform its counterpart and is considered by many the incubation of the future.

The importance of this section is just to bring light to the role that incubators play inside the start-up domain and which practices can be considered useful and important when interacting with start-ups.

2.2.9 Conclusion on Models

This section tries to summarise all the different frameworks, models and tools reviewed in Section 2.2. This summary can be seen in Figure 2.10:

2.2 Models and Frameworks Engaged with for Start-up Enterprises

METHOD USED	DESCRIPTION OF PRINCIPLES
TRL	Gives an indication on how the technology readiness levels are measured for a new concept or enterprise. Serves as a strategic guideline when considering a companies technology maturity level.
GEDI	Gives an overarching view of the South African entrepreneurial ecosystem and how it compares to other countries. Also, pinpoints certain indicators used to do this measurement. This is a practical gauging method to see where the enterprise is currently benchmarking in the South African context.
BMC	The most common practice for developing a business model. Shows the importance of determining the value proposition and using indicators to justify the value of the enterprise. This is a purely operational exercise. Even though some of the questions posed when answering the BMC are strategic of nature, the depth in which an enterprise can be investigated when completing the BMC is quite limited.
CRI	Clear method of how the As-Is to To-Be methodology is employed. Six established levels in a framework to determine the commercial readiness of an industry. Incorporates TRL into a modern business concept, with the ideology that one can be technology ready, but not necessarily commercially ready. A set of indicators that independently function to describe the various states of an enterprise. This assist with establishing a more strategic view of the enterprise.
Deming Cycle	A method to clearly showcase a successful iteration methodology. This can be applied by entrepreneurs when completing frameworks like CRI. As the continuous feedback loop allows the entrepreneur to continuously question the current state of affairs of the enterprise.
VC Check list	Understanding the As-Is to To-Be state in the context of a VC. To assist with the understanding of the various phases a VC considers when viewing a start-up. A clear indication of the various categories incorporated in a due diligence process. A validation process of what VC's general view of the start-up environment is. An operational and strategic tool.
Enterprise Engineering Process	One of the most used methodologies in understanding and designing the As-Is to To-Be state. This also defines three different phases in which an enterprise can be considered. This is a strategic tool in mapping where the enterprise currently finds themselves. This assists frameworks like CRI to map As-Is and To-Be states of the enterprise.
Incubators and Accelerators	An indication of how incubators and accelerators influence the As-Is to To-Be state of an enterprise. This also serves as a validation process of what is currently happening in incubators and accelerators in South Africa. An operational and strategic assistance to entrepreneurs.

Figure 2.10: A summary of the various frameworks, models, and tools used during Section 2.2.

2.3 Consolidating the Various Methods

This chapter has looked at a broad range of aspects which affect entrepreneurs and their start-up enterprises. These include the entrepreneurial ecosystem discussed in Section 2.1 and the various frameworks, models and tools utilised for managing and assisting growth in start-up enterprise in Section 2.2. This section will explore how the content discussed in Section 2.2 relates to one another, and how they are useful in devising a framework to guide an enterprise strategically and operationally from conception to commercialisation. This section will broadly investigate the purpose of these frameworks in relation to the one being developed, and also identify the eventual objectives that each of the items discussed in Section 2.2, contributes to the framework.

The purpose of the proposed framework gives context and direction to how the various methods should be integrated. The *purpose* of this framework is derived as - **A framework that assists an enterprise from conception to commercialisation. By incorporating the operational and strategic aspects of various models or frameworks, and comparing them in a systematic method to various categories and indicators, a better understanding of the enterprise can be derived. The framework urges the entrepreneur to 'think' and consider their current shortcomings. The framework should attempt to give guidance to the various stakeholders of the enterprise, as to where the questions need to be asked, where the development needs to be accelerated, and where the prioritisation of the enterprise should be taking place. In essence - where does the enterprise need to be (To-Be status), where is it now (As-Is status).**

Given this purpose statement, a *summary* can be derived for each method illustrated in Section 2.2. Each framework, model and tool is used to cover a specific aspect of developing this framework. For example, the Deming Cycle is not necessarily directly related to start-ups, but it is a good method to ensure a systematic iteration process takes place when an entrepreneur is engaging with this framework. These observations are:

- To determine the As-Is and To-Be stages of an enterprise, and assisting with the strategy to move the enterprise from the As-Is state to the To-Be state. (Subsection 2.2.4, 2.2.6, 2.2.7, and 2.2.8)

2.4 Validation of Chapter 2.

- To establish various phases that showcase and explore the various stages of a start-up enterprise. (Subsection [2.2.4](#), [2.2.5](#), [2.2.6](#), and [2.2.7](#))
- To ensure that a technology start-ups' TRL level is incorporated in the model. (Subsection [2.2.1](#) and [2.2.4](#))
- Ensuring an iterative feedback loop is incorporated into the methodology of the framework. (Subsection [2.2.5](#))
- Ensuring that all known aspects of an enterprise - being the various indicators and categories, are all incorporated into the framework. This includes the overlaps of various models and tools. (Subsection [2.2.2](#), [2.2.3](#), [2.2.4](#), and [2.2.6](#))
- Validation on the methods followed need to be obtained. (Subsection [2.2.6](#), and [2.2.8](#))

These various observations and the purpose previously described and derived from the literature will be utilised to derive the framework for this study. With Chapter 3 reviewing how this literature will be adapted, and Chapter 4 showcasing how it will be implemented.

2.4 Validation of Chapter 2.

This chapter was derived by using various literature resources. The Delphi technique was infrequently used throughout by consulting experts in their respective fields. C. van Schalkwyk was consulted on the South African entrepreneurial ecosystem, where validation was sought on what makes a start-up successful in the start-up domain. D. Strauss was consulted on the investor traits of South Africans and what the investment tendencies of South Africans are. All other research was derived from the referenced sources. Section [2.3](#) serves as a summary of the previous sections and what important aspects were taken from each model or framework.

2.5 Chapter Summary

This chapter explores the South African entrepreneurial ecosystem, the general success rates of start-up enterprises and the theories behind what makes a start-up successful.

2.5 Chapter Summary

It then goes on to explore various models, tools, and frameworks used to measure, monitor or evaluate business models. More specifically they are viewed in the light of the start-up domain. These include TRL, GEDI model, BMC, CRI framework, the Deming cycle, VC check-lists, enterprise engineering process, and incubators and accelerators. Each one of these aspects contribute to the development of this thesis' framework and a summary of all of these is given at the end. Finally, the validation of this chapter is explained at the end. This chapter also marks the completion of *Objective 1 - How can existing tools and frameworks be applied to the start-up domain*, as defined in Section 1.2.3. Chapter 3 is used to further elaborate on the CRI framework, derived by ARENA (2014a), and its applicability to the start-up domain.

Chapter 3

CRI Indicators for Start-up Enterprises

This chapter completes the remaining components of objective 2. After the literature has been covered, the current literature on CRI is further explored. The Delphi technique is used to verify the components of using the CRI in the start-up domain.

3.1 Introduction Into the Indicators, Categories and Phases

The thesis uses the indicators from the study conducted by ARENA (2014b), along with those added by the research of Bezuidenhout (2017). The only indicator additionally used in this thesis is the *Entrepreneur Capability*, which was recommended by D’niell Strauss (*D. Strauss, personal communication, June 09, 2018*) in an attempt to include industry experience. As the original document by ARENA (2014b) was aimed at renewable energy the indicators need to be adjusted to suit the requirements of the start-up domain. This is elaborated on in Section 3.2.1.

Various categories were introduced, which will be explored in greater detail in Section C.1, in an attempt to bring the various pillars of an enterprise to the forefront. Furthermore, it was realised that the CRI levels designed by ARENA (2014b) did not necessarily fit the industry of start-up enterprises. These various CRI levels are explored and analysed in the context of the start-up domain.

To simplify some of the complexities of the various indicators, categories and phases they are individually assessed throughout this chapter. The complexity of applying the

3.2 Defining the Indicators and Categories

CRI to the start-up domain requires a simplification of the levels defined by ARENA (2014a). By grouping the start-ups into phases of maturity as described in Section 3.3, the level of complexity is reduced. Through the various interactions with the incubation centres like LaunchLab (2018), it is established that each enterprise needs to be monitored according to their current position in their life cycle. This chapter aims to establish what the various indicators, categories and phases are, and how they link with one another. By achieving this, a framework can be built around these defined elements.

3.2 Defining the Indicators and Categories

The following sections will attempt to elaborate on the indicators and categories and the definitions associated with each item. These indicators and categories are adapted to suit the domain of technology orientated start-up enterprises.

3.2.1 Indicators

Various factors contribute to an enterprise becoming a sustainable venture. When analysing an enterprise from its fundamental cornerstones, it becomes evident that there are clear indicators that define an enterprise. These indicators were derived from the ARENA (2014b) framework, from the research of Bezuidenhout (2017), and consultation with industry experts¹. The indicators from ARENA (2014b) and Bezuidenhout (2017) are adapted to fit the start-up enterprise domain. The 11 indicators are displayed in Figure 3.1, and these include the following:

It is important to define each of these terms, as to ensure no ambiguity exists when referring to a specific indicator. The definitions of these indicators are defined as:

- **Regulatory Environment** - Which pertains to the maturity of planning and active participation by the start-up enterprise into the regulations currently controlling the industry, the industry standards defined, and the permitted functioning domain of the industry.

¹Details elaborated on in the validation section, Section 3.4.

3.2 Defining the Indicators and Categories

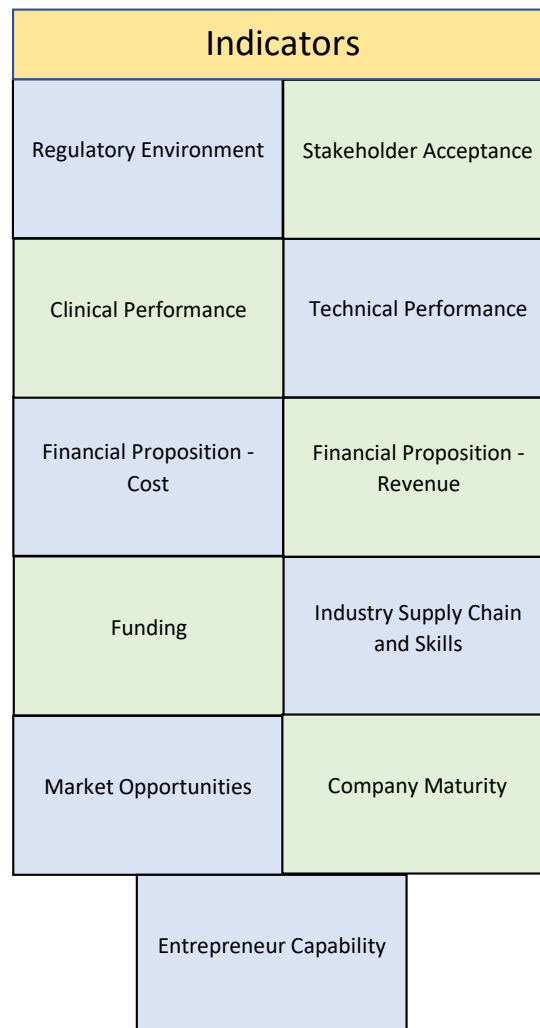


Figure 3.1: Proposed Indicators for the Start-up Environment.

- **Stakeholder Acceptance** - Pertains to the process of the start-up enterprise to engage in evidence-based stakeholder consultation, and include all possible stakeholders linked with the various aspects of the enterprise.
- **Clinical Performance** - This indicator is only applicable in the medical industry. It is the maturity of the enterprises' knowledge of the industry standards relating to the particular medical device or service, specifically linked to the performance of the technology or service in the particular regulated environment.
- **Technical Performance** - The enterprises' ability to analyse the technical per-

3.2 Defining the Indicators and Categories

formance standards of the industry, and to benchmark the current product or service to the industries' technical background. This indicator also pertains to the technical viability and relevance of the product or service in the particular industry.

- **Financial Proposition - Costs** - The aspect of the enterprises' financials relating to the costs associated with its activities. This includes but is not limited to; the forecasts of the costs, financial performance in terms of costs, and the risks associated with the costs.
- **Financial Proposition - Revenue** - The aspect of the enterprises' financials relating to the revenue streams associated with its activities. This includes but is not limited to; the forecasts of the revenue, financial performance in terms of revenue, and the risks associated with the revenue.
- **Funding** - Procurement of funds by the enterprise from external stakeholders, including public funds through sources like government. In other words, funds that are not generated or stem from the revenue streams generated by the enterprises' activities.
- **Industry Supply Chain and Skills** - This pertains to the development and maturity of the enterprises' systems and methods of efficiently moving products or services internally or externally in a value adding technique for the industry and the supply chain associated with it.
- **Market Opportunities** - This pertains to the development of the enterprises' hypothetical commercial plan, to a strategy that can compete in the particular industry with sustainable business plans and market penetration strategies.
- **Company Maturity** - The development of the enterprise to become an established enterprise that surpasses the 42-month existence mark, with strong credit ratings and established performance records. The maturity of an enterprise stretches beyond the growing of the enterprise, but includes internal policies and documentation, removing ambiguity within the internal and external structures.

3.2 Defining the Indicators and Categories

- **Entrepreneur Capability (*Proposed Indicator*)** - The development of the entrepreneur him/herself and adequately reflecting past experiences in the various domains of the industry. This particularly pertains to the ability of the entrepreneur to fulfil specific functions within the enterprise to an acceptable standard. This helps the enterprise to clearly identify the weaknesses of the entrepreneur and their team.¹

These indicators are not a measuring tool, but rather serve as a tool to indicate the relative progress of the enterprise in the different domains of their start-up. The indicators are used in unison with the various categories discussed in Section C.1. It is important to note that each indicator is used independently of the others, and at this stage of the research, they do not have an effect on one another. For example, even though **Financial Cost** and **Technical Performance** have a direct influence on one another, the appropriate weighted influence of these indicators are not yet established in any previous study on CRI, as also stated by [Bezuidenhout \(2017\)](#). This is outside of the scope for this research study. It is also important to note that not all indicators are applicable to every enterprise. An evaluation of each enterprise is thus required before engaging with the indicators, to determine which indicators are applicable.

3.2.2 Proposed Categories

Having a product or a service does not constitute a sustainable enterprise. When reviewing an enterprise holistically, there are various factors that have a significant contribution towards the maturity and interdependencies that the various factors have on the enterprise. The success or commercial sustainability of the enterprise is dependent on various categories that are linked with one another.

These categories are often overlooked, which leads to an enterprise not realising its full potential. With consultation of industry experts, existing VC platforms and the incubator centre - [LaunchLab \(2018\)](#), various categories are identified that play a pivotal role in the commercial success of an enterprise. The categories selected are the categories currently being utilised by [LaunchLab \(2018\)](#) and considered by some incubators and VC check-lists, for example [Ansarada \(2019\)](#), [NRI Investment Platform \(2019\)](#) and [Fintelligent \(2019\)](#). When reviewing the due diligence process that various

¹Indicator proposed based on engagement with selected experts. *Strauss and Pistorius in particular.*

3.2 Defining the Indicators and Categories

VC's employ, it is evident that this is an intricate problem. The majority of the online sources only consists of a check-list to determine whether an enterprise does or does not have the particular item, but nowhere does it check the progress of the individual items' relevance.

The methodology employed when considering these categories is twofold. The various check-lists used by [Ansarada \(2019\)](#), [Fintelligent \(2019\)](#), [LaunchLab \(2018\)](#), and [NRI Investment Platform \(2019\)](#) were gathered and consolidated. These are all incubation centres and VC firms that deal with the due diligence of start-ups. Thereafter, LaunchLab, the incubator chosen, was used to validate these categories and their importance, based on their experience with VC's and start-ups within LaunchLab. The definitions are elaborated on for each category. It is important to note that the categories noted below are used in the testing of the framework. To break each category down into its smaller components, can be seen in Appendix C.

Depending on the stage in which the start-up is, the definitions will slightly differ for the categories. For example, if the company is in the first phase of development (as explained in Section 3.3), the category will be more inclined to focus on the operational aspect of the enterprise. Whereas, if the enterprise is in a latter stage, the category will have a greater inclination towards the strategies that the enterprise deploys. These categories include:

- **Background and Ownership** - This pertains to the core composition of an enterprise and its documentation. This extends to the composition of members, the way in which the enterprise engages with the public, and the administrative composition of the enterprise.

This consists of two sub-categories: **Company Details** and **Ownership Structure**. Company Details is a more administrative element, with ownership structure the more strategic element.

- **Strategy** - This pertains to the manner and documentation in which the enterprise positions itself to eventually expand into a commercially sustainable venture, this includes the way the enterprise presents itself to investors. Strategy also seeks to determine the medium- to long term future of the specific enterprise.

This is further broken down into two sub categories; **Business Plan** and **Partner Universe**. The business plan pertains to the proposed business plan and the

3.2 Defining the Indicators and Categories

strategy behind it of the enterprise. The partner universe pertains to the partners involved in the enterprise and the future strategy pertaining to the various partners.

- **Product or Service and Technical** - This pertains to the documentation of the actual product or service the enterprise offers and its technical capabilities. This extends to the long-term strategy for scaling the product or service to an extent where the demand can be met, and the technical aspects of the product or service is competitive with industry standards. This all falls under the sub-category of **product**.
- **Operations** - Basically, to see if the technology is a hobby or an actual product/service. This differs from TRL, as it is a benchmarking activity to gauge other industry products or services currently performing the same or similar functions. This can be regarded as a competitive analysis of the industry to determine how mature the technology is. This falls under the generic category **Operations**.
- **Marketing** - This pertains to the documentation and strategy employed to reach out to the target market of the enterprise and the affiliated industry, and the methodology employed to achieve this. Marketing also incorporates the strategy of the enterprise to create a market through disruptive technologies or services, should a market not exist.

This consists of two sub categories; **Marketing Collateral** and **Customer Related**. Marketing collateral refers to the enterprises' ability to utilise various platforms to get their product or service across to potential customers. Customer related refers to the interaction between enterprise and customer.

- **Sales** - This pertains to the documentation and strategy employed to generate revenue for the enterprise and ensure that the product and service strives towards breaking even and assisting with the venture becoming competitive in the particular industry.

This consists of two sub-categories; **Process and Pipeline** and **Market and Competitors**. Process and pipeline refer to the sales processes taking place, and planned, as well as the financial elements pertaining to delivering on the specific

3.2 Defining the Indicators and Categories

sales. Market and competitors pertain to the analyses of the strategies employed by competitors and how they target the market with their products or services.

- **Finances** - This pertains to the documentation and prediction of the financial position of the enterprise, and the strategy employed to generate a financial proposition for the enterprise that can be sustained. This includes documenting the relationship between costs and revenue, with particular emphasis on finding a sustainable balance between the two.

This is further divided into two sub-categories; **Historical Financials** and **Financial Projections and Valuations**. Historical Financials is clearly described in the name and refers to the documentation of past financial reports. Financial Projections and Valuation refers to the future budgetary plans and where these funds will be acquired and how they will be spent.

- **Human Resources** - This pertains to the documentation and strategy employed by the enterprise to ensure that a working plan is introduced that guides the current and future employees of the enterprise. This includes the contractual side of the enterprise employment plan and does not exclude the owners.

This is further divided into two sub-categories; **Employee Info** and **Agreements**. Employee info refers to various roles and responsibilities that all employees will need to fulfil and how the different positions and hierarchy looks like. The agreements refer to the type of contractual agreements the enterprise puts in place for their employees.

- **Leadership and Soft Skills** - This pertains to the documentation and strategy employed by the enterprise to ensure that shortcomings in the entrepreneurs' and the employees' background in the industry is addressed, and value adding culture and skills development is cultivated in the domain of the industry. This falls under the generic category **Leadership and Soft Skills**.
- **Legal** - This pertains to the documentation and strategy employed to ensure the legal requirements of the enterprise and the industry of the enterprise are being addressed.

This can be further broken down into three sub-categories; **Corporate Documents**, **Previous Issuance of All Securities**, and **Material Contracts or**

3.3 Phases Outline

Agreements. Corporate Documents refer to the documentation that forms the core workings of the enterprise. Previous issuance of all securities refers to previous financial dealings that the enterprise has embarked on, be it in the issuing of stocks and bonds or even old shares of the enterprise. Material contracts or agreements refer to the enterprises existing or planned contracts or agreements to acquire or sell/release materials or assets, and what these contracts or agreements stipulate.

- **Intellectual Property** - This pertains to the documentation and strategy employed to protect the enterprise's intellectual property and applications for protection. This should also address the necessity of intellectual property protection for the particular enterprise and the relevance to the particular industry. This falls under the generic category **Intellectual Property**.
- **Environmental, Social, and Governance** - This pertains to the documentation and strategy employed to strive towards environmental, social and governance compliance and a competitive benchmark to industry. This falls under the generic category **Governance**.

The categories proposed are therefore categories that were identified as value adding towards the domain of a start-up enterprise. The list of categories and indicators are quite comprehensive, and it is thus important to stress the importance to note that this framework is not designed to be a measuring tool, but rather a tool to determine relevance of completeness (with the case of the check-list) and monitor progress of the enterprise (with the case of the framework). The link between the categories described in this section, and the indicators described in Section 3.2.1 and expanded on in the Phases Outline in Section 3.3.

3.3 Phases Outline

The original framework described by ARENA (2014b) was intended to bridge the disparity between a technology that is technology ready, but not necessarily commercially ready. There is a distinct difference between the two different statements. A technology

3.3 Phases Outline

that is ready, refers to an adequate TRL level, as described in Section 2.2.1, and proposes that the technology is developed to an adequate stage of being functional. Being technology ready, does not mean that it is ready to be commercially viable, or even scaled. The framework will seek to address a similar disparity in the start-up domain, specifically the technology sector. In other words, having a sound idea, product or service, does not mean that the enterprise will be commercially sustainable or scalable.

The aim of this framework is to monitor entrepreneurs and their enterprises based on the various indicators and categories described in Section 3.2.1 and Section C.1, to monitor the enterprises' progress towards becoming commercially sustainable and ready to scale, with the assistance of various tools. As even defining sustainability in a start-up environment becomes relatively hard to nearly impossible, due to the ambiguity, it must be clearly stated that this is a tool to monitor and self-evaluate progress between the two parties:

1. The entrepreneur, and
2. the mentoring party.

The mentoring party can extend from the incubator that the entrepreneur is utilising, or the funder - be it a venture capitalist or other form of funding or assistance. The framework should give a relative indication of the entrepreneurs' progress and leads to a dialogue between the two parties about the results and streamlines the due diligence process, whilst cultivating value adding questions from the engagement with the framework.

The framework should be modified from the one used by ARENA (2014b) and Bezuidenhout (2017) to be more user-friendly and relevant for technology enterprises in the start-up domain. The six levels described by ARENA (2014b) are too big and time consuming¹ to integrate into such a proposed system. This is also a recommendation done by previous research on this topic, where it was stated that the six levels need to be simplified and easier to utilise (Bezuidenhout, 2017). This is further re-iterated by various experts who found the proposed method to complicated and user unfriendly to be of practical use. The originally defined six levels can be seen in Figure 2.5.

The six levels described by ARENA (2014b) are:

¹Based on experiential trials of the framework and discussions with industry experts.

3.3 Phases Outline

1. **Level 1** - Hypothetical Commercial Proposition;
2. **Level 2** - Commercial Trial, Small Scale;
3. **Level 3** - Commercial Scale-up
4. **Level 4** - Multiple Commercial Proposition;
5. **Level 5** - Market Competition, Driving Widespread Competition; and
6. **Level 6** - Bankable Asset Class.

These various levels have been explicitly defined for the case study conducted for the renewable energy sector. These defined levels are quite universal, and for the sake of completeness can be found in Appendix A. It is however pivotal to expand on the understanding of these levels, and consider grouping them together. Especially considering that the start-up environment is not as rigid as these levels suggest. Figure 3.2 clearly depicts the proposed simplification of the commercial readiness framework. It is also important to note that this is not a linear process, and that the levels merely depict the initial stages of the start-up enterprise. This eventually serves as an iterative process¹, as the enterprise matures and new products or services are introduced that could disrupt the initial business model of the enterprise. This is depicted in Chapter 1, in Figure 1.1 iteration process is discussed. It is also possible for the enterprise to revisit certain stages. A start-up enterprise and the success that goes along with it, is not a linear process. The analogy of *'two steps forward, one step back'*, is often associated with this process.

The phases being recommended serve as a framework to assist the enterprise in better managing and understanding their enterprise. Considering the dire state of success rates of start-up enterprises in South Africa and the importance of guidance during these initial stages, as described by industry experts and literature. It is clear to see how important a more systematic approach is to conceptualising and developing a start-up. From Figure 3.2, the three phases are identified as:

- **Phase 1** - Viable proposition and establishing enterprise, fundamentally considered a start-up.

¹As described with a Deming Cycle in Section 2.2.5.

3.3 Phases Outline

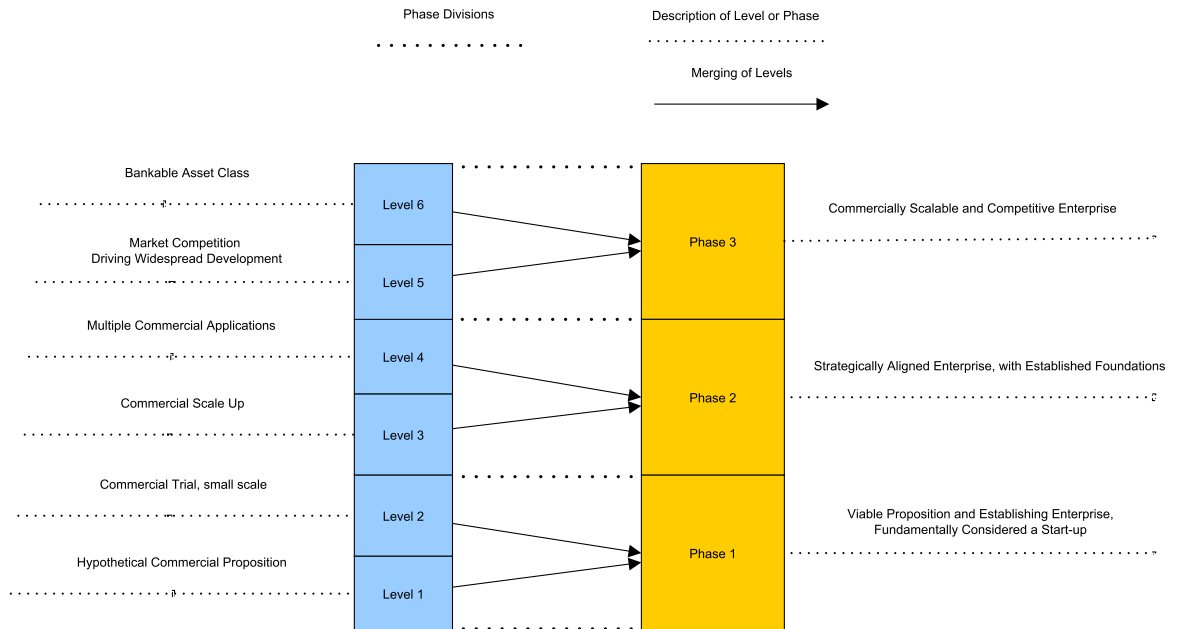


Figure 3.2: The proposed phases derived from the original [ARENA \(2014a\)](#) levels, into three easily interpretable phases.

- **Phase 2** - Strategically aligned Enterprise, with established foundations.
- **Phase 3** - Commercially scalable and competitive enterprise.

These phases do not take away the original core meaning of each of the levels described by [ARENA \(2014a\)](#), but rather seeks to simplify the process and make it more effective and user-friendly. The rest of this section will aim to expand on what each phase represents, and how they link with the levels already established by [ARENA \(2014a\)](#). Each phase will also be discussed and how they will be executed in real time. At the end of the three phases, an insight into how the three phases are linked is considered. It is important to note that the various phases were derived through multiple discussions and interviews conducted by industry experts and stakeholders. The version seen in the following sections were derived through a process of consultations. The various contributions to the conceptualisation of this framework can be seen in the validation section, in Section [3.4](#).

3.3.1 Phase 1

This phase incorporates *Hypothetical Commercial Proposition* and *Commercial Trial, and Small Scale* into a single category and can now be referred to as *:Phase 1 - Viable proposition and establishing enterprise, fundamentally considered a start-up*. This stage involves the entire TRL phase, and the initial commercialisation process. This phase is an extremely iterative phase, especially in the technology incubating environment where research and development is a crucial part in product or service conceptualisation and implementation.

Phase 1 is designed to assist enterprises to:

- Interpret their TRL level;
- To formalise the operational viability of the enterprise for each of the various indicators;
- To interpret and understand the enterprise through a Phase 1 viewpoint of the various indicators and categories;
- To self-evaluate progress made and needed by the enterprise for Phase 1 in the broader context of the framework.

From Section 3.2.1 and Section C.1, which is the Indicators and Categories respectively, the items are all defined. During Phase 1, the indicators and categories are used in a comparative matrix format to establish how the enterprise has evolved thus far. This gives an indication on the areas that still requires attention. As this is the first attempt at a framework of this kind, the indicators act independent of one another. Further development of the framework can lead to a weighted balance to each element (categories and indicators), and assist the user in prioritising aspects of the framework. This could potentially assist the user in seeing the effect of indicators and categories on one another.

As previously mentioned, there are specific outcomes of which Phase 1 needs to suffice. The actual implementation of Phase 1 is elaborated on in Chapter 4. Furthermore, how the phases fit into one another is elaborated on in Subsection 3.3.4, which showcases the link between phases.

3.3.2 Phase 2

This phase incorporates *Commercial Scale Up* and *Multiple Commercial Applications* into a single category and can now be referred to as *:Phase 2 - Strategically Aligned Enterprise, with Established Foundations*. This phase deals with TRL ready products or services, which need strategic direction to be able to scale. The commercial application for the product at this phase is also at a revenue generating capacity, but needs strategic direction to ensure adequate growth. The categories and indicators at this stage are no longer operational, but rather need to be strategically aligned to link the operations to the proposed strategy. At this stage it is important for the enterprise to meet the "need" and demand of the consumer.

Phase 2 is designed to assist enterprises to:

- Define the various strategies needed to position the enterprise in a more strategic manner;
- To link the strategy and operational components of the enterprise for each of the various indicators;
- To interpret and understand the enterprise through a Phase 2 viewpoint of the various indicators and categories; and
- To self-evaluate progress made and needed by the enterprise for Phase 2 in the broader context of the framework.

Phase 2 follows the same comparative matrix approach as Phase 1. As the entire framework functions on an iterative approach, it should be noted that should an aspect of the enterprise 'pivot'¹ in Phase 2, Phase 1 should be revisited with a similar approach. As mentioned in Phase 1, there are various methods of improving the accuracy of the framework, but the focus of this study is establishing a working framework that can be further developed. It is possible for specific indicators to still be lagging in Phase 1, or be even be in Phase 3. If the enterprise is in Phase 2, it refers to the majority of indicators still being in Phase 2.

If the operational aspects of Phase 1 is linked with the strategic intent of Phase 2, and a clear As-is state is established, a To-Be strategy could be derived for the user

¹An alteration of strategy or need within the enterprise.

to progress to Phase 3. Phase 2 is important in establishing the eventual To-Be state of the enterprise, and required to effectively engage with Phase 3. The method links between the different phases can be seen in Subsection 3.3.4, and how to engage with Phase 2 is further explored in Chapter 4.

3.3.3 Phase 3

This phase incorporates *Market Competition and Widespread Development* and *Bankable Asset Class* into a single category and can now be referred to as *:Phase 3 - Commercially Scalable and Competitive Enterprise*. This phase deals with taking an enterprise from operationally ready to commercially ready. In other words, transforming the enterprise into a bankable asset that is generating enough revenue and profit to succeed on its own. This phase monitors how far the enterprise has come from its As-Is state to the eventual To-Be state required.

Phase 3 is designed to assist enterprises to:

- Define the various strategies needed to establish enterprise strategy implementation;
- To ensure the proposed strategies are implementable and capable of being commercialised for the product or service of the enterprise for each of the various indicators;
- To interpret and understand the enterprise through a Phase 3 viewpoint of the various indicators and categories;
- At the end of Phase 3, the enterprise needs to be commercially viable; and
- To self-evaluate progress made and needed by the enterprise for Phase 3 in the broader context of the framework.

Phase 3 only looks at the implementation of the various strategies designed in Phase 2, and looks at the implementability of these strategies in the pursuit of commercialisation. Should the enterprise pivot on its key value proposition, the iterative nature of the framework takes it back to Phase 1. Or if the strategy needs to be altered a return to Phase 2 is required. Phase 3 is a good test for an enterprise as to determine how far off they are from moving from a start-up to an established SMME. The As-is to

3.3 Phases Outline

To-Be state method is effective in this. Furthermore, as mentioned in the other phases, various methods can be used to further the accuracy of the framework. Although, this framework seeks to establish an initial attempt at monitoring the status of enterprises.

Phase 3 is by no means an approval stamp to declare that an enterprise will be successful or commercialised, but rather indicates a systematic approach to showing the changes in the state of nature of the enterprise through its initial life-cycle. In Chapter 4 the method of engaging with Phase 3 is discussed.

3.3.4 The Link Between Phases

After each phase has been evaluated and is considered adequate to move on to the next phase, a transition takes place. The transition refers to the movement from one phase to the next, and how that 'change in state' should be considered.

As previously explained, Phase 1 refers to the operational aspects of the enterprise. When this phase is completed, a transition takes place from Phase 1 to Phase 2, as seen in Figure 3.3. Phase 2 consolidates the operational aspects of Phase 1, with the strategic intent of the enterprise. Thus, when Phase 2 is entered, the enterprise has shifted its view from the operational to linking the operational to strategic. The only exception, as seen in Figure 3.3, is the case where a pivot in an indicator of operations takes place. In this situation, an iteration takes place back to Phase 1, and Phase 1 is repeated until the phase is again completed for all the operational aspects. Thereafter, Phase 2 is again initiated, with the consolidation of the operational aspects and strategic intent of the enterprise.

The next transition is from Phase 2 to Phase 3. As Phase 2 is the consolidation between the operational aspects with the enterprise's strategic intent, the transition to Phase 3 is taking that strategic intent and transforming it into a strategically implementable plan that can allow the enterprise to become financially sustainable over the long term. As seen in Figure 3.3, this transition is the final transition before the enterprise is considered commercially ready, as previously described by Phase 3. Also seen in Figure 3.3, is the iterative process that can potentially take place. In the scenario where there is a change to the strategic intent to the enterprise, an iteration is made back to Phase 2. The process for Phase 2 is then repeated, before a transition back to Phase 3 can be completed. In the scenario that a pivot of the operational aspects is made in Phase 3, an iteration is made all the way back to Phase 1. Thereafter, the

3.3 Phases Outline

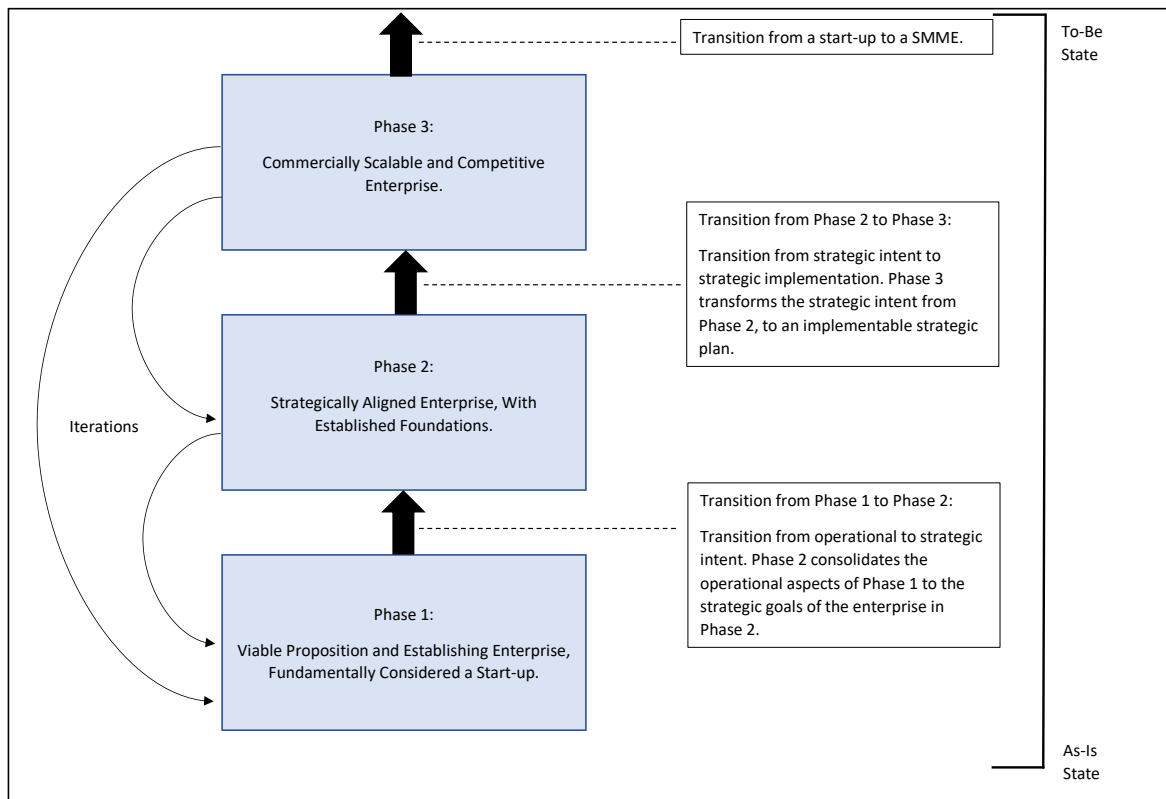


Figure 3.3: The link between the various phases, and how they transition from one phase to the next.

normal process resumes of moving through the various phases until Phase 3 is reached again.

It is important to note, as seen in Figure 3.3, that there is an overarching theme that is continuously considered. This is discussed in depth in Section 2.2.7, where the As-Is state to To-Be state is considered. In Figure 3.3, during the initiation of all the phases, the ideal To-Be state needs to be identified, and then the current As-Is state needs to be plotted. This needs to be considered during each phase and should provide the user with an indication of where the priority development areas of the framework is located. The framework should also serve as a tool to determine where the proposed strategies are maybe not sufficient to move the enterprise from the As-Is state to the desired To-Be state.

The actual methodology of testing and plotting this framework will be discussed and elaborated on in Chapter 4, and thereafter tested via case studies in Chapter 5.

3.4 Validation of Chapter 3.

Based on the evidence presented, the need for CRI in the start-up domain is validated.

3.4 Validation of Chapter 3.

This chapter is derived through the use of literature, as well as the Delphi Technique to consider the opinion of industry experts. This section will offer a breakdown of what has been validated by the various sources in the various sections, to prove validation. This breakdown can be seen in Figure D.1, Figure D.2 and Figure D.3, which can be found in Appendix D.

Following these two basic methodologies of literature and the Delphi Technique, the indicators, categories and phases are identified and developed in Chapter 3.

3.5 Chapter Summary

This chapter explores the conceptualisation of the commercial readiness framework by exploring the available literature and using industry experts to theoretically determine the applicability on the start-up domain. The chapter starts by defining the various indicators that will be used throughout the framework, thereafter the various categories are defined in a similar method, as summarised in Figure 3.4.

The Delphi Technique is used throughout to validate the various indicators and categories. The current six levels used by ARENA (2014b) is simplified to a three-phase framework, similar to the one defined by the Enterprise Engineering Process. The three different phases are then defined, and the respective goals for each phase is defined. The link between the different phases are defined, and the transition from each phase is explained, as showcased in Figure 3.4. Finally, the chapter validation method is explained. This chapter also serves as partial completion of *Objective 2: Generating a framework that can be evaluated against expert opinions and refined through various iterations*. This chapter defines the basic principles of the framework, and Chapter 4 represents the refined and defined implementable version of how the framework should be implemented, with the various described tools.

This Chapter, along with Chapter 2, is used to showcase the importance of CRI and also the need within the start-up domain to monitor progress. From this point of the research, the framework will be developed and validated.

3.5 Chapter Summary

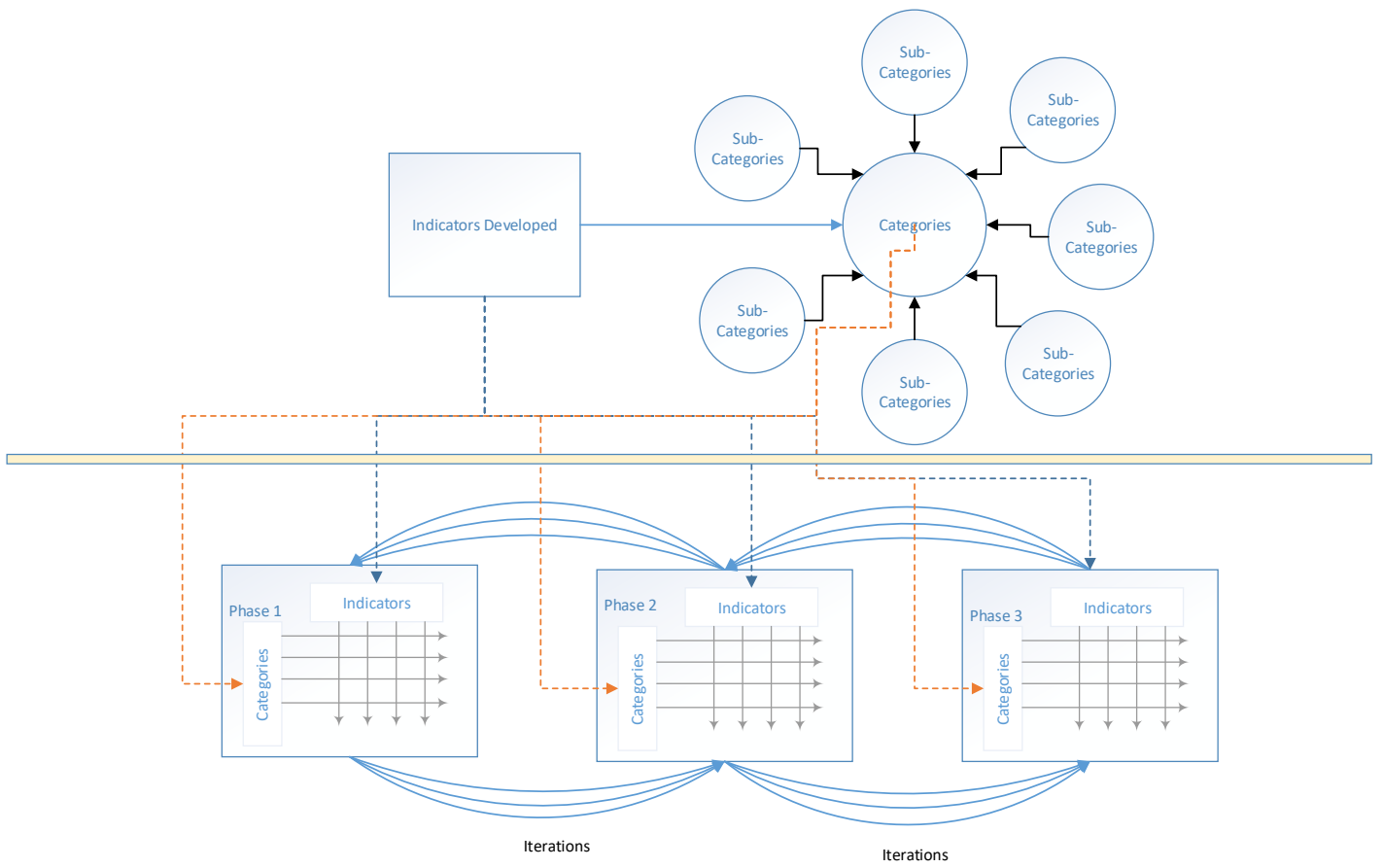


Figure 3.4: A high level consolidation of the indicators, categories and phases, and how it all comes together.

Chapter 4

Conceptualising and Validating the Framework

This chapter develops the framework used in this research and investigates how to implement the framework for this thesis. The chapter aims to meet Objective 2 set out in Chapter 1, and the various objectives defined in Chapter 2. The indicators, categories and phases defined in Chapter 3 is defined with the view of implementation and validation. The chapter serves as the consolidation between the literature previously discussed, and the model literature discussed in Chapter 3. Experts are consulted throughout this chapter via the Delphi Technique, and the contributions are noted in Appendix E. The experts range from a variety of backgrounds and expertise.

4.1 Purpose of the Framework

When considering why the framework is developed, the purpose defined in Chapter 2 in Section 2.3 serves as a guide. To refresh the readers' memory, it states: - **A framework that assists an enterprise from conception to commercialisation. By incorporating the operational and strategic aspects of various models or frameworks, and comparing them in a systematic method to various categories and indicators, a better understanding of the enterprise can be derived. The framework urges the entrepreneur to 'think' and consider their current shortcomings. The framework should attempt to give guidance to the various stakeholders of the enterprise, as to where the questions need**

4.1 Purpose of the Framework

to be asked, where the development needs to be accelerated, and where the prioritisation of the enterprise should be taking place. In essence - where does the enterprise need to be (To-Be status), where is it now (As-Is status). This purpose holds true and was updated as more experts were consulted. Thus, the practical implementation to achieve this purpose is now the query.

To achieve this purpose, a clear systematic approach is required, with clear guidelines on how to consolidate the indicators, categories and phases defined in Chapter 3. Thus, to test this framework;

1. A clear process mapping is designed to showcase the flow of the framework.
2. Clear and concise tools are defined and developed.
3. Clear methods of showcasing the results in an understandable and analytic method to gauge the start-up progress is described.
4. The method is tested against real world situations to validate the findings. (This is done in Chapter 5)
5. The results are interpreted. (This is done in Chapter 6)

If these items are completed as mentioned above, a clearer understanding on the validity of this research will take shape and guide future research to more clear objectives.

4.1.1 Methodology Employed

A systematic process mapping is designed to accurately reflect the process and steps of the framework being employed. As seen in Figure 4.1, the full process flow is mapped out from beginning to end. It is imperative to note that it starts with the "need" of the enterprise. This need refers to the external need of the customer, and why the customer would even consider buying or using the product or service. Based on interviews with experts from industry, this is a crucial factor that needs to be considered by any start-up enterprise. If the external need is defined, the enterprise establishes credibility and a basis to operate from.

4.1 Purpose of the Framework

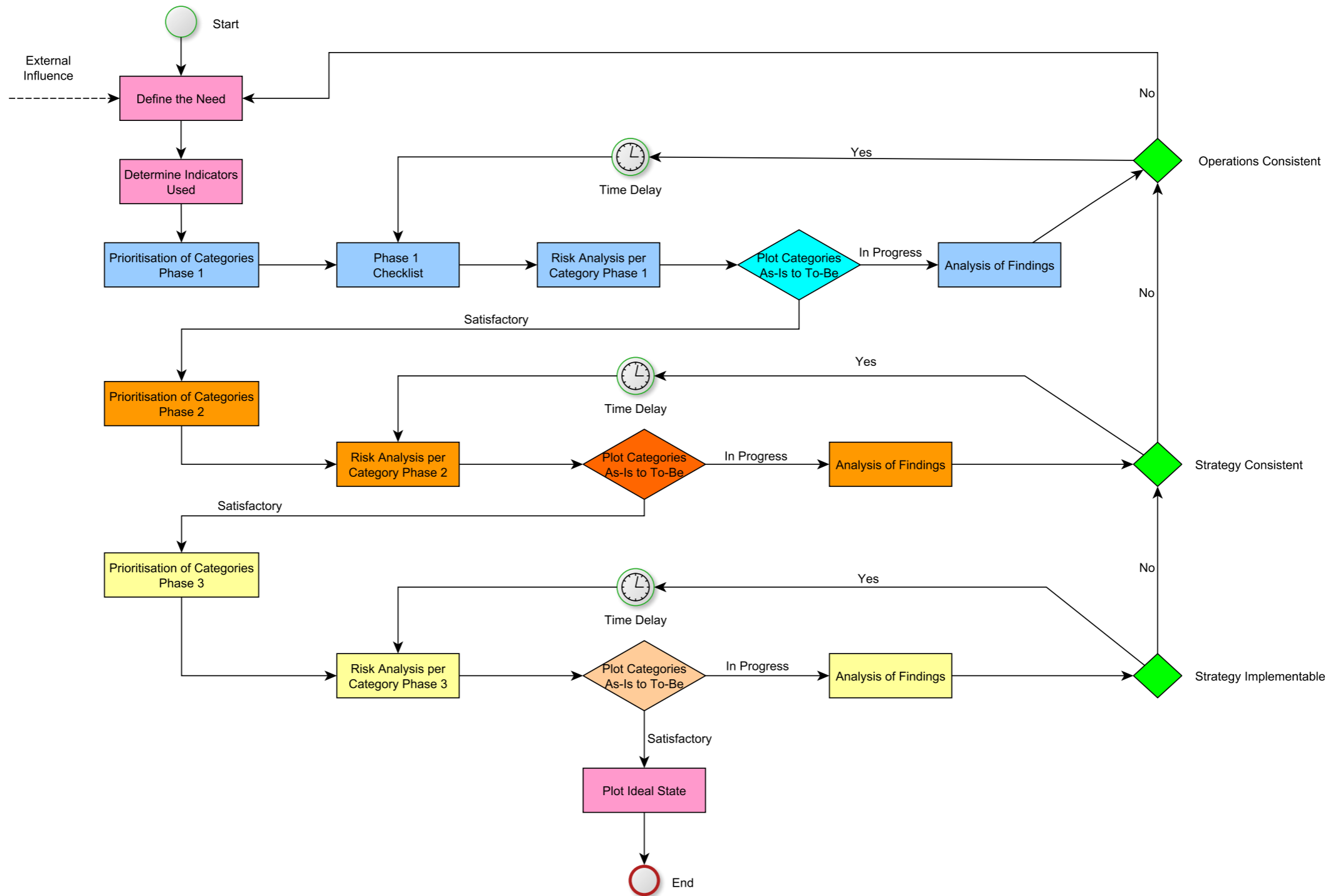


Figure 4.1: Process map indicating the flow through the phases of a start-up enterprise.

4.1 Purpose of the Framework

The next step refers to "*Determine Indicators Used*". With the indicators defined in Chapter 3, in Section 3.2.1, some of these indicators might not be of necessity for the specific enterprise. For example, **Clinical Performance**, as defined, is only applicable to an enterprise involved in the medical industry. Based on the definitions previously defined, an enterprise should determine which of these indicators are applicable to their industry and activities. The irrelevant indicators for the specific enterprise are thus disregarded when reviewing the start-up in the context of the developed framework. The final note that needs to be made from Figure 4.1 for this section, is the '*External Influence*' arrow. This is important based on the fact that the world is continuously changing and the market needs are continuously changing with it. Especially, when considering the South African entrepreneurial environment, it is important for the start-up to frequently reflect on the external influence that might alter the respective parameters in which they can operate. As quoted by Peter F. Drucker - "*The enterprise that does not innovate inevitably ages and declines. And in a period of rapid change such as present... the decline will be fast.*". It is thus pivotal for an enterprise to continuously monitor their external environment.

4.1.2 What the Framework Entails

Apart from the initiation phases of Figure 4.1 that have been explained above, there are various other steps that take place in the framework developed. The framework is divided into three different phases - Phase 1, Phase 2, and Phase 3. These various phases have been described in Section 3.3. The phases also take on a specific sequence of events that are coherent throughout. Apart from Phase 1, which has a check-list, the phases follow the same methodology and sequence.

This section is used to explain the essence of this methodology, and the following sections will elaborate on the functioning of these described items in the context of the various phases. This sequential range of events can be seen in Figure 4.2, and are:

1. **Prioritisation of Categories per Phase** - The categories defined in Section C.1, are considered individually and evaluated based on the tools provided. These tools are explained in 4.2, where the implementation of the framework is discussed. This prioritisation is a perceived prioritisation of the enterprises' functionality over the various categories. This offers a reflection on the natural biases of the

4.1 Purpose of the Framework

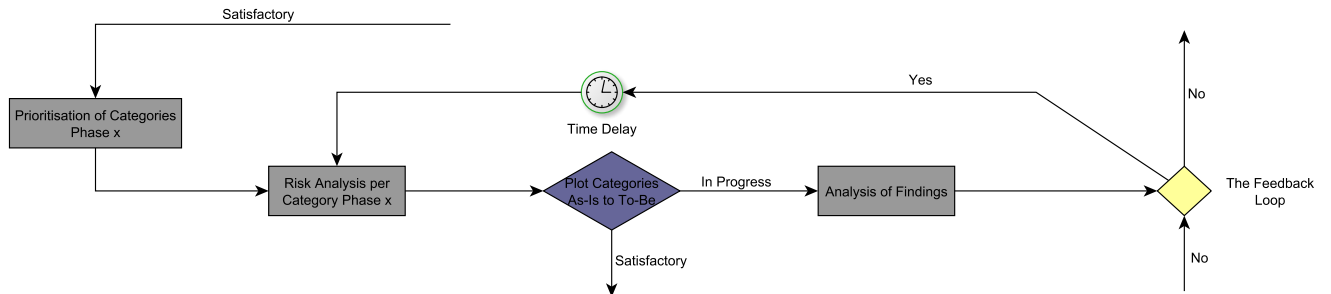


Figure 4.2: The consistent method that the framework displays for each phase.

individual utilising the tools. This also creates parameters in which the user defines what they perceive as acceptable and unacceptable.

2. **Phase 1 Check-list** - This is only applicable to Phase 1, and will be discussed separately in Section 4.2.1.
3. **Risk Analyses per Category Phase** - This refers to the next tool utilised. This allows the user to determine what they consider their To-Be or ideal State to be, what the Unacceptable-State is, and where their As-Is state is for the specific category in the phase they are active in. They also associate a risk profile to each category, and use a plotting system to showcase where they currently are. This tool will be showcased and discussed in Section 4.2. This step is fundamental in determining the commercial readiness and risk profile position of the enterprise.
4. **Plot Categories As-Is to To-Be** - This decision diamond serves as the transition point between an iteration of the same phase, or progression to the next one. This is where the previously utilised tools' results are taken and plotted into the framework. This reflects the current position of the enterprise within the discussed phase. This decision diamond requires the user to decide on whether the plotted results are satisfactory on where the enterprise should be for the specific phase or whether an evaluation needs to be considered for an iteration. If the plotted outcome is considered satisfactory, the next phase can be considered. If the plotted outcome is deemed as 'in progress', further analysis is needed. If the enterprise does move to the next phase, the process restarts at the *Prioritisation of Categories*.

4.2 Implementation and Tools of the Framework

5. **Analysis of Findings** - In this action block, an analysis needs to be conducted on the previous findings. A determination into why the phase is not considered satisfactory is conducted, and whether the reasons are fundamentally contradictory to the phase the enterprise currently finds itself in.
6. **The Feedback Loop** - A feedback loop is built into the framework, to ensure that iterations are considered, and that the enterprise adequately considers whether they are indeed in the correct phase. If the enterprise does not fit the criteria of the phases defined in Section 3.3, they iterate back to previous phases, or even all the way to the 'need' (should their internal operational needs alter). If the enterprise has not adequately completed its current phase, a time delay is built in to assist them. When they have further progressed than the previous time they used the tools, they restart with the risk analysis of the enterprise and run through the exercise again.

The functionality of the framework is further elaborated on under each phase, along with how the definitions of the phase influences the way the user interacts with the framework. The actual interaction with the framework and the parameters to be applied will be discussed in Section 4.4.

4.2 Implementation and Tools of the Framework

When considering the implementation of the framework described in Chapter 3 and Section 4.1.1, tools are developed to assist the user in obtaining meaningful data to establish the current as-is state of the enterprise. These tools need to establish the following criteria:

- Establishing what the existing progress of a start-up in its initiation phase. In other words the core operational and administrative functions of the enterprise.
- The perceived prioritisation of the various categories of the enterprise in the various phases described.
- Perform a risk-analysis of the various indicators and categories in each specific phase, and the current state they find themselves in based on their ideal To-Be state.

4.2 Implementation and Tools of the Framework

- An As-Is to To-be plotting of the enterprises' current state.

These tools will assist the user utilising the framework to better understand what the status of their enterprise is, and in which phase it is currently functioning. This will serve as a self-evaluation as well as a monitoring mechanism of the progress made in the framework, whilst doing a reality check. These tools will be explored in the following subsections.

4.2.1 Phase 1 Check-list

The Phase 1 check-list is a series of categories that are sub divided under various activities that a start-up needs to pursue in order to improve the various categories. These include the streamlining of a possible due diligence procedure that might take place from potential investment, understanding the exact need that the enterprise is trying to address in the market. Furthermore, giving a basic guideline to start-ups on the possible requirements that will be needed from them, with a level of guidance and initial required activities. This check-list is derived from various VC check-lists as to what they deem important and verified by ([LaunchLab, 2018](#)).

The various categories and sub-categories are all defined in Section [C.1](#), where the definition of each is specified and explained. In [Table 4.1](#), the proposed check-list is displayed. As mentioned the check-list is verified by various models of VC's, including in the one as mentioned by [LaunchLab \(2018\)](#), but also [Fintelligent \(2019\)](#), [Ansarada \(2019\)](#), and [NRI Investment Platform \(2019\)](#). The various categories and sub-categories refer to the current needs of VC's and investors. This not only serves as a good method of determining what the basic requirements are, but serves as a progress meter when sorting out the operational considerations and documentation at the infant phase of a start-up. This serves as the first step in Phase 1, but could still be applicable to more mature enterprises who have not completed some of these aspects.

It is important to note that some of these items listed in [Table 4.1](#), could be deemed as not-applicable to the specific start-up. Reasons could range from the start-up not being physically old enough, for example if the enterprise is not older than three years, they would not have financials of more than three years old. Other examples include where an item is just irrelevant for that specific enterprise and the industry they are participating in.

4.2 Implementation and Tools of the Framework

Category	Sub-Categories	Name	Check-List	
Background & Ownership	Company Details	Company Registration No, etc.	_____	
		Contact Information: Address, Website, Telephone, Email	_____	
		Twitter Handle / Social Media	_____	
		Key Contact Person & Details	_____	
		SARS Tax Registration No.	_____	
		VAT Registration No.	_____	
	Ownership Structure	Company/ Group Structure Chart with Subsidiaries, JV's etc.	_____	
		List of Shareholders & Details of Each	_____	
	Strategy	Business Plan	Company Abstract Doc (2-3 Page Exec Summary)	_____
			Business Plan detailing Finance Requirements	_____
Company Pitch Deck			_____	
Partner Universe		List of Strategic Partners	_____	
		Key market entry partners	_____	

Product & Technical	Product	Current Products & Features	_____	
		Product Roadmap	_____	
		Technology Readiness Level	_____	
		Product Life Cycle expectancy	_____	
		Technology Maturity	_____	
Operations	Operations	Operation Activities	_____	
		Key Processes	_____	
		Inputs and Outputs	_____	
		Operations Budget	_____	
Marketing	Marketing Collateral	Marketing Plan/Strategy	_____	
		Market Penetration Areas	_____	
	Customer Related	Key Customers (and Revenue by Customer)	_____	
		Target Market	_____	
Sales	Process & Pipeline	Sales Pipeline	_____	
		Distribution Method/Shelving Method	_____	
		Break-Even-Point of Sales	_____	

4.2 Implementation and Tools of the Framework

	Market & Competitors	Competitive Analysis & Ecosystem Outline Market risks
Finances	Historical Financials	Audited Financial Statements for Past 3 Years Last FY Monthly Management Accounts
	Financial Projections & Valuation	Detailed Budget for next 12 months Financial Model / 3-5 Year Projections Funding Partners Funding requirements / 'Shopping List' of the use of funds
Human Resources	Employee Info	Organizational Chart, by Location Roles and Management Bios List of all Employees, Positions and Gross Compensation
	Agreements	Employment Agreements
Leadership & Soft Skills	Leadership & Soft Skills	Description/ Outline of Company Culture Development of Management and Employee Strategy Distinctive Management Traits and Qualification Fundability of Entrepreneur
Legal	Corporate Documents	Co. Registration Certificate Memorandum of Incorporation Shareholders Agreement(s) Valid Tax Clearance Certificate
	Previous Issuance of All Securities	Detailed Capitalisation Table Schedule of Financing History
	Material Contracts/ Agreements	Material Contracts/ Agreements
Intellectual Property	Intellectual Property	Intellectual Property Schedule Patents/Intellectual Property/Protection pursued
Environmental, Social& Governance	Governance	List of Board Members Draft Sample Resolutions

Table 4.1: Derived Check-List from Venture Capitalists.

4.2 Implementation and Tools of the Framework

If this is the case, the specific item can be regarded as Not Applicable (N/A). The companies participating in the case studies in Chapter 5 should have completed the check-list by the point of partaking in this study. The systematic method of completing Table 4.1 is thus a simple completed or not completed check. With the cases where the specific item is not relevant it is considered as N/A. The documentation aspect of this exercise is of vital importance, especially in a start-up enterprise. As often this is the only paper trail of progress at the conception and iteration stage of the enterprise. Various industry experts also stressed the importance of this documentation, as it takes the ambiguity out of the roles of the team, whilst also serving as a method to introduce new members of the team to the existing working environment.

4.2.2 Perceived Priority of Framework

Each individual has a perception on the realities of their environment. These realities are however not always a reflection on the actual state of affairs and often guides an individual to focus on their own perceptions, rather than the actual need of the enterprise. Natural bias is often derived from the individuals' own background that leads to a further skew of what the actual versus perceived priorities are.

As seen in Figure 4.3, the tool is constituted of the 12 different categories defined in Section C.1 and showcases a simplified matrix ranking from one to five. The objective of the tool is to allow the user to give a rating on what they perceive each category's current prioritisation rating is within their enterprise. This should give an indication on what the entrepreneur is currently focussing on and where exactly the current priorities are.

This process should be conducted for each phase, as each phase has a different focus. Whether it be Phase 1, where the emphasis is placed on the operational aspects, Phase 2, where it aligns the strategic with the operational, or Phase 3, where the strategy is expanded on. This tool should reflect the current perceived priorities.

4.2.3 As-Is to To-Be Analyses and Risk Management of Framework

The greatest challenge with the described framework is accurately capturing the current as-is state of the enterprise. The tool showcased in Figure 4.4 is the mechanism developed to achieve this. It is designed in a manner where the user can plot rather

4.2 Implementation and Tools of the Framework

Category	Priority Rating				
Background & Ownership	1	2	3	4	5
Strategy	1	2	3	4	5
Product & Technical	1	2	3	4	5
Operations	1	2	3	4	5
Marketing	1	2	3	4	5
Sales	1	2	3	4	5
Finances	1	2	3	4	5
Human Resources	1	2	3	4	5
Leadership & Soft Skills	1	2	3	4	5
Legal	1	2	3	4	5
Intellectual Property	1	2	3	4	5
Environmental, Social, & Governance	1	2	3	4	5

Figure 4.3: A matrix that serves as a tool for the prioritisation of categories.

than measure their progress and risk profile. The reason being, is that natural bias towards higher scores can alter the answers given by the enterprise. This tool's primary function is to gauge the current position of the enterprise in each category and indicator. A degree of bias can be expected, the goal is that with time and a few iterations, the bias will be neutralised by the understanding of the entrepreneurs' own enterprise.

This exercise is to be performed in each phase, and with each main category. Depending on the particular phase, the method in approach will be altered according to the definitions previously defined for each phase. As seen in Figure 4.4, the plot is divided into four quadrants, separated by two legs; namely the risk leg, and the state leg.

The risk aspect of the tool is divided into two poles; the high risk pole and the low risk pole. As indicated with the **red block**, this indicates the high risk aspect of the tool, the **orange block**, indicates the neutral risk, and the **blue block**, indicates the low risk aspect of the poles. The different colour blocks represent how risk will be spread along the tool.

The state of the enterprise is represented on the other leg of the tool. This is divided into two poles; the lowest possible state and the ideal to-be state. Across this leg the current as-is state needs to be identified. The user identifies the lowest state they could be in for the particular phase for the particular category, and also determines the ideal

4.2 Implementation and Tools of the Framework

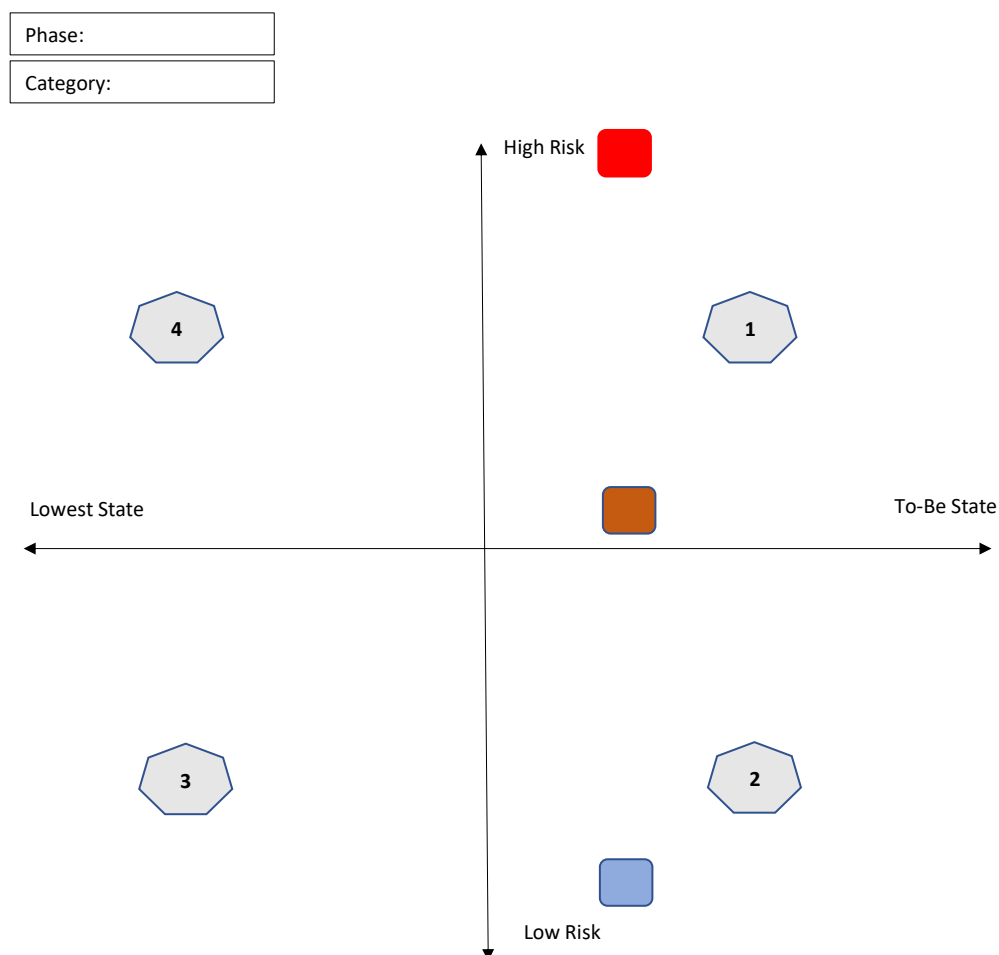


Figure 4.4: Determining the risk factor associated in each phase, and the As-Is to To-Be state ratio of the enterprise.

to-be state of which they are striving for in the particular phase. The onus then rests on them to determine, as honestly as possible where their current as-is state is.

As seen in Figure 4.4, there are four marked quadrants. Each quadrant represents the different states in which the enterprise currently presides for the specific phase and category. This also assists with the next step of plotting where exactly the current As-Is and To-be phases are within the phase the enterprise finds themselves in.

Quadrant 1 represents a state where the enterprise is close to their ideal state, but the current risk is still significant and possibly detrimental to the long term success of the enterprise. **Quadrant 2** refers to the ideal state of the enterprise. The enterprise

4.3 Framework Outline and Implementation

is close to their ideal state and the risk is well managed. **Quadrant 3** refers to an enterprise where the current state is still some way off from the ideal To-Be state they are striving for, but the risk is low enough for it not to be a threat to their immediate survival as a start-up. Finally, **Quadrant 4** is the danger zone. This indicates the quadrant where the risk is of great significance and potentially even detrimental to the existence of the enterprise, and still way off the ideal To-Be state that needs to be achieved. These quadrants give a good indication of where the discrepancies are on perceived risk versus actual risk, as mentioned in Section 4.2.2.

When this tool is being exercised, the various categories are grouped together in each indicator and in the specific phase, to indicate the average risk profile and As-Is state of the particular indicator engaged on. After each iteration inside each phase, it is to be expected that the risk should reduce after each iteration and a natural progression on the current As-Is state to the To-Be state. This tool will aim to assist the enterprise in setting realistic goals inside each phase and have a more realistic chance of commercialisation.

4.3 Framework Outline and Implementation

The framework mapping is seen in Figure 4.1, the outline will specifically consider how the framework will tackle each of the phases in a sequential and analytical manner. This section investigates the various phases and how they function uniquely inside the process described in Figure 4.1. The As-Is to To-Be states will also be discussed, as it serves as an analytical mechanism to evaluate the phases.

4.3.1 Phase 1 Outline

Phase 1, or, *viable proposition and establishing enterprise, fundamentally considered a start-up*; is described in Figure 4.5. The process map for Phase 1 is discussed, and shows the sequential steps of the developed framework. As seen in Figure 4.5, there are various sequential steps that are considered in completing Phase 1. These steps are repeated throughout in Phase 2 and Phase 3. The context with which each of these activities are conducted within these various phases differ significantly, and is explained in these particular contexts.

4.3 Framework Outline and Implementation

In Phase 1 an additional activity is also included, which is referred to as, "Phase 1 Check-list". This activity consists of a range of tick boxes, which need to be completed for the enterprise to gauge whether or not they are adequately addressing the fundamental building blocks of a start-up enterprise. This check-list can be seen in Section 4.2.1, where it was explained in depth. These categories and sub-categories are unique to Phase 1, as they form the operational building blocks of a start-up enterprise.

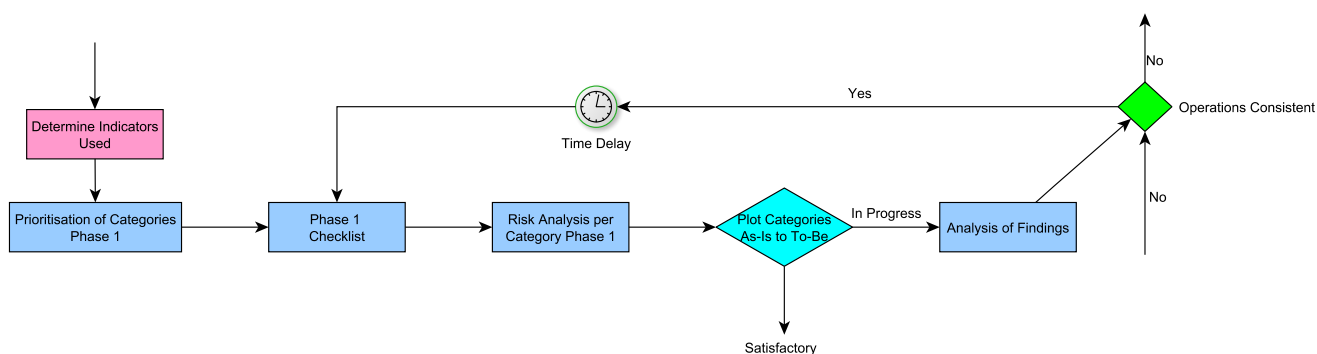


Figure 4.5: An explanation of the frameworks process mapping for Phase 1.

As seen in Figure 4.5, the prioritisation of categories is the first activity block. As Phase 1 deals with the operational aspects of an enterprise, the prioritisation of the categories should be viewed through an operational lens. Considering each category, the questions regarding the prioritisation of each category is considered in an operational sense. This specifically refers to questions regarding the operational progression of each category and the perceived risks associated with each category¹. The intricacies of how these questions and rules of engagement with the tools will work is elaborated on in Section 4.4.

The second action in the process flow is the previously discussed check-list. The next action in the process mapping is the risk analysis per category for Phase 1. This reflects directly on the risk associated with each indicator and the category corresponding with that specific indicator. The risks are viewed specifically in the operational risk profile of each indicator with the risk of the category the main criteria. An additional criteria monitoring the ideal To-Be State and the current As-Is State plotted along the risk profile. This should give a general perception of the risk associated with each indicator

¹As described in Section 4.2.2

4.3 Framework Outline and Implementation

and the category considered within the definition of the specific category. The tool to monitor the risk profile is previously discussed in Section 4.2.3.

The next part of the process map represents a decision that needs to be made. The various plotted data points represent a specific location for the As-Is to To-Be state of the enterprise within Phase 1. This should give the user a decision to make on whether they have made adequate progress in Phase 1 to continue to Phase 2 or not. All these decisions are based on the operational adequacies of the enterprise and whether the enterprise feels confident and assured that the results are ready to be viewed in a more strategic manner. If there is enough confidence regarding progress, the user can proceed to the next action block where the analysis of the findings takes place.

The analysis of the findings leaves the user with the opportunity to analyse the findings in the previous step and identify possible opportunities for improvement. Thereafter, another decision needs to be taken. The user needs to decide whether the operations are still consistent with the internal and external need of the enterprise. If not, the enterprise re-evaluates the original internal and external needs defined and restarts the entire process. However, if the operations remains consistent, they go into a time delay to allow for further development of Phase 1. After an appropriate amount of time has passed for the user, the process restarts and the check-list is considered once again. It is important to note that each phase is considered an iterative process, and strives for continuous improvement.

4.3.2 Phase 2 Outline

Phase 2, or, *strategically aligned Enterprise, with established foundations*; is described in Figure 4.6. The process map for Phase 2 is discussed, and shows the sequential steps of the developed framework. As seen in Figure 4.6, there are various sequential steps that are considered in completing Phase 2. These steps are repeated throughout in Phases 1 and Phase 3, but the context with which each of these activities are conducted within these various phases differ significantly, and is explained in these particular contexts.

As seen in Figure 4.6, the prioritisation of categories is the first activity block (the same as in Phase 1). As Phase 2 deals with bringing together the operational aspects with the strategic intent of the enterprise, this aspect of the framework will specifically be considering the transformation from operational ideals to the strategy deployed by the enterprise.

4.3 Framework Outline and Implementation

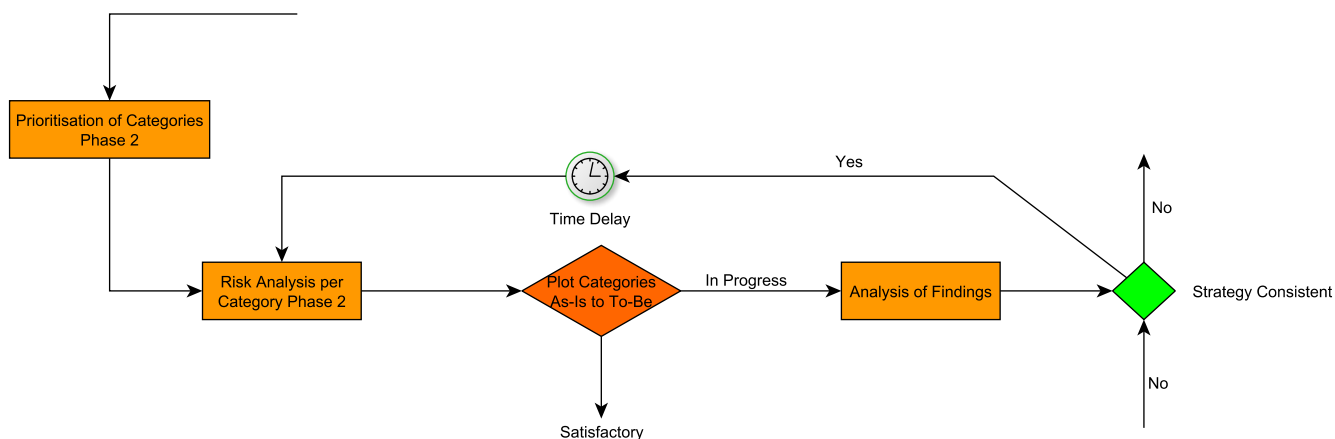


Figure 4.6: An explanation of the frameworks process mapping for Phase 2.

Each category is considered with the lens of moving from operational to strategic, and emphasising the strategic intent in activities. This specifically refers to questions regarding the operational to strategic progression of each category and the perceived risks associated with each category¹. The intricacies of how these questions and rules of engagement with the tools will work will be elaborated on in Section 4.4.

The second action in the process mapping is the risk analysis per category for Phase 2. This reflects directly on the risk associated with each indicator and the category corresponding with that specific indicator. The risks are viewed specifically in the transformational sense of operational to strategic for the risk profile of each indicator with the risk of the category the main criteria. An additional criteria monitoring the ideal To-Be State and the current As-Is State plotted along the risk profile. This should give a general perception of the risk associated with each indicator and the category considered within the definition of the specific category. The tool to monitor the risk profile is previously discussed in Section 4.2.3.

The next part of the process map represents a decision that needs to be made. The various plotted data points represent a specific location for the As-Is to To-Be state of the enterprise within Phase 2. This should give the user a decision to make on whether they have made adequate progress in Phase 2 to continue to Phase 3 or not. All these decisions are based on the transformational adequacies from operational to strategic of

¹As described in Section 4.2.2

4.3 Framework Outline and Implementation

the enterprise and whether the enterprise feels confident and assured that the results are ready to be viewed in a strategic manner with the goal of commercialisation or scaling. If there is enough confidence regarding progress, the user can proceed to the next action block where the analysis of the findings take place.

The analysis of the findings leaves the user with the opportunity to analyse their findings in the previous step and identify possible opportunities for improvement. Thereafter, another further decisions need to be taken. The user needs to decide on whether the strategy remains consistent, or if there are fundamental changes to the originally proposed strategy. If not, the user needs to move to the decision tree in Phase 1. The user needs to decide whether the operations are still consistent with the internal and external need of the enterprise. If not, the enterprise re-evaluates the original internal and external needs defined and restarts the entire process. If the strategy remains consistent, they however go into a time delay to allow for further development of Phase 2. After an appropriate amount of time has passed for the user, the process restarts and the risk analysis is considered once again. It is important to note that each phase is considered an iterative process, and strives for continuous improvement and the external influence is appropriate throughout. If the external need differ, the entire business model needs to be altered.

4.3.3 Phase 3 Outline

Phase 3, or, *commercially scalable and competitive enterprise*; is described in Figure 4.7. The process map of Phase 3 is discussed, and shows the sequential steps of the developed framework. As seen in Figure 4.7, there are various sequential steps that are considered in completing Phase 3. These steps are repeated throughout in Phases 1 and Phase 2, but the context with which each of these activities are conducted within these various phases differ significantly, and is explained in these particular contexts.

Phase 3 is also the final phase of this framework, and it can be considered that if a start-up progresses through Phase 3, that they are no longer considered a start-up enterprise. At this stage they should be financially and commercially sustainable enough to make ends mead.

As seen in Figure 4.7, the prioritisation of categories is the first activity block (the same as in Phase 1 and Phase 2). As Phase 3 deals with taking the strategic intent

4.3 Framework Outline and Implementation

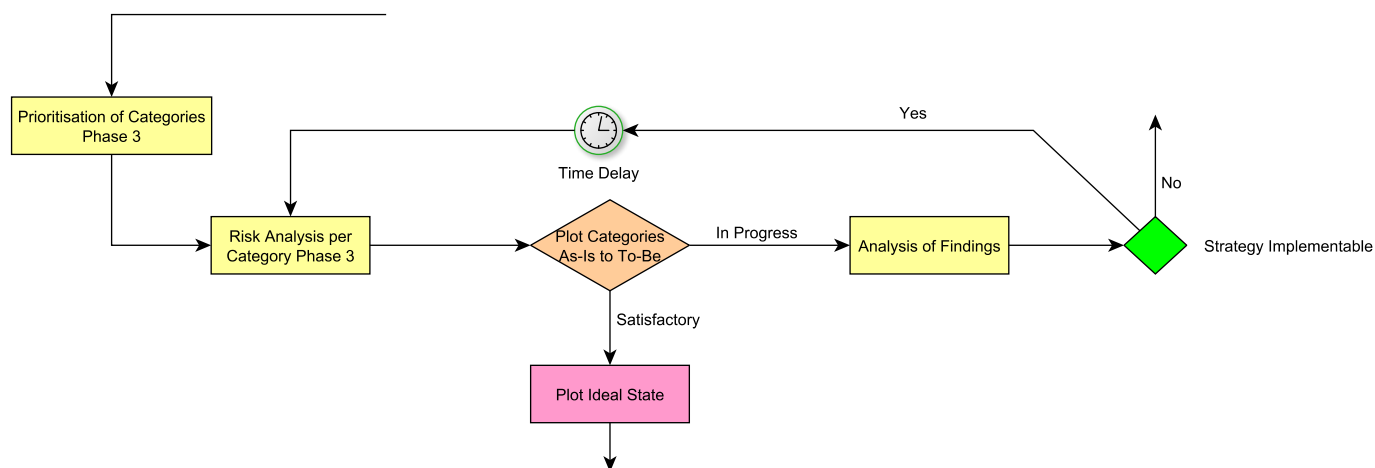


Figure 4.7: An explanation of the frameworks process mapping for Phase 3.

and translating it into implementable, realistic strategies that can be utilised to commercialise the start-up in a sustainable manner. This aspect of the framework will be looking at monitoring the progression of these strategies. Each category is considered through the lens of moving to implementable, commercialising strategies, and emphasising the strategic intent and commercialisation in the activities. This specifically refers to questions regarding the strategic progression of each category and the perceived risks associated with each category¹. The intricacies of how these questions and rules of engagement with the tools will work will be elaborated on in Section 4.4.

The second action in the process mapping is the risk analysis per category for Phase 3, which reflects directly on the risk associated with each indicator and category associated with that specific indicator. The risks are viewed specifically in the implementability of the strategies for the risk profile of each indicator with the risk of the category the main criteria. An additional criteria monitoring the ideal To-Be State and the current As-Is State plotted along the risk profile. This should give a general perception of the risk associated with each indicator and the category considered within the definition of the specific category. The tool to monitor the risk profile is previously discussed in Section 4.2.3.

The next part of the process map represents a decision that needs to be made. The various plotted data points represent a specific location for the As-Is to To-Be state of

¹As described in Section 4.2.2

4.3 Framework Outline and Implementation

the enterprise within Phase 3. This should give the user a decision to make on whether they have made adequate progress in Phase 3 to no longer be considered a start-up, but rather a commercially viable business proposition. All these decisions are based on the implementability of the strategies set aside by the enterprise and whether the enterprise is confident enough in the strategies employed to ensure sustainable financial and operational commercialisation. If there is not enough confidence regarding progress, they proceed to the next action block where the analysis of the findings take place.

The analysis of the findings leaves the user with the opportunity to analyse their findings in the previous step and identify possible opportunities for improvement. Thereafter, another further decisions need to be taken. The user needs to decide on whether the strategies are actually implementable, or if the strategies have become unrealistic or even detrimental to the enterprise. If they are not, the user needs to move to the decision activity in Phase 2. The user needs to decide on whether the strategy remains consistent, or if there are fundamental changes to the originally proposed strategy. If not, the user needs to move to the decision tree in Phase 1. The user then needs to decide whether the operations are still consistent with the internal and external need of the enterprise. If not, the enterprise re-evaluates the original internal and external needs defined and restarts the entire process. If the strategy remains consistent, the user moves into a time delay to allow for further development of Phase 3. After an appropriate amount of time has passed for the user, the process restarts and the risk analysis is considered once again. It is important to note that each phase is considered an iterative process, and strives for continuous improvement and the external influence is appropriate throughout. If the external need differ, the core business model needs to be altered.

4.3.4 As-Is to To-Be Conceptualisation

The As-Is to To-Be concept is required throughout the framework. This is based on the principles used by (ARENA, 2014a) and explained in Section 2.2.4. By identifying the current as-is state of the enterprise, it becomes easier to determine an appropriate to-be state to set as a goal for the enterprise when strategy is conceptualised and on planning future endeavours. By having a more realistic idea of what the end goal is, it is easier for the enterprise to evaluate their current shortcomings.

4.3 Framework Outline and Implementation

Phase	Regulatory Environment	Stakeholder Acceptance	Technical Performance	Financial Proposition -Cost	Financial Proposition -Revenue	Funding	Industry Supply Chain & Skills	Market Opportunities	Company Maturity	Entrepreneur Capability
Phase 3							62%	54%		
Phase 2	62% ↑ 72%	75% ↑ 61%	52%	18% ↑ 18%	68%	62% ↑	62% ↑	37% ↓ 54%		53%
Phase 1						33% ↑			27%	

Figure 4.8: The plotting of the As-Is to the To-Be status of the enterprise across the various phases.

4.4 Parameters of Framework

With this in mind, the As-Is to To-Be analysis is conducted for each phase and each indicator based on the data retrieved from the enterprise. As explained in the previous sections, there are various tools available to gather this information, but it still needs to be portrayed in a method that gives a meaningful visual representation of the current state of the enterprise. Therefore, not only the entrepreneur can interpret it, but also colleagues and investors. This representation should serve as a communication tool for the framework and can be seen in Figure 4.8. From Figure 4.8 it can also be seen how the various indicators are linked with the specific phases. This visual representation, will serve as a reflection of the current state the enterprise currently finds themselves in. The risk, and As-Is analysis tool used in Figure 4.4 assists with determining the current risk associated and relative position of the enterprise as reflected in Figure 4.8. Therein the average position in each indicator is showcased, as well as the associated colour of risk profile inside the specific indicator.

This should give an indication of the current position the enterprise finds themselves in at the specific point in time, and also point to the riskier areas of the enterprise. It is important to note that at this stage of research, the indicators are still considered independent of one another and serve as a monitoring and reality-checking tool to assist in the process of commercialisation. By no means is this a measurement tool. In Chapter 5 this is seen in practice. The to-be state analysis is outside of the scope of this study, but the methodology is discussed. To obtain accurate data for determining the to-be analysis, an enterprise needs to be monitored over a longer period of time.

4.4 Parameters of Framework

This section is a brief set of rules on how to engage with the framework and sequentially work through the process. A few rules are stipulated to help guide the individual to completing the exercise and assist them to be as objective through the process as possible. As each enterprise is unique, this is only a guideline and common sense should be applied throughout to obtain maximum value adding impact from the process.

1. Each phase should be considered in light of their respective definitions. This also applies to the various indicators and categories.

4.5 Testing of Framework Outline

2. Regardless of the current state of the enterprise, the enterprise should engage with the framework from Phase 1. This will highlight the areas of improvement required in lower phases as well.
3. When engaging with the various phases, it is imperative to consider each phase as independent entities, and engage with them accordingly.
4. It is important to note that the framework is not a competitive analysis with other enterprises, but rather a monitoring assessment of the enterprises' own progress. That being said, benchmarking with other enterprises remains part of the external factors that need to be considered.
5. The framework is only value adding when honest and concise feedback is given. Thus, if the enterprise does not use the framework as a reality check, or if they try to be too hard on themselves - little value adding knowledge will be obtained.

These rules or parameters are concepts to be considered throughout the process. The limitations to this study is also noted. The sample size of individuals partaking in the interviews are relatively small, especially when it comes to start-up enterprises. Even though various experts were consulted, the possibility of bias towards certain ideas do exist. It is also acknowledged that within the scope of this research, the quantitative analysis on various start-ups is not possible. Further studies on this will be required. In particular the to-be analysis.

4.5 Testing of Framework Outline

The current description of the framework is particularly theoretical at this stage, and case studies need to be conducted to ensure proper validation of the process. Three case studies are conducted in each phase as part of the validation process on the various companies in different stages of their start-up journey. In Chapter 5, these case studies will be conducted and analysed to gain value adding knowledge of the proposed framework. The current form of the framework was refined through various engagements with industry experts and literature, the case study is the final test of validation for the proposed objectives of this research paper. Before the case studies are conducted, it is important to note that one of the most value adding capabilities of this framework,

4.6 Validation of Chapter 4.

is in the process of participating in the framework. The enterprise should gain valuable insight into their enterprise when engaging with the various indicators and categories.

4.6 Validation of Chapter 4.

This chapter is derived through the use of literature, and various interviews with industry experts via the Delphi Technique. This section presents a breakdown of what has been validated by the various sources in the various sections, to prove validation. This illustrated in Figure E.1, Figure E.2 and Figure E.3, which can be found in Appendix E. Following these two basic methodologies of literature and the Delphi Technique, the methodology for implementation in Chapter was derived. The methodology for implementation in Chapter 4 was derived by following the two basic methodologies via literature sources and the Delphi Technique

4.7 Chapter Summary

This chapter serves as an indication of how the framework should be implemented in reality. It starts off by re-iterating the purpose of the framework, and what the objectives of the framework should achieve. The methodology is then discussed, and a process map is drawn up on how the process of the framework takes shape. The generic aspects of the process map is explained, in the context of the various tools that are used in the framework. The tools are then individually discussed, starting with the Phase 1 check-list, which incorporates all the fundamental elements of an enterprise. The use of the check-list is explained and broken down. The perceived priorities of the enterprise is then discussed, and explained, along with the purpose of the specific exercise. Following this, the As-Is to To-Be analysis is explained and discussed. It is also broken down into its various quadrants and what each quadrant represents. The two elements within the tool is also explored, namely the risk factor and the current state determination.

The various phases are discussed with the context of the tools explained. The respective case scenarios are explained, along with the iterative process built into the phases. Each phase is individually covered, but a generic tendency can be seen within each one. The method of portraying these results are then discussed and visually

4.7 Chapter Summary

showcased in the As-Is to To-Be conceptualisation. The refining of the framework presented by ARENA (2014a) is discussed and elaborated on throughout. With specific emphasis on the categories introduced and the transition from a six tier framework to a three phase framework. The links between the three phases are also explained. Thereafter, basic rules for engaging with this framework is laid out, showcasing some of the restrictive elements to this study. Finally, a validation summary of the chapter is conducted. This chapter, along with Chapter 3 serves as the completion of Objective 2 - *Conceptualising a framework that can be evaluated against expert opinions and refined through various iterations*. The implementation of this framework can be seen in Chapter 5.

Chapter 5

Case Studies

After establishing how the framework will look and how the framework will be implemented in theory. Various companies were approached, to assist with the validation process, and the company names are not listed for privacy reasons. This chapter will give an overview of the companies being reviewed, and an analysis of the companies current as-is status is observed and documented.

5.1 Overview of Implementation

The implementation was conducted through a series of interviews, known as case studies. A document was written, giving a summary of the work done in the previous chapters, with an explanation of what the framework entails and how the tools are applied to estimate the current position of the enterprise within the framework.

This document entailed:

- A context section of where CRI stems from.
- An overview of how the current CRI framework is adapted from the framework developed from ARENA (2014a) to incorporate the enterprise development cycle developed by du Preez *et al.* (2015).
- An overview of how this framework can be applied on the enterprise and how it assists with the determining of the current as-is state and the future to-be state.
- It then elaborates on the various tools described in the previous chapters, these include the prioritisation matrix, the risk analysis and current state polar matrix,

5.1 Overview of Implementation

and finally the plotting of the current as-is and risk categorisation state in the framework.

- Finally, the document outlines the various polar matrix's of risk analysis and current state plotting of the position the enterprise finds themselves in, and the actual questions on how to implement this position.

Using this document as a guide, and the information provided as context, the interviews were conducted. The entrepreneur first does an estimation on the prioritisation matrix, as seen in Figure 4.3, on what they deem their current priorities are to determine how the operational aspects of the enterprise have been dealt with. As the interviewee is prepared to an extent beforehand, the process runs more efficiently. The questions around the interview revolve around two core concepts:

1. Determining the phase in which the enterprise is for each indicator.
2. Asking the question - "*In the indicator ..., based on the definition provided in the context document¹, what would you reflect to be your current risk profile, and current as-is state compared when considering the ideal to-be state for this specific category² in the phase indicated*", an indication on the current state of the categories inside the specific indicator can be established. This is done by using the risk and current state tool as seen in Figure 4.4.

These two concepts are used throughout, with each component of the framework, where the concepts are unpacked and deliberated to determine the most accurate possible outcome. These two concepts simplify a complex scenario, and assists in keeping some of the variables to a minimum. For example, when evaluating the **Regulatory Environment** and the category **Sales** there would be two main questions. The first one would be something like, "*When considering the regulatory environment of your enterprise, and looking at the three definitions of the phases, where would you say your enterprise currently resides.*". Ensuing from this a discussion takes place to assist the individual in determining what the current phase is they are engaging with. The second question revolves around the risk- and as-is state analysis. This question would

¹Definitions can be found in Chapter 3 under Section 3.2.1.

²Category definitions can be found in Chapter 3 under Section C.1

5.2 Assumptions on Case Studies

be asked along the line of, ” *When considering the particular phase for the category of Regulatory Environment and thinking of your Sales. How much risk would you associate with sales in a regulatory sense? For example, how probable is it for the regulatory environment to change significantly. Then, thinking of the left side of the matrix (the least ideal state) as the least amount of development and the right side (ideal state) as the ideal amount of development within the phase, where would you plot your current as-is state.*“.

These questions are posed for each indicator, and its corresponding categories. These results give a relative overview of the current position of the enterprise within each indicator, and establishes the risk associated with the current business portfolio. Certain assumptions were made beforehand to reduce variability and certain validity risks were discovered during implementation.

In ideal circumstances, the entrepreneur would be able to use this framework to determine their current as-is state, and re-do the exercise over time to track their progression to their ideal to-be state. This is currently not feasible, as the framework is still underdeveloped, and would require a few more case studies to prove it effective. This being said, with the help of a facilitator and external consultation with individuals who have background in the particular industry, an indication to the relative as-is state of the enterprise can be obtained.

5.2 Assumptions on Case Studies

Some assumptions needed to be made to ensure the least amount of variability was made throughout the case studies. These assumptions are believed to be of little interference to the integrity of the study, but rather a mechanism to avoid confusion or duplicating interpretations of specific indicators. These assumptions are derived through the engagement with the various incubators consulted, in particular Launch-Lab. A test case study was done to determine the challenges of implementation, and these assumptions were considered. These assumptions hold true to all tech-start-ups engaging on this framework. Furthermore some of the assumptions were influenced by the discourse with experts in the venture capitalist field. These assumptions are:

- The definitions provided in Chapter 3 are the reference point when questioning the implementation of the framework or if any uncertainty arises.

5.3 Validity Risks

- Each indicator is seen as independent of one another within the framework. This ensures that there is specific focus on the indicator when it is being investigated, and also allows for an enterprise to be in different phases on different indicators.
- As pointed out in the previous point, an enterprise can be in more than one phase simultaneously. In other words, the enterprise can be at a strategic level for their sales, but still be working on their operations when considering finances.
- That the enterprise has completed the check-list¹ for the items related to the specific category, in the case that the enterprise is at least established in Phase 1.
- The enterprise needs to have a background and active participation in the technology domain. Albeit consultancy, or practical application, the core business function needs to be centred on technology. This reduces the variability of the industry and ensures for more comparable results.

These are the fundamental assumptions taken before engaging on the case studies and needs to be communicated to the participant in the case study. Variability was further reduced with iterative engagement with the candidates and external stakeholders with minimal knowledge of the company, but particular knowledge of the industry.

5.3 Validity Risks

When conducting the case studies, certain challenges are highlighted beforehand, and others only discovered during the interviews. Particularly challenging obstacles included the ability to simplify the framework into an understandable and easily interpretable document that could be utilised without the physical presence of a facilitator. Even with the simplified version, the average processing time for a case study had the potential of lasting up to three hours, depending on the participant's grasp of the concepts.

Identifying possible case studies and convincing those involved to participate in the case study posed another challenge to the success of this study. Start-ups are notoriously pre-occupied and significantly more invested in their own activities than in

¹As seen in Table 4.1

5.3 Validity Risks

research. The other major challenge included mitigating bias within the results, which requires intricate interrogation into decisions, and posed as a time consuming process.

Bridging the knowledge gap posed another serious concern. As the interviewee only engages with the material for a limited time period, it does become difficult to communicate certain key concepts. A learning curve is thus notable within the case studies and should definitely be taken into account with future case studies. This risk was mitigated with the context document sent out beforehand as pre-reading and the interviewer being present during each case study. As the document is also a manual document, the transcribing of results often become a lengthy process.

The Kotter framework, described by Gupta (2011) is an effective method to perceive the change model for adopting particular strategies derived from this framework. The change management in adopting the described needs derived from the framework is important in capturing the value of the framework, and poses a risk if the particular enterprise does not entertain the findings in their proposed strategies.

A degree of bias is to be accepted. Even though this might seem as a validation concern, the bias is part of the process to get the entrepreneur thinking about different indicators within their enterprise. The case studies were validated through consultation with the incubator in which all these enterprises reside, namely LaunchLab in Stellenbosch. As mentioned in Chapter 1, this field of study is quite new, and the framework being developed needs to be quite robust to be incorporated into the Industry 4.0 drive. This research piece takes the existing framework and adapts it via literature and expert consultation. It is therefore important to note that it is not new work, and the testing of the framework is used to investigate feasibility, not effectiveness.

Another potential validity risk of note, is the fact that start-up enterprises generally have limited executives, and often access to these individuals are limited. Results will thus at some points be determined by an individual executive from the enterprise. This bias is however countered through thorough consultation with the incubator or direct stakeholders of the enterprise. This is done with this study.

Finally, the time constraint on this research, restricts the to-be state from being developed, as this should be done over several interviews over a period of time, to monitor the progression of the indicators within the phases.

5.4 Criteria of Companies Selected

A criteria is established for the selection of companies on which to perform the case study. The criteria needs to be in line with the methodology of mitigating validation concerns. In other words, the companies selected need to assist with the mitigation of the validity risks listed in Section 5.3.

The framework is specifically being tested for enterprises within the technology domain, the obvious criteria is thus that the company is required to be in a technological associated field. This includes enterprises who consult on technology, apply technology, or whose core business practices are directly related to technology.

The enterprise still needs to be considered as a start-up. The company should thus not be completely financially sustainable (paying salaries on a consistent basis, a lower than normal company maturity, not generating sustainable profitable revenue) and should still be considered a start-up, based on the definitions investigated in the literature in Chapter 2.

Furthermore, the start-up should be willing to engage on the topic, and disclose their inner workings. This allows the interviewer and interviewee to openly question the strategies and deliberate the relative position on the CRI framework. As the framework is not a measuring tool, but rather a framework to help determine the relative progress the company has made in the commercialisation process, the deliberations need to be open and honest to be of any value adding contribution.

Finally, each company needs to be in a different industry within the technology domain. This will increase the sample size of the case studies and give more insight and depth into the results obtained. Ideally, a sample of enterprises need to be taken from different phases within the CRI framework, to offer a broader validation of the framework.

5.5 Company A

Company A is a data consulting enterprise, currently entering its third year of operations. Both individuals leading the enterprise have technical backgrounds and have multiple years' experience, pre-dating the start of their enterprise. The data consulting enterprise uses various techniques and particularly open source programming tools to deliver a solution to their clients.

5.5 Company A

Company A describes themselves as a start-up, with financial stability, client satisfaction through customised product solutions and client acquisition still at the forefront of their priorities. The enterprise currently does not employ any other individuals, with the majority of the value adding skills residing with the founders.

5.5.1 Case Study Company A

The case study was conducted on 10 June 2019, with two of the founding members from Company A. The case study was conducted with the view of validating whether the proposed methodology for reviewing the framework was attainable and also to obtain valuable feedback on what the implementation could reveal of the enterprise. At the end of the case study, a follow-up meeting was conducted to validate results, and get feedback for the process followed.

At the start of the case study, the current perceived priorities were surveyed. This gave an indication of what the enterprise currently considers the areas where their time and resources were being allocated to. These result for Company A can be seen in Figure 5.1:

Category	Perceived Priority
Background & Ownership	4
Strategy	5
Product & Technical	4
Operations	2
Marketing	1
Sales	3
Finances	4
Human Resources	4
Leadership & Soft Skills	3
Legal	3
Intellectual Property	2
Environmental, Social, & Governance	1

Figure 5.1: The estimated category prioritisation by Company A.

From this prioritisation by Company A, five specific categories are prioritised. These include, **Background and Ownership, Strategy, Product and Technical, Finances, and Human Resources**. Strategy was outlined as the category that demanded the most amount of allocated time and resources. These priorities will be

5.5 Company A

compared to the actual as-is position that is determined through the utilisation of the framework.

Company A engaged with the various tools of the framework, in an attempt to establish the relative as-is position within the framework, along with the associated risk profile. The methodology used for the various stages of implementation can be reviewed in Section 4.2 and Section 5.1 where the tools are described and the processes explained respectively.

Based on the engagement by Company A with the risk and as-is status tool, as seen in Figure 4.4, an estimated current state analysis could be performed. The results from this case study can be found in Appendix F, where the data can be seen in Table F.1. The various figures describing the current as-is state and risk profile of the various indicators of Company A can be found in this section. The summary of these results, can be seen in Figure 5.2 below.

In Figure 5.2 the various locations of the current as-is states for each indicator is plotted, along with the respective percentage of the risk associated with each indicator. From Figure 5.2 it is evident that the enterprise is still in the early stages of its existence. This is verified by the enterprise's active functioning being less than two years. Company A can still be considered a Phase 1 enterprise. This is defined as a - **Viable proposition and establishing enterprise, fundamentally considered a start-up.**

Company A is nearing the end of their Phase 1 stage, but certain high risk indicator can be a hurdle. This refers to Market Opportunities and Company Maturity. Based on Market Opportunities it is evident that the enterprise has no clear direction in terms of a marketing strategy and direction. As it is still Phase 1, the marketing aspect is still operationally related and thus easier to address.

Company Maturity poses a high risk, and this could simply be a result of the age of the company. As they are still relatively new, certain procedures and credibility is still being established. When considering the consulting industry, there are extremely competitive rivals and maturing into an established entity is a challenge.

From the indicators that are already in Phase 2, namely Stakeholder Acceptance and Financial Proposition in terms of Costs. The strategy established by the co-founders seems relatively set, but the risk associated with the longevity of the enterprise increased the risk that the strategy might not hold.

5.5 Company A

Phase	Regulatory Environment	Stakeholder Acceptance	Technical Performance	Financial Proposition -Cost	Financial Proposition - Revenue	Industry Supply Chain & Skills	Market Opportunities	Company Maturity	Entrepreneur Capability
Phase 3									
Phase 2		69% 		46% 					
Phase 1	53% 		68% 		68% 	39% 	75% 	70% 	38%

Figure 5.2: The current as-is status and risk profile of Company A, as transcribed from data.

5.5 Company A

The risks for the costs are managed quite effectively, but this is largely down to the limited employees in its current state. Once the enterprise starts moving towards Phase 3, the risk will increase with the attempted scaling of processes. The other indicators border on the upper half of Phase 1 and reflects the final stages of '*sorting out their operations*'. Even though through the case study, it was evident via verbal conversations that thought has been put into strategy, the enterprises' position will need to change on the majority of the indicators to actually reflect these ideas.

This leads to the to-be concept. Even though the framework has plotted a current as-is state, the next steps need to be considered. From the data gathered, it is evident that indicators like Market Opportunities, Technical Performance, Revenue and the Company Maturity needs significant attention for the enterprise to proceed to the next phase. Their risks are in the top quartile and could pose a threat to the companies' existence. The Phase 2 indicators, Stakeholder Acceptance and Costs, need to be monitored and managed appropriately, particularly Stakeholder Acceptance, where a high risk can be found.

5.5.2 Reflection of Framework on Company A

Based on the prioritisations initially laid out by Company A in Figure 5.1, an estimation was formulated of where the enterprise currently views their biggest challenges within the organisation. The framework reflects a different picture and indicates where the lowest current as-is states can be found and in some cases where the priorities might need to shift towards.

Furthermore, when getting feedback on the initial results, the framework reflected the thoughts of the entrepreneurs to an extent, and no significant differences were picked up. The one big criticism of the framework is the time it takes to complete the tools to establish the current as-is state. It is also noted that follow-up sessions would be required to get the real value adding effect on the enterprise on at least quarterly intervals. This would allow the enterprise to track progress through the phases and monitor the effect of short- and long term strategies. This however falls outside the scope of this study.

From the literature reviewed in Chapter 2, and looking specifically at the ARENA model and the Enterprise Engineering Framework in Section 2.2, along with the derived

framework explained in Chapter 3, a strategy to move the enterprise nearer to commercialisation can be established. This will allow the enterprise to set realistic, achievable goals, without overestimating their current as-is state. This serves as a terrific reality check on the progress of an enterprise.

Company A is a good example of a Phase 1 enterprise in the transition process of Phase 2. This reflects the process map in Figure 4.1 of the framework and the linking between phases described in Figure 3.3.

5.6 Company B

Company B is an enterprise that specialises in soil microbiology. They have adapted and specialised technology within the industry to increase efficiency and shorten the process time in labs for their specific experiments. The origin of the enterprise stems from the academic sphere where significant research and development was performed within a public institution, before a spin-off into the private sector was established.

Company B is currently in its second year of existence, and the founders within the enterprise are research experts in their fields. This has led to the organisation acquiring clients based on technology and the reputation of the participants. The enterprise currently has a small workforce outside the founders, with one employee employed full time, and two as part time. The enterprise generates sustainable revenue for the size they currently find themselves in, and the prospect of expanding is on the horizon.

The enterprise is disrupting a particular part of an industry, within soil microbiology, but the market penetration capacity of the enterprise is still limited and often constrained by their own ability to scale their operations. Company B is entering an interesting phase of its life cycle, and certain crucial strategies and company directions need to be decided on.

5.6.1 Case Study of Company B

The case study was conducted on 2 July 2019, with one of the founding members from Company B. The case study was conducted with the view of validating whether the proposed methodology for reviewing the framework was attainable and also to obtain valuable feedback of what the implementation could reveal of the enterprise. At the

5.6 Company B

end of the case study, a follow-up meeting was conducted to validate results, and get feedback for the process followed.

At the start of the case study, the current perceived priorities were surveyed. This gave an indication of what the enterprise currently considers the areas where their time and resources are being allocated to. These result for Company B can be seen in Figure 5.3.

Category	Perceived Priority
Background & Ownership	3
Strategy	5
Product & Technical	2
Operations	4
Marketing	3
Sales	3
Finances	5
Human Resources	3
Leadership & Soft Skills	2
Legal	2
Intellectual Property	2
Environmental, Social, & Governance	2

Figure 5.3: The estimated category prioritisation by Company B.

From this estimation of Company B, three categories were deemed as a priority at this stage. These include, **Strategy, Operations, and Sales**. Strategy is seen as a current priority by the enterprise as they deem themselves to be in a scenario where various crucial decisions and directions need to be established at this stage of the life cycle. Operations forms a fundamental part of these decisions, and a significant increase in sales is required to maintain their growth. From Figure 5.3, it can be established that there are various categories inside the enterprise that does not currently seem important enough for the allocation of significant resources.

In an attempt to establish the relative as-is position within the framework, along with the associated risk profile, Company B engaged with the various tools of the framework. These tools also served as an excellent sound board to test whether these priorities were currently being correctly classified. The methodology used for the various stages of implementation can be reviewed in Section 4.2 and Section 5.1 where the tools are described and the process explained respectively.

5.6 Company B

Based on the engagement by Company B with the risk and as-is status tool, as seen in Figure 4.4, an estimated current state analysis could be performed. The results from this case study can be found in Appendix G, where the data can be seen in Table G.1. The various figures describing the current as-is state and risk profile of the various indicators of Company B can be found in this section. The summary of these results, can be seen in Figure 5.4 below.

In Figure 5.4 the various locations of the current as-is states for each indicator are plotted, along with the respective percentage of the risk associated with each indicator. From Figure 5.4 it can be deduced that Company B is quickly entering a strategic phase of their life cycle within Phase 2. Although four indicators are still in Phase 1, they are all in the upper quadrant of their as-is state. From the indicators currently in Phase 1, the cost, funding and company maturity are seen as low risk areas. Since the enterprise has a history of public funding and to an extent, is still being supported by public funds, the risk remains low. Company maturity is a risk being managed, and will eventually escalate progress once more clearly defined strategies are in place. The one significant risk within Phase 1, refers to regulatory environment. Since the enterprise is engaging in new technology, and particularly disruptive technology, the regulatory field for this industry is barely defined. In the case that massive regulatory changes occur, the enterprise might find themselves obsolete. The risk is thus high, but being managed, based on the current as-is state. Clearer strategies will need to be developed for the enterprise to progress through Phase 2.

The majority of the indicators find themselves in Phase 2, which refers to - *Strategically Aligned Enterprise, with Established Foundations*. From the current as-is state of Company B, it is evident that the operations for the majority of these indicators have been properly established. The question now is to link these operations to relevant strategies that could assist with the scaling of the enterprise once they enter Phase 3. The two main risks pertain to the revenue and the stakeholder acceptance.

The revenue is also the lowest ranking indicator, and poses a significant risk in the expansion of the enterprise. The enterprise is heavily dependent on sales to validate their technology and build a broader market in a competitive industry. The stakeholder acceptance poses a risk, due to the vastly different background and demographic groups within the enterprise. This could become problematic when defining the strategy to be applied to take the enterprise forward.

5.6 Company B

Phase	Regulatory Environment	Stakeholder Acceptance	Technical Performance	Financial Proposition -Cost	Financial Proposition - Revenue	Funding	Industry Supply Chain & Skills	Market Opportunities	Company Maturity	Entrepreneur Capability
Phase 3										
Phase 2		61% 	52% 		68% 		47% 	54% 		53%
Phase 1	63% 			46% 		33% 			27% 	

Figure 5.4: The current as-is status and risk profile of Company B, as transcribed from data.

5.6 Company B

As the enterprise is currently in their second year of operation, their current as-is state reflects positively on them. The other indicators within Phase 2 indicate that certain strategies need to be put in place and defined for the enterprise to progress further within the framework. The main priority of the enterprise, based on their current as-is state, is to bring their company maturity on par with their other Phase 2 indicators as to ensure the company simultaneously matures along with other activities. The revenue, cost and funding need significant attention, and clear strategies need to be established to mitigate risk, and ensure the maturing of these indicators.

5.6.2 Reflection of Framework on Company B

Company B is in the process of becoming an established Phase 2 enterprise, meaning that the majority of the indicators are currently in Phase 2. Based on this, it can be expected that Company B should soon start prioritising the establishment of specific strategies to assist with the scaling of the enterprise. Before the enterprise can move into Phase 3, these strategies need to be established and initial efforts should already be reflected.

Company B also has an extreme regulatory risk, as mentioned in the previous section. This can drastically affect the way in which the enterprise operates, and possibly even hamper it altogether. The enterprise is aware of the risks and currently have a good understanding of the possible risk within the indicator and have the relative legal mechanisms in place to protect them.

The enterprise is currently in the middle of Phase 2, and the speed of scaling will significantly start to increase if the strategies are implemented. The risks will become more volatile unless managed through significant planning of strategies to penetrate and sustain competition in a competitive market environment.

Feedback gained from Company B was positive, although one take away from the interview is the importance to include all senior management in the framework analysis. This could be a to-be iteration of the framework and assist in the reduction of bias and other variables, for example the background of the entrepreneur could make the individual oblivious to certain shortcomings.

5.7 Company C

Company C is an enterprise within the agriculture and manufacturing industry. Company C specialises in the development, manufacturing and implementation of commercial grade scales in the agriculture sector. Throughout the process, Company C generates a significant amount of data on their smart scales, which allows them to offer a customised solution to their various clients.

The enterprise is currently a spin-off¹ from an existing business. The smart scales are the specific organisational differentiator and the enterprises' structures have altered significantly enough for the enterprise to be considered a new start-up enterprise.

The enterprise is entering its third year of these changes, and the challenges of internal change and the commercialisation of the enterprise has truly been brought to the forefront of discussions. The enterprise employs a small team on a full time basis, and have established clients. Even though the agriculture industry in which they are involved has seen a downturn in performance, the opportunity for growth and client acquisition is still very much available.

5.7.1 Case Study of Company C

The case study was conducted on 9 July 2019, with one of the founding members from Company C. The case study was conducted with the view of validating whether the proposed methodology for reviewing the framework was attainable and also to get valuable feedback of what the implementation could reveal of the enterprise. At the end of the case study, a follow-up meeting was conducted to validate results, and get feedback for the process followed.

At the start of the case study, the current perceived priorities were surveyed. This gave an indication of what the enterprise currently considers the areas where their time and resources are being allocated to. These result for Company C can be seen in Figure 5.5:

From figure 5.5 five categories are seen as current priorities. These include, **Strategy, Product and Technical, Marketing, Sales, Human Resources, and Leadership and Soft skills**. Due to the current stage the enterprise finds itself in, strategy

¹A new or re-defined enterprise within the structures of an existing enterprise. This could lead to the establishment of a new enterprise or the replacement of an old one from which the spin-off stems.

5.7 Company C

Category	Perceived Priority
Background & Ownership	2
Strategy	5
Product & Technical	4
Operations	3
Marketing	5
Sales	5
Finances	3
Human Resources	4
Leadership & Soft Skills	4
Legal	3
Intellectual Property	2
Environmental, Social, & Governance	2

Figure 5.5: The estimated category prioritisation by Company C.

will play a pivotal role in the upcoming decisions the enterprise will need to make. The enterprise is also looking at scaling its market share and thus marketing and sales are seen as priorities, and along with that the enterprise will need to look at its human resources and the training of these individuals. These are all signs that the enterprise is actively looking at expanding its market share and strategy will coincide with this proposed expansion.

The **Background and Ownership, Intellectual Property, and Environmental, Social, and Governance** are seen as the categories that currently need the least amount of effort. This could be down to various factors. One could be that the enterprise considers these elements to be at an adequate level or that the enterprise deems them as simply not important enough to allocate any significant resources. Certain risks within the as-is state in Figure 5.6 does however contradict this.

Company C engaged with the various tools of the framework, in an attempt to establish the relative as-is position within the framework, along with the associated risk profile. These tools also served as an excellent sound board to test whether these priorities were currently being classified correctly. The methodology used for the various stages of implementation can be reviewed in Section 4.2 and Section 5.1 where the tools are described and the process explained respectively.

Based on the engagement by Company C with the risk and as-is status tool, as seen in Figure 4.4, an estimated current state analysis could be performed. The results

5.7 Company C

from this case study can be found in Appendix H, where the data can be seen in Table H.1. The various figures describing the current as-is state and risk profile of the various indicators of Company B can be found in this section. The summary of these results, can be seen in Figure 5.6 below.

In Figure 5.6 the various locations of the current as-is states for each indicator is plotted, along with the respective percentage of the risk associated with each indicator. From the as-is state it is evident that Company C is moving towards a stage where the enterprise is almost completely in Phase 3. This means that the company is, *Commercially scalable and a competitive enterprise*. This leads to the assumption that Company C is currently implementing their strategies in an attempt to be commercially scalable and financially sustainable in a competitive and difficult agriculture industry. Certain indicators are currently still in Phase 2, and need to be addressed and managed accordingly. The regulatory environment and the two financial streams, cost and revenue, are the three indicators still in Phase 2. The regulatory environment currently does not have an extreme significance on the manner in which the enterprise operates, but in a Phase 3 context this will change. The growth of the enterprise significantly alter the way in which the regulations that guide them are interpreted. It is currently one of the lowest risks for the enterprise, but in Phase 3, that is bound to change. Strategies managing this risk need to be considered.

The financial aspects of the enterprise are both deemed as high risk items, and both residing in Phase 2. Thus, even though certain strategies might have been planned, the actual implementation of these strategies might be more difficult to manage and implement. This is a crucial risk that needs to be managed, and unless certain steps are taken, could potentially lead to certain financial constraints within the cash flow and cash generating activities, particularly if the enterprise is scaling. From Figure 5.6, the most notable aspect of Company C appears to be the extremely high risks associated with each indicator.

The only indicator in Phase 3 with a lower risk is the industry supply chain and skills, which is largely due to the origins of the enterprise where most of these processes were already established. It is a factor that also explains why this is the indicator with the highest as-is state. The other indicators within Phase 3 tell a different story. Apart from the indicator mentioned previously, the other five indicators in Phase 3 all have a risk profile exceeding 80%.

5.7 Company C

Phase	Regulatory Environment	Stakeholder Acceptance	Technical Performance	Financial Proposition -Cost	Financial Proposition - Revenue	Industry Supply Chain & Skills	Market Opportunities	Company Maturity	Entrepreneur Capability
Phase 3		84% 	82% 			58% 	81% 	93% 	89%
Phase 2	68% 			73% 	83% 				
Phase 1									

Figure 5.6: The current as-is status and risk profile of Company C, as transcribed from data.

5.7 Company C

They are all located at a similar as-is state, but the risk profiles are worrisome. Specific risk management strategies need to be implemented along with the commercialisation strategies. Unless these risks are managed, it will potentially spell the end of the longevity of Company C.

Stakeholder acceptance and entrepreneur capability both have similar risks. Due to the major age variations of employees within the enterprise, there is a clear knowledge and contingency gap within the organisation. Too much of the knowledge rests with the founders, whilst the lower structures are laid barren should the top structure alter. Along with this, current crucial international partnerships are in the pipeline that would require stakeholder cooperation and agreement. Similarly, technical performance and market opportunities share similar risks. The enterprise is currently in the process of new research and development of a new product, as the current product is not on par with other products in the market. As seen in Figure 4.1, the process flow of the framework might urge the enterprise to re-evaluate their current position as they aim to mitigate these astronomical risks associated with these indicators. The risks are compounded by a downturn in the grape industry, where the majority of the market share currently resides in.

All of these factors are reflected in the company maturity, where the current as-is state is already in Phase 3. Although, some of the risks are still significant across throughout the other indicators. The company has a high risk associated with their current company maturity and specific risk management needs to be employed across this indicator. Even though Company C in theory seems to be close to their scaling targets, the risk profiles in the various categories reflect that significant changes and planning is required in terms of risk management. The most value that Company C can retrieve from this framework is to have regular reviews of their current as-is state and monitor how their risk management strategies are affecting their risk profile.

5.7.2 Reflection of Framework on Company C

Company C is a good example of an enterprise that is currently in the escalating domain of Phase 3, but simultaneously still has various processes that need to be managed and risk that needs to be mitigated. Company C is also at the risk of over-estimating its current position, particularly with their efforts of research and development. This could potentially lead to them engaging on Phase 1 and Phase 2 activities whilst trying to

5.8 Conclusion of Company Analysis

commercialise. The methodology showcased in Figure 4.1, indicates what the process flow should be to establish whether they are in fact in the correct phase. Funding was also considered to be relevant on this case study, but Company C needs to establish clearer parameters of their requirements before an as-is state can be determined.

Another lesson learnt from Company C during the implementation of the case study, is the possible bias intrinsic in the determination of risk. An element of normalisation might need to be implemented in future iterations of the framework. Even though the indicators were considered independent of one another, Company C highlighted specific scenarios where the level of one indicator could potentially have a direct impact on the as-is state of another indicator. This should be considered and kept in mind for future iterations and the development of the framework.

The case study creates various questions regarding the sustainability of the enterprise, and should serve as a sound board for the enterprise in future discussions regarding strategy and implementation. It is also evident from the original prioritisation of categories in Figure 5.5, that they do not necessarily correspond to the actual as-is state and the requirements in terms of risk and growth.

5.8 Conclusion of Company Analysis

The three different case studies are a reflection of the three potential states of the framework and further showcases how to navigate the enterprise where different indicators can be found within different stages of the enterprise. However, the framework does offer an insight on the applicability of the framework on differing enterprises within the technology domain. The common denominator from all the case studies, is that the company utilises technology to serve their clients.

5.8 Conclusion of Company Analysis

Phase	Regulatory Environment	Stakeholder Acceptance	Technical Performance	Financial Proposition -Cost	Financial Proposition - Revenue	Industry Supply Chain & Skills	Market Opportunities	Company Maturity	Entrepreneur Capability
Phase 3									
Phase 2		69%	75%	46%				60%	
Phase 1	45% ↑ 53%		68% ↑		39% ↑ 68%	39%	73% ↑ 75%	70% ↑	38%

Figure 5.7: The potential iterative step of Company A, when determining their To-Be state when following up.

5.9 Chapter Summary

This being said, it cannot be assumed that this framework will be applied to any company that utilises technology. It was however successful in gauging these three companies, but further investigation will be required to test the concept. The framework did succeed in generating relevant questions regarding the commercialisation potential of each company and plotting their current as-is state.

The next step of the framework is to establish relevant plans of action, and follow the process flow established in Figure 4.1. From this stage, the changes to the original as-is state documented need to be investigated. For example, should one take Company A, and Company A evaluated their current standing, their growth would be monitored and documented as seen in Figure 5.7. From this Company A would have invested resources in establishing more concrete operational processes for the various indicators. As observed, certain risk might fluctuate up or down, based on whether a new phase was entered.

This displays how the framework can be utilised to monitor continuous changes within the organisation and monitor potential changes that might occur. This is however outside the scope of this study, as the third objective outlined in Section 1.2.3, refers specifically at estimating the current as-is state of the enterprise and explaining how the future as-is state should be predicted. On the basis of monitoring the current as-is state, the framework has been successful in its first tested iteration. However, to have a clearer understanding of the value adding capabilities of the framework, a study over a longer period of time needs to be conducted.

5.9 Chapter Summary

This chapter reviews the framework developed in previous chapters and aims capture case studies for the completion of objective 3 in Section 1.2.3. The chapter reviews the strategy for implementation and how the interaction will take place between the interviewer and interviewee. Thereafter, the assumptions made during the case studies are outlined and explained, as to decrease the probability of influence from variables. The validity risks are briefly considered and discussed, where-after the criteria for the companies selected is elaborated on.

The three cases studies are then documented and discussed. The methodology for each remained consistent. Starting with the distributing of an information pack for

5.9 Chapter Summary

the interviewee, the data gathering on each respective company, the documenting and analysis of the data, and finally the discussion of the data. This process is repeated for each company, and lessons learnt from each case study is investigated. Finally, a short conclusion on the case studies is conducted and the to-be state process is explained with an example. The final conclusions can be found in Chapter 6.

Chapter 6

Findings and Recommendations

In this final chapter a review will be conducted of the findings throughout this study, and aim to establish the future research that follow from this thesis.

6.1 Findings of Framework

A comprehensive methodology was followed to move through the entire process of establishing the final framework. From Chapter 1, the problem was defined and a methodology to systematically work towards a solution was formulated. These three objectives were the guide throughout the study, with all the research and interviews with experts framed around solving these three statements. In Chapter 1 the full context of each of these is elaborated on. In this section, a discussion surrounding the way in which was achieved will be covered. The objectives were established and completed which included:

- **Objective 1:** Can existing tools and frameworks be applied to the start-up domain.

In Chapter 2, a literature review was performed where various tools and frameworks were discussed and explained. From this chapter, it was evident that various tools and frameworks are currently being used to assist and monitor start-up enterprises. Although, nearly none are used as a continuous monitoring framework to engage continuously with start-ups enterprises. Through consultation with incubators, such as [LaunchLab \(2018\)](#), it is evident that tools like the BMC, are merely used as an initial gauge, rather than a monitoring tool. This was

6.1 Findings of Framework

part of the problem that needed to be addressed for the completion of objective 1. Objective 1 was thus completed as could be seen in the summary found in Section 2.3.

- **Objective 2:** Conceptualising a framework that can be evaluated against expert opinions and refined through various iterations.

Objective 1 and partly objective 2 were further explored in Chapter 3, where specific reference was made to the various definitions that would be engaged on. Specifically, referring to the indicators highlighted by ARENA (2014a) and Bezuidenhout (2017) through their various research. The various categories were also identified through the various venture capital check-lists that were investigated. This defined the majority of the terms that would be used throughout the framework, as to avoid any ambiguity. One additional indicator was also identified through interviews, namely *Entrepreneur Capability*, which specifically refers to the competency of the entrepreneur as explained in Section 3.2.1.

Finally, the various phases were established, with the help of existing frameworks, such as those defined by ARENA (2014a) and du Preez *et al.* (2015) in Chapter 2. The phases, along with how the links between the phases and possible iterations are all defined in Chapter 3. This process in itself was an iterative process, with various versions of the framework being tested, before it was enhanced after each attempt. The final version is included in this study. A complication that can be foreseen is the amount of time required to complete the exercise, and continuously monitoring the progress of the start-up.

The final part of objective 2 was completed in Chapter 4, where the framework is drafted and developed, and the tools created to acquire the necessary data to populate the framework. This process was conducted with multiple consultations in an attempt to create a user-friendly interface and reduce the time required to acquire the needed data. The eventual time required to conduct the exercise was eventually reduced from four and a half hours of interaction to a mere one hour and fifteen minutes. The various tools are elaborated on in Chapter 4 and if all are followed the most accurate reflection of the value adding capabilities of the framework will be achieved. This is in completion for objective 2 where the framework is conceptualised and refined through iterations.

6.2 Conclusion of Findings

- **Objective 3:** Verifying the framework through various case studies, to increase the value adding capability.

Finally, the fulfilment of objective 3 can be seen in Chapter 5, where three companies were selected to test the validity of the framework. From these interviews, some of the shortcomings of the framework were highlighted. The main purpose of the case studies is thus to determine whether the framework could establish the current as-is state of each enterprise and the appropriate risk profile of each indicator. With these parameters the case studies are successful in determining this factor and was generic enough to cover each industry tested which had technological application. For the completion of objective 3, the framework was therefore successful and serves as an appropriate tool to monitor the progress of a start-up enterprise to the point where they are commercially sustainable.

6.2 Conclusion of Findings

The findings were satisfactory in terms of the three objectives set at the beginning of the research. Although it is evident that further research into this topic can provide a more refined framework which can more effectively monitor the progress of the start-up enterprises. A research study over a longer time period would be able to test the framework and its application more accurately, and allow for more value adding data to be gathered.

Future research is thus a requirement and in particular continuous monitoring of the enterprise would particularly go a long way in establishing the quantified effect of this framework. The various categories need to be investigated in more depth as well, and possible biases could yet prove more prevalent than anticipated. In conclusion, the framework achieved its original purpose and completed the various objectives set out at the beginning of the research. This document serves as a first iteration of a framework that needs to be further developed to achieve the eventual goal of assisting multiple enterprises with the least amount of guidance from the researcher.

In conclusion, for the aim of this research in determining whether the CRI framework can be interpreted and adapted to a start-up environment, has been successfully tested within the context of the three objectives defined in Section 1.2.3, at the beginning of the research.

6.3 Future Work and Recommendations

There is still a vast amount of improvements to the research that can be conducted. This section will serve as an overview of the potential adjustments that can be made to the framework, and more iterative approaches which can be followed. These include:

- The indicators are currently seen as independent of one another throughout the study. However, this assumption seems to be flawed in some cases, in particular the start-up environment. Certain indicators need to carry different weighted averages and the influence that the different indicators have on one another needs to be explored.
- Even though the indicator '*Entrepreneur Capability*' was introduced, the value of this indicator is currently under-estimated. Through the various interviews, it is evident that this indicator plays a significant role in the proneness of investors and clients to contribute to the various start-up enterprises.
- Certain correlations need to be investigated in the context of this framework. One being the relationship of the priorities start-ups deem important versus the priorities that are historically associated with successful incubators. This was mentioned in the literature review under Section 2.2.8.
- The automation of the data collection needs to be investigated. One of the most consistent feedback points from the framework implementation, is to engage with the framework electronically and receive feedback instantly. This would require the programming of an online platform, and was beyond the scope of this study.
- One of the most important parts of the proposed future work. An entire life cycle of a start-up enterprise needs to be monitored to gauge the accuracy of the framework in determining the current as-is state of the enterprise. Furthermore, analysing the strategies employed by the enterprise to alter the current as-is state, and finally to determine the projected to-be state of the enterprise. A continuous improvement methodology and change management strategies are key to the monitoring and improvement of the to-be state.

- The various categories need to be investigated and possible weighted averages need to be established, as this is currently the main reason for bias within the framework. Along with this, certain indicators could have more quantitative measurements than the entrepreneur themselves. For example, by including the financial statements in the as-is state determination, bias within the framework could be reduced.

These recommendations appeared through the various interviews and case studies. Particularly in the refining stage of the framework. The items fall outside the scope of this research, but could prove to make the framework more effective and increase the general effectiveness of the framework in assisting entrepreneurs in the early stages of their enterprises' life cycles.

6.4 Reflection

Reflecting on a study spanning more than one year can often prove difficult. As time has passed, a multitude of developments have shaped how this study was perceived and conducted. Like most complicated questions, the answers obtained are often not what you expect and often takes you down a completely different road than originally expected. This study was not an exception to this.

From starting out with the idea that the author is all knowing on the topic and know exactly what makes a start-up successful, the author quickly realised that the research topic is extremely complicated and often very murky. There is no black or white on this topic and the experts engaged with over the two years of research helped the author to understand that.

The personal objective with this research, was to research and write something that could truly help start-ups. To ensure that research with real world applicability was initiated and tested to try and battle the tragic survival rate for start-up enterprises and play a small part in combating the unemployment rate plaguing South Africa. The hope is, that this is a small step towards reaching that objective.

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Appendix A

The Commercial Readiness Levels Described by ARENA

This appendix covers the CRI levels and model developed by ARENA (2014a). In Table A.1 the six levels of commercial readiness are shown with adapted definitions to make it more applicable to the global environment and not solely for the renewable energy sector. The revised version of these levels and how they will be explored in this thesis can be found in Chapter 2 and Chapter 3 where it is discussed in depth in relation to other variables.

Table A.1: CRI Levels Definitions [ARENA \(2014a\)](#)

	<p>6. Bankable asset class driven by same criteria as other mature industry technologies. Considered as a "Bankable" grade asset class with known standards and performance expectations. Market and technology risks not driving investment decisions. Proponent capability, pricing and other typical market forces driving uptake.</p>
	<p>5. Market competition driving widespread deployment in context of long-term policy settings. Competition emerging across all areas of supply chain with commoditisation of key components and financial products occurring.</p>
	<p>4. Multiple commercial application becoming evident locally although still with the possibility of being subsidised. Verifiable data on technical and financial performance in the public domain driving interest from variety of debt and equity sources however still requiring additional support. Regulatory challenges being addressed in multiple jurisdictions.</p>
	<p>3. Commercial scale up occurring driven by specific policy and emerging debt finance. Commercial proposition being driven by technology proponents and market segment participants - publicly discoverable data driving emerging interest from finance and regulatory sectors.</p>
TRL 9+	<p>2. Commercial trial: Small scale, first of a kind project funded by equity, investors or government support. Commercial proposition backed by evidence of verifiable data typically not in the public domain.</p>
TRL 1-8	<p>1. Hypothetical commercial proposition: Technically ready - commercially untested and unproven. Commercial proposition driven by technology advocates with little or no evidence of verifiable technical or financial data to substantiate claims.</p>

Appendix B

GEDI Matrix

This Appendix looks at **GEDI (2019)** and showcases the graphs used by the source. The **GEDI (2019)** matrix explores the areas where the greatest improvement per indicator is needed to be in the range of industry standards. This is pivotal if the South African entrepreneurial ecosystem is expected to grow to international standards.

	PILLARS		INSTITUTIONAL VARIABLES		INDIVIDUAL VARIABLES	
Entrepreneurial Attitudes	Opportunity Perception	0.42	Market Agglomeration	0.53	Opportunity Recognition	0.60
	Start-up Skills	0.07	Tertiary Education	0.21	Skill Perception	0.49
	Risk Acceptance	0.43	Business Risk	0.44	Risk Perception	0.78
	Networking	0.31	Internet Usage	0.51	Know Entrepreneurs	0.49
	Cultural Support	0.38	Corruption	0.49	Career Status	0.72
	Entrepreneurial Attitudes	28.76				
Entrepreneurial Abilities	Opportunity Startup	0.34	Economic Freedom	0.52	Opportunity Motivation	0.53
	Technology Absorption	0.21	Tech Absorption	0.71	Technology Level	0.39
	Human Capital	0.25	Staff Training	0.66	Educational Level	0.30
	Competition	0.63	Market Dominance	0.65	Competitors	0.85
		Entrepreneurial Abilities	31.19			
Entrepreneurial Aspirations	Product Innovation	0.54	Technology Transfer	0.56	New Product	0.73
	Process Innovation	0.50	GERD	0.55	New Tech	0.95
	High Growth	0.55	Business Strategy	0.57	Gazelle	0.74
	Internationalisation	0.49	Globalization	0.54	Export	0.70
	Risk Capital		Depth of Capital Market	0.86	Informal Investment	0.30
		Entrepreneurial Aspirations	37.99			
	GEI	32.65	Institutional	0.56	Individual	0.61

Figure B.1: GEDI comparative matrix on South African ranking of the various indicators explored by **GEDI (2019)**.

Figure B.1 showcases the various indicators used by **GEDI (2019)** to rank the how the South African entrepreneurial environment compares to other countries, and high-

lights where the biggest changes are required as explained in Chapter 2.

Pillar	Required Increase in Pillar	Percentage of total new effort
Opportunity Perception	0.00	0%
Startup Skills	0.17	63%
Risk Acceptance	0.00	0%
Networking	0.00	0%
Cultural Support	0.00	0%
Opportunity Startup	0.00	0%
Technology Absorption	0.03	11%
Human Capital	0.00	0%
Competition	0.00	0%
Product Innovation	0.00	0%
Process Innovation	0.00	0%
High Growth	0.00	0%
Internationalization	0.00	0%
Risk Capital	0.07	26%

Figure B.2: Quantitative change required to affect South African entrepreneurial ecosystem per indicator (GEDI, 2019).

Figure B.2 identifies the indicators that need drastic improvements and shows the percentage of extra effort that will be required to achieve the necessary improvements.

Appendix C

Proposed Categories and Sub-Categories

This section presents a proposed list of sub-categories and corresponding definitions that guide a user to engage with the categories in more depth. These sub-categories were however not validated throughout the case studies, and only through the engagement with [LaunchLab \(2018\)](#). This does however serve as a useful tool when an enterprise is engaging with the various categories.

C.1 Categories and Sub-Categories

These categories and sub-categories are actively used in the incubation centre of Stellenbosch, namely [LaunchLab \(2018\)](#), along with various VC and incubators using these to perform due diligence on prospective companies. This can be used as a guide for start-up enterprises when engaging with the entire framework. The methodology employed when considering these categories is twofold. The various check-lists used by [Ansarada \(2019\)](#), [Fintelligent \(2019\)](#), [LaunchLab \(2018\)](#), and [NRI Investment Platform \(2019\)](#) were gathered and consolidated. These are all incubation centres and VC firms that deal with the due diligence of start-ups. Thereafter, LaunchLab, the incubator chosen, was used to validate these categories and partially validate the sub-categories, and their importance, based on their experience with VC's and start-ups within LaunchLab.

Depending on the stage in which the start-up is, the definitions will slightly differ for the categories. For example, if the company is in the first phase of development (as

C.1 Categories and Sub-Categories

explained in Section 3.3), the category will be more inclined to focus on the operational aspect of the enterprise. Whereas, if the enterprise is in a latter stage, the category will have a greater inclination towards the strategies that the enterprise deploys. These categories include:

- **Background and Ownership** - This pertains to the core composition of an enterprise and its documentation. This extends to the composition of members, the way in which the enterprise engages with the public, and the administrative composition of the enterprise.

This consists of two sub-categories: **Company Details** and **Ownership Structure**. Company Details is a more administrative element, with ownership structure the more strategic element.

Company Details:

1. **Company Registration Number etc.** - Pertains to the progress the enterprise has made on the administrative aspects of the enterprise. This includes registering the company, confirming no Copyright infringement with other companies, and completing all documentation to ensure the enterprise conforms to the regulatory environment.
2. **Contact Information: Address, Website, Telephone, Email** - Ensuring the enterprise has the relative contact platforms in place to adequately interact with stakeholders, from clients to investors. This also pertains to adequately documenting these platforms to ensure the various stakeholders has ease of access to this information.
3. **Twitter Handle/Social Media** - Ensuring the relevant modern platforms are in place to communicate and interact with various stakeholders. This includes the documentation of the relevant platforms to ensure accessibility of the information by all stakeholders.
4. **Key Contact Person and Details** - Ensuring the key contact person in the enterprise is identified and documented. These individual's details also need to be available and accessible to the various stakeholders.

C.1 Categories and Sub-Categories

5. **SARS Tax Registration Number** - The process and documentation of registering the individual with the Tax Authorities of the region and ensuring conformity with the regulatory environment.
6. **Vat Registration Number** - Pertains to the registration and documentation of a VAT number at the relevant regulatory authorities.

Ownership Structure:

1. **Company/Group Structure Chart with Subsidiaries, JV's, etc.** - The planning and documentation on how the company/group is comprised of, and into what the planned future structure evolves. Also, the company structure and the connections to one another.
 2. **List of Shareholders and Details of Each** - A documented and proposed list of shareholders, breakdown of how shares are allocated, along with details of the shareholders and specific contributions of each individual or company.
- **Strategy** - This pertains to the manner and documentation in which the enterprise positions itself to eventually expand into a commercially sustainable venture, this includes the way the enterprise presents itself to investors. Strategy also seeks to determine the medium- to long term future of the specific enterprise.

This is further broken down into two sub categories; **Business Plan** and **Partner Universe**. The business plan pertains to the proposed business plan and the strategy behind it of the enterprise. The partner universe pertains to the partners involved in the enterprise and the future strategy pertaining to the various partners.

Business Plan:

1. **Company Abstract Document** - The guiding document that gives a summarised overview of the enterprise and informs investors and other stakeholders of the strategy the company is planning to utilise to commercialise activities.
2. **Business Plan Detailing Finance Requirements** - The documentation used to show the planned finance requirements to achieve the set objectives in the abstract document. This includes how the enterprise plans to utilise

C.1 Categories and Sub-Categories

existing funds, what is still required, how they plan to acquire it, and how these finances will be used to work towards the commercialisation of their activities.

3. **Company Pitch Deck** - The documented plan on how sales, along with the respective goods or services are portrayed to the various stakeholders. Be it investors, or clients, it is the strategy they will employ to acquire the required resources for the enterprise.

Partner Universe:

1. **List of Strategic Partners** - Listing the various stakeholders that are considered partners of the enterprise. This includes the reason they are considered partners, and the strategic intent behind the partnership.
 2. **Key Market Entry Partners** - The strategic partners that will/are assisting the enterprise to penetrate the market, this pertains to their strategic positioning in the market or their resources for penetrating the market. The expertise of the partner is also important.
- **Product or Service and Technical** - This pertains to the documentation of the actual product or service the enterprise offers and its technical capabilities. This extends to the long-term strategy for scaling the product or service to an extent where the demand can be met, and the technical aspects of the product or service is competitive with industry standards. This all falls under the sub-category of **product**.

Product:

1. **Current Product and Features** - A documented breakdown of what exactly the product or service of the enterprise is, and the functions of that activity. This can also include future projected products or services.
2. **Product Roadmap** - The projected product roadmap of the enterprise, and how the enterprise is planning for their product or service to evolve and mature. This should be a high level vision of how the company sees its product offering over time.

C.1 Categories and Sub-Categories

3. **Technology Readiness Level (TRL)** - This is a well-defined concept. The enterprise should be able to gauge the maturity levels of the product or service on the TRL scale. It should also give an indication on how far the enterprise is from being able to consider commercialisation of the enterprise itself.
 4. **Product Life-Cycle Expectancy** - The documented expectation of the projected life span of the product or service. This should include thorough analysis of future disruptive technologies or industries, and general risk assessment of the enterprise. This process is a continuous process, with an updated risk register at regular time intervals.
 5. **Technology Maturity** - Basically, to see if the technology is a hobby or an actual product/service. This differs from TRL, as it is a benchmarking activity to gauge other industry products or services currently performing the same or similar functions. This can be regarded as a competitive analysis of the industry to determine how mature the technology is.
- **Operations** - Basically, to see if the technology is a hobby or an actual product/service. This differs from TRL, as it is a benchmarking activity to gauge other industry products or services currently performing the same or similar functions. This can be regarded as a competitive analysis of the industry to determine how mature the technology is. This falls under the generic category **Operations**.

Operations:

1. **Operations Activities** - This includes all activities pertaining to the operations of the enterprise, and how it functions. This requires the enterprise to document the operations of the enterprise and document its strategy in increasing production or service capacity.
2. **Key Processes** - The documentations of the fundamental processes of the enterprise. The key processes can be defined as the processes that make up the core business of the enterprise. This should also include expansion strategy of these processes.
3. **Inputs and Outputs** - The inputs and outputs of the enterprise is all resources that the enterprise produce or deliver and put into the enterprise.

C.1 Categories and Sub-Categories

This pertains to financial and human resources, along with all other activities that is time dependent and influences the process or final product/service of the enterprise.

4. **Operations Budget** - The forecast and historic budget used to keep the activities of the enterprise afloat. This includes the required cash flow required to perform day-to-day activities.
- **Marketing** - This pertains to the documentation and strategy employed to reach out to the target market of the enterprise and the affiliated industry, and the methodology employed to achieve this. Marketing also incorporates the strategy of the enterprise to create a market through disruptive technologies or services, should a market not exist.

This consists of two sub categories; **Marketing Collateral** and **Customer Related**. Marketing collateral refers to the enterprises' ability to utilise various platforms to get their product or service across to potential customers. Customer related refers to the interaction between enterprise and customer.

Marketing Collateral:

1. **Marketing Plan or Strategy** - How the enterprise is planning to get their product or service across to their potential and existing customers. This also includes the strategy that the enterprise is planning on using to attract new customers and financial implications of these campaigns.
2. **Market Penetration Areas** - The identified market where the projected sales will come from, and the strategy to infiltrate these markets. This also includes the analysis of competitors and how they are currently obtaining or monopolising these clients and how these clients can be acquired. Also, the identification of clients currently not being serviced.

Customer Related:

1. **Key Customers (And Revenue by Customer)** - Identifying the customers that will be considered repeat customers, and directly contribute to the sustainability of the enterprise. This also includes the financial analysis of the revenue per customer. An analysis of the contribution per different segment of customers also needs to be documented.

C.1 Categories and Sub-Categories

2. **Target Market** - The documentation of the target market of the enterprise, and how the interaction between enterprise and customer takes place. This also includes benchmarking direct competition that could potentially target the same market.
- **Sales** - This pertains to the documentation and strategy employed to generate revenue for the enterprise and ensure that the product and service strives towards breaking even and assisting with the venture becoming competitive in the particular industry.

This consists of two sub-categories; **Process and Pipeline** and **Market and Competitors**. Process and pipeline refer to the sales processes taking place, and planned, as well as the financial elements pertaining to delivering on the specific sales. Market and competitors pertain to the analyses of the strategies employed by competitors and how they target the market with their products or services.

Process and Pipeline:

1. **Sales Pipeline** - How the enterprise will eventually aim to sell its products or services. What is its approach, and what are the sequential steps to get to the sale. This includes prospective target areas.
2. **Distribution Method/Shelving Method** - The documentation of the process of which the enterprise gets the product or service to the customer, and if applicable the shelving method they use to stock the products. This pertains to the logistical elements of the enterprise as well.
3. **Break-Even-Point Analysis (BEP Analysis)** - The documentation and prediction of how many products the enterprise needs to sell in order to reach their BEP. This further extends to doing a BEP analysis on the various possible outcomes under different circumstances.

Market and Competitors:

1. **Competitive Analysis and Ecosystem Outline** - Pertains to the documentation of an in-depth competitive analysis on the performance and strategies of companies functioning in a similar domain. Also, the ecosystem outline of the industry and where all competitors and partners fit into the specific industry.

C.1 Categories and Sub-Categories

2. **Market Risks** - A risk analysis of the industries' market, along with a thorough analysis of potential competitors' customer segmentation of that market.

- **Finances** - This pertains to the documentation and prediction of the financial position of the enterprise, and the strategy employed to generate a financial proposition for the enterprise that can be sustained. This includes documenting the relationship between costs and revenue, with particular emphasis on finding a sustainable balance between the two.

This is further divided into two sub-categories; **Historical Financials** and **Financial Projections and Valuations**. Historical Financials is clearly described in the name and refers to the documentation of past financial reports. Financial Projections and Valuation refers to the future budgetary plans and where these funds will be acquired and how they will be spent.

Historical Financials:

1. **Audited Financial Statements for the Past Three Years** - If applicable, a thorough documentation of the audited financial statements of the previous three years.
2. **Last Full Year Monthly Management Accounts** - All monthly financial statements of the past year should be clearly documented to assist the understanding of the enterprise.

Financial Projections and Valuations:

1. **Detailed Budget for the next 12 months** - The documentation clearly outlining how the enterprise is planning on spending resources in the next 12 months. The more clearly this is defined, the more trustworthy the enterprise will be in terms of good governance.
2. **Financial Model and 3-5 Year Projections** - The financial model and strategy being used by the enterprise, clearly documented with financial predictions for the next three to five years. The financial model needs to be clearly described.

C.1 Categories and Sub-Categories

3. **Funding Partners** - Listing the partners the enterprise currently have and are planning on acquiring to fund their endeavours and operations. The strategic intent also needs to be clearly outlined.
 4. **Funding Requirements / ‘Shopping List’ of the use of Funds** - The funding required to make the enterprise commercially sustainable, and what exactly these requirements are. It is important to clearly showcase the sustainability and strategic intent behind these requirements.
- **Human Resources** - This pertains to the documentation and strategy employed by the enterprise to ensure that a working plan is introduced that guides the current and future employees of the enterprise. This includes the contractual side of the enterprise employment plan and does not exclude the owners.

This is further divided into two sub-categories; **Employee Info** and **Agreements**. Employee info refers to various roles and responsibilities that all employees will need to fulfil and how the different positions and hierarchy looks like. The agreements refer to the type of contractual agreements the enterprise puts in place for their employees.

Employee Info:

1. **Organizational Chart by Location** - A documented organizational chart showcasing the hierarchy and structure of the organisation. It further defines the various positions and showcases how all the different positions interact with one another.
2. **Roles and Management Bios** - The documentation describing the various roles of each position, and the responsibilities of the various management positions.
3. **List of all Employees, Positions and Gross Compensation** - Documenting the various employees, the positions they fulfil, and the compensation associated with each of these positions.

Agreements:

1. **Employment Agreements** - The various contracts and agreements that the enterprise has in place with their various employees and all other agreements that are under contract.

C.1 Categories and Sub-Categories

- **Leadership and Soft Skills** - This pertains to the documentation and strategy employed by the enterprise to ensure that shortcomings in the entrepreneurs' and the employees' background in the industry is addressed, and value adding culture and skills development is cultivated in the domain of the industry. This falls under the generic category **Leadership and Soft Skills**.

Leadership and Soft Skills:

1. **Description or Outline of Company Culture** - The proposal of company culture and the planned strategy to achieve this particular working environment. Also, the strategic intent behind this particular company culture being pursued.
 2. **Development of Management and Employee Strategy** - The documentations of how the enterprise is planning on further developing their management and employees internally. This also includes the strategic intent behind this development and the strategy behind these training opportunities.
 3. **Distinctive Management Traits and Qualification** - An analysis of the current skills of the employees and qualifications obtained. Thereafter, a gap analysis on the opportunities for further development that could benefit the enterprise.
 4. **Fundability of Entrepreneur** - An analysis of the distinct abilities of the founders of the enterprise that would make it lucrative for investors to consider them. Also, an analysis of where the shortcomings are that make an enterprise less attractive to investors. An honest assessment of the individuals is needed.
- **Legal** - This pertains to the documentation and strategy employed to ensure the legal requirements of the enterprise and the industry of the enterprise are being addressed.

This can be further broken down into three sub-categories; **Corporate Documents**, **Previous Issuance of All Securities**, and **Material Contracts or Agreements**. Corporate Documents refer to the documentation that forms the

C.1 Categories and Sub-Categories

core workings of the enterprise. Previous issuance of all securities refers to previous financial dealings that the enterprise has embarked on, be it in the issuing of stocks and bonds or even old shares of the enterprise. Material contracts or agreements refer to the enterprises existing or planned contracts or agreements to acquire or sell/release materials or assets, and what these contracts or agreements stipulate.

Corporate Documents:

1. **Company Registration Certificates** - The documented company registration certificates and the details of that contract.
2. **Memorandum of Incorporation** - The document that establishes or defines the rights, duties and responsibilities of shareholders, directors and all other stakeholders within the company, with this document clearly stipulating these roles in accordance with the law.
3. **Shareholder Agreement(s)** - The documented agreement that the enterprise has with shareholders, clearly defining the terms of investment, dividends, etc. This needs to be in accordance to the law.
4. **Valid Tax Clearance Certificate** - The official tax clearance certificate issued by the relevant tax authority.

Previous Issuance of All Securities:

1. **Detailed Capitalisation Table** - A detailed document stating the different capitalisation or ownership stakes in the enterprise, including equity shares, preferred shares and options, along with the capital stake shareholders had to invest to acquire these shares.
2. **Schedule of Financing History** - Showcasing historical financing history of the enterprise and the schedule of time on which these payments occurred.

Material Contracts or Agreements:

1. **Material Contracts or Agreements** - The agreements that are in place or planned and documented for the enterprises existing or planned contracts or agreements, to acquire or sell or release materials or assets, and what these contracts or agreements stipulate.

C.1 Categories and Sub-Categories

- **Intellectual Property** - This pertains to the documentation and strategy employed to protect the enterprise's intellectual property and applications for protection. This should also address the necessity of intellectual property protection for the particular enterprise and the relevance to the particular industry. This falls under the generic category **Intellectual Property**.

Intellectual Property:

1. **Intellectual Property Schedule** - The planned and documented schedule of future and past registrations or submissions to the relevant authorities to secure the enterprises' intellectual property.
 2. **Patents, Intellectual Property, and Protection Pursued** - A detailed analyses and documentation of products or methods that should or could be protected, as well as a detailed listing of patent applications already submitted to the relevant authorities and have a fixed priority date. The same goes for the intellectual property for elements such as branding or contact details of the enterprise.
- **Environmental, Social, and Governance** - This pertains to the documentation and strategy employed to strive towards environmental, social and governance compliance and a competitive benchmark to industry. This falls under the generic category **Governance**.

Governance:

1. **List of Board Members** - A complete list and details of contribution of each board member of the enterprise.
2. **Draft Sample Resolutions** - The document guiding the board and ensuring good governance. This needs to be well documented and clearly state the roles of the individuals, as well as be a guiding document.

The categories used in this framework are therefore categories and sub-categories that were identified as value adding towards the domain of a start-up enterprise. The list of categories and indicators are quite comprehensive, and it is thus important to stress the importance to note that this framework is not designed to be a measuring tool, but rather a tool to

C.1 Categories and Sub-Categories

determine relevance of completeness (with the case of the check-list) and monitor progress of the enterprise (with the case of the framework). The link between the categories described in this section, and the indicators described in Section 3.2.1 and was expanded on in Section 3.3, where the phases are outlined.

Appendix D

Chapter 3 Validation

This appendix showcases a summary of the validations used for Chapter 3, to find the full list of interviews refer to Appendix D. Chapter 3 validation can be seen in Figure D.1, Figure D.2 and Figure D.3 in this appendix. This chapter is validated through literature and the Delphi Technique. The contribution of each expert is highlighted in the figures below.

In Chapter 3, 11 experts were consulted. From Figure D.1, Strauss and van Schalkwyk were selected due to their own success in these industries. Strauss in particular has extensive background in academics and industry. Both could offer insight into the indicators proposed. Paschal is involved at LaunchLab, and could offer insight into the categories and sub-categories at the incubator, and the general feedback from all the VC's and entrepreneurs currently active in that space. From Figure D.2, Bosman assisted with the simplification and transition from the six-level CRI framework to the three phase CRI framework as presented in this thesis. The transition from one phase to another was also critically discussed.

From Figure D.2 and Figure D.3, the framework outline was conducted by seven different experts. The profile of the experts ranged from VC's, Dr. Khota from the IDC, academics, entrepreneurs who started multi million Rand companies, and entrepreneurs who only recently acquired funding. All the experts were given the framework outline, and an iterative process of improving it took place.

Section	Method	Source	Description
Indicators	Literature	Bezuidenhout (2017)	The thesis conducted by Bezuidenhout (2017), showcases and explains the additional indicators – Clinical Performance and Funding. These indicators are considered throughout this research.
		ARENA (2014b)	ARENA (2014b) describes the original framework and indicators used in the renewable energy sector. The research conducted by ARENA forms an integral part of the formulation of the proposed framework.
	Delphi Technique	D. Strauss	Interview conducted 09 June, 2018. Strauss is a private equity and venture capital expert, participating in the creation of a multitude of start-up enterprises. He explored the importance of incorporating the capabilities of the entrepreneur themselves. As this influences the probability of investment. He was the biggest proponent of an indicator relating to the expertise of the entrepreneur. This led to the addition of <i>Entrepreneur Capability</i> in the framework. Strauss also delved into the validity of the study and helped refine the scope to be attainable.
		C. van Schalkwyk	Interview conducted 02 June, 2018. Van Schalkwyk served as the Head of Risk at Capitec Bank, and works with multiple other ventures. He was consulted on the success factors of start-up enterprises, where the importance of the entrepreneur was re-iterated. He emphasised the need for an indicator monitoring the entrepreneur to allow investors to evaluate an enterprise more effectively.
Categories and Sub-Categories	Literature	Ansarada (2019) Fintelligent (2019) LaunchLab (2018) NRI Investment Platform (2019)	These various platforms assist enterprises with the VC and due diligence process. From these various platforms the categories, sub-categories and their definitions were derived and documented.
		GEDI (2019)	This platform showcases various categories and sub-categories that directly impact the current state of the entrepreneurial ecosystem. This assisted in drafting a more strategic and holistic framework, from the international perspective that GEDI considers.
	Delphi Technique	B. Paschal (2018)	The interview was conducted on 27 July 2018. Paschal has a history of working with incubation centres and currently manages and mentors entrepreneurs at the incubation centre at Stellenbosch University. He was consulted on the various categories, and one of the recommendations was to incorporate the various categories with the current indicators, to move away from the linearity of the indicators. Thus creating a matrix to incorporate the core functions of an enterprise with indicators that monitor the more strategic side of an enterprise.

Figure D.1: A matrix indicating the different contributions and theory development of Chapter 3.

Section	Method	Source	Description
Framework Outline	Literature	ARENA (2014b)	Arena (2014b) defines the CRI framework and the associated levels for the framework. This is particular for the renewable energy sector.
		Du Preez <i>et al.</i> (2015)	The enterprise Engineering Process was considered when developing a three phase framework. This is applicable in simplifying the six level CRI framework and is explained in Chapter 2.
		Enkel (2013) Cowan (2019) King (2017)	The BMC indicates the linear relationships between various aspects in the business and gives an indication of what all needs to be incorporated when considering the context of an enterprise.
	Delphi Technique	S. Bosman (2018)	Interview conducted 06 August 2018. Bosman is currently a Professor at CPUT for Industrial and Systems Engineering. He was consulted on the migration and defining from the current six level CRI framework to the proposed three phase framework. Bosman gave inputs regarding how the phases should be designed. He assisted in questioning and forming how the frameworks outer phases should be named and how they could be linked with one another. The concept of an operational, operational to strategic, and strategic phase was derived through this interview. This matched quite similarly to the theory of Du Preez <i>et al.</i> (2015).
Framework Outline	Delphi Technique	Dr I. Khota (2018)	Interview conducted 06 November 2018. Khota currently serves on the IDC as a venture capitalist, investing particularly in novel technological enterprises. He was consulted on his expertise from the IDC on monitoring start-ups. This was incorporated into the design of the framework. His expertise on entrepreneurs in the context of the South African entrepreneurial ecosystem was crucial in deriving the parameters for the outline of the framework.
		C. Pistorius (2018)	Interview conducted 07 August 2018. Pistorius is the former vice-chancellor at the University of Pretoria, and the University of Hull in the UK and current Director at DeltaHedron. He was consulted on his knowledge of incorporating technology development into a framework. His expertise contributed to the development of the phase parameters. Pistorius was continuously consulted throughout the research and gave insight and guidance throughout. In particular, he served as a sound board to test ideas and refine concepts. He played a crucial role in the iterative approach of deriving a framework.

Figure D.2: A matrix indicating the different contributions and theory development of Chapter 3.

Section	Method	Source	Description
		C. Bester (2018)	Interview conducted 14 August, 2018. Is the founder of BrainWorks and active venture capitalist. He was consulted on the parameters of the various phases. He gave insights into his own experience, and assisted in setting parameters in which the framework could operate.
		B. Paschal (2018)	Interview conducted 17 August, 2018. A consultation with an enterprise was conducted with the assistance of Paschal (2018) to test the proposed framework and make alterations accordingly. This served as an important feedback session of the current state of the framework, and highlighted implementation deficiencies.
		Prof R. Grimaldi (2018)	Interview conducted 28 September, 2018. Grimaldi is a full professor in entrepreneurship and innovation management at the University of Bologna in Italy. She was consulted on the linking of phases to one another, and how the process should be documented. She gave context of entrepreneurship from an European perspective, and advised on the framework.
		C. Mchugh (2018)	Interview conducted 11 November, 2018. Mchugh is the founder and CEO of MoodBean in the UK. She advised on the incorporation of the categories into the proposed framework. As she is running a start-up with significant public funding, she gave excellent advise on the possible pitfalls with regards to start-ups which should be considered for the framework.
		S. Pilgrim (2018)	Interview conducted 11 November, 2018. Pilgrim is one of the founders and directors at BIMSense, a start-up in the UK. He advised on the enterprise engineering process, and how the phases should reflect the proposed life-cycle of a start-up. He gave insights in the processes that BIMSense followed and acted as a sound board for the framework proposed.

Figure D.3: A matrix indicating the different contributions and theory development of Chapter 3.

Appendix E

Chapter 4 Validation

This appendix showcases a summary of the validations used for Chapter 4, to find the full list of interviews refer to Appendix E. Chapter 4 validation can be seen in Figure E.1, Figure E.2 and Figure E.3 in this appendix. This chapter is validated through literature and the Delphi Technique. The contribution of each expert is highlighted in the figures below.

Chapter 4 used seven different experts in the validation process. From Figure E.1, Erwin and Menzies are both part of FinFind, a VC company base in Durban. Both have vast experience in analysing the current status of start-ups. They assisted with the methodology and helped validate how to gear the approach to perform case studies.

From Figure E.2 and Figure E.3, five different experts were consulted to construct and validate the framework implementation methodology. LaunchLab provided the resources in terms of a start-up, and the enterprise was used as a guinea pig to establish the limitations of the study, and verify the assumptions that needed to be made. Pistorius, Prawel, Malherbe, and Seesink are individuals with years of experience in industry, and assisted in validating and refining the implementation of the framework. Some of the experts were consulted at various stages during this process.

Section	Method	Source	Description
Methodology	Literature	Arena (2014a)	The methodology employed by ARENA in their 2014 study in the renewable energy sector was used as reference throughout the formulation of the methodology employed in this research. The method is adapted to the start-up environment.
		L. Bezuidenhout (2017)	Bezuidenhout used a similar methodology in the additive manufacturing industry, where a similar chain of thought was utilised in this research. Her study is also based on the framework employed by ARENA (2014)
		Du Preez <i>et al.</i> (2015)	The book written by Du Preez, N. Essman, H. Louw, L. Schutte, C. Marais & W. Bam in the <i>Enterprise Engineering</i> describes the enterprise engineering process which replicates the proposed three phase approach described in Chapter 3. This process is ideally designed to propose the development of a start-up enterprise.
		ISIXSIGMA (2019) Balanced Scorecard Institute (2019) Hershall (2017)	These various references were used to understand the Deming Cycle and eventually how to build in iterative processes within the process flow. This ensures that multiple iterations take place and ensures that a feedback loop is inserted.
	Delphi Technique	R. Erwin	This interview was conducted on 12 February 2019. Erwin is a venture capital consultant at FinFind, and has assisted in the growth of multiple start-ups across South Africa, with a multitude of years within the industry. Erwin gave an analysis of the current proposed framework and assisted in the formulation of some key concepts. She also recommended how to engage with enterprises to get as much value adding knowledge from the start-up in the interview stage as possible.
		D. Menzies	This interview was conducted on 2 February 2019. Menzies is a renowned specialist at a venture capitalist firm called FinFind, who has started multiple ventures successfully and currently assists start-ups to achieve similar results. Menzies gave insight into the framework and the methodology that is proposed when testing this framework with start-ups in the early phases of their development. She specifically referred to the necessity of ensuring proper guidance in all indicators be explained to the enterprise and emphasised the importance of the literature associated with the start-up domain.

Figure E.1: A matrix indicating the different contributions and theory development of Chapter 4.

Section	Method	Source	Description
Implementation of Framework	Literature	BMC	Using the concepts discussed in Chapter 2, the BMC tool was considered as a method to gather the data from the various start-ups. The BMC is however very one-dimensional and could not be used isolated to achieve the objectives set out by this research paper.
		Roberts <i>et al.</i> (2016)	This report on – <i>What’s working in Start-up acceleration</i> , was used to identify particular concepts that have been quantitatively measured as success factors within start-ups. The aim of these tools was to include these concepts and capture similar data.
	Delphi Technique	LaunchLab (2018)	Launchlab, and more particularly B. Paschal was consulted with a test case of the first versions of the framework and the tools used to gather the respective data. They assisted with the conceptualisation of the final product within this thesis, and through various discussions and implementation, a final framework was derived. Certain failures of the framework were consistently highlighted and addressed. Including the inability of the first few versions of the framework to capture the relevant data required, as well as the problems surfacing in the complicated user interface. Through these iterations, a greater understanding of the tools required was achieved and finally a workable and implementable framework was conceptualised. This process stretched over multiple months and nearly to the end of the implementations.
		C. Pistorius (2018)	This interview was conducted on 12 March 2019. Pistorius was again consulted on the framework and the tools required to implement this in a case study. Pistorius offered guidance on the tools proposed and the practical implications within the implementation phase. Pistorius particularly assisted with the as-is and risk tool. Pistorius has particular expertise in technology transfer and emphasised the importance of monitoring risks within the start-up phases of a start-up in the technology domain.

Figure E.2: A matrix indicating the different contributions and theory development of Chapter 4.

Section	Method	Source	Description
Framework Implementation Overview	Delphi Technique	D. Prawel (2018)	This interview was conducted on 16 November 2018. Prawel is an expert in start-up enterprises and in particular the additive manufacturing industry. The framework and the proposed tools were tested with Prawel, where valuable feedback was obtained. Prawel recognised the potential of the framework in assisting entrepreneurs to monitor their enterprises holistically. Prawel indicated that a longer term monitoring of enterprises would be more valuable to quantitatively establish the value of the framework. This was however not feasible within the scope of this research. Prawel furthermore questioned the validity of the framework in the case where all indicators and categories were seen as independent from one another. Even though the concern is valid this would have created too many variables within the study, particularly on a first iteration. Prawel agreed to this, and recommended that this be considered for future research. Prawel was however in agreement that the framework needed to be tested on actual start-ups to start identifying the shortcomings of the framework.
		J. Malherbe (2019)	This interview was conducted on 11 January 2019. Malherbe is the COO of SKEG Product Development and venture capitalist. He has particular background in the manufacturing domain. Malherbe particularly referenced the importance of including the industry 'need' within the framework. This vastly influenced the method on which the tools were presented during the case studies. With the 'need' constantly being considered, he believed that some of the bias would be left out of the answers by participants. Malherbe reviewed the general framework and made recommendations on how the participants should be considered and approached to increase the value adding information extracted.
		A. Seesink (2019)	This interview was conducted on 21 June 2019. Former senior technical manager of sub-Saharan Africa with Cisco. Seesink has more than 25 years experience of being involved and assisting start-ups in their early phases of operation. Seesink reviewed the current framework, but was particularly consulted on the implementation of the tools to assist with the data gathering to monitor the framework. Seesink shared multiple real world scenarios from personal experience and assisted in the formulation of the survey used in the three respective case studies. Seesink spoke of the general phases of a start-up enterprises, which coincidentally followed a similar methodology to the three phases set out by this framework. He further went on to warn against potential pitfalls when testing the framework. In particular, the risk of natural bias creeping into answers.

Figure E.3: A matrix indicating the different contributions and theory development of Chapter 4.

Appendix F

Company A

This appendix refers to the data gathered for Company A in the attempt to establish their current as-is state within the CRI framework. The data represented in Table F.1 refers to the determination of the x- and y-axis'. With the x-coordinates referring to the current as-is state of the enterprise, and the y-axis referring to the current risk profile of the enterprise. From this data, a holistic view of the various indicators are established.

From the data in Table F.1, the risk tool, as seen and described in Figure 4.4, can be populated. As seen in this section, the various figures for each indicator is displayed with the relevant as-is state for each indicator specified. The colour indicates the risk associated with the indicator, and runs on the spectrum from blue - which is the lowest risk, to red - which is the highest risk. Mild risk is indicated with orange.

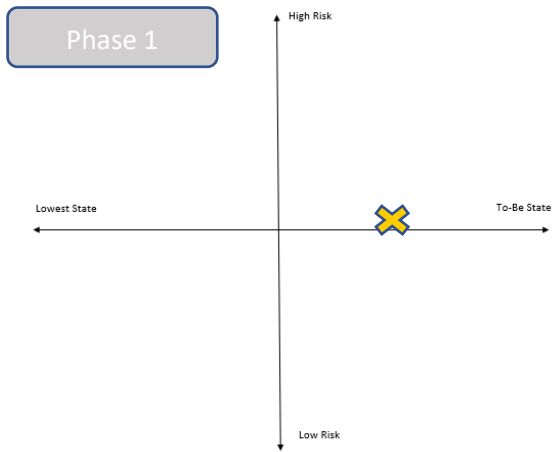
The data in Table F.1 has been normalised in portraying the average for each indicator. The reason the data is not adjusted for standard deviation, for example using a maximum - minimum ratio or a standard deviation multiplier, is to reflect the original intent of the interviewee. Thus, the data has been normalised in an attempt to reduce the variables included in the first iteration of this framework and its future outcomes.

This data is discussed in Section 5.5, where Company A is discussed in more detail.

Table F.1: Company A: X-axis and Y-axis Coordinates for Each Indicator.

Phase	Rating X	Background & Ownership	Strategy	Product & Technical	Operations	Marketing	Sales	Finances	Human Resources	Leadership & Soft Skills	Legal	Intellectual Property	Environmental, Social & Governance	x-Average
1	Reg Envi	4,5	-4,5	-1	-2,5	-3,2	1	4	5	4,5	5	5	5	1,9
2	Stake Acc	5	-1	-3,5	-4	-4,5	4,5	-1	-4	-1,5	-2	-2	-3	-1,4
1	Tech Perf	NA	-4	3,5	4	-5	5	0,3	-2,5	3,5	3	3,5	NA	1,1
2	Fin Cost	NA	-1	-3,5	-4	-4	-1,5	2,5	-4,5	1,5	1,5	3	2,5	-0,7
1	Fin Rev	NA	-5	-3	2	-5	3,5	4	-5	1,5	5	5	5	0,7
1	Supp Chain	NA	4	2,5	4	-4,5	4	5	5	5	5	5	5	3,6
1	Mark Opp	-2,5	-5	-4,5	-4,5	-5	3	4	-1	-3,5	3	-2,5	4,5	-1,2
1	Comp Matu	3	1	1	-1	-5	2,5	1	-5	3	5	4	5	1,2
1	Entr Capabil	5	3,5	5	5	2,5	4	4,5	4,7	4,7	4,2	1,5	4	4,1
Phase	Rating Y	Background & Ownership	Strategy	Product & Technical	Operations	Marketing	Sales	Finances	Human Resources	Leadership & Soft Skills	Legal	Intellectual Property	Environmental, Social & Governance	y-Average
1	Reg Envi	-2,5	1,5	5	5	-5	2	1	-1	-1	-5	5	-1	0,3
2	Stake Acc	-2	3	5	5	5	5	-0,5	5	-1	1,5	1	-4	1,9
1	Tech Perf	NA	4,5	3,5	0,5	5	-1	-0,5	5	2,5	-0,5	-1	NA	1,8
2	Fin Cost	NA	-0,5	1	3	-1,5	-1	-2	5	1	-4	-1	-4,5	-0,4
1	Fin Rev	NA	5	4	2	5	1	1	5	1	-0,3	-0,5	-3	1,8
1	Supp Chain	NA	-0,5	-0,5	1	3	1	-0,5	-4	-2,5	-3,5	-0,5	-5	-1,1
1	Mark Opp	2,5	5	5	2,5	5	5	0,5	2	2	-2	4	-2	2,5
1	Comp Matu	1	3	1	1	5	3,5	1	5	1,5	1,5	1,5	-1	2,0
1	Entr Capabil	-1	1	-3	-3	0,5	-1,5	-2,5	-2,5	-0,5	-1	2	-3	-1,2

Indicator: Regulatory Environment



Indicator: Stakeholder Acceptance

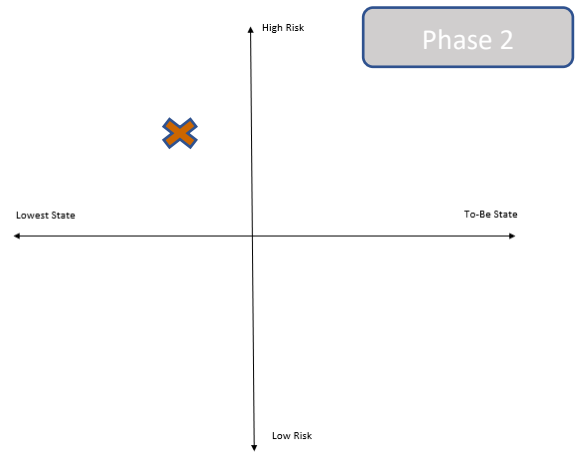
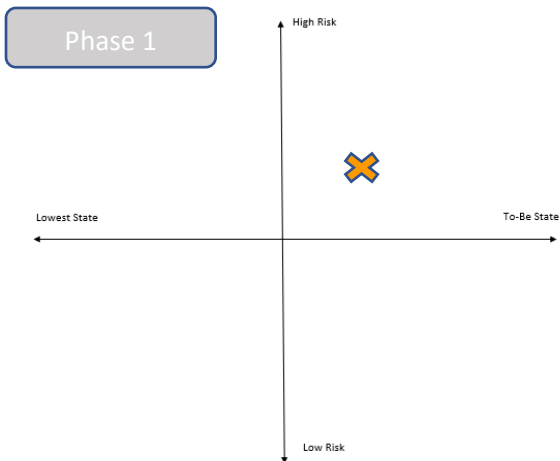


Figure F.1: Company A Regulatory Environment and Stakeholder Acceptance Indicators

Indicator: Technical Performance



Indicator: Financial Proposition - Cost

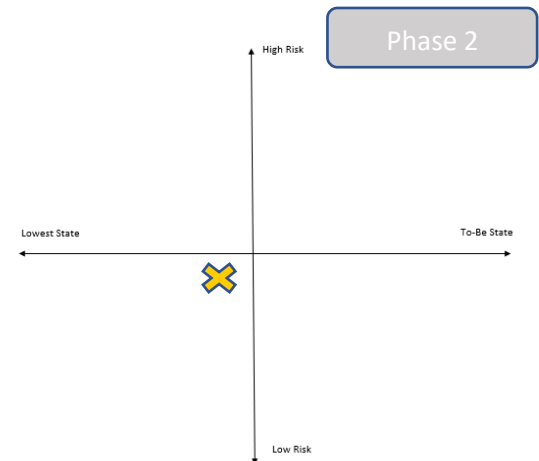


Figure F.2: Company A Technical Performance and Financial Proposition - Cost, Indicators

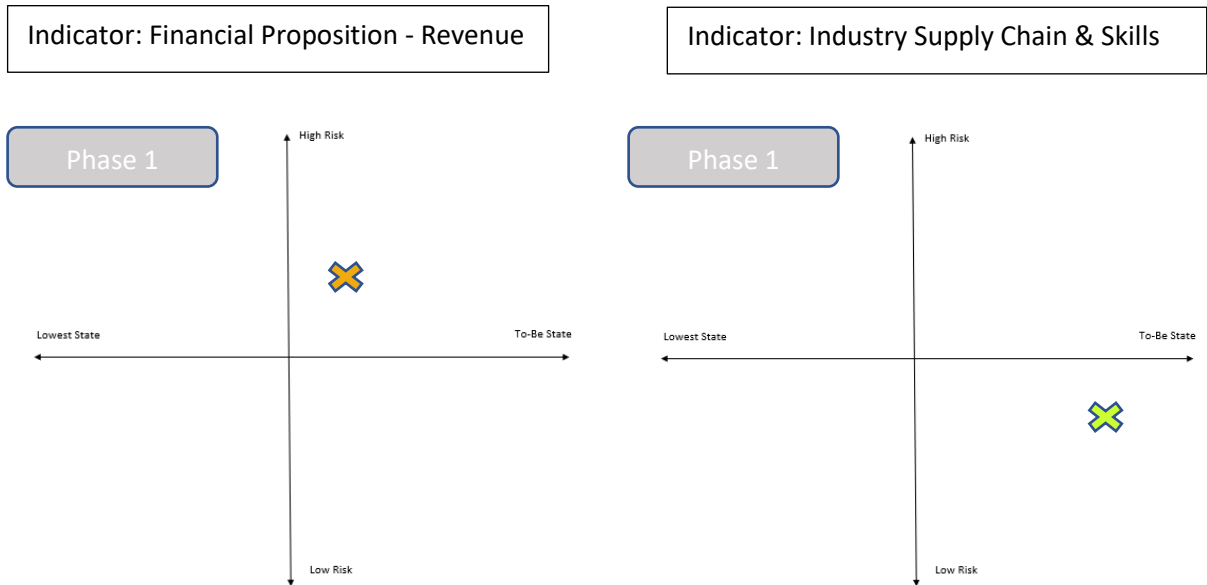


Figure F.3: Company A Financial Proposition - Revenue, and Supply Chain & Skills, Indicators

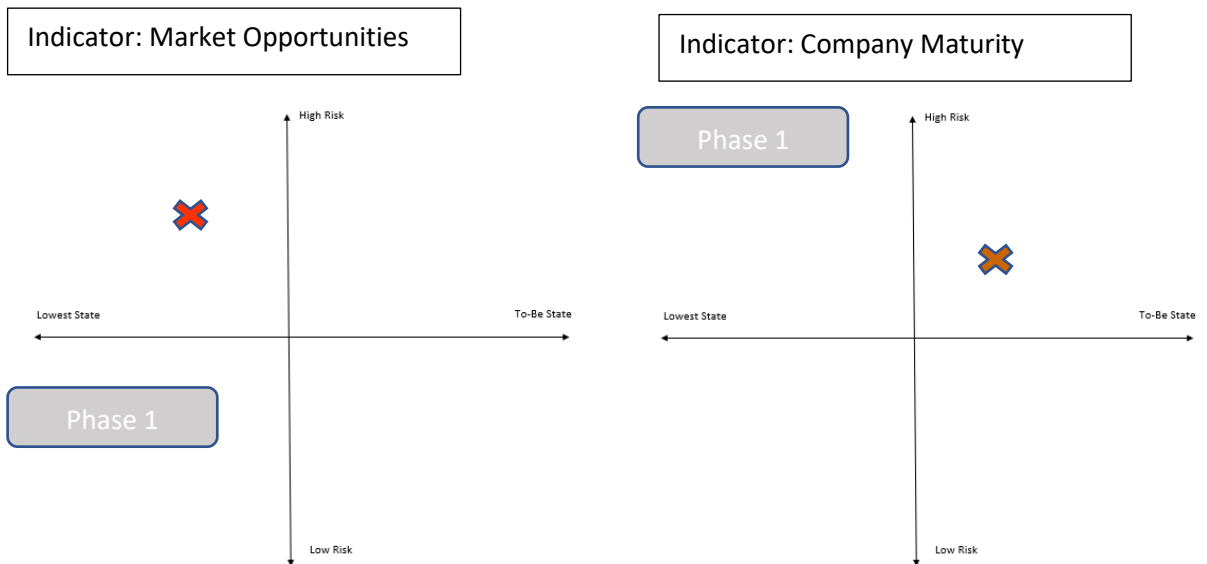


Figure F.4: Company A Market Opportunities and Company Maturity Indicators

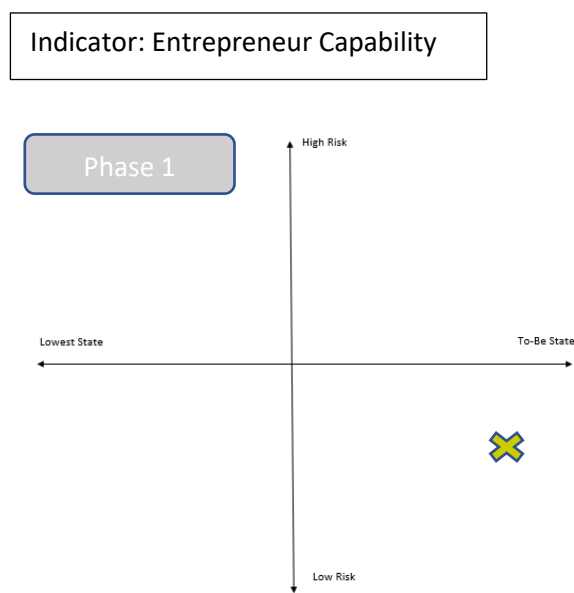


Figure F.5: Company A Entrepreneur Capability Indicator

Appendix G

Company B

This appendix refers to the data gathered for Company B in the attempt to establish their current as-is state within the CRI framework. The data represented in Table G.1 refers to the determination of the x- and y-axis'. With the x-coordinates referring to the current as-is state of the enterprise, and the y-axis referring to the current risk profile of the enterprise. From this data, a holistic view of the various indicators are established.

From the data in Table G.1, the risk tool, as seen and described in Figure 4.4, can be populated. As seen in this section, the various figures for each indicator is displayed with the relevant as-is state for each indicator specified. The colour indicates the risk associated with the indicator, and runs on the spectrum from blue - which is the lowest risk, to red - which is the highest risk. Mild risk is indicated with orange.

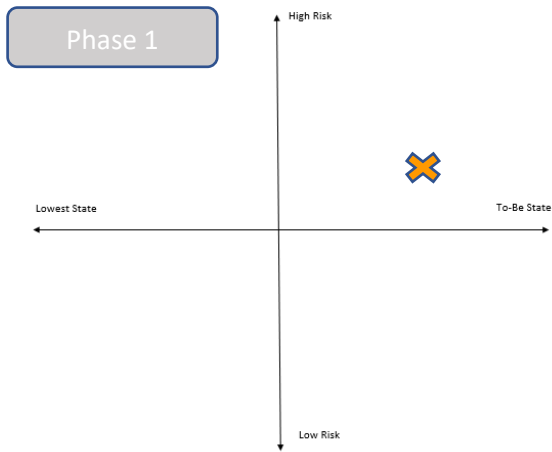
The data in Table G.1 has been normalised in portraying the average for each indicator. The reason the data is not adjusted for standard deviation, for example using a maximum - minimum ratio or a standard deviation multiplier, is to reflect the original intent of the interviewee. Thus, the data has been normalised in an attempt to reduce the variables included in the first iteration of this framework and its future outcomes.

This data is discussed in Section 5.6, where Company B is discussed in more detail.

Table G.1: Company B: X-axis and Y-axis Coordinates for Each Indicator.

Phase	Rating X	Background & Ownership	Strategy	Product & Technical	Operations	Marketing	Sales	Finances	Human Resources	Leadership & Soft Skills	Legal	Intellectual Property	Environmental, Social & Governance	x-Average
1	Reg Envi	3	2	5	5	3	4	3	4	4	-4	3	-3	2,4
2	Stake Acc	1	-3	3	-1	-2	-1	-4	0	1	-4,3	1	3	-0,5
2	Tech Perf	3	3	1,5	1	-0,3	0	-0,2	-1	2,3	0	1	-3	0,6
1	Fin Cost	4	1,5	0,3	0,2	0,5	0,7	-0,2	-0,2	0,5	-2	1,5	-4	0,2
2	Fin Rev	0,5	-3	0,4	-0,6	-0,5	-3	-3,8	-3	-4	-4,5	-2,5	-3,5	-2,3
1	Funding	3,2	-3,2	3	4	3	3	NA	1,2	0,5	2	4	-1	1,8
2	Supp Chain	4	0,5	0,8	1	-1	-1,5	-0,5	-2,3	0,2	-2	1	-0,6	0,0
2	Mark Opp	0,5	-1	2	1	-0,1	-0,3	-0,2	-3	0,4	-1	0,5	-1	-0,2
1	Comp Matu	3,5	4	4	3,5	0,5	0,2	0,2	2	0,5	2	3,5	-0,3	2,0
2	Entr Capabil	NA	-0,5	3	0,5	-1	0,4	0,8	1,2	-0,5	0,1	0,4	-0,4	0,4
Phase	Rating Y	Background & Ownership	Strategy	Product & Technical	Operations	Marketing	Sales	Finances	Human Resources	Leadership & Soft Skills	Legal	Intellectual Property	Environmental, Social & Governance	y-Average
1	Reg Envi	-3	2	5	5	-5	5	4	5	-5	5	0	-2	1,3
2	Stake Acc	5	0	-3,5	4	-0,5	4,5	3	-2,5	0,75	-0,5	0	2,5	1,1
2	Tech Perf	-5	-1,5	1,5	1,5	1	2	4	2,3	-1	-2	0,4	-1	0,2
1	Fin Cost	-4,5	-4	2	-1	-3,5	-0,2	1	1,5	-0,1	-3,5	-4	-4	-1,7
2	Fin Rev	-1	3,2	1	1	2	3,5	4	-1	2	-0,3	3	4	1,8
1	Funding	-0,5	-0,5	-2	-3	-0,2	-3	NA	-0,2	-3	-1,5	-4	-0,4	-1,7
2	Supp Chain	-4,5	0,7	0,5	0,5	-0,5	0,3	2	1,8	-0,5	-1,5	-1	-1	-0,3
2	Mark Opp	-0,5	0	-2	0,7	3	3,2	3	-3	-0,2	-0,5	2	-1	0,4
1	Comp Matu	-3,5	-4	-3,5	-1,5	-4	-0,2	0,7	-2	-0,5	-1,5	-3,5	-4	-2,3
2	Entr Capabil	NA	1	-3	-0,5	1,2	1	1	1	-0,5	0,1	1	0,5	0,3

Indicator: Regulatory Environment



Indicator: Stakeholder Acceptance

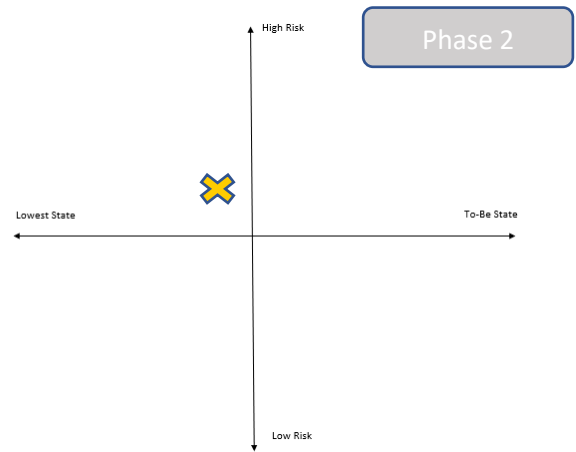
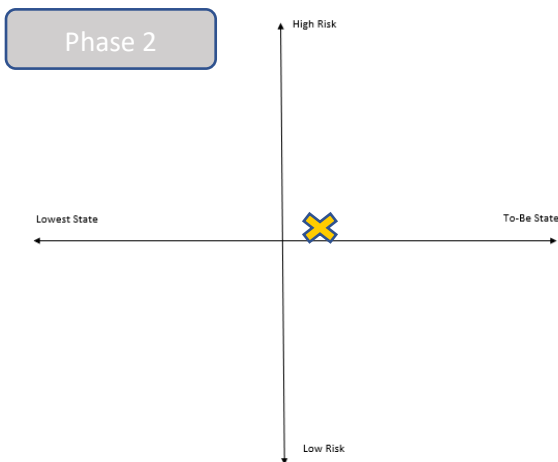


Figure G.1: Company B Regulatory Environment and Stakeholder Acceptance Indicators

Indicator: Technical Performance



Indicator: Financial Proposition - Cost

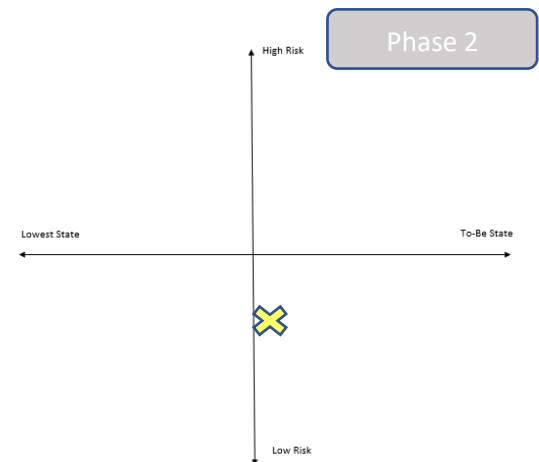


Figure G.2: Company B Technical Performance and Financial Proposition - Cost, Indicators

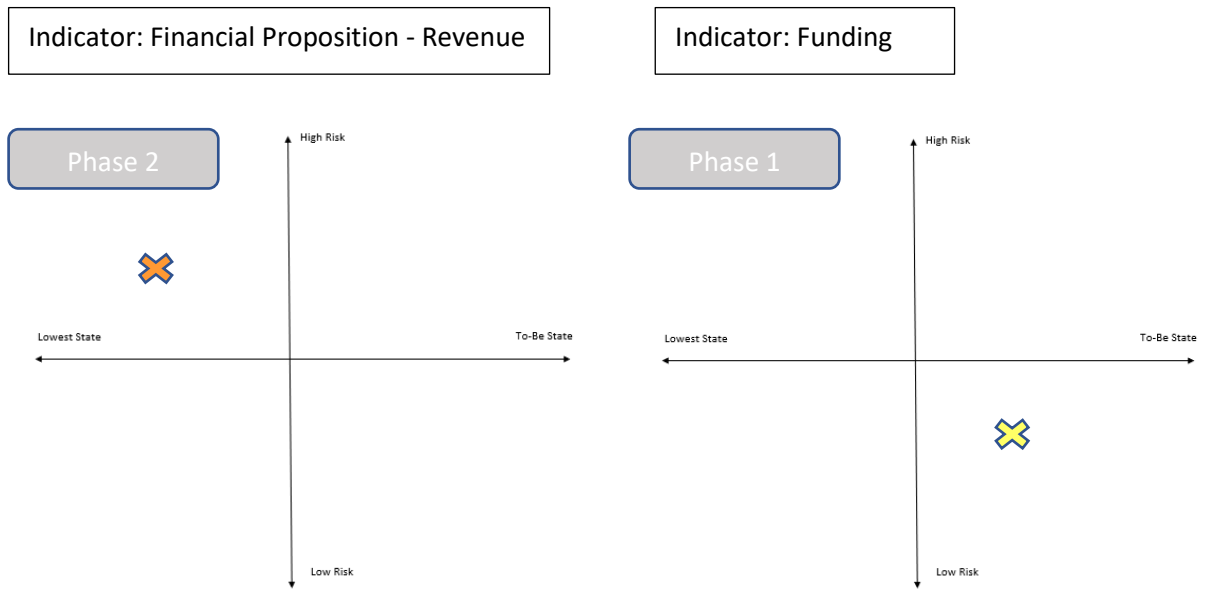


Figure G.3: Company B Financial Proposition - Revenue, and Funding Indicators

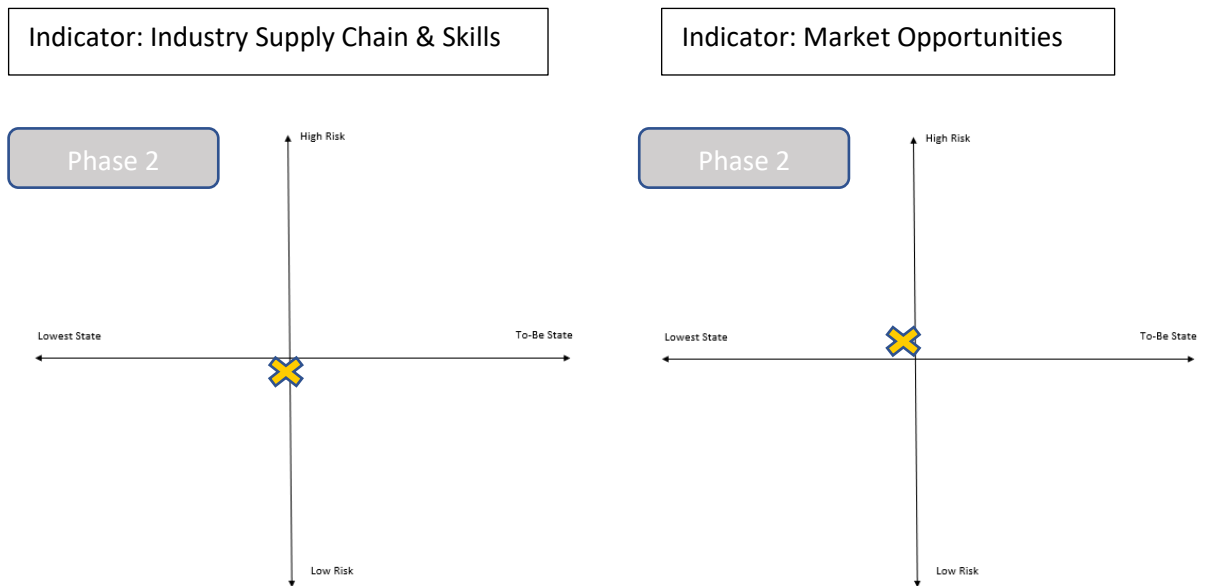


Figure G.4: Company B Supply Chain & Skills, and Market Opportunities Indicators

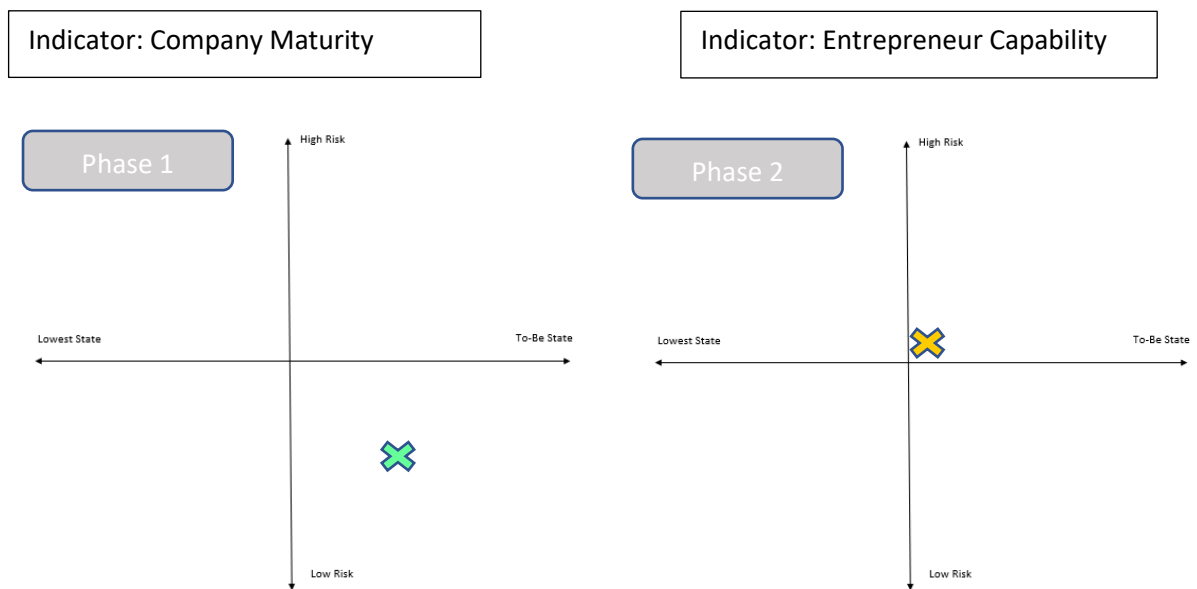


Figure G.5: Company B, Company Maturity and Entrepreneur Capability Indicator

Appendix H

Company C

This appendix refers to the data gathered for Company C in the attempt to establish their current as-is state within the CRI framework. The data represented in Table H.1 refers to the determination of the x- and y-axis'. With the x-coordinates referring to the current as-is state of the enterprise, and the y-axis referring to the current risk profile of the enterprise. From this data, a holistic view of the various indicators are established.

From the data in Table H.1, the risk tool, as seen and described in Figure 4.4, can be populated. As seen in this section, the various figures for each indicator is displayed with the relevant as-is state for each indicator specified. The colour indicates the risk associated with the indicator, and runs on the spectrum from blue - which is the lowest risk, to red - which is the highest risk. Mild risk is indicated with orange.

The data in Table F.1 has been normalised in portraying the average for each indicator. The reason the data is not adjusted for standard deviation, for example using a maximum - minimum ratio or a standard deviation multiplier, is to reflect the original intent of the interviewee. Thus, the data has been normalised in an attempt to reduce the variables included in the first iteration of this framework and its future outcomes.

This data is discussed in Section 5.7, where Company C is discussed in more detail.

Table H.1: Company C: X-axis and Y-axis Coordinates for Each Indicator.

Phase	Rating X	Background & Ownership	Strategy	Product & Technical	Operations	Marketing	Sales	Finances	Human Resources	Leadership & Soft Skills	Legal	Intellectual Property	Environmental, Social & Governance	x-Average
2	Reg Envi	5	-0,5	-0,5	-0,5	-2	5	5	-4	1	-4	-2,5	-3,5	-0,1
3	Stake Acc	5	-3,5	-1	4	-1	-0,5	-3	-1,5	-2	-3,5	3	-4	-0,7
3	Tech Perf	3,5	-0,5	1	-2,5	-2	-2,5	2,8	-4,5	-3	-3,5	-3	NA	-1,3
2	Fin Cost	-4	-0,5	-2,5	-2,5	-5	-1	3,5	-1,2	-5	-5	-4	NA	-2,5
2	Fin Rev	3	-1	-2	-1,5	-2,5	-1	3	-4	-2	NA	1	NA	-0,7
3	Supp Chain	5	5	0,5	1	0,5	1,5	4	2	3	2,5	-1	NA	2,2
3	Mark Opp	0,5	-1	1,2	-3,2	-4	-4	-4	-3	-4	-1	2	NA	-1,9
3	Comp Matu	4,5	2	-4	-4	-2,5	-4,5	-4,5	-4	-3,5	-3	-1,5	NA	-2,3
3	Entr Capabil	5	-0,7	-2	-1,5	-1,5	-1	-1,2	-0,5	-2,5	-4,5	-0,5	-4,5	-1,3
Phase	Rating Y	Background & Ownership	Strategy	Product & Technical	Operations	Marketing	Sales	Finances	Human Resources	Leadership & Soft Skills	Legal	Intellectual Property	Environmental, Social & Governance	y-Average
2	Reg Envi	-2,5	2	4,5	2	1	2	-4	5	4	5	5	-3	1,8
3	Stake Acc	1	5	4,5	2	4	2	5	5	3	5	3,5	1	3,4
3	Tech Perf	2	5	4	3	2	2,2	-0,5	4	4	5	5	NA	3,2
2	Fin Cost	5	4,8	5	1,5	1	2	1,5	5	1,5	-1	-0,5	NA	2,3
2	Fin Rev	5	5	5	2,5	2	3	1	3,5	3	NA	2,5	NA	3,3
3	Supp Chain	-2	-4,8	3	1	2	3,5	1,2	1,5	1	1	1,5	NA	0,8
3	Mark Opp	1,2	2	3	3	3,8	4	4,6	4,8	5	0,5	2	NA	3,1
3	Comp Matu	4	5	5	5	5	5	5	4,8	5	0,5	2,5	NA	4,3
3	Entr Capabil	1,5	3	5	5	5	3	5	2,8	4,8	4	3	5	3,9

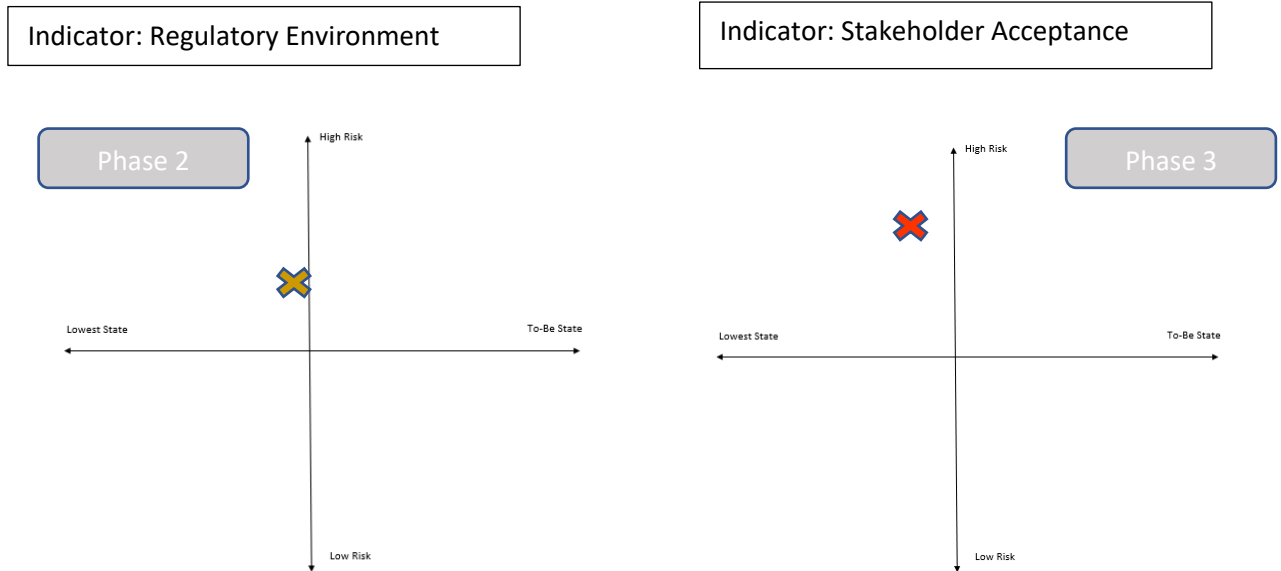


Figure H.1: Company C Regulatory Environment and Stakeholder Acceptance Indicators

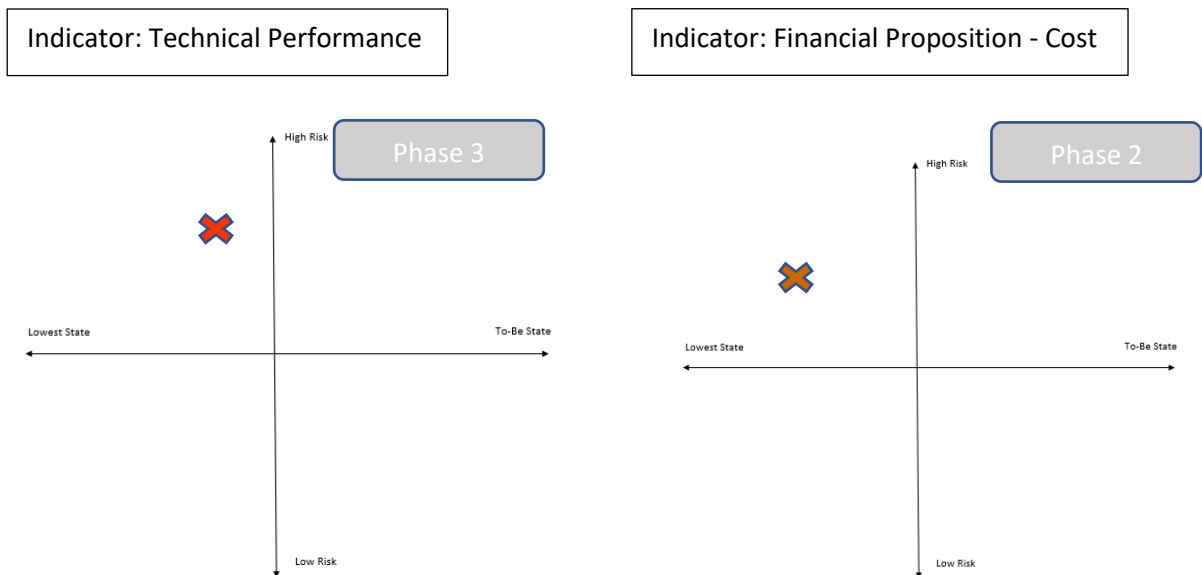


Figure H.2: Company C Technical Performance and Financial Proposition - Cost, Indicators

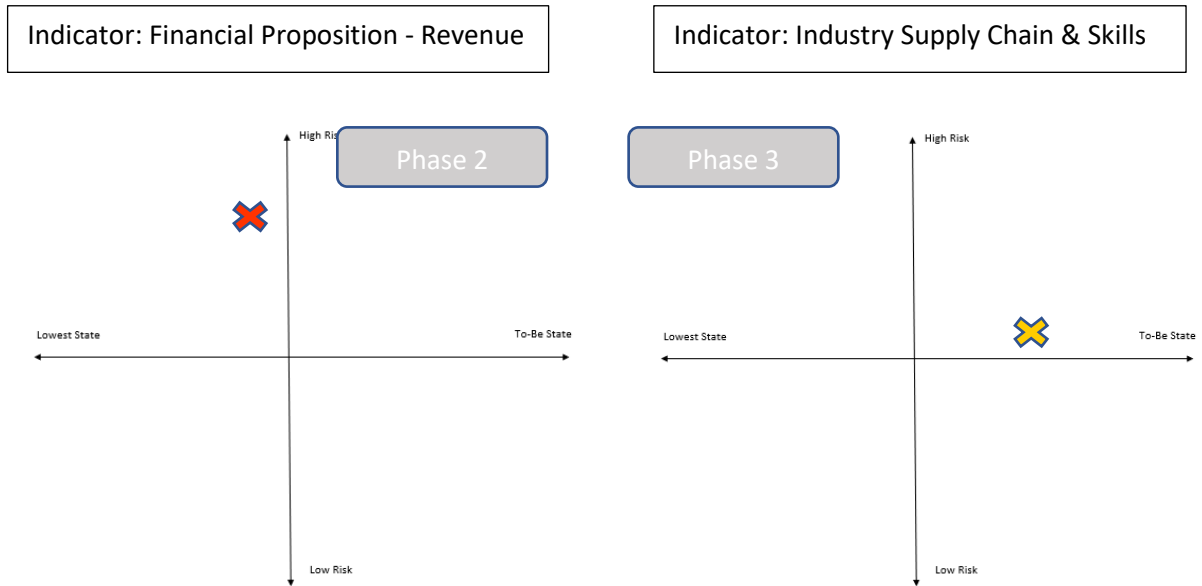


Figure H.3: Company C Financial Proposition - Revenue, and Supply Chain & Skills, Indicators

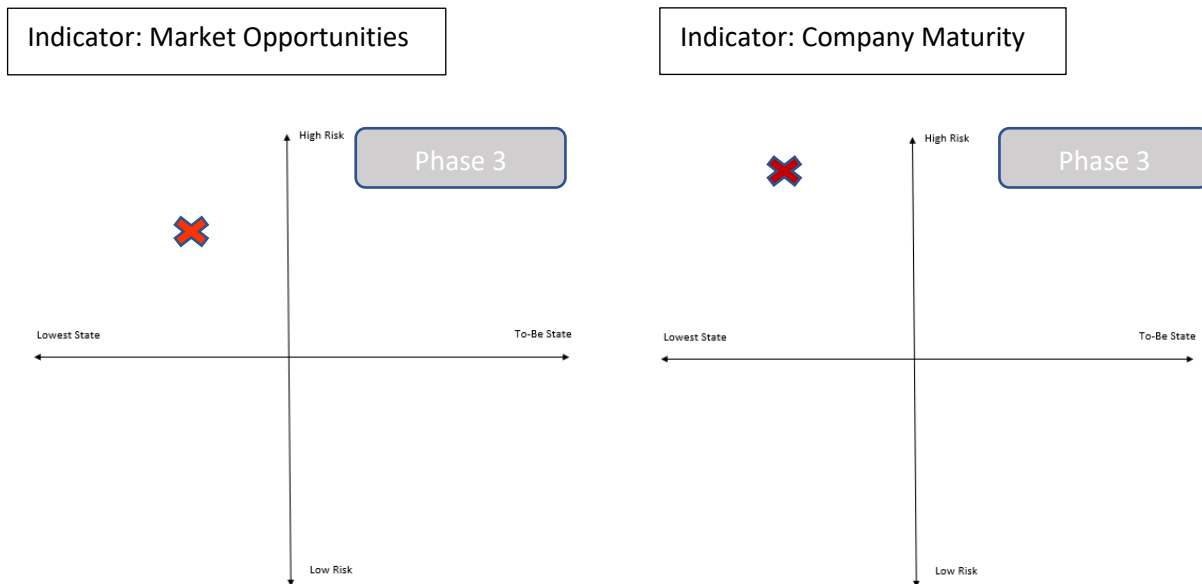


Figure H.4: Company C Market Opportunities and Company Maturity Indicators

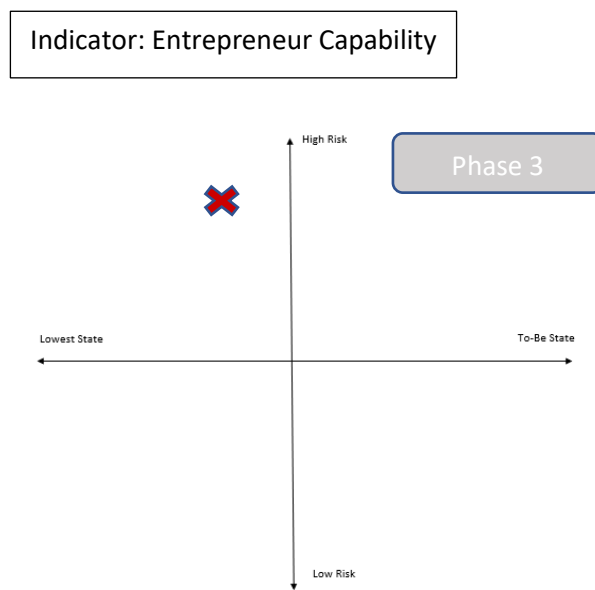


Figure H.5: Company C Entrepreneur Capability Indicator