CREATING A MODEL TO DEVELOP SELF-SUSTAINABLE AQUACULTURE AGRIBUSINESS ENTERPRISES IN SOUTH AFRICA

By

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Declaration

I, Bernadette Brown-Webb, declare that the dissertation hereby submitted by me for the Doctor of Philosophy degree in Sustainable Agriculture (PhD) degree at the University of the Free State is my own independent work and has not previously been submitted by me at another university/faculty.

25 January 2023

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Bernadette Brown-Webb 25 January 2023

Dedication

Glory belongs to the true God in the heavens above and on the earth beneath:

"For God hath not given us the spirit of fear; but of power, and of love, and of a sound mind" – 2 Timothy 1:7

This thesis is dedicated to all those brave entrepreneurs, farmers, workers, and stakeholders who are trying to build their businesses and create an enabling environment to build the aquaculture industry to its fullest potential.

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List of Abbreviations and Acronyms

AASA	-	Aquaculture Association of Southern Africa
ADB	-	Aquaculture Development Bill
ADEP	-	Aquaculture Development and Enhancement Programme
ADZs	-	Aquaculture Development Zones
AFF	-	Agriculture, Forestry and Fisheries
AgriBEE	-	Agriculture Black Economic Empowerment
AISA	-	Aquaculture Institute of South Africa
ANC	-	African National Congress
AOPS	-	Aquaculture Operation Phakisa Strategy
APSS	-	Agro-processing support scheme
ARC	-	Agricultural Research Council
ARTD	-	Aquaculture Research and Technology Development Programme
AquaSA	-	Aquaculture South Africa
ASSA	-	Aquaculture Association of Southern Africa
ASC	-	Aquaculture Stewardship Council
AsgiSA	-	Accelerated and Shared Growth Initiative – South Africa
ASTRAL	-	All Atlantic Ocean Sustainable, Profitable and Resilient
AVCRT	-	Aquaculture Value-chain Round Table
BBBEE	-	Broad-Based Black Economic Empowerment
BIS	-	Black Industrialists Scheme
BRC	-	Brand Reputation through Compliance
BSASA	-	Bivalve Shellfish Farmers Association of South Africa
CASIDRA	-	Cape Agency for Sustainable Integrated Development in Rural Areas
CASP	-	Comprehensive Agricultural Support Programme
CBA	-	Community-based aquaculture
CIP	-	Critical Infrastructure Programme
CIRD	-	Centre for Integrated Rural Development
COVID-19	-	Coronavirus disease 2019
COVID19TERS	-	Corona Virus Temporary Employer-Employee Relief Scheme
CPPP	-	Community Public Private Partnership Programme
CSAF	-	Comprehensive Small-scale Aquaculture Framework
CSF	-	Community-Supported Fisheries

CSIR	-	Council for Scientific and Industrial Research
CSR	-	Corporate Social Responsibility
CSSAF	-	Comprehensive Small-scale Aquaculture Framework
DAFF	-	Department of Agriculture, Forestry & Fisheries
DALRRD	-	Department of Agriculture, Land Reform and Rural Development
DEA	-	Department of Environmental Affairs
DEFF	-	Department of Environment, Forestry and Fisheries
DFFE	-	Department of Forestry, Fisheries and the Environment
DFIs	-	Development Finance Institutions
DoH	-	Department of Health
DPW	-	Department of Public Works
DSBA	-	Development Bank of Southern Africa
DSBD	-	Department of Small Business Development
DWS	-	Department of Water and Sanitation
ED	-	Enterprise Development
EDZs	-	Economic Development Zones
EIA	-	Environmental Impact Assessment
EIP	-	Enterprise Incubation Programme
EMIA	-	Export marketing and investment assistance
EPWP	-	Extended Public Works Programme
ESD	-	Enterprise and Supplier Development
EU	-	European Union
FAO	-	Food and Agricultural Organisation
FASA	-	Franchise Association of South Africa
FAWU	-	Food and Allied Workers Union
FMCG	-	Fast-Moving Consumer Goods
GDP	-	Gross domestic product
GEAR	-	Growth, Employment and Redistribution
GEM	-	Global Entrepreneurship Monitor
GMP	-	Good Management Practices
GVA	-	Gross Value Added
HAB	-	Harmful Algal Bloom
HACCP	-	Hazard Analysis Critical Control Point
HDIs	-	Historically disadvantaged individuals
HDPE	-	High-density Polyethylene

HoReCa	-	Hotel, restaurant, and catering
IAC	-	Inter-governmental Authorisations Committee
IBM	-	Inclusive business models
IDC	-	Industrial Development Corporation
IDZ	-	Industrial Development Zones
IMTA	-	Integrated multi-trophic aquaculture
IoT	-	Internet of Things
IPAP	-	Industrial Policy Action Plan
IRR	-	Internal rate of return
ISO	-	International Organization for Standardization
ISP	-	Incubation Support Programme
JSE	-	Johannesburg Stock Exchange
KPIs	-	Key Performance Indicators
MAFISA	-	Micro Agricultural Financial Institutions of South Africa
MAWG	-	Marine Aquaculture Working Group
MSC	-	Marine Stewardship Council
NAIF	-	National Aquaculture Intergovernmental Forum
NAQUARF	-	National Aquaculture Research Forum
NAPF	-	National Aquaculture Policy Framework
NASF	-	National Aquaculture Strategic Framework
NCRS	-	National Regulator of Compulsory Specifications
NDP	-	National Development Plan
NEF	-	National Empowerment Fund
NFSD	-	National Framework for Sustainable Development
NGO	-	Non-governmental Organisation
NGP	-	New Growth Path
NPAT	-	Net profit after tax
NPC	-	National Planning Commission
NPV	-	Net present value
NSBA	-	National Small Business Act
NSSD 1	-	National Strategy for Sustainable Development and Action Plan 2011-2014
NYDA	-	National Youth Development Agency
OEMs	-	Original Equipment Manufacturers
PAIF	-	Provincial Aquaculture Intergovernmental Forum

PDIs	-	Previously Disadvantaged Individuals
PI	-	Profitability index
PLAAS	-	Institute of Poverty, Land and Agrarian Studies
PIC	-	Public Investment Corporation
PPD	-	Product Process Development
PPP	-	Public and private partnerships
PPPFA	-	Preferential Procurement Policy Framework Act
QCTO	-	Quality Council for Trades Occupations
RAS	-	Recirculating aquaculture system
RDP	-	Reconstruction and Development Plan
RIS	-	Re-imagined Industrial Strategy
SA	-	South Africa
SAAGA	-	South African Avocado Growers' Association
SADC	-	Southern African Development Community
SAMSA	-	South African Maritime Safety Authority
SARS	-	South African Revenue Service
SARS-CoV-2	-	Severe acute respiratory syndrome coronavirus 2
SASSI	-	Southern African Sustainable Seafood Initiative
SASMCP	-	South African Shellfish Monitoring and Control Programme
SEA	-	Strategic Environmental Assessment
Seda	-	Small Enterprise Development Agency
Sefa	-	Small Enterprise Finance Agency
SEZ	-	Special Economic Zones
SIC	-	Standard Industrial Classification
SFFs	-	Small-scale Fisheries
SL	-	Sustainable Livelihoods
SMMEs	-	Small, medium and micro enterprises
SOPs	-	Standard Operating Procedures
SPII	-	Support Programme for Industrial Innovation
SPP	-	Strategic partnership programme
SRTs	-	Sustainability Reporting Tools
SSA	-	Sub-Saharan Africa
SSAS	-	Sector Specific Assistance Scheme
Stp	-	Seda Technology Programme
TBL	-	Triple Bottom Line

TEA	-	Total Early-stage Entrepreneurial Activity
The DTIC	-	The Department of Trade, Industry and Competition
THRIP	-	Technology and Human Resources for Industry Programme
TPA	-	tonnes per annum
TNPA	-	Transnet National Ports Authority
UIF	-	Unemployment Insurance Fund
UNDP	-	United Nations Development Programme
UNIDO	-	United Nations Industrial Development Organization
USB	-	University of Stellenbosch Business School
WCADI	-	Western Cape Aquaculture Development Initiative
WHO	-	World Health Organisation
WoRMS	-	World Register of Marine Species
WRC	-	Water Research Commission
WFFP	-	Working for Fisheries Programme

Abstract

South Africa's policies emphasize the importance of small enterprise and aquaculture sector development in meeting development goals. Public and private investments do not have the expected impacts on enterprise development and job creation, and enterprise sustainability remains low. Many start-ups receiving support, including public funding, fail to become self-sustainable after the financial support ends.

This study hypothesized that the development of self-sustainable aquaculture enterprises is not adequately supported by the enabling environment for the sector. The research objectives were to (1) determine the impacts of key stakeholders on enterprise development; (2) identify critical success factors for enterprises; (3) understand the impacts of the COVID-19 pandemic on the sector; (4) understand the challenges that compromise development of self-sustainable enterprises; and (5) develop and validate an enterprise development model to create self-sustainable aquaculture enterprises.

The study was conducted in Saldanha Bay, in the Western Cape Province on South Africa's west coast. A multiple-case study approach was followed, focusing on the marine bivalve shellfish farming industry. Semi-structured interviews were conducted with the owners or managers of ten aquaculture enterprises in Saldanha Bay, and with nine representatives of key role players in the sector. Consultations with enterprise development experts and stakeholder focus groups were also conducted.

The mussel farming sector has a well-developed commercial value chain. Vertical integration is prominent, and 32% of farms have access to 51% of the farming area. Self-sustainable enterprises had minimum farm sizes of 15 ha, produced for at least 5 years, had a commercial focus and strong leadership. In-depth analysis of four case studies indicated success factors as having commercial focus, good management and leadership, access to finance, economies of scale, and perseverance.

Key aquaculture stakeholders had positive and negative impacts on aquaculture sector development. Role players listed the main impacts as the approach to enterprise development (56%), community-based/co-operative ventures (67%) and impacts of different mandates (44%). Enterprise respondents listed community-based/co-operative ventures (50%), impacts of different mandates (40%) and the enabling environment (60%). Recommendations include resourcing of aquaculture industry associations, developing a focused aquaculture enterprise

and supplier development (ESD) strategy and programme, streamlining application processes, and finalising the Oceans Economy Master Plan, to include aquaculture specific legislation.

Both enterprise and role player respondent groups described critical success factors as environmentally sustainable farming (80% and 78%), addressing economic challenges/opportunities (90% and 89%) and good business leadership and management (100% each). Recommendations include a focused aquaculture development programme such as an incubator, a market development mechanism and an integrated research and development programme.

Enterprise respondents listed the main areas of COVID-19 impacts on operations and production (100%), requirements to survive and rebuild (89%), factors promoting resilience (78%) and initiatives to prepare and rebuild (67%). Role player respondents listed impacts on the sector (100%), requirements to survive (89%), factors promoting resilience (78%) and support measures (67%). Recommendations include interventions to rebuild a more resilient sector, follow-up assessments, prioritising interventions for surviving enterprises, and developing an industry-based Business Continuity Strategy.

The key factors affecting mussel production were a supportive regulatory framework, favourable environmental and economic conditions, appropriate species and technologies, and efficient farm and enterprise management. Challenges affecting these factors were identified and used to develop an aquaculture enterprise development model (AEDM) that could develop self-sustainable enterprises. The AEDM includes a vision for the sector, a mechanism for implementation, an aquaculture incubator, an integrated research and development programme, and a market development mechanism. The study recommends the implementation of a pilot AEDM in the Saldanha Bay Aquaculture Development Zone (ADZ). This will allow for testing of assumptions and refining of the model before rolling it out to other ADZs or industries.

Keywords:

Aquaculture, agribusiness, enterprise development model, self-sustainable, institutional framework, support systems, mussel farming, case study methodology

Chapter 1 - Introduction

1.1 Background of the study

South Africa's current economy and social context is shaped by its history of colonialism and apartheid. Segregation and unequal development were institutionalised and implemented through several policies and legal instruments. This left a legacy of unequal distribution of wealth and poverty, low levels of education and high unemployment rates for most black people (categorized as African, Coloured, and Indian under apartheid legislation) and historically disadvantaged citizens (including black people, women, youth and people with disabilities). After 1994, when apartheid legally came to an end, policies and legal instruments were aimed at poverty reduction, employment creation and inclusive economic development. These include strategy and policy instruments such as the Reconstruction and Development Plan (RDP), Growth, Employment and Redistribution (GEAR) Strategy, Accelerated and Shared Growth Initiative – South Africa (AsgiSA), National Development Plan (NDP), New Growth Path (NGP) and Industrial Policy Action Plan (IPAP). Although many good policies, strategies and development plans were put in place to address inequality, it remains a problem.

The Gini index is an economic inequality measure, with 0 representing perfect equality, and 100 representing perfect inequality. In 1993, the Gini index for the South African economy was 59.33, in 1994 the annual economic growth rate was around 3.2% and the official unemployment rate was 22% (Stats SA, 2014; The World Bank, 2014a). More than 20 years after 1994, the country still has one of the most unequal societies in the world. The Gini index was 63 in 2014 (The World Bank, no date), and the unemployment rate was 26.5% in Quarter 4 of 2016 (Stats SA, 2017b). This has a negative effect on income and demand, which in turn affect production and growth. The country's GDP growth rate remains lower than planned, and in the first half of 2017 reached a recession status, when the growth rate was negative for the second quarter in a row (Stats SA, 2017c).

1.2 Aquaculture, enterprise, and agribusiness development

Aquaculture and enterprise development are important strategies implemented by the South African Government to address socio-economic issues such as economic empowerment, wealth creation, transformation, and economic growth. The South African aquaculture sector is regarded as having huge potential to contribute to economic growth, economic empowerment, and food security. The sector is based on cultivation of 11 freshwater and marine species including mussels, oysters, abalone, trout, and tilapia, across all provinces in

the country. Aquaculture production is more than 6000 t p.a., valued at about R1.1 billion (DEFF, 2021a).

Depending on the source, aquaculture can be defined in different ways. One of the definitions listed by the Food and Agriculture Organisation of the United Nations (FAO) in its Term Portal is "the farming of aquatic organisms including fish, molluscs, crustaceans, and aquatic plants. Farming implies some sort of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators etc. Farming also implies individual or corporate ownership of the stock being cultivated, the planning, development and operation of aquaculture systems, sites, facilities and practices, and the production and transport" (FAO, no date b).

Globally, aquaculture growth is driven by a decrease in wild fisheries, the challenge of providing food and livelihoods to a growing population and an increase in consumption of aquatic products. Global fish production (excluding aquatic mammals, reptiles, seaweeds, and other aquatic plants) was estimated at 171 million tonnes in 2016, with aquaculture contributing about 80 million tonnes (47%). Total first sale value of fish production was estimated at USD 362 billion, with aquaculture contributing USD 232 billion. Total fish production is projected to grow to 201 million tonnes by 2030, with aquaculture expected to contribute 54%. Food fish consumption grew from 9 kg per capita in 1961 to 20.2 kg in 2015. In 2016, Africa contributed 2.5% (1 982 thousand tonnes) to the world's aquaculture food fish production, with Sub-Saharan Africa (SSA) contributing 0.4% to this total (FAO, 2018).

To enhance economic growth and employment, it is also important to stimulate the development of enterprises. All business enterprises in a country (small to large) contribute to the state of the economy, as measured by the gross domestic product (GDP). In South Africa, the development and support of enterprises is used as a tool for growing and developing the economy.

After 1994, several policy and strategy instruments were developed to promote equal participation in the economy, and to support enterprise development and economic growth through leveraging of private and public investment. The National Small Business Act No. 102 of 1996 (NSBA), as amended, aims to promote the interests of small businesses. The Cooperatives Act (No. 14 of 2005), as amended, aims to promote co-operatives as legal instruments for economic and enterprise development.

The importance of enterprise development, especially small business development, is also reflected in the financial and non-financial support provided by the public and private sectors. In the 2015/16 financial year, the DSBD's Small Enterprise Finance Agency (SEFA) disbursed R1.1 billion in loan facilities to 45 263 small businesses and cooperatives. In the same period, the Department disbursed R99 million to 503 enterprises through incentive schemes aimed at youth, women and black women suppliers (DSBD, 2016). In the same financial year, the Department of Agriculture, Forestry & Fisheries (DAFF) made about R2.2 billion grant funding available for support of agricultural producers and value adding enterprises (DAFF, 2016a). Also in the same year, the dti provided R7 billion in financial support to about 1770 firms through its main incentive schemes, enabling them to leverage more than R57 billion in new private-sector investments (The dti, 2016).

The institutional framework and support systems in South Africa reflects the importance of enterprise development, and in particular small businesses as vehicles for economic growth and job creation. Although small businesses do contribute to the GDP and employment, the lack of reliable statistics makes it difficult to accurately measure the impact or sustainability of these businesses. Available information indicates that enterprise sustainability remains low (Herrington and Kew, 2018).

Globally, there is recognition that GDP growth in developing countries, based mainly on exports of oil, minerals, and agricultural commodities, is not enough to lead to substantial poverty reduction. A rural transformation process that raises the economic value of agricultural commodities and create off-farm employment could accelerate sustainable growth and development. In order to achieve this, farming should be seen as a modern industry with distinctive scientific, technological and management inputs and development focus should shift beyond agriculture towards agribusiness (UNIDO, 2013).

The South African agriculture, forestry and fishing industry is a primary economic sector that contributed R81.3 billion to the GDP in 2019, and R95.7 billion to value added (a 2.1% share in total value added) (DALRRD, 2020). The agriculture and related services industry (as represented by commercial farms registered for value added tax) provided employment to 748 113 persons in 2017 (Stats SA, 2017a).

Agribusiness can be defined in various ways, including as agriculture conducted on commercial principles, especially using advanced technology, or the group of industries dealing with agricultural produce and services required in farming, or the various businesses that relate to

producing, preparing, and selling farm products. The United Nations Industrial Development Organization (UNIDO) describes it as a broad concept covering input suppliers, agro-processors, traders, exporters and retailers, or a term that means "farming plus all the other industries and services that constitute the supply chain from farm through processing, wholesaling and retailing to the consumer", p.28, (Yumkella *et al.*, 2011). Aquaculture enterprises can therefore be regarded as agribusinesses.

Full exploitation of the potential of agribusiness is expected to accelerate sustainable and inclusive growth on the African continent. It could be achieved through increasing agro-industrial value added and employment along the whole agribusiness value chain including agriculture, industry and services (Yumkella *et al.*, 2011). Agro processing refers to "the sub-set of the manufacturing sector that processes raw materials and intermediate products derived from the agricultural sector", or "transforming products that originate from agriculture, forestry, and fisheries" (p.223). The agro-industry excludes industries supplying agriculture with industrial machinery, inputs and tools (FAO, 1997). Agro processing is one of the sectoral focus areas identified in IPAP 2018/19-2020/21, with potential for labour-intensive growth (The dti, 2018a).

1.3 The economic impact of COVID-19

The COVID-19 pandemic (also known as the coronavirus pandemic) did not exist at the outset of this study. In the absence of a readily available vaccine that could provide protection against the disease, countries around the world, including South Africa, reacted to this public health threat by implementing measures to curb the spread. These measures included travel restrictions, lockdowns and other measures that caused global social and economic disruption, and a global recession.

As elsewhere, in South Africa, these measures have caused widespread social and economic disruption and a downturn in the economy which was felt across all provinces and sectors. Although agricultural activities (including aquaculture) were considered as essential services, the negative impact on other industries such as retail, catering and accommodation meant that the local and export markets for aquaculture products were affected.

The severity of the impacts of the COVID-19 pandemic on the economy necessitated a consideration of the impacts of the pandemic on aquaculture enterprises and agribusinesses as part of this study.

1.4 The research problem

The country's current developmental strategies and policies reflect the importance of enterprise development, the agro-industrial cluster/agricultural value chain and diversification of the manufacturing sector in meeting job creation and economic development goals. These national level strategies provide government departments with guidance regarding development of their own strategies and initiatives to support employment creation and economic development. However, despite all the policies in place, development still does not meet expectations.

The corporate sector annually commits billions of Rand to Enterprise Development in terms of BBB-EE policy; however, this investment has not realised its potential nor accomplished the underlying intentions of the policy (Impact Amplifier and NYU Centre for Global Affairs, 2013). Because of the prominence of the BBB-EE policy, enterprise development in South Africa tends to be interpreted mostly in terms of this context, and is in some cases regarded only as a tool for companies and organisations to meet the requirements of the Act (Verwey, 2011). However public investment in enterprise development is equally important.

Despite substantial financial support (more than R10 billion) in the 2015/16 financial year in the form of loan facilities, youth, women and black women incentives, agricultural support etc., there is a perception that the institutional framework, support measures and public and private investments in enterprise development are not having the expected impact on economic growth, job creation and transformation. Public funding invested into enterprises also does not produce enough self-sufficient enterprises. Business sustainability remains low, and the SMME mortality rate in their first two to five years of trading is estimated between 62% and 80% (The dti, 2014). Despite the supportive environment and development initiatives aimed at starting and developing enterprises, unemployment is increasing (30.1% in Quarter 1 of 2020), and economic growth remains low (0.2% growth in GDP in 2019) (Stats SA, 2020e, 2020d).

The author of this thesis has been working in the enterprise development domain for about twenty years. She has been involved in several programmes and projects aimed at enterprise development and creation, in South Africa and neighbouring countries. Her own observation over several years is that too many enterprises, including those that are public funded, fail to become self-sustainable after the financial support ends. Discussions with other stakeholders and implementation agents in the enterprise development domain confirmed this perception. The researcher sought to understand the underlying reasons for this failure, and to identify ways to improve the chances of enterprises to become self-sustainable in the long term.

The problem to be addressed through this study is that many aquaculture enterprises in South Africa, including those that are public funded, fail to become self-sustainable after the financial support ends.

1.5 Research aims and objectives

1.5.1 Aim

The aim of the research study is to develop a model that aids the development of self-sustainable aquaculture enterprises, including those that are public funded. This model is to include all role players, and to propose new institutions, interventions, strategies etc. to achieve this aim.

1.5.2 Objectives

The study has the following objectives:

1. To determine the motivations, contexts, key drivers, and impacts of the main stakeholders on aquaculture enterprise development in South Africa.
2. To identify critical success factors for aquaculture enterprises in South Africa.
3. To understand the impacts of the COVID-19 pandemic on aquaculture sector and enterprises, and what is needed to recover from these impacts.
4. To understand the challenges that compromise the development of self-sustainable aquaculture enterprises.
5. To develop and validate an enterprise development model supported by role players, for creating self-sustainable aquaculture agribusiness enterprises in South Africa, including those that are public funded.

1.6 Research questions

To realise the objectives, several primary and secondary research questions need to be answered through the study:

1. Who are the main role players in the South African aquaculture sector?
2. How do the motivations, contexts, and key drivers of the main role players impact on aquaculture enterprise development in South Africa?
    a. How do South Africa's current institutional framework and support systems for agribusiness or aquaculture development impact the sector and individual enterprises?

b. Which role players are important to aquaculture enterprises, and how do they impact on the sustainable development and growth of the agribusiness/aquaculture sector?

3. What are the critical success factors for aquaculture agribusiness enterprises in South Africa, and why?
    a. What is the definition for a self-sustainable enterprise?
    b. What are the critical success factors for economic/financial, social, and ecological/environmental sustainability in an enterprise?
    c. Why do some public-funded enterprises fail to become self-sustainable after financial support ends?
4. How did the global COVID-19 pandemic impact on aquaculture enterprises, and what is needed for enterprises to overcome these impacts?
    a. What are the current effects of COVID-19, and the resulting national lockdown from 27 March 2020, on aquaculture enterprises?
    b. What are the potential longer-term effects of the disease and the national lockdown on aquaculture enterprises?
    c. Are aquaculture enterprises resilient enough to survive the national lockdown and global effects of the pandemic, and why?
5. What are the most important gaps, needs and challenges that compromise successful aquaculture enterprise development?
6. How can an enterprise development model be developed, that could assist aquaculture enterprises in becoming self-sustainable?

1.7 Contribution of the study

The researcher hypothesised that the development of self-sustainable aquaculture enterprises is not adequately supported by the enabling environment for the aquaculture sector in South Africa. The researcher further proposed to identify the factors inhibiting or promoting self-sustainability in aquaculture enterprises, and to develop an aquaculture enterprise development model, covering all relevant aspects and stakeholders, to create self-sustainable aquaculture enterprises.

Addressing the problem in a scientific way as a doctoral research study will create new knowledge about aquaculture enterprise development in South Africa. Improving the success rate of aquaculture enterprises, including those that are public-funded, will have a positive

impact on rural economies and the lives of some of the most marginalized members of society. It will also increase the impact of public and private funding investment into such enterprises.

The intended contributions of this research study include creation of new knowledge about the factors inhibiting or promoting self-sustainability of aquaculture agribusiness enterprises in the South African context, influencing strategic choices about resource allocation, and propose the creation of a model with new institutions, interventions, and strategies, to sustain aquaculture enterprise development.

The planning, appraisal, implementation, and impact of aquaculture enterprise creation and development interventions can be enhanced by a more complete understanding and application of the factors that inhibit or promote self-sustainability of such enterprises. This is especially true in the case of emerging enterprises receiving public funding and support, especially in rural areas of South Africa.

Proposed outputs include publications in peer-reviewed international journals, recommendations for aquaculture enterprise development that could be included in current aquaculture policy development processes, and an aquaculture enterprise development model validated by stakeholders, that could be implemented for testing of assumptions.

Chapter 2 - Literature Review

2.1 Introduction

The problem at the heart of this study is that many aquaculture enterprises, including those that are public funded, fail to become self-sustainable after the financial support ends. The scope of the Literature review therefore includes the importance and development of aquaculture, the importance and development of enterprises, sustainability of enterprises and aquaculture, and the enabling environment for aquaculture in South Africa. The scope also includes a review of the South African mussel farming industry, as the study focuses on this industry as a case study.

2.2 Background to aquaculture

2.2.1 What is aquaculture?

Depending on the source, aquaculture can be defined in different ways. One of the definitions listed by the Food and Agriculture Organisation of the United Nations (FAO) in its Term Portal is "the farming of aquatic organisms including fish, molluscs, crustaceans, and aquatic plants. Farming implies some sort of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators etc. Farming also implies individual or corporate ownership of the stock being cultivated, the planning, development and operation of aquaculture systems, sites, facilities and practices, and the production and transport" (FAO, no date b). Aquaculture can be sub-divided into mainly marine aquaculture (mariculture) or freshwater aquaculture. However, variations include coastal aquaculture, which is practised in human-made structures (such as coastal ponds and lagoons) and cultivation in saline-alkaline water in inland areas (FAO, 2018).

Aquaculture facilities and production systems are commonly classified as extensive, intensive, or semi-intensive based on the production per unit volume (m^3) or unit area (m^2) farmed. Extensive production systems have low production output per unit volume, and usually have low levels of technology and investment. In intensive systems, high production per unit volume is achieved through more technology and artificial inputs, requiring more investment cost per unit farmed. Semi-intensive systems combine extensive and intensive systems, e.g. where an intensive process such as fry production is combined with extensive on-growing (Odd-Ivar, 2013).

Farming systems can also be classified according to the design and function, which are influenced by the type of species and life-stage farmed. Fish can be raised in closed production

units separate from the outside environment, or in open production units with permeable walls such as nets. Farms could be in the sea, a tidal zone or on land. Land-based farms may have gravity-fed, pumped or tidal exchange water supply systems. In flow-through systems, water flows through and is used once but if the outlet water is recycled and used several times, it is a recirculating aquaculture system (RAS). Monoculture production systems are based on only one species, and polyculture involves two or more species (Odd-Ivar, 2013). Different aquaculture production systems including a land-based RAS, an off-bottom oyster production system and earthen ponds for tilapia and catfish production are illustrated in Figure 2.1.

Figure 2.1: Examples of aquaculture production systems

2.2.2 Global history of aquaculture

It is not possible to pinpoint exactly when aquaculture first started because of the absence of definitive evidence. However, a review of the history of aquaculture shows that there is some information about the development of freshwater and marine aquaculture in traditional societies across different continents and areas including in Africa, Asia, Europe, the Americas, and Hawaii.

Evidence suggests that fish farming in Egypt dates to more than 4000 years before present (BP). In Asia, China is widely credited with the first aquaculture development, with freshwater fish farming dating back to 2300 years BP, and marine aquaculture dated to less than 1000 years old. Available literature suggest that common carp aquaculture has been practiced in continental Europe for much of the past 2000 years, and shellfish farming is thought to have been established in the Adriatic more than 2000 years BP. In pre-Hispanic Mexico, the Aztecs were credited with the creation of a patchwork of peninsulas and islands around lake margins (called chinampas), where it is thought that fish production may have been practiced. However,

in spite of the long history of fish and shellfish farming, aquaculture production became important as industrial, technology-led activities in most countries only after the 1950s (Beverage and Little, 2002).

Hawaiian mariculture systems are estimated to be between 1500 to 1800 years old and were sophisticated farming systems incorporating ocean harvesting and integrated sea farming with watershed management and food production systems (the *ahupua'a*). These systems were based on the traditional Hawaiian societal hierarchy and a subsistence and barter economy, which were largely destroyed after first contact with Europeans in 1778, and the Hawaiian land decision in 1848 which allowed the purchase of crown lands (Costa-Pierce, 2002).

2.2.3 History of South African aquaculture sector

The history of aquaculture development in South Africa dates to the establishment of provincial hatcheries by colonial government, to stock water bodies with exotic species like bass and trout for angling purposes. Then, in the 1980's, hatcheries and production units were established in former homelands for food security projects. Around the same time commercial aquaculture started with production of trout, barbel, ornamental fish and several marine species (Rouhani and Britz, 2004a).

An Aquaculture Working Group was appointed by the Council for Scientific and Industrial Research (CSIR) in 1981, and they initiated an aquaculture research programme with objectives including facilitation of food and other commodity production, provide scientific support to existing aquaculture activities, facilitate optimal use of resources such as water, select and adapt available technologies, and generate and support problem-oriented research (Safriel and Bruton, 1984).

The decline in capture fisheries and recognition of the potential of aquaculture to contribute to national priorities led to accelerated progress in aquaculture development after 2009. The South African government, through the Department of Agriculture, Forestry and Fisheries (DAFF) invested into research and development to stimulate aquaculture growth. Key milestones included the recognition of aquaculture as an agricultural activity, development of aquaculture-specific policies and implementation of Operation Phakisa (Aquaculture work stream). Operation Phakisa's five-year goals included growth of the industry from annual revenue of R 670 to R 2.3 billion, production from 4 000 t to 21 644 t and number of jobs from 2 227 to 4 811 (Operation Phakisa, 2014).

As summarised in Table 2.1, there were 152 freshwater and 37 marine aquaculture farms in South Africa in 2015. Most of the freshwater sector was concentrated in Mpumalanga Province, and most of the marine sector in the Western Cape Province. In the marine sector, mainly four species were farmed – abalone, finfish, mussels, and oysters. There were four mussel farmers and eight oyster farmers in the country.

Table 2.1: Total aquaculture farm statistics

Sector	Species	Number of farms	Highest concentration (Province)
Freshwater	Tilapia, Trout, Catfish, Marron crayfish, Carp, Koi-Carp, Ornamental species	152	Mpumalanga (33)
Marine	Abalone	18	Western Cape (23)
	Finfish	7	
	Mussels	4	
	Oysters	8	
Total marine		37	
Total aquaculture farms		189	

Source: Aquaculture Yearbook 2016 (DAFF, 2016c)

As set out in Table 2.2, FAO statistics indicated that total aquaculture production increased from 6613 t in 2013, with a value of US$ 67 853 (R 658 million), to more than 9000 t in 2018. This represented 0.01% of world aquaculture production of 82.1 million t, and 0.03% of world aquaculture value. By 2019, estimated production had increased to over 9 000 t, and revenue had grown to US$82 million (R 1.2 billion).

Table 2.2: Aquaculture production in South Africa

Aquaculture	2013	2014	2015	2016	2017	2018	2019
Quantity (t)	6 613	7 222	6 730	8 094	6 338	7 868	9 344
Value (US$ 000)	67 853	56 206	52 330	45 692	48 141	77 133	82 072

Source: FAO –Fisheries and Aquaculture Information and Statistics Branch
https://www.fao.org/fishery/statistics-query/en/aquaculture

By 2018, the main commercial species cultivated in the South African mariculture sub-sector included abalone, pacific oyster, mussels, dusky kob and salmon. In the freshwater sub-sector, the main species included trout, tilapia, catfish, carp, and marron crayfish. Total production included about 4300 t (valued at R959 million) from 39 mariculture farms and about 2100 t (valued at R130 million) from 190 freshwater aquaculture farms. Mussels contributed the most (2200 t) to the marine sub-sector, whilst trout contributed the most (1500 t) to the freshwater sub-sector. Total investment in 2018 was estimated at R715 million, with the number of jobs in the sector estimated at 6500 across the value chain (3 486 on farms) (DEFF, 2021a). Figure 2.2 illustrates some of the freshwater and marine species farmed in South Africa, including Mediterranean mussels, pacific oysters, marron crayfish, abalone, dusky kob, Nile tilapia, and rainbow trout.

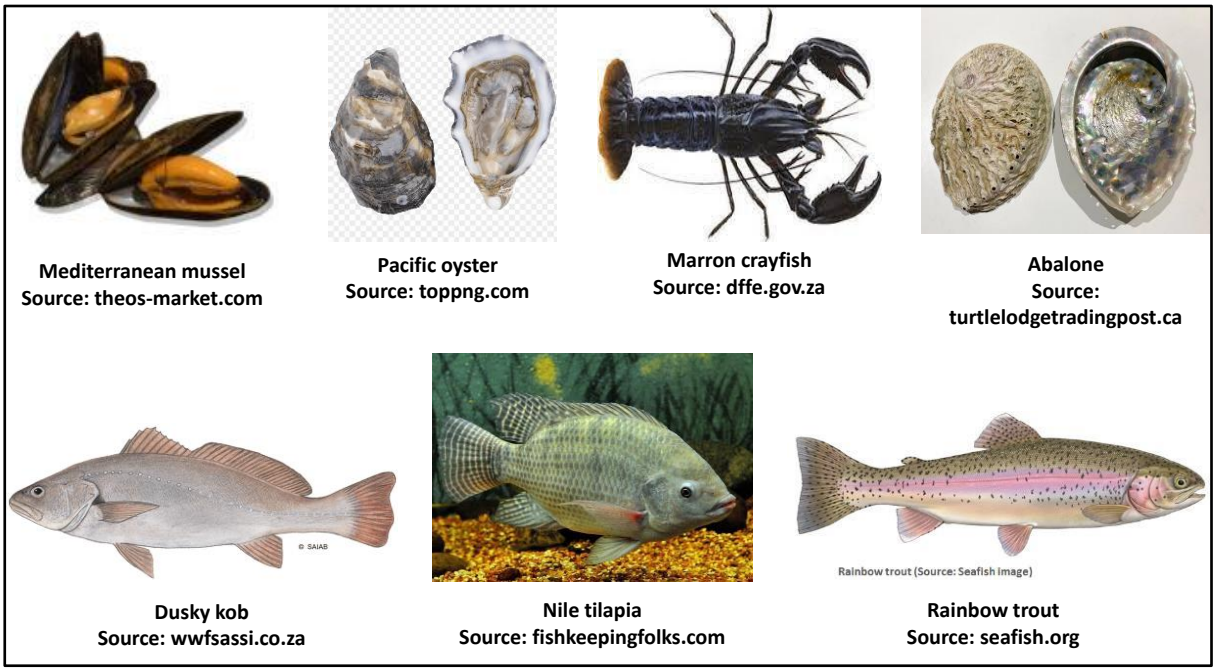

Figure 2.2: A selection of the freshwater and marine species farmed in South Africa

The aquaculture sector in South Africa remains very small (less than 8 000 t p.a. in 2018) in comparison to the commercial wild capture fishery industry (about 700 000 t per annum). It also forms a very small component of African aquaculture (around 1%) which, in turn, contributes around 1% to worldwide aquaculture production (FAO, 2018).

2.2.4 Economic contribution of aquaculture

Total global fish production was estimated at 179 million tonnes (t) in 2018, with a first sale value of US$ 401 billion. Aquaculture accounted for 46% (82 million t) with a value of US$250 billion. Human consumption accounted for 156 million t (87%), of which 81 million t (52%) came from aquaculture. These figures exclude aquatic mammals, crocodiles, alligators, caimans, seaweeds, and other aquatic plants. About 39 million people were employed in capture fisheries, and 20.5 million in aquaculture. Average global annual fish consumption increased from 13.4 kg per capita in 1986 to 20.5 kg in 2018. The average annual rate of global food fish consumption increased at 3.1% (twice the average rate of annual world population growth of 1.6%) from 1961 to 2017. Global capture fisheries remained stable at between 81 and 86 million t from 1996 to 2017, with an increase to 96.4 million t in 2018. However, long-term monitoring shows a continued decline in capture fisheries over time. In contrast, world aquaculture production of aquatic animals grew at an average annual rate of 5.3% between 2001 and 2018. By 2030, global aquaculture production is expected to contribute 53% to global fish production, and 59% to global food fish consumption (FAO, 2020b).

Total world aquaculture production (including aquatic algae, ornamental seashells, and pearls) reached 114.5 million t in live weight in 2018, with total farm gate sale value of US$ 263.6 billion. The aquaculture sector is expected to increase by 48% in Africa and 33% in Latin America, driven by additional production capacity and local policies promoting aquaculture (FAO, 2020b). World aquaculture production of fish, crustaceans, molluscs, and other aquatic organisms (excluding aquatic plants) reached 82.1 million t, valued at US$ 250 billion, in 2018 (see Table 2.3). This included all environments (freshwater, brackish water and marine). China contributed 47.6 million t (58%), and Africa contributed 2.2 million t (2.7%) to world production (FAO, 2020a). About 99% of global seaweed production (more than 35 million t) is from aquaculture, with an estimated value of US$15 billion (Cottier-Cook *et al.*, 2021).

Molluscs contributed 17.2 million t (21%) to world aquaculture production, valued at US$ 34.6 billion. Molluscs included abalones, oysters, mussels, scallops, clams etc. (FAO, 2020a). In

2019, world aquaculture production (excluding aquatic plants) was 85.4 million t, valued at US$ 260 billion (FAO FishSTAT, 2021).

Table 2.3: World aquaculture and mollusc production

2018	World	China	Africa	Molluscs (World)
Quantity (t)	82 095 054	47 559 074	2 195 859	17 510 949
Value (US$ 1000)	250 115 178	144 999 209	3 279 668	34 605 959

Source: (FAO, 2020a)

The major aquaculture producers of marine and coastal molluscs in 2018 are listed in Table 2.4. China produced 14.4 million t (84%) of the total world production of 17.3 million t, while Africa produced 6 000 t (0.04%) (FAO, 2020b).

Table 2.4: Major aquaculture producers of marine and coastal molluscs

Country	China	Republic of Korea	Chile	Japan	Viet Nam	Spain	USA	France	Italy	Thailand	New Zealand	Africa
Production (1000 t)	14 400	400	400	350	301	287	181	145	93	93	88	6

Source: (FAO, 2020b)

The major global aquaculture producers with relatively high percentages of bivalve shellfish in 2018 are listed in Table 2.5. New Zealand (84%), Spain (83%), France (78%) and Republic of Korea (69%) had the highest shares of bivalves as a percentage of total aquaculture production of aquatic animals (FAO, 2020b).

Table 2.5: Major aquaculture producers with high percentage of bivalve production 2018

Country	China	Chile	Japan	Republic of Korea	USA	Spain	Taiwan	Canada	France	Italy	New Zealand
Total aquaculture production (1000 t)	47 559	1266	643	568	468	348	283	191	185	143	105
Bivalves (1000 t)	13 358	377	350	391	181	287	76	43	145	93	88
Share of bivalves (%)	28	30	55	69	39	83	27	23	78	65	84

Source: (FAO, 2020b)

2.2.5 International development goals and aquaculture

The United Nations 2030 Agenda for Sustainable Development identified 17 Sustainable Development Goals (SDGs) for global peace and prosperity in 2015. SDG 14 is to "Conserve and sustainably use the oceans, seas and marine resources for sustainable development". It provides a blueprint for the worldwide development of fisheries and aquaculture. (United Nations, 2016). Goal 14's aims, and targets are related to the contribution and conduct of fisheries and aquaculture towards food security and nutrition, and the sector's use of natural resources in a way that ensures sustainable development in economic, social, and environmental terms. In terms of Agenda 2030, the fisheries and aquaculture sector is expected to contribute to food security, human nutrition, livelihood diversification and income generation in poor households in developing countries (FAO, 2018).

The fisheries and aquaculture sector forms an important part of SDG 14, and the Food and Agriculture Organization of the United Nations (FAO) is responsible for four of the ten indicators of progress related to SDG 14. The FAO, as a technical agency fighting poverty and hunger, is also responsible for collecting and collating technical insights and statistics on global fisheries and aquaculture, and for promoting sustainability of the sector.

The FAO provides a global forum for the development of aquaculture by providing technical assistance (through its Code of Conduct for Responsible Fisheries), consultation and discussion (through a Sub-Committee of Aquaculture) and advising on technical and policy matters

related to aquaculture (through the Committee on Fisheries). The organisation also provides information and tools on worldwide aquaculture development, issues, and opportunities.

2.2.6 Scales and types of aquaculture operations

In aquaculture development there is general recognition of a difference between small-scale and commercial aquaculture systems and producers. Additional terms used to refer to different scales and motives of aquaculture operations include community-based aquaculture (CBA), emerging farmers, co-operatives, and subsistence farmers. Commercial aquaculture differs from rural or subsistence aquaculture in that it entails the rearing of aquatic organisms with a profit motive, is done mainly by the private sector and does not need direct assistance from donor or government sources. It also has a business orientation and uses labour instead of relying on family members (Percy and Hishamunda, 2001).

However, there is no general and operational definition of small-scale food producers, farmers or smallholders and these terms are sometimes used interchangeably. To arrive at a definition of smallholder that could be used to monitor indicators of the SDGs, the FAO reviewed different approaches used to define small-scale food producers. Most countries use a definition that emphasizes national priorities, with the target populations being the relatively more disadvantaged. An internationally agreed definition will therefore not replace country-specific definitions (Khalil *et al.*, 2017).

To assist with the development of the small-scale aquaculture (SSA) industry, the South African Department of Agriculture, Forestry & Fisheries (DAFF) developed a Comprehensive Small-scale Aquaculture Framework (CSSAF) for the development of a programme or implementation plan in 2019. Small-scale aquaculture was defined as "an aquaculture activity that is undertaken with fewer than 10 employees and an annual production of fewer than 20 t per annum for the purpose of making a profit" (DAFF, 2019c). The CSSAF was followed by the development of a Small-scale Aquaculture Support Programme (Implementation Plan) (DEFF, 2021b).

Adding to the complexity, the terms emerging farmer, or community-based aquaculture (CBA) are also used in some instances. In a study of emerging farmers and agribusinesses in South Africa, an emerging agribusiness is described as a micro-to medium-sized agribusiness owned by an HDI (Mabaya *et al.,* 2011). Community-based aquaculture is described as "situations whereby communities are empowered through skills, financial investment and the legal authority to practices aquaculture", and the rationale is to "increase fish production for local

consumption (and thus contribute towards protein security, create local employment, generate income and reduce poverty" (Hara, Njokweni and Semoli, 2017).

A co-operative is a legal business structure and defined in the Co-operatives Amendment Act (No. 6 of 2013) as "an autonomous association of persons united voluntarily to meet their common economic, and social or cultural needs and aspirations through a jointly owned and democratically controlled enterprise organised and operated on co-operative principles". Co-operatives can be small or large enterprises in terms of turnover and number of employees. They are also classified as primary (with minimum of five members), secondary (formed by two or more primary co-operatives) or tertiary (whose members are secondary co-operatives). The objectives of primary co-operatives are to provide employment or services to their members and to facilitate community development. The DBSD manages a Co-operative Incentive Scheme (CIS) which is a 90:10 matching cash grant (to a maximum of R350 000) for registered primary co-operatives whose members are HDIs. The establishment of co-operatives seem to be actively encouraged by government for projects with social objectives such as community development, poverty alleviation, job and livelihoods creation, and food security.

2.2.7 Global development of aquaculture industries

Aquaculture development management is defined by the FAO as "the implementation of policies and plans, including institutional development, regulatory aspects, capacity building and establishing practical links to other policies and plans of use for aquaculture development" (FAO, no date b).

Given the increasingly important role of aquaculture in meeting global demand for food and generating revenue, it is not surprising that aquaculture development is an important strategy for many countries around the world. The establishment of a successful aquaculture industry could take decades to achieve and requires sustained commitment of investment and resources, and research and development by government, industry, academia, and other stakeholders. Typical challenges that need to be addressed include disease management, production of inputs, market development, product development, technology development, environmental management, and regulation of the industry. The development path in many instances includes a few phases, starting with pilot cultivation of indigenous or introduction of alien species with market potential, development of technologies, products and markets, expansion of production, development of policies, legislation and guidelines, and industry development and stabilisation. These phases can be seen in development of aquaculture industries such as the

salmon industry in New Brunswick; shrimp and pangasius industries in Bangladesh; tilapia farming in China; mussel, salmon and oyster industries in New Zealand, salmon and mussel industries in Chile, tilapia industry in Ghana and in Zambia (Perlman and Juárez-Rubio, 2010; Chang, Coombs and Page, 2014; Asiedu, Failler and Beyens, 2016; Kaminski *et al.*, 2018; Xu and Ming, 2018; Islam *et al.*, 2020; Stenton-Dozey *et al.*, 2021).

In Norway, the research, industry, and public authorities are working together to develop the Norwegian bioeconomy based on cultivated seaweed and processing biomass. As in development of other aquaculture industries, they also started with experimental cultivation schemes. Challenges faced in the upscaling to commercial production include the assessment of risks and benefits, development of a regulatory framework, and ensuring environmental and economic sustainability (Stévant, Rebours and Chapman, 2017).

2.3 Aquaculture development in South Africa

2.3.1 Creating an enabling environment

The development of the aquaculture sector has been slow due to several constraints. These include environmental conditions (limited fresh water, extreme seasonal temperature fluctuations and a high energy coastline), limited choice of appropriate species, high production costs, lack of appropriate technologies and lack of an enabling regulatory environment (Rouhani and Britz, 2004a), (DAFF, 2012a), (Hara, Njokweni and Semoli, 2017). Problems with reliable access to electricity made matters worse. In addition, the freshwater and marine aquaculture sub-sectors used to be managed and regulated by different government departments. There was a lack of national legislation for the freshwater aquaculture sub-sector, which was managed by provincial departments responsible for nature conservation. The marine aquaculture sub-sector was historically managed by the national department responsible for fisheries, and complexity of compliance contributed to a difficult operating environment.

Due to the limited reporting on and availability of statistics about the aquaculture sector, two benchmarking surveys were conducted by the Aquaculture Institute of South Africa, in 2006 and 2009 (Botes, Thompson and Louw, 2006a; Britz, Lee and Botes, 2009). The 2006 report focused on the status of aquaculture production, enterprise development and the status of the sector. Results indicated a high level of business formalisation (Botes, Thompson and Louw, 2006a).

The 2009 report focused on aquaculture production, enterprise development, employment, and products and markets. Most enterprises were relatively young, with 50% less than 10 years old, and 76% were small businesses with turnover of less than R5 million. Most larger enterprises with turnover of more than R5 million were in the marine sector, produced abalone and were in the Western Cape Province. Primary producers showed a high degree of vertical integration (including hatcheries), and were also vertically integrated into secondary production activities, packing and distribution, and processing. An exodus of small producers over the survey period contrasted with a phase of consolidation and expansion of larger producers. The results indicated that medium size enterprises formed the backbone of the aquaculture industry, because they have achieved the critical mass to run vertically integrated operations (Britz, Lee and Botes, 2009).

The decline in capture fisheries and realisation of the potential of aquaculture to contribute to national development goals led to increased efforts by industry, government, and the research community to develop the sector to date. Three initiatives were critical in accelerating progress in this regard. A National Aquaculture Strategic Framework (NASF) for South Africa was developed in 2012, a National Aquaculture Policy Framework (NAPF) was approved in 2013, and the Operation Phakisa: Aquaculture Programme was introduced as an approach to address key national priorities in practical ways, including aquaculture (DAFF, 2012a, 2013c; Operation Phakisa, 2014).

In 2016, the DAFF and Department of Environmental Affairs (DEA) launched a national level Aquaculture Strategic Environmental Assessment (SEA) across all nine provinces, to identify suitable areas for prioritising aquaculture, and to provide an integrated management and legislative framework to reduce compliance complexities. The SEA identified environmental attributes, specific siting criteria and key impacts of marine and freshwater aquaculture in natural and artificial culture systems. This project was expected to reduce the time frame and complexities for prospective farmers related to identification of suitable sites and obtaining authorisations. The second phase of the project resulted in identification of draft aquaculture development zones, to be studied in more detail in Phase 3 of the SEA (CSIR, 2017).

Figure 2.3 illustrates the areas investigated as part of the SEA for Aquaculture Development Zones (ADZs), which include areas where aquaculture farms are located and where development initiatives will be concentrated. ADZs are land- or water-based areas reserved exclusively for aquaculture development and are meant to help develop small-scale aquaculture producers through improved access to extension services, hatcheries and markets, formation of

production clusters, reduction of the cost of Environmental Impact Assessments (EIAs) and creation of economies of scale for marketing purposes.

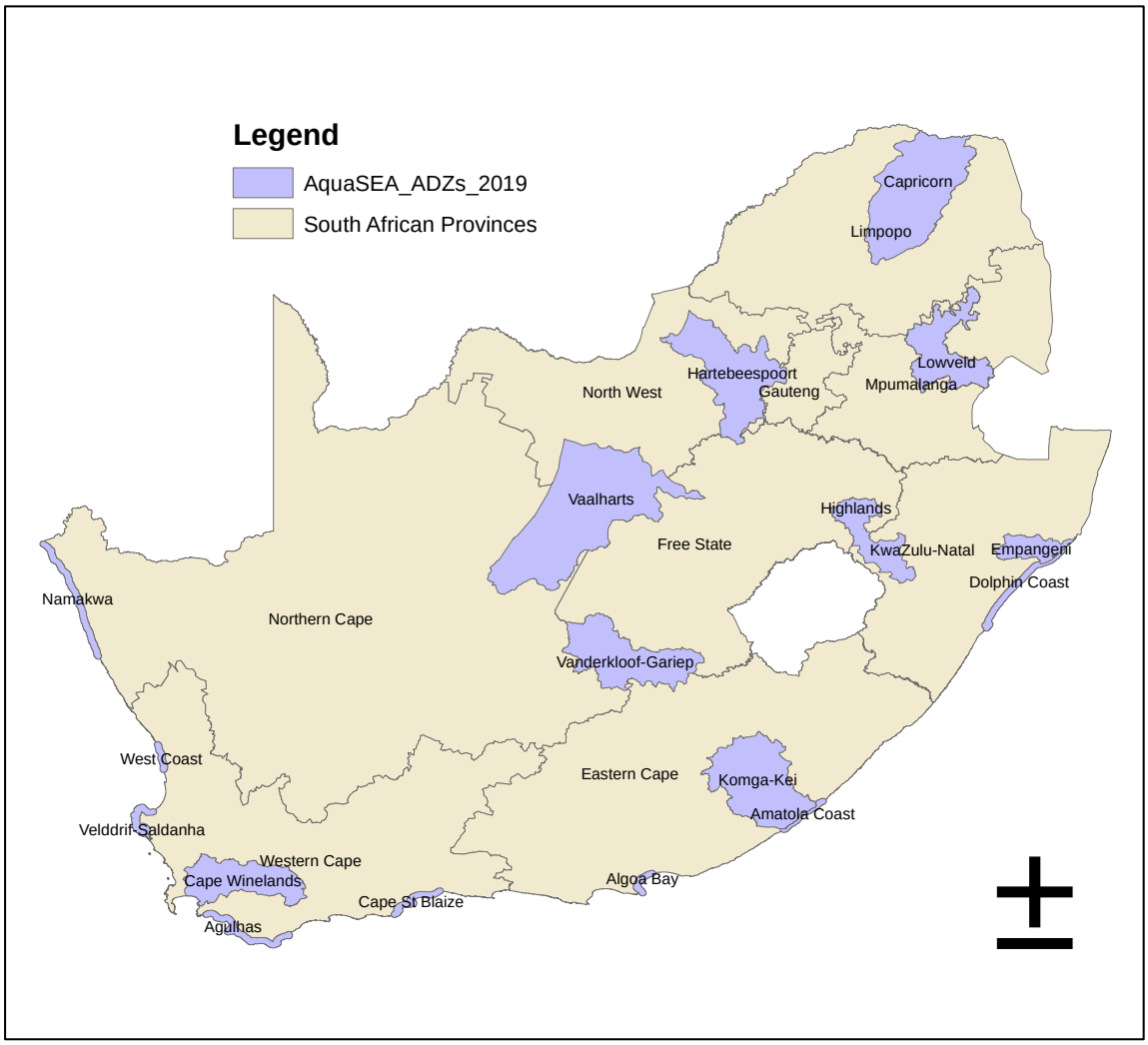

Figure 2.3: Potential Aquaculture Development Zones identified in 2019

Source: BSASA, CSIR

2.3.2 Operation Phakisa

Operation Phakisa: Unlocking the Economic Potential of South Africa's Oceans was a government initiative launched in 2014, as part of the implementation plan for the National Development Plan (NDP). An Oceans Economy Lab included a work stream on the Aquaculture sector, which resulted in an Aquaculture Operation Phakisa Strategy (AOPS), with eight initiatives to stimulate growth in the sector (Operation Phakisa, 2014):

a) Selection and implementation of 24 projects to serve as catalysts for growth of the sector

b) Legislative reform to promote aquaculture development, including an Aquaculture Act that includes freshwater and marine aquaculture under one Act
c) Establishment of an Inter-Departmental Authorisations Committee to reduce the timeline for authorisations and administrative processes
d) Establishment of a globally recognised monitoring and certification system to ensure health assurances and unlock new markets
e) Establishment of an Aquaculture Development Fund to provide end-to-end project financing
f) Capacity building for support services to support growth of the sector
g) Coordination of industry-wide marketing efforts to improve access to markets
h) Preferential procurement of aquaculture products to create local markets, contribute to transformation and improve food security.

At a later stage, the development of Aquaculture Development Zones was added as a ninth initiative. This was aimed at establishing areas on land or at sea, set aside exclusively for aquaculture used or development, possibly with bulk infrastructure to attract investors (DAFF, 2018b).

The AOPS targets for 2019 included growth of annual revenue from R670 million to R3 billion, production increase to 20 000 t per annum and increase in the number of jobs from about 2300 to 15 000 (Operation Phakisa, 2014). The Year 5 review of Operation Phakisa indicated these targets were not met. Private and public investment of about R2 billion resulted in additional revenue of more than R580 billion, production increase of more than 3500 t, and almost 2400 additional jobs by 2018 (DEFF, no date). Therefore, there is still much to be done to meet the sector targets for development set in 2014.

Although not all the initiatives emanating from the AOPS have been completed or achieved the targets, the five-year review of the initiative listed substantial progress and achievements. These include the development of an Aquaculture Development Bill, an international conference of the World Aquaculture Society in Cape Town, completion of a certification framework, hosting of an Aquaculture Finance and Investment seminar in 2019, completion of revised guidelines for the Aquaculture Development and Enhancement Programme (ADEP), a Skills and Needs Analysis of the sector, the development of a Public Awareness and Marketing Strategy for the sector, the completion of various aquaculture authorisations and 45 Operation Phakisa aquaculture projects, progress made by the Aquaculture Development Fund working

group and an audit of the aquaculture sector by the European Union (EU) (DEFF, no date; DAFF, 2017d).

Halley's assessment of the AOPS identified gaps in the implementation of the strategy and made recommendations for improvement the Strategy's implementation success. These include change management, identification of responsible structures and personnel and development of communication platforms within the DAFF, Branch Fisheries Management. Further recommendations include a review of the outcomes of the AOPS, and ensuring commitment from all at the DAFF, Branch Fisheries management. The study indicated that the DAFF, Branch Fisheries Management as a whole, negatively affected the strategy as the leadership, culture and structures for strategy implementation was in place in the Chief Directorate: Aquaculture and Economic Development, but not in the support functions of the Branch (Halley, 2019).

2.3.3 Aquaculture feasibility studies

To understand the financial viability of the most important freshwater and marine aquaculture species in South Africa, the DAFF commissioned a series of high-level, non-site-specific feasibility studies in 2016. These considered the location, site characteristics, environmental parameters, available technologies, financial and human resources, environmental impacts, market opportunities and risk factors. The results were intended to be used in an advisory manner to focus efforts and funds in the development of commercial aquaculture, to help determine the time period of leases and permits, and to stimulate interest in investment into the industry (DAFF, 2016d). The following species were included in the feasibility studies:

a) Dusky kob
b) Atlantic salmon
c) Mediterranean and black mussels
d) Pacific oyster
e) Abalone
f) African sharptooth catfish
g) Marron crayfish
h) Freshwater and marine ornamental fish
i) Nile and Mozambique tilapia
j) Rainbow trout.

Most of the species assessed, presented viable investment opportunities under specific technical and economic conditions. In the case of dusky cob, government interventions such as detailed international market assessments and increased institutional support were recommended to increase the viability of dusky kob aquaculture (DAFF, 2017b). These feasibility studies were made available to aspirant aquaculture entrepreneurs to assist them with their business planning and applications for funding, rights, leases and permits.

2.3.4 Transformation and socio-economic development

Because of South Africa's challenges to overcome the legacies of colonialism and apartheid, poverty and inequality are still rife. The official unemployment rate was 29.1% in Quarter 4 of 2019%, and 35% in Quarter 4 of 2021 (Stats SA, 2020e; Statistics South Africa, 2022). The Gini index was 63.0 (among the highest in the world) when last measured in 2014 (The World Bank, no date). It is therefore important that sector development initiatives include goals related to transformation and participation of historically disadvantaged individuals (HDIs), which include black, female, and disabled persons. Through Operation Phakisa, this was promoted through investments into 28 small enterprises and co-operatives, and engagement of organizations such as the Micro Agricultural Financial Institutions of South Africa (MAFISA) and Small Enterprise Development Agency (Seda) to stimulate small farmer development and clustering (DEFF, 2021a, no date).

The meaningful participation of HDIs and small enterprises in the aquaculture sector remained hampered by barriers to entry such as access to capital, access to spat or fingerlings, access to affordable aquaculture feed, access to natural resources such as land, and access to value addition facilities. The National Aquaculture Transformation Strategy was developed to address these challenges. Its vision was an inclusive sector where small-scale enterprises, HDIs and marginalised groups contribute meaningfully throughout the value chain, and where new entrants, small-scale farmers, and the marginalised produce sustainably and competitively to formal aquaculture markets (DAFF, 2020).

Saldanha Bay became an important area for implementation of many of Operation Phakisa's initiatives. The bay is one of the primary locations for culture of key commercial species including oysters, mussels, and salmon. Fifteen of 35 registered aquaculture projects are in the area, with many being small, medium, and micro enterprises (SMMEs) in the oyster and mussel subsector. The Saldanha Bay ADZ was the first to be approved, which enabled sustainable aquaculture expansion with the expectation to contribute towards Operation Phakisa's targets.

The ADZ has the potential to unlock up to 2500 permanent jobs, attract over R400 million investment into the area and generate production revenue of over R800 million p.a. (DAFF, 2018b).

The Environmental Impact Assessment (EIA) for the Saldanha Bay ADZ resulted in several recommendations impacting on the expansion of aquaculture in the Bay. Proposed new aquaculture areas were reduced from 1 404 ha to 420 ha. This allowed a total of 884 ha (including areas already allocated) for aquaculture of all species including finfish, shellfish and seaweed in Small Bay, Big Bay, and North Bay. The recommended phased approach would limit production of ungraded shellfish to 10 000 t p.a. for the first two years, thereafter, increasing annually by 5 000 t p.a. if environmental health is maintained. The proposed maximum production of ungraded shellfish is 27 600 t p.a. (DAFF, 2017e).

The limitations on shellfish aquaculture expansion meant that existing mussel farmers had to compete with newly approved mussel farmers for a share of the total allowable shellfish production of 10 000 t p.a. This impacted on their rate of expansion of farming activities to fill their total allocated water space.

2.4 Socio-economic development in the aquaculture industry

The public and private investments into, and the number of jobs supported by the aquaculture and mussel sectors in 2015 and 2017 are set out in Table 2.6. From a baseline of 2 227 aquaculture and an estimated 80 mussel farming jobs in 2012, the total number of aquaculture jobs grew to 4 862, and mussel farming jobs to 409 in 2017.

Table 2.6: Aquaculture jobs and investments

	SA aquaculture		**Mussel aquaculture**	
	2015	**2017**	**2015**	**2017**
# Jobs	3826	4862	154	409
Investments (R 000)	264 447	528 000	7 781	25 274

Source: (DAFF, 2017a), *DFFE Aquaculture Economics statistics*

Transformation in the sector was identified as an important issue during Operation Phakisa in 2014. At the time, the participation of Historically Disadvantaged Individuals (HDIs) at the management level was estimated at 10%. One of the Key Performance Indicators (KPIs) was that 25% of projects funded through the Aquaculture Development Fund should have HDI

ownership (Operation Phakisa, 2014). Transformation progress reported in 2017 included a total of 16 SMMEs, 1 Cooperative and an average Broad Based Black Economic Empowerment (BBBEE) level of <Level 4 for the industry (DAFF, 2018b).

In the mussel farming industry, efforts to transform the sector had been ongoing since the 1990s. The development and growth of the Masiza empowerment project (which led to the establishment of the current-day Imbaza Mussels) is well documented (Botes, Thompson and Louw, 2006b; Britz, Lee and Botes, 2009; Ferreira, 2016; Hara, Njokweni and Semoli, 2017; FINSA reporter, 2019). One of the main lessons learnt was the need for government and other donors involved in transformational projects, to use grant money to build capacity for financial independence and commercial viability. Failure to do this could result in perpetuating conditions that turn such projects into social projects with ongoing requirements for government financial support (Hara, Njokweni and Semoli, 2017).

The development and closure of a second empowerment initiative that started as community-based small-scale mussel farming in 1997, is also documented in the literature (Karaan, 1999; Brierly, 2003; Jordaan, 2003; Botes, Thompson and Louw, 2006b). Challenges experienced in this project related to commitment, leadership, managerial ability and accountability, and no balance between economic goals and social dynamics (Brierly, 2003). The reasons cited for the closing of the business were internal dynamics amongst owners, lack of capital and no business support mechanisms (Botes, Thompson and Louw, 2006b).

The effects of a socio-economic focus on other aquaculture initiatives are well documented in the literature. The Hands-On initiative is a community-based, small-scale trout farming programme (trading co-operative) that was created to alleviate socio-economic challenges. It started as a research collaboration spearheaded by the University of Stellenbosch, for the benefit of farm workers on selected farms, and funded by several public and private funding institutions. It had many achievements in terms of empowerment, access to finance, uptake agreements, corporate governance etc. However the business was faced with the challenge of trying to build and run a profitable business and meet a developmental agenda at the same time (Botes, Thompson and Louw, 2006b; Mabaya *et al.*, 2011).

The Siyazama Aquaculture Cooperative Project and the Camdeboo Satellite Aquaculture Project are further examples of community-based aquaculture projects with socio-economic development goals. Some of the challenges were related to lack of business plans, and questions around the ability of communities to gain the required skills, knowledge, and

confidence to eventually become independent and successful businesses. Achievements included incubation by commercial partners for technical, management and marketing support (Hara, Njokweni and Semoli, 2017).

2.4.1 Approaches to community based, small-scale or commercial aquaculture

Due to the legacies of poverty and inequality amongst HDIs resulting from past discriminatory practices, transformation and the meaningful participation of formerly marginalised people and communities in the economy underpins many of the country's policies, strategies, programmes, and projects. This is evident in initiatives aimed at developing small enterprises, and emerging farmers and agribusinesses, and the investment of especially public funding in economic empowerment projects and enterprises. Over the last two decades, several studies in the agribusiness and aquaculture sector have attempted to understand the contribution of aquaculture to rural livelihoods, what makes some empowerment projects and businesses successful, and what cause them to fail.

A lack of information on the status and potential for contribution of aquaculture in rural areas proved to be a major constraint for developing a sustainable aquaculture policy. As a result, the Water Research Commission (WRC) commissioned a baseline study of the actual and potential contribution of aquaculture to rural livelihoods in 2004. The results indicated that the contribution of aquaculture to rural livelihoods was negligible, despite a long history of public sector initiatives to establish rural aquaculture. This pointed to a problem with the development approach that had been applied, with emerging aquaculture policy placing a focus on food security. "Small scale commercial" projects were found to be more viable than "food security" projects. The "food security" type project problems included production of low value species with no commercial sector for those species, poor education amongst participants, little personal capital, low extension and technical support, and too many participants with too little income per participant. The commercially oriented small-scale projects were more viable because of formal markets for their products, existing private sector producing those species, better education amongst participants, and availability of more personal capital. These projects also suffered from lack of training and experience in aquaculture and required extension and technical support. The study suggested that aquaculture for food security in rural areas could be promoted either as an "on-farm diversification strategy" for emerging farmers or in the form of "culture based fisheries" for subsistence farmers, where the fishery inputs are low and fish production per unit area is also low. The results also suggested that small scale commercial

aquaculture in rural areas is possible, if technical support is sustained and there is an established link to an existing private sector (Rouhani and Britz, 2004a).

AISA conducted case studies of two successful empowerment projects in 2006, to document success stories, document their operating models and investigate the value chain for identification of challenges to further SMME opportunities. These include the Masiza Mussel farm and the Hands-on Small-scale Trout Farming project, which are described in detail above. (Botes, Thompson and Louw, 2006b).

In 2017, the Institute of Poverty, Land and Agrarian Studies (PLAAS) at the University of the Western Cape conducted a study on CBA projects launched or facilitated by DAFF as part of Operation Phakisa. One of the main objectives were to investigate the most viable models for bringing marginalised communities into commercial aquaculture. The three CBA projects used as case studies included the Siyazama Aquaculture Cooperative Project in Hamburg, Eastern Cape, the Masake Closed Corporation (CC) within Imbaza Mussels in Saldanha Bay, Western Cape, and satellite farms within the Camdeboo Satellite Aquaculture Project in Graaff-Reinet, Eastern Cape. Siyazama started in 2011 with oysters and dusky kob), received public funding (R11 million) and was registered as a co-operative with 58 members. Camdeboo started in 2006 with catfish, received a mixture of private and public funding (R65 million), and was registered as a trust with 54 members. Masake originally started as Masiza Mussels, as reviewed in (Botes, Thompson and Louw, 2006b). Masake CC became a shareholder in Imbaza Mussels (Pty) Ltd. Thus Masake started in 2004 with mussels, received a mixture of private and public funding (R11.8 million) and was registered as a CC with six members, which obtained shareholding in a Pty (Ltd) (Hara, Njokweni and Semoli, 2017).

Of the three projects, the Masake/Imbaza Mussels project was the only one that was instituted as a commercial undertaking and was accountable to the rest of the shareholders from the beginning. The other two projects lacked business plans to show how they could make the transition from donor-funded projects to independent commercial entities. All three benefited from pioneering companies and entrepreneurs sharing their knowledge, technical skills, and marketing outlets with communities. Whilst this avenue of access to markets is good in the initial years, the beneficiaries of such arrangements lose out on possible additional revenues and profits through their own value addition. The Masake CC business structure seemed to be the most successful as a commercial enterprise as it provided for knowledge transfer, and managerial and management support for communities (Hara, Njokweni and Semoli, 2017).

From the assessment of the three case studies, is appears that the Masake project was not really a community project but rather, an enterprise owned by a specific group of entrepreneurs originating from the community. The Siyazama and Camdeboo projects were community projects, with multiple beneficiaries, social and community empowerment origins, and structures that lent themselves to co-operative and democratic governance (Co-operative and Trust).

A 2011 study of 15 emerging farmers and agribusiness across a variety of commodity sectors and geographical areas in South Africa described the experiences of HDI entrepreneurs entering the formal agriculture and agribusiness value chains. Case studies included sole proprietors, collective business enterprises, projects assisting emerging farmers and established agribusinesses working with emerging enterprises. A large variety of industry sectors such as a plant nursery, wine production, dairy production, fish farming, avocado farming and citrus farming were included (Mabaya *et al.*, 2011). The Hands-On Fish Farmers Co-operative (one of the projects reviewed by Botes in 2006) was one of the case studies reviewed in 2011. Although they had achieved a lot of progress and success since inception, by 2011 they had started experiencing problems in generating enough income to repay debts. At the time of writing, they were considering a partial buy-out offer for a percentage in the company, that would provide them with a chance to rescue the company (Salie, 2011).

One of the general findings from the agribusiness case studies indicated a preference for providing development support for individual farm business models over group/communal land holding schemes because of issues such as negative group dynamics, accountability regimes and political interference. Some of the common themes emerging from all case studies indicated that most emerging agribusinesses exist by chance rather than planning, that farmers and entrepreneurs lack the skills to compete effectively, that success or failure can mostly be linked to access to markets and that only a few of the emerging enterprises were "ready for investment" (Mabaya *et al.*, 2011).

Hecht and De Moor (1997), cited in (Rouhani and Britz, 2004a) were quoted as saying that "we must always be mindful of the fact that aquaculture is an economic activity no matter how small the scale of the enterprise". Furthermore, they said that "Aquaculture must be promoted and developed as an enterprise and not simply to enhance nutrition…and it is only on this reality that small and large-scale aquaculture in Africa can attain the potential that the continent offers…". These words were true in 1997, and the experiences described in the literature above confirms that they were still true in 2004, 2011 and 2017. Whether small- or large scale,

aquaculture ventures that are not commercially oriented, and have food security, community development or other social motives as their reason for being, have little chance of becoming independent commercial enterprises.

However, we still find policy orientation towards development of aquaculture ventures with community development, poverty alleviation or other social motives, with emphasis on creation of co-operatives when public funding is invested in community-based ventures. There seems to be perceptions or assumptions that emerging farmers and entrepreneurs originating from historically disadvantaged communities are the same as community-development projects in historically disadvantaged communities, or that enterprise development is the same as community development. The literature clearly shows that this is not the case.

2.5 Aquaculture and sustainability

2.5.1 Sustainable aquaculture

The World Bank describes a sustainable aquaculture system as having the following components (The World Bank, 2014b):

a) "Environmental sustainability – aquaculture should not create significant disruption of the ecosystem, or cause loss of biodiversity or substantial pollution impact.
b) Economic sustainability – aquaculture must be a viable business with good long-term prospects.
c) Social and community sustainability – aquaculture must be socially responsible and contribute to community well-being."

Aquaculture sustainability can be assessed in terms of farm and sector level (a sectoral approach), or the contribution of aquaculture farms to the sustainability of the areas where they are located (a territorial approach). Typically, sustainability assessment includes elements of the sustainable development paradigm including economic, social, and environmental. A comparative methodology for assessing aquaculture sustainability (Lazard *et al.*, 2014) indicates that such an approach tends to be unbalanced unless the institutional sustainability (governance) dimension is included.

Between 2013 and 2016, a team of researchers in Brazil developed a portfolio of 56 quantitative indicators of economic, environmental, and social sustainability to assess different aquaculture systems on farm, regional, global, or sectorial scales. They defined sustainable aquaculture as "the cost-effective production of aquatic organisms, which maintains a harmonious and

continuous interaction with the ecosystems and the local communities. The aquaculture farm should be productive and profitable, generating and distributing benefits; and should optimize the use of capital and natural resources, conserving the surrounding ecosystems. The farm must generate employment for local communities, increasing the quality of life, respecting the local cultures, and promoting human development. In addition, the farm should be resilient in order to persist over time"(Valenti *et al.*, 2018).

2.5.2 COVID-19 impacts

A discussion about aquaculture sustainability is not complete without mentioning the impacts of the COVID-19 pandemic. The coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), started in China in December 2019 and then spread through the world with devastating consequences. COVID-19 was declared as a pandemic in March 2020. The World Health Organization (WHO) recommended a Global Strategy for the disease (WHO, 2020), which caused a reduction in travel, freight movement and individual freedom of movement for several months at a time. This devastated economies around the globe.

In South Africa, the declaration of a State of Disaster in March 2020 and measures that curbed social and economic activities including travel restrictions, caused widespread shutdowns of markets and supply of goods and services in most economic sectors. Government's response was the development of a three-phase approach to economic interventions to preserve the economy, recover from the immediate effects of the pandemic and build a stronger economy after the pandemic. Some of the interventions included a R500 billion financial support package and monetary policies such as the Corona Virus Temporary Employer-Employee Relief Scheme (COVID19TERS) (Department of Labour, 2020; National Treasury, 2020).

Although the aquaculture sector was regarded as an essential services sector, the markets for aquaculture products were severely impacted. A survey of the sector in April 2020 indicated an average 54% loss in sales compared to the previous year. Total estimated loss in sales up to October 2020 was estimated at 39% of sector sales, and an anticipated impact on more than 1200 jobs. Perhaps the worst prediction was that, without cash reserves, up to 70% of aquaculture farms were at risk of closure (DEFF, 2020). The COVID-19 pandemic intensified some of the challenges already experienced by aquaculture enterprises, such as access to markets and finance.

The pandemic also impacted other enterprises and economic sectors in different parts of the world. Early studies done in aquaculture sectors in 2020 showed similar results and predictions. In the United States, an early study indicated that the primary impact on aquaculture farms and businesses was the disruption of traditional marketing channels, with knock-on effects such as loss of revenue, impacts on farm labour, difficulty securing production inputs and managing unsold product (van Senten, Engle and Smith, 2021). In the Indian shrimp farming sector, an economic loss of USD 1.5 billion was estimated in 2020, based on an expected decline in production and export performance. This was expected to lead to constraints in seed production and supply, disruptions in the supply chain, loss of employment and loss of income. Mitigation measures included the declaration of fisheries and aquaculture as an essential activity, and announcement of a Fisheries Development Scheme (Kumaran *et al.*, 2021).

A more detailed study of aquaculture farmers in five countries in the Mekong region (Vietnam, Myanmar, Thailand, Cambodia and Laos) showed that the effects of the pandemic were broadly similar to those reported or projected during earlier studies, especially regarding disruption of supply chains and reduced demand. However, this study showed differences in impacts between farm sizes, production goals, animals produced, and levels of intensification. Impacts also varied between countries, with some farmers able to cope through adjusting practices and accessing external assistance (Lebel *et al.*, 2021).

In the Philippines, a study of the impacts of the pandemic lockdown on the fisheries and aquaculture sectors revealed strong market disruptions, and different coping strategies used by the two sectors such as online buying and selling. The study also revealed the importance of social support, diversity of food sources, local food systems and the role of governance structures, in contributing to resilience in the face of such a threat (Manlosa, Hornidge and Schlüter, 2021).

Studies of aquaculture sectors in other countries largely showed similar impacts on markets and supply chains, with knock-on effects including loss of income. It also highlighted the important role of governments in providing access to support, to help enterprises cope during and after the pandemic.

2.6 Enterprise development

2.6.1 The importance of enterprises

The Oxford Learner's definitions for the term "enterprise" include "a business or company", "a large project", "the development of businesses by the people of a country rather than by the

government", and "the ability to think of new projects and make them successful". In this study, the term enterprise refers to a business or company.

The government recognised the development and support of enterprises, especially small businesses, as an important strategy for the development and growth of the economy. In support of small business development, several initiatives were implemented such as proclamation of the National Small Business Act (No. 102 of 1996), as amended, the setting up of a national Department of Small Business Development, and the setting up of a national Small Enterprise Development Agency (SEDA). The Broad-Based Black Economic Empowerment (BBBEE) Act No. 53 of 2003, as amended, attempts to stimulate investments from the corporate sector into the development of enterprises in their supply chains. The Preferential Procurement Policy Framework Act No. 5 of 2000 (PPPFA) and Regulations of 2017 aim to utilise government procurement activities and state-owned entities in providing economic opportunities for black owned enterprises.

In South Africa, a distinction is made between small and large enterprises. Small enterprises are classified into small, medium, and micro enterprises (SMMEs). The criteria used to identify the size or class of enterprise include the total full-time equivalent of paid employees, and the total annual turnover per sector. This study uses the term small enterprise as defined in the Revised Schedule 1 of the National Definition of Small Enterprise in South Africa as: "a separate and distinct business entity, together with its branches or subsidiaries, if any, including co-operative enterprises, managed by one owner or more predominantly carried on in any sector or subsector of the economy mentioned in column 1 of the Schedule and classified as a micro, a small or a medium enterprise by satisfying the criteria mentioned in columns 3 and 4 of the Schedule". The new annual turnover thresholds for defining enterprise size classes by sector, are listed in Table 2.7. In the agriculture sector (which includes fisheries and aquaculture), the maximum turnover thresholds for small enterprises is R7 million (micro), R17 million (small) and R35 million (medium) (DSBD, 2019). The study further assumes large enterprises to be those with more total full-time employees and annual turnover than the thresholds defined for small enterprises in the Revised Schedule.

Table 2.7: Annual turnover thresholds for defining enterprise size classes

Sectors or sub-sectors in accordance with the Standard Industrial Classification	Medium ≤ Rm	Small ≤ Rm	Micro ≤ Rm
Agriculture	35.0	17.0	7.0
Mining & quarrying	210.0	50.0	15.0
Manufacturing	170.0	50.0	10.0
Electricity, gas & water	180.0	60.0	10.0
Construction	170.0	75.0	10.0
Retail, motor trade and repair services	80.0	25.0	7.5
Wholesale	220.0	80.0	20.0
Catering, accommodation & other Trade	40.0	15.0	5.0
Transport, storage & communications	140.0	45.0	7.5
Finance & business services	85.0	35.0	7.5
Community, social & personal services	70.0	22.0	5.0

Source: (DSBD, 2019)

2.6.2 Status of the SMME sector

There is no regular census or survey for SMMEs in South Africa. This means that there is an absence of reliable data about the SMME environment, including the number, success/failure rate, their contribution to GDP and employment statistics. Nevertheless, during the last 15 years several studies and reviews have been completed to generate an understanding of small businesses. These studies used different methods of estimating the number of SMMEs, contribution to employment and contribution to the economy.

The South African Department of Small Business Development (DSBD) was established in 2014 and is mandated to lead and coordinate an integrated approach to the promotion and development of entrepreneurship, small enterprises, and co-operatives. The Small Enterprise Development Agency (SEDA) is an agency of the DSBD and is mandated to implement government's small business strategy, implement small enterprise development initiatives, and

integrate government-funded small enterprise support agencies. The DSBD and SEDA are also responsible for the generation of research studies and reports about small businesses in South Africa. The Annual Review of Small Business and Co-operatives is a requirement in terms of the National Small Enterprise Act of 1996, as amended. The Annual Review of 2016/2017 categorized small businesses in terms of their status as SMMEs and co-operatives and compared statistics to an Annual Review completed in 2008. In 2016, the number of small businesses in South Africa was estimated at 2.2 million, with contribution to employment estimated at 64% and contribution to GDP estimated at 48% (DSBD, 2017).

However, until 2014, only limited information was available in the form of datasets dealing with small enterprises and limited quantitative data on the experiences of government departments and agencies dealing with small enterprise development. Therefore, the DSBD's 2016/2017 Annual Review of Small Business and Cooperatives in South Africa addressed these limitations through an integrated research methodology including a literature review, statistical analysis of available datasets, interviews with key stakeholders, case studies of provincial governments and surveys of the formal and informal sectors (DSBD, 2017).

According to this Review, there were an estimated 2.2 million SMMEs in 2016, with micro- and small enterprises contributing 48% to the Gross Domestic Product (GDP), 53% to employment opportunities (8.5 million people), and 55% to employment in the agriculture sector (DSBD, 2017; Stats SA, 2017b).

In 2015 the number of formal and informal SMMEs in South Africa was estimated at 2.3 million, including 56 774 agricultural SMMEs (2.5% of total SMMEs). Contribution to Gross Value Added (GVA) was estimated at 22%, and employment numbers at 15.7 million. 74% employed other workers beside the owner. In the same year, 67% of all SMMEs were informal (unregulated and not abiding by legal requirements such as payment of taxes). About 20% of SMMEs were white-owned, however they constituted 51% of formal SMMEs (BER, 2016).

By 2019, the number of small businesses was estimated at 2.7 million, providing 11.6 million jobs and contributing 37% to turnover of all enterprises (excluding agriculture, financial intermediation, insurance and government institutions) (SEDA, 2020).

In a contrasting study, the Small Business Institute (SBI) conducted a Baseline study of small businesses in South Africa in 2018. Using a firm-level dataset from the South African Revenue Service and National Treasury, they estimated that there are 262 224 formal SMMEs and 5 735 large enterprises in South Africa. As set out in Table 2.8, SMME contribution to employment

was estimated at 3 863 104 (28% of formal jobs), whilst large enterprises contributed 72% to formal jobs (SBI, 2018).

Table 2.8: Statistics on formal enterprises and employment numbers in 2018

Firm size	Firm numbers	% Of total firms	Employment numbers	% Of total employment
Micro	176333	66%	685264	5%
Small	68494	26%	1549411	11%
Medium	17397	6%	1628429	12%
Large	5735	2%	9702416	72%
Total	**267959**	**100%**	**13565520**	**100%**

Source: (SBI, 2018)

These studies indicate that, although the estimated number of SMMEs and co-operatives have decreased since 2008 and different studies yielded different statistics, small enterprises are still very important for their contribution to employment and GDP. SMME contribution to GDP and employment was most important in the Construction, Wholesale, Retail and Tourism sectors in 2016 (DSBD, 2017).

2.6.3 Enterprise sustainability

Because of their significant contributions to employment and GDP, the development and support of small enterprises in South Africa is an important strategy in achieving national objectives related to revenue growth, job creation, and economic transformation. It is difficult to establish the success or failure rate of businesses, especially small businesses. However, available data indicates that the country does not have a good track record in terms of business sustainability. The Global Entrepreneurship Monitor (GEM) measures entrepreneurship according to the following three life cycle indicators (Herrington and Kew, 2018):

- Total Early-stage Entrepreneurial Activity (TEA), which indicates the percentage of people aged 18-64 who are in the process of starting or have just started a business
- Established business ownership rate, which indicates the percentage of people aged 18-64 who are currently an owner-manager of an established business (older than 42 months), and
- Business discontinuation rate, which indicates the percentage of people aged 18-64 who have discontinued a business in the last 12 months.

Table 2.9 indicates the South African entrepreneurship indicators for 2016 and 2017, in comparison with the Africa region average for 2017. South Africa lags the Africa region in terms of TEA and the established business rates. The difference between the 2017 South African TEA (11%) and Established Business rate (2.2%) point to a 5-fold loss of businesses from start-up, and thus a problem in maintaining sustainability. Low sustainability is also reflected in the high business discontinuation rate (6%), indicating that more businesses are discontinuing than are being established. In contrast, the Africa region average shows that, although the business discontinuation rate is not much different from South Africa, the high TEA (13.7) and Established Business rate (11.9%) indicate much higher business sustainability (Herrington and Kew, 2018).

Table 2.9: Entrepreneurship indicators

	TEA (%)	**Established business rate (%)**	**Business discontinuation rate (%)**
SA 2016	6.9	2.5	4.5
SA 2017	11.0	2.2	6.0
Africa region average (2017)	13.7	11.9	6.9

Source: (Herrington and Kew, 2018)

Available data thus indicate a fivefold loss of businesses from start-up to established business ownership, a high business discontinuation rate, and a problem in maintaining business sustainability (Herrington and Kew, 2018). Different statements about the SMME failure rate is reported in a study by Hewitt and Janse van Rensburg, ranging from 50%-80% failure rates within the first year, to 80% within the first five years (Hewitt and van Rensburg, 2020). SEDA estimated that 80% of SMMEs fail within their first year (SEDA, 2011).

2.6.4 Enterprise sustainability versus sustainable development

The issue of business or enterprise sustainability should not be confused with the broader issues associated with sustainable development. The United Nations definition of sustainable development in the 1987 Brundtland Report ("development that meets the needs of the present without compromising the ability of future generations to meet their own needs") introduced the term and its social, economic and environmental dimensions into international policy discussions (World Commission on Environment and Development, 1987). Evolving from this definition, the use of the three-pillar conception of sustainability became widespread. The

Triple Bottom Line (TBL) model of sustainability was developed as an accounting framework to evaluate the performance of organisations in social, environmental, and financial terms.

Despite their widespread use, there is no transparent, rigorous theoretical foundation in which to ground the concepts of sustainability and the three-pillar paradigm. Therefore sustainability remains context specific and its use in operationalisation requires a description of how it is understood (Purvis, 2019). The dimension of institutional sustainability is recognised as a fourth dimension of sustainable development and can be described in terms of inter-personal processes such as communication and co-operation which results in information and systems of rules governing the interaction of members of a society (Spangenberg 2002).

Successful or sustainable businesses should be financially viable and profitable and should bring in more revenue than it is spending on the costs of operation. The success or failure of enterprises depend on their ability to become self-sustainable. Synonyms for the term self-sustainable include but are not limited to independent, self-sufficient, self-sustained, self-supported, self-subsistent or unaided. For this study, a self-sustainable enterprise is defined as an enterprise that can sustain its own operations from income derived from the sale of its goods and services, without external financial support. An inherent assumption is that the enterprise should also be sustainable in environmental, social, and institutional terms.

Given the problems with improving and maintaining business sustainability, it is important that enterprise development initiatives should aim to improve sustainability and survival rates of SMMEs.

2.6.5 Enterprise challenges and success factors

Efficient enterprise development requires an understanding of the challenges that enterprises face, the reasons why they fail or succeed, and the factors that inhibit or promote self-sustainability. The challenges faced by SMMEs are well understood, as reported in the DSBD Annual Review of 2016/17.

The key challenges experienced by small enterprises included insufficient access to finances and operating premises, heavy regulatory and legislative burdens, inability to employ skilled staff, readiness to access government procurement opportunities, and a struggle to cope with the risks associated with entrepreneurship. Key findings regarding the experiences and challenges of government institutions responsible for assisting enterprises included a lack of comprehensive mandates and focus, inter-departmental or agency collaboration with relative skill sets, integration and standardisation of small enterprise development systems and

processes, and high non-payment to small enterprises and repayments to government bodies. The key conclusions of the Review were that the challenges faced by small enterprises in South Africa have been persistent over time with the main constraints being lack of access to finance and suitable premises, low market access and burdensome regulations. The Review also found that government entities mandated with small enterprise support remain disconnected, have poor systems and procedures, and little national leadership in terms of small enterprise development (DSBD, 2017).

When looking closer at enterprise sustainability, the abilities of business owners or managers and business complexity need to be considered. The business environment is very complex, with many internal and external components impacting on each other. For example, product changes could impact on quality, the market, equipment, and income. These impacts in turn, affect other components such as credit policy, competition, and business risk. Business owners and managers must manage most of these components efficiently to become self-sustainable.

A study aimed at determining the factors that influence the sustainability of small enterprises in Potchefstroom, North West, described ten factors considered as important contributors to small enterprise sustainability. These included communication skills, experience, service delivery, product quality, relationship building with clients, honesty, good financial skills/knowledge, establishment and accomplishment of business goals and objectives, internet connectivity and good networking. The study concluded that small enterprises need specifically formulated guidance to create sustainable businesses, which must be focused on creating the right conditions for small enterprises to create jobs, stimulating entrepreneurs and encouraging suitable workplaces (Wiese, 2014).

Given the complexities of the business environment and challenges faced by enterprises, they need support to grow and become self-sustainable. However, it is important that such support must include a balance of financial and non-financial interventions (Rogerson, 2001).

2.6.6 Defining enterprise development

Although the development of enterprises, especially small enterprises, is a national objective, the term “enterprise development” is not clearly defined in the legislation and related policy instruments aimed at stimulating enterprise development and black empowerment. These include the National Small Business Act 102 of 1996, as amended), and the Broad-Based Black Economic Empowerment (BBB-EE) Act No 53 of 2003 (as amended). The BBB-EE Act and Regulations provide a framework for black-owned Enterprise and Supplier Development

(ESD), in support of empowerment and transformation of the economy. The requirement for especially large companies to invest a percentage of their annual Net Profit After Tax (NPAT) in ESD, has stimulated an industry of BBB-EE Enterprise Development (ED) specialists aiming to assist such companies with compliance. One of the consequences is that the concepts of ED and ESD tend to be interpreted narrowly as BBB-EE compliance.

In addition, none of the relevant legal instruments, nor the regulations and guidelines dealing with their implementation, adequately define ED. The BBB-EE Commission Guide on ESD distinguishes between development of enterprises and suppliers in that "a supplier development beneficiary is an entity that is part of the measured entity's supply chain (meaning that the beneficiary entity is registered as a supplier on the measured entity's supplier database), whereas an enterprise development beneficiary is not registered on the measured entity's database" (B-BBEE Commission, 2021). In a study of small business incubators, ED is defined as the support and growth of SMMEs, introduced as a component of BBB-EE policy (Ryan, 2012).

This study uses the definition of enterprise development described by the Stellenbosch University Business School as "the act of investing time and capital to help people establish, expand or improve business", and that the main goal is "to create sustainable businesses that grow and lead to job creation, which, in turn, contributes to economic growth" (USB-ED Editor, 2019).

2.7 Enabling environment for sustainable aquaculture enterprise development

The study is based on the hypothesis that development of self-sustainable aquaculture enterprises is not adequately supported by the enabling environment for the aquaculture sector in South Africa. It is therefore appropriate to define and describe the enabling environment in this section, including the legislative and policy framework, support systems, the influence of stakeholders and the values and belief systems underpinning the approach to aquaculture enterprise development in South Africa.

(Shehadeh, 1999) described the need for governments to provide an "enabling environment" for the sustainable growth of the aquaculture sector, by creating and maintaining a suitable climate. This is supported in more recent literature (Hishamunda, Ridler and Martone, 2014; FAO, 2017). Such an environment comprises economic, legal, social, and physical components that ensures "fair access to resources, mechanisms for conflict resolution and access to information, credit and markets". An institutional framework for fishery governance is defined

by the FAO as “the sets of principles, rules, conditions, agreements, processes, mechanisms, and organizations used for the development and management of fisheries. Its functioning and outcome are influenced by the set of ideas, values, beliefs and assumptions under which the people concerned operate” (Manning, 2016). Support systems for aquaculture development include research and technology support, extension services, enterprise development support, industry associations, education and training, access to finance, access to markets and other support systems.

The terms stakeholder or role player describe individuals or groups who hold some interest or stake in a resource. The interest of stakeholders in a fishery can be either directly (because they are involved in exploitation of a resource) or indirectly (because they are concerned with managing the resource or depend at least partially on wealth or business generated by the resource) (Townsley, 1998).

2.7.1 Stakeholders in aquaculture and enterprise development

Some of the most important stakeholders in the aquaculture and enterprise development sectors are listed in Figure 2.4. This is not an exhaustive list, but it provides an understanding of the types of stakeholders according to the main stakeholder groups (including government, private and state-owned institutions, and other important stakeholders). The role of government as a key stakeholder in the development and management of aquaculture sectors is clear in South Africa, as it is in different parts of the world such as China and Norway (Yu and Yin, 2019; Puvanendran *et al.*, 2021).

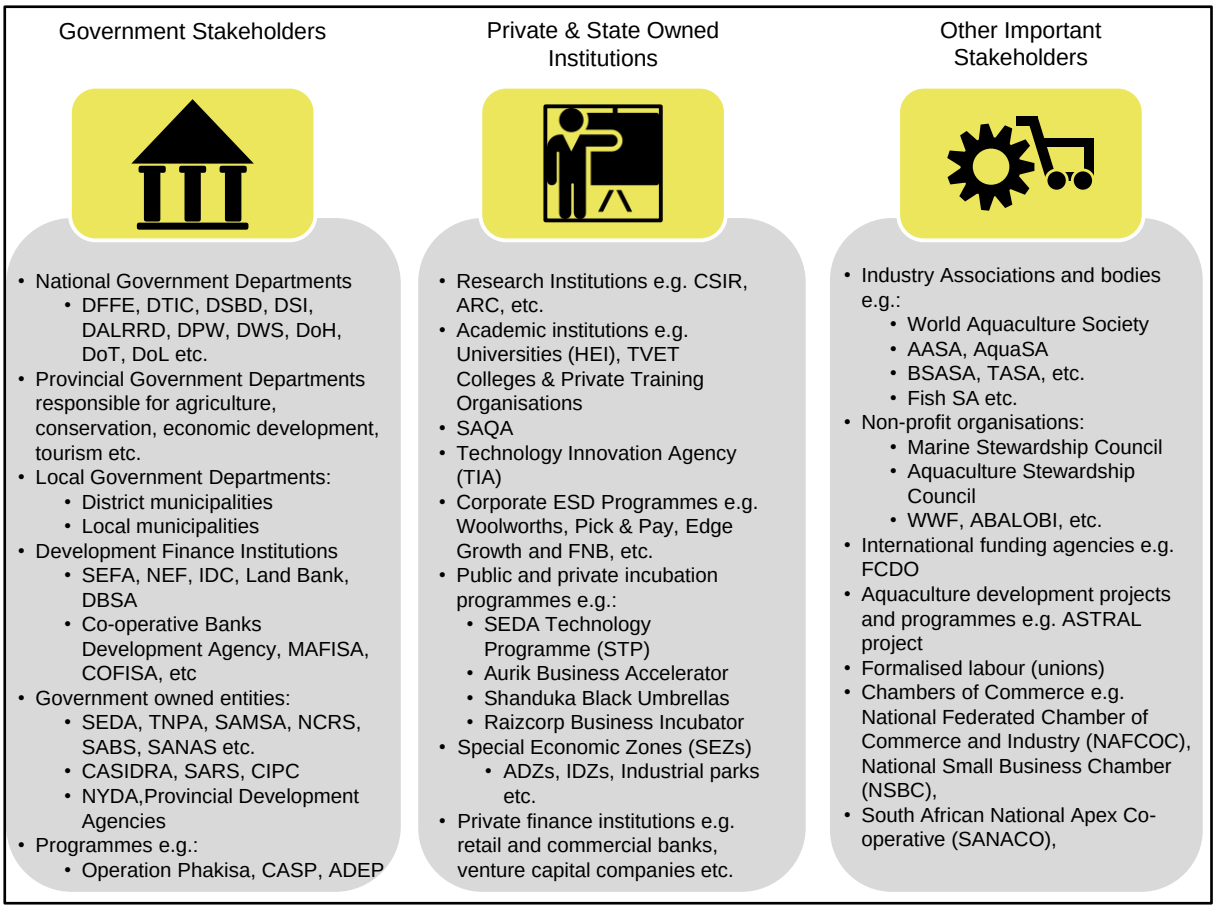

Figure 2.4: Stakeholders in the aquaculture and enterprise development sectors

2.7.2 Legislative and policy framework

Since 1994, several strategy and policy instruments aimed at poverty reduction, employment creation and inclusive economic development were implemented. These include the Reconstruction and Development Plan (RDP), Growth, Employment and Redistribution (GEAR) Strategy, Accelerated and Shared Growth Initiative – South Africa (AsgiSA), National Development Plan (NDP), New Growth Path (NGP) and Industrial Policy Action Plan (IPAP).

The National Development Plan 2030, drafted by the National Planning Commission (NPC), is a broad strategic framework aimed at eliminating poverty and reducing inequality by 2030 (National Planning Commission, no date). The Plan set out six interlinked priorities for national development, three of which are emphasised (p.27):

- "Raising employment through faster economic growth
- Improving the quality of education, skills development, and innovation
- Building the capability of the state to play a developmental, transformative role."

The New Growth Path (NGP) is a framework for economic policy and the driver of the country's jobs strategy. It set out the key jobs drivers and priority sectors expected to create five million new jobs by 2020, in five key sectors including the agricultural value chain and manufacturing (EDD, 2011).

The IPAP is guided by the National Industrial Policy Framework and is updated on an annual basis. The Plan is informed by the NDP and supports the NGP. It reflects Government's intention to turn around the country's dependence on the export of unprocessed products and to transform the ownership, management, and employment profile of the economy. The IPAP 2018/19 – 2020/21 focused on transversal areas including Special Economic Zones (SEZs), and key sectoral focus areas such as Agro-processing (The dti, 2018a).

The NDP, NGP and IPAP emphasise the importance of enterprise development, rural development, the agro-industrial economic cluster and manufacturing sector in economic growth, the creation of new jobs, diversification, and transformation of the economy.

The national Department of Agriculture, Forestry and Fisheries (DAFF) became the lead agency for aquaculture in 2009. This led to the completion of a National Aquaculture Strategic Framework (NASF) for South Africa in 2012. The NAPF was developed and gazetted in response to the NASF and opportunities and challenges associated with aquaculture development (DAFF, 2012a, 2013c). These instruments reflected government's classification of aquaculture as an agricultural activity, its commitment to management and development of the freshwater and marine aquaculture sub-sectors as one industry, and the creation of an enabling environment for development of the industry.

The NASF and NAPF also reflect government's intentions for aquaculture to "contribute to national food security, national wealth and job creation, and to regional and world fish supply" (DAFF, 2012a), p.9, and for the NAPF to "serve as a guide to national, provincial and local government in pursuing aquaculture development for job creation, livelihood opportunities and broadening participation by disadvantaged groups whilst achieving food security at every level" (DAFF, 2013c), pp 10-11.

Following these Frameworks, Operation Phakisa: Ocean's Economy was launched in 2014 as part of the implementation plan for the NDP. This resulted in an Aquaculture Lab, which is described in detail in Section 2.3.2. As part of the creation of an enabling regulatory environment, an Aquaculture Development Bill was drafted and introduced to the National Assembly in 2018 (DAFF, 2018b). Unfortunately, this Bill was withdrawn in 2020. In the

absence of a dedicated piece of legislation, aquaculture continues to be regulated as set out in the NAPF:

a) Marine aquaculture is regulated by the Marine Living Resources Act 1998 (Act No. 18 of 1998)

b) While there is no main legislation governing the freshwater aquaculture sector, different government departments are responsible for implementing different pieces of legislation.

The regulatory framework for the aquaculture sector thus remains fragmented. In addition, the Department of Agriculture, Forestry and Fisheries (DAFF) was changed in 2019. The agriculture mandate was moved to the Department of Agriculture, Land Reform and Rural Development (DALRRD), and the Forestry and Fisheries mandates moved to the Department of Forestry, Fisheries, and the Environment (DFFE). The legislation applicable to aquaculture include the following main National Acts of Parliament, as supported by national and provincial policies, regulations and development planning regulation (WCADI, 2012):

a) The National Environmental Management Act (No. 107 of 1998)
b) Marine Living Resources Act, (No. 18 of 1998)
c) National Environmental Management: Biodiversity Act (No. 10 of 2004)
d) National Environmental Management: Integrated Coastal Management Act (No. 24 of 2008)

In addition, the legislation controlling freshwater aquaculture also include the following (DAFF, no date):

a) Conservation of Agricultural Resources Act (No. 43 of 1983)
b) Agricultural Pests Act (No. 36 of 1983)
c) Animal Diseases Act (No. 35 of 1984)
d) Animal Improvement Act (No. 62 of 1998)
e) The Genetically Modified Organisms Act (No. 15 of 1997
f) The National Water Act (No. 36 of 1998).

The legislative environment for freshwater and marine aquaculture has long been a challenge, as no single department had the mandate or capacity to provide all the information (or one-stop-shop services) required by any aspirant aquaculture entrepreneur to enter the sector. A legal guide published in 2013 attempted to assist parties interested in aquaculture, to understand the laws governing and regulating the industry (DAFF, 2013b).

The gradual change in aquaculture policy focus from promotion of environmental conservation pre-2007 to development of an economically sustainable and competitive sector by 2018 is described in more detail in a study of the "Aquaculture Operation Phakisa Strategy" (Halley, 2019). When the national department responsible for agriculture (DAFF) was disestablished in 2019 and the responsibility for aquaculture moved to DFFE, the department responsible for fisheries and the environment, aquaculture was no longer managed as an agricultural activity. This has introduced uncertainty into further development of the sector.

2.7.3 Support systems

Several government programmes are active in supporting the aquaculture sector. These include ADEP, Operation Phakisa, the Working for Fisheries Programme (WFFP) of the Extended Public Works Programme (EPWP), the Agriculture Black Economic Empowerment (AgriBEE) Fund, the Micro Agricultural Financial Institutions of SA (MAFISA), the Comprehensive Agriculture Support Programme (CASP) and the National Empowerment Fund (NEF). There are also five existing aquaculture stakeholders' forums with specific purposes and objectives related to the development of the industry and addressing of specific challenges. These include the National Aquaculture Intergovernmental Forum (NAIF), the Marine Aquaculture Working Group (MAWG), Aquaculture Industry Liaison, Provincial Aquaculture Intergovernmental Forum (PAIF), and the Aquaculture Value-chain Round Table (AVCRT). Aquaculture associations are privately run, and they interact with government about the issues related to specific aquaculture species or industries. The Aquaculture Association of Southern Africa (AASA) is an overarching body including all types of stakeholders, while Aquaculture South Africa (AquaSA) is an umbrella producer representing commodity associations in the freshwater and marine sub-sectors. Commodity-based associations include the Tilapia, Abalone, Marine Finfish and Bivalve Shellfish producer groups (DAFF, 2020).

In addition to the various forums, there are also more than 60 aquaculture extension officers spread around each of the nine provinces, and eight (ADZs) in various provinces. These ADZs are spread across four provinces including the Amatikulu ADZ in KwaZulu-Natal, the Coega Industrial ADZ, East London Industrial Development Zone (IDZ), Qolora ADZ and Algoa Bay ADZ in Eastern Cape, the Vanderkloof ADZ in Northern Cape, and Saldanha Bay ADZ in Western Cape (DAFF, 2020).

An Aquaculture Research and Technology Development Programme (ARTD) was developed in 2012 to address specific priority areas including environmental interaction, food safety,

animal health and wellness, new species, genetics, production systems, technology transfer and piloting, nutrition and feed development, and markets and post-harvest technology. This was followed by the establishment of an Apex Research Body to develop a unified research and development agenda for the Agriculture, Forestry and Fisheries (AFF) sectors, which resulted in the establishment of the National Aquaculture Research Forum (NAQUARF). This Forum involved various stakeholders including universities, agricultural colleges, provincial departments of agriculture, various aquaculture associations, government departments, research institutions and development finance institutions (DAFF, 2020).

Considering that access to finance is one of the main challenges faced by small enterprises, both government and private sectors contribute to investments into the aquaculture sector. Financial support from government includes funding programmes and Development Finance Institutions (DFIs). ADEP is a dedicated aquaculture incentive scheme offered by the DTIC. Its main objective is to stimulate investment by commercially viable enterprises in the aquaculture sector. ADEP contributes up to 50% (capped at R20 million) of qualifying costs for new, upgrading or expanding projects. ADEP is available for primary, secondary, or ancillary aquaculture activities in marine and freshwater aquaculture classified under Standard Industrial Classification (SIC) 132 (fish hatcheries and fish farms) and SIC 301 and 3012 (production, processing and preserving of aquaculture fish) (The dtic, no date).

The DTIC also provides general financial support to qualifying companies for various economic activities including manufacturing, agro processing support, export development and market access. The CASP is an agricultural support programme. DFIs such as the Industrial Development Corporation (IDC) and the National Empowerment Fund (NEF) also contributed to the increased investment into the sector. In 2015, an estimated R264 million was invested into the marine and freshwater aquaculture sectors. Of this amount, 67% (R179 million) was invested into the abalone sector (DAFF, 2017a). DAFF produced a guideline for funding opportunities in the public and private sectors. The purpose was to provide information about available funding that could be accessed from different organizations in the country for the purpose of aquaculture development (DAFF, 2019a).

2.7.4 Enabling environments for aquaculture in other countries

The complexity of creating an enabling environment for aquaculture, with regards to the numerous role players, legislation and support required, is reflected in the literature describing aquaculture development in other parts of the world. The aquaculture sector in Turkey grew

from 3075 metric tons in 1986 to 373 356 metric tons in 2019. By 2016 the country ranked 21st in terms of world aquaculture production. This was possible not only because of its geographic location and suitable natural resources, but also through investments in the sector, and creation of an enabling environment through appropriate policy and support instruments. Various financial instruments are available to aquaculture entrepreneurs, and specialized Aquaculture-based Fisheries and Aquaculture Organized Industrial Zones are being created to stimulate investment, increase production and minimize conflicts with other sectors. Some of the challenges include the high cost of fish feed, the effects of climate change, developing new species, and managing the environmental impacts of aquaculture. The Turkish aquaculture production target for 2023 has been set at 600 000 metric tons, with an export target of USD 2 billion (Çoban, Demircan and Tosun, 2020). In this case, government played an important role throughout the development of the sector.

In the case of the blue mussel industry in Chile, the government played an important role in the development of the sector, improving the regulatory and institutional environment and supporting development of small and medium producers. However, the Chilean mussel industry's move to 2nd place as world producer after 2012 is thought to be due to market incentives and investments in medium to large farms and firms (Gonzalez-Poblete *et al.*, 2018).

In other cases, government may have played an initial role in aquaculture development, however other actors became more important in the further development of the sector. In Myanmar, which ranks amongst the world's leading aquaculture producers (12th in 2016), the development of small and medium scale farms was stimulated by the "informal" relaxation of restrictions around conversion of paddy land to ponds in the main fish farming zones. This has led to private investments into small and medium enterprises including upstream (feed and seed) and midstream (wholesale and logistics) segments, and a "dualistic" aquaculture farm structure that includes large and smaller operators (Belton *et al.*, 2018). Similarly, the fish farming sector in Bangladesh benefited from initial government investment and grew from 124 000 metric tons in 1984 to almost 2 million metric tonnes in 2014. The recent growth was found to be due to investments by thousands of actors across the fish value chain including smallholder farmers, and small and medium enterprises (Hernandez *et al.*, 2018).

From the above examples it is clear that government played an important role in the development of the aquaculture sectors of these countries, although in Myanmar and Bangladesh the industrial actors eventually took a more prominent role. The governments in Turkey and Chile seem to still be involved in a prominent way, utilising policy and support

instruments to continually develop the sector. This is comparable to what the South African government is trying to achieve.

Other studies confirm the complexities around the institutional dimension and governance models of aquaculture activities. A study of fish farming activity in Mexico revealed a complex web of stakeholders including fish producers, government representatives, and civil and academic associations, less than ideal implementation of policies, and inadequate support and information exchange (Kanchi, Wehncke and López-Medellín, 2022). In Greece, deficient implementation of legislation led to an investigation of how scientific management tools (hydrodynamic models) could assist in the development of more effective environmental legislation for mussel farming (Konstantinou, Kombiadou and Krestenitis, 2015). In Norway's salmon industry, there is a conflict between regulating the industry for environmental sustainability and optimum production levels (Osmundsen, Almklov and Tveterås, 2017).

2.8 Enterprise development models

The concept of a model is that it provides an example of something that can be followed or imitated. An enterprise development model means anything that can be used as an example to improve the sustainability of enterprises, such as a policy, strategy, infrastructure, or process. Although ESD programmes set up in compliance to BBB-EE policy can be regarded as a type of ED model, this is not the only model available. ESD programmes could be set up by corporates independent of BBB-EE policy, to strengthen their own supply chains or to strengthen local economies. ESD initiatives could also be set up by corporates as part of their Corporate Social Responsibility (CSR) programmes.

Other ED models include business support infrastructure such as incubators, business hubs, clusters, or Special Economic Zones (SEZs). A business incubator is defined as a physical and/or virtual facility that supports the development of early stage SMMEs through a combination of business development services, funding, and access to the physical space necessary to conduct business. The idea is that incubates can grow independently once incubation ends. The Department of Trade, Industry and Competition (the DTIC), previously the Department of Trade and Industry (the DTI) supports business incubation as an important strategy for economic inclusion and industrial development (The dti, 2014). Incubators could be focused on specific sectors or technologies, or enterprises in general, and they could be public, private or a mixture of both.

A comprehensive analysis of 84 small business incubators in 2014 highlighted the difference between public and private sector incubators. Most public sector incubators focused on broadening economic participation especially for disadvantaged communities, while private sector incubators focused more on growing small businesses into assets of value by maximising profitability and annual turnover. While public sector incubators have been around for much longer, private sector incubators were found to support more SMMEs per incubator, create more jobs and graduate more SMMEs from their incubation programmes than those in the public sector (Masutha and Rogerson, 2014).

An industrial cluster is defined as a group of business enterprises and non-business organizations for whom membership of the group promotes the individual competitiveness of each member firm (Bergman and Feser, 1999). The support of clusters and networks can promote innovation, technological upgrading and enterprise sustainability (Rogerson, 2001). The DTIC promotes the role of industrial clusters to improve the competitive capacity of the economy. The Special Economic Zone (SEZ) Programme is supported by the SEZ Act (No. 16 of 2014, and makes provision for Industrial Development Zones, Free Ports, Free Trade Zones, and Sector Development Zones. There are seven SEZs in South Africa, including the Saldanha Bay Industrial Development Zone (The dti, 2018b).

In franchising models, a franchisor provides access to proprietary business knowledge, processes, and trademarks to a franchisee. The franchisee is allowed to sell a product or service under the franchisor's business name, and access is provided via a type of license that attracts a fee from the franchisee. The franchisee benefits from access to the experience and knowledge from a franchisor that gives it a better chance of success than start-ups without this type of support. In South Africa, there is no legislation that regulates franchise relationships. However, there are legislation that impact on franchising, including the Trademarks Act (No. 194 of 1993), the Competition Act (No. 89 of 1989) and the Consumer Protection Act (No. 68 of 2008) (Whichfrancise.co.za, no date). The Franchise Association of South Africa (FASA) is an association formed to protect, lobby, promote and develop ethical franchising across all sectors in South Africa, and they focus specifically on transformation.

2.8.1 Inclusive business models

If the needs of poorer actors are not included and recognized in aquaculture development, commercial development of the sector could result in the exclusion of smallholders, consumers and other poor actors. Inclusive business models (IBMs) are aimed at specific contractual

relations and mechanisms to integrate poor people into value chains. IBMs are defined as "pro-poor, equitable and profitable business activities that integrate poor producers, processors, retailers, distributors and consumers in value chains whilst generating broader positive development outcomes" (Kaminski *et al.*, 2020). In a review of IBMs commonly used in agriculture value chains, these authors identified seven types of IBMs using a global value chain (GVC) analysis summarised in Table 2.10. They evaluated these IBMs in terms of two types of upgrading in a value chain – economic (increasing competitiveness) and social (improvements in overall social well-being of workers and actors in the value chain).

Table 2.10: Summary of IBMs commonly used in agriculture value chains

Type of model	Models	Coordination
Buyer-driven	"Contract farming or out-grower schemes: pre-agreed supply & purchase agreements between farmers & buyers, usually at an agreed price and delivery date"	Vertical
	"Micro-franchising: involves the selling and replication of tried & tested agribusiness models by micro-franchisor (firm) to micro-franchisee (smallholder or entrepreneur)" (Fairbourne 2007, as cited in Kaminski *et al.*, 2020)	Horizontal
	"Joint ventures: co-ownership of a business venture by two independent market actors who share equity in venture, thus also sharing financial risks and rewards"	Vertical
Producer/Farmer-driven	"Farmer-owned businesses (cooperatives, associations, or groups): groups of farmers organize to generate collective action, share costs & risks, and increase bargaining power"	Horizontal
	"Tenant farming sharecropping: management contracts in which individual farmers (or landless labourers) work the land of larger agribusinesses and/or farms"	Horizontal
Intermediary driven models	"Public private partnerships: a governing arrangement where public agencies engage with non-state stakeholders (usually private sector) in collective decision-making process that is consensus oriented" (Bjärstig, 2017, as cited in Kaminski *et al.*, 2020)	Vertical and horizontal

Type of model	Models	Coordination
	"Certification: governance approach incentivizing supplier upgrading by providing food production standards" (Bush *et al*. 2019, as cited in Kaminski *et al*., 2020) through "setting up and enforcing standards that set the norm, levels and values of production and marketing of food products"	Vertical

Source: (Kaminski et al., *2020)*

Given the issues regarding the inclusion of HDI aquaculture farmers and entrepreneurs in the aquaculture value chains, these IBM models provide a platform for the assessment of potentially suitable models to use in the development of aquaculture enterprises in South Africa.

2.9 The mussel industry in South Africa

The mussel sub-sector is the highest contributor to aquaculture production in South Africa, with 49% contribution to marine and 32% to total production in 2015 (DAFF, 2018b). The implementation of Operation Phakisa led to 18 new projects since 2014, 11 of which were mussel cultivation projects. This emphasised the importance of mussel farming in the development and expansion of the aquaculture sector in South Africa. (DAFF, 2017a). The two main mussel species cultivated in the country is the exotic Mediterranean mussel (*Mytilus galloprovincialis*) and indigenous Black mussel (*Choromytilus meridionalis*).

2.9.1 History of mussel farming in South Africa

South African mussel culture reportedly started in the 1980's in Saldanha Bay with farming of indigenous mussels in a tidal pool and seeding of mussels in the Knysna Lagoon. Thereafter a mussel raft was set up in Port Elizabeth, longline systems were set up in Saldanha Bay and rafts were set up in the 1990s (Safriel and Bruton, 1984; DAFF, 2017c).

The Mediterranean mussel is thought to have been introduced to South Africa in the 1970's, possibly through ship traffic (Grant and Cherry, 1985), and to have spread since then to the west and southern coasts. Although initial research efforts identified indigenous black mussel (*C. meridionalis*) and brown mussel (*Perna perna*) as having potential for aquaculture development, further development of the mussel farming industry focused on the Mediterranean mussel due to its better growth rates and adaptability to culture conditions (Safriel and Bruton, 1984; DAFF, 2017c).

Due to poor growth in the Port Elizabeth farming site, Saldanha Bay became the focus for mussel aquaculture due to its sheltered bays, nutrient-rich water, well connected transport network and bulk services (DAFF, 2017c). Sea Harvest, a capture fishing company, started a mussel farming operation in Saldanha Bay in the 1990s. As part of its aquaculture farming activities, the company also established an empowerment mussel farming project with six employees. The mussel farming operation was bought out by Blue Bay Mussels (Ferreira, 2016), previously known as Blue Bay Aquafarm.

A second empowerment mussel farming initiative (the Saldanha Bay small-scale mussel farming project) was established as a pilot in 1997. The project used an economic clustering strategy, based on the principle of one family per raft, and after the pilot set out on a process to establish 18 mussel farming families (Karaan, 1999; Brierly, 2003). This initiative closed around 2006.

There was only one mussel farming enterprise recorded for South Africa in 2008, which was a partnership between Blue Bay Mussels and Masiza Mussel farming initiative (Britz, Lee and Botes, 2009). By 2011 there were three mussel farms, increasing to six by 2015 (DAFF, 2012b, 2016b). These numbers included aquaculture farms that listed other species such as oysters as their main farming activity, and farmed mussels as a secondary activity. In 2019, DAFF recorded eight mussel farming projects with combined production of 3070 t (Department of Environment, Forestry and Fisheries, Economics information, 2020).

By 2020, the number of mussel farmers recorded by the Bivalve Shellfish Farmers Association (BSASA) had increased to 23 with total allocated water space of 336 ha, due to interest and investments arising from Operation Phakisa. This number included three aquaculture farms that also cultivate other species such as oyster.

As illustrated in Figure 2.5, the number of mussel farming initiatives in South Africa increased slowly between 2000 and 2015, with an almost 6-fold increase in the number of farmers in the five years thereafter. Total mussel production was 500 t in 2000, 700 t in 2010, 1 758 t in 2015 and 3 053 in 2019 (FAOSTAT, April 2021). The production for 2020 was estimated at 6 000 t, and the forecast for 2021 is 10 000 t (F. Endemann, personal communication, 2021).

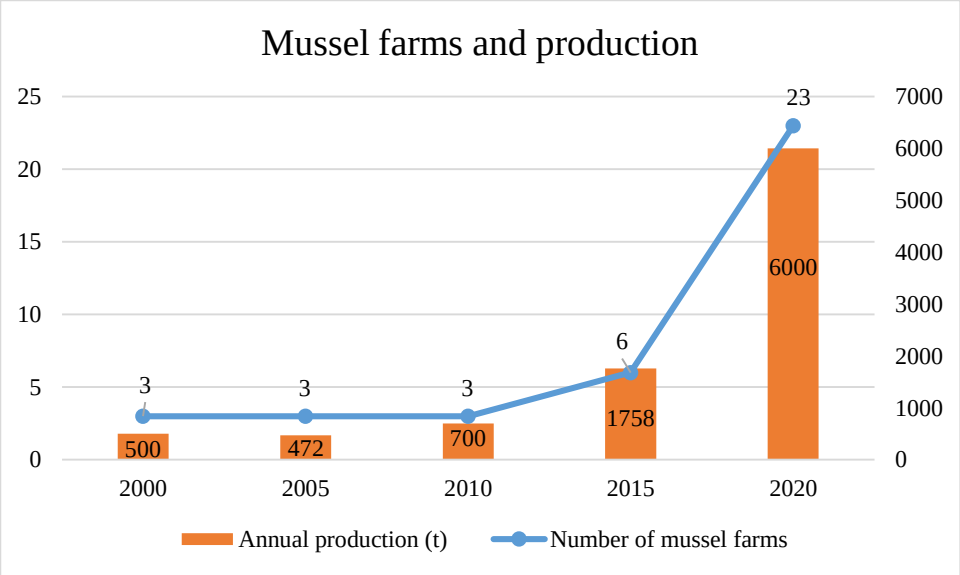

Figure 2.5: Growth in mussel farms and production since 2000

Sources: FAOSTAT, BSASA, F. Endemann (personal communication, 2021)

2.9.2 Taxonomy and biology of mussels

Mussel is the name commonly used for members of certain families of freshwater and saltwater bivalve (soft body enclosed within a hinged double shell) molluscs (invertebrate living in aquatic or damp habitats). According to the World Register of Marine Species (WoRMS), marine mussels are classified as part of the Family Mytilidae, under the Phylum Mollusca.

Globally, commercially important marine mussels include *Mytilus edulis* (blue mussel), *M. galloprovincialis* (Mediterranean), *M. chilensis* (Chilean), *Aulacomya atra* (Cholga), *Perna viridis* (Green), *P. perna* (South American rock mussel) and *P. canaliculus* (New Zealand or green lipped) (Duncan, 2003). Other globally commercially important bivalves include oysters (Family Ostreidae), clams (various taxonomic groups) and scallops (Family Pectinidae).

Mussels are filter feeders, using gills to feed on phytoplankton and organic matter. They move about with the aid of a foot and secrete byssal threads with which they attach to the substrate. They produce millions of eggs, and fertilisation is external. Fertilized eggs develop into trochophore larvae and then into veligers that are carried around by currents and tides. At a length of about 0.25 mm the pediveligers use their byssus threads to attach to filamentous substrates (FAO, no date a).

2.9.3 Economic value of mussels

In 2018, the worldwide production of mussels was 2 197 000 t, of which only 4% (84 158 t) was from capture fisheries (Table 2.11). Production from aquaculture was 2 113 000 t, valued

at US$ 4.5 billion. Mussel aquaculture production therefore represented 12% of mollusc, and 3% of total aquaculture production. International exports accounted for about 1 million t, valued at just below US$ 1 billion (FAO, 2020a).

Table 2.11: World mussel production 2018

2018	Capture fisheries	Aquaculture	Total	International exports
Quantity (t)	84 000	2 113 000	2 197 000	1 001 726
Value (US$ 1000)	67 000	4 519 000	4 586 000	969 825

Source: (FAO, 2020a)

Global aquaculture production of *Mytilus galloprovincialis* in 2016 was 105 331 t. This excluded data from Spain or China. It is estimated that China has the highest production of the species (more than 663 000 in 2002). At the same time, Spain's production of the species was estimated at more than 200 000 t (FAO, no date a).

A comparison of total world, African and South African aquaculture production (excluding aquatic plants), with mussel production in 2019 is set out in Table 2.12. Africa contributed 0.04%, and South Africa 0.02% to world mussel production. World Mediterranean mussel production was 0.6% of total mussel production (FAO FishSTAT, April 2021).

Table 2.12: World, Africa, and SA aquaculture (excluding aquatic plants) and mussel production 2019

2019 Aquaculture	World	Africa	SA	World Mussels	Africa Mussels	SA Mussels	World Mediterranean Mussels
Production (1000 t)	85 362	2 277	9 344	17 551	7.4	3.1	105.4
Value (US$ million)	259 776	4 857	82.1	31 089	80	2.1	100

Source: FAO FishStat, April 2021, (FAO, no date a)

2.9.4 Mussel production technology

Mussel production systems are off shore based, and relatively simple because no energy, feed or other inputs such as antibiotics are required. The basic requirements for mussel farming are access to sheltered culturing areas, good seawater quality, and sufficient food (planktonic organisms). Success therefore depends on ideal locations for mussel cultivation. In South Africa, there are limited areas suitable for mussel aquaculture due to high energy wave patterns along most of the west coast, and more limited nutrients in the waters along the southern coast (DAFF, 2017c).

As described in Figure 2.6: Mussel production cycle, young mussels (seeds) are collected from the sea and placed on ropes. The seeds are kept in place by nylon nets (tubing), which are then suspended from rafts (raft culture), wooden frames (rack culture) or longlines (longline culture). After the nylon mesh have disintegrated and the mussels have attached themselves to the rope, declumping and thinning is done. When the mussels have reached commercial size, harvesting, declumping and grading takes place. The mussels are then processed into fresh products (after depuration) and processed products (after sterilization) (FAO, no date a). Depuration is a process whereby mussels are held in tanks of clean seawater, to expel potential contaminants in the intestines accumulated during their growth cycle.

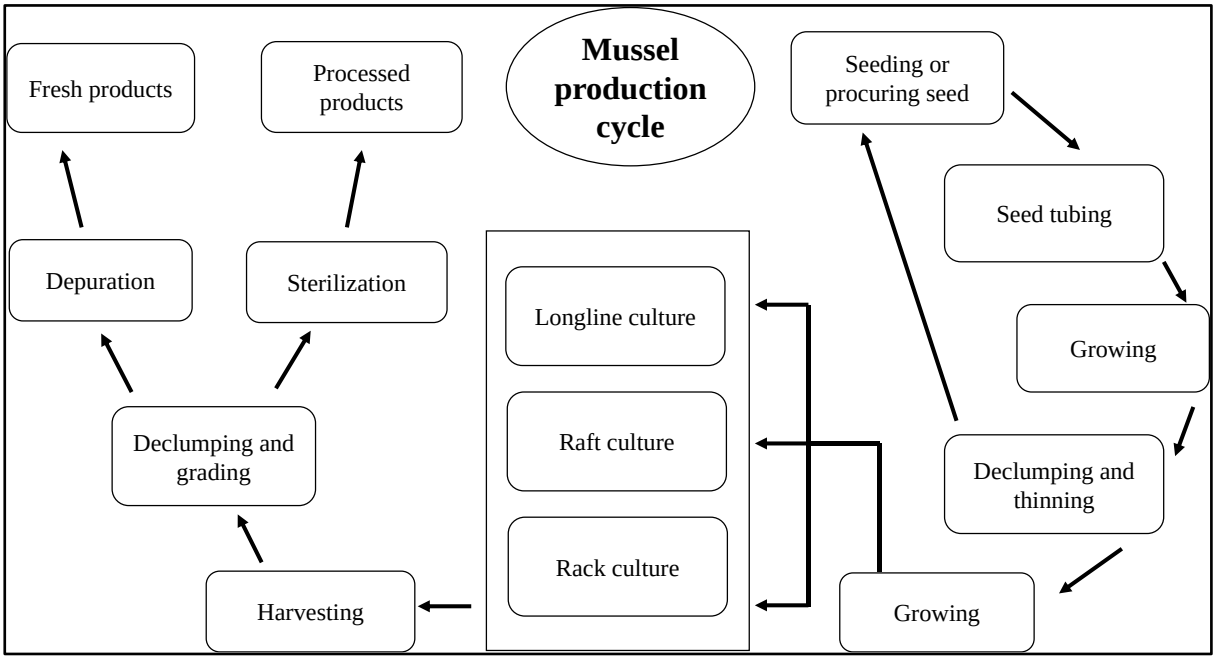

Figure 2.6: Mussel production cycle

Source: Adapted from (FAO, no date a)

The first mussel culture reportedly took place in Tarragona and Barcelona in 1901 and 1909, using poles. Thereafter floating systems and bottom culture were tried. Floating rafts consisted of square wooden framework supported by a central float. Ropes hanging from the framework were used to attach mussel seed, which was collected upon reaching commercial size (FAO, no date a).

The first rafts in Saldanha Bay were wooden rafts, an example of which can be seen in Figure 2.7. One raft could hold about 500 ropes, each yielding about 300 kg mussels p.a. Of the total potential yield of 150 t, 25% (37.5 t) was marketable. Profit per raft (before capital redemption) was calculated at R 28 125 p.a., and one raft cost about R 70 000 (Brierly, 2003). These rafts did not do well in the winter storm conditions, and typically broke within a year or two.

Figure 2.7: Wooden mussel raft

Source: Researcher's own collection

Given the problems experienced with wooden rafts, Blue Bay Aquafarm invested in the development of a High-density Polyethylene (HDPE) raft (Figure 2.8), that could better withstand the weather conditions (Vos Pienaar, personal communication).

Figure 2.8: High-density Polyethylene raft

Source: Researcher's own collection

Mussel longline systems consist of long lines with floats, anchored to the substrate on each side. Mussels are grown on ropes attached to the main long lines. Examples of longline systems are illustrated in Figure 2.9.

Figure 2.9: Longline culture systems

Source: Researcher's own collection

2.9.5 Economics of mussel farming

Mussels are sold into fresh and processed markets. Fresh mussels are destined for restaurants and consumers. Processed mussels typically have a longer shelf life and can be canned, preserved or frozen.

The assumptions for calculating the potential mussel crop yield for raft and long line systems are set out in Table 2.13. Assuming an average of 1.7 crops p.a. and one raft per ha, the potential production yield for raft cultivation is 41 t per ha p.a. A feasibility study on mussel and oyster aquaculture indicated that the minimum viable scale for a mussel farm is 100 t p.a. However, a 500 t p.a. mussel farming operation, using raft technology, represents a reasonable scale that could be financially viable under certain assumptions (DAFF, 2017c). Assuming a density of one raft per ha, the minimum size needed for financial viability of raft cultivation is 12 ha, or 12 units.

Long lines are installed at a density of ten per 5 ha. Assuming an average of 4.5 crops p.a., the potential production yield for long line cultivation is 53 t per ha p.a. (Ferreira, 2016), (F.

Endemann, personal communication, 2021). Assuming that the minimum viable scale for long line cultivation is also 500 t p.a., the minimum size needed for longline cultivation is 9 ha. As one longline unit takes up 5 ha, the actual minimum size required for financial viability would be 10 ha, or two units.

The actual yield p.a. is influenced by factors such as the number of rafts allowed per ha, Harmful Algal Bloom (HAB) occurrence and duration, weather events, nutrient availability, production management practices or events such as the COVID-19 pandemic.

Table 2.13: Comparison of potential mussel yield for raft and long line systems

Unit	Crop rotation (months)	# Crops p.a.	# Ropes per unit	Yield per rope (kg)	Yield per unit (kg)	Yield per ha p.a. (t)	Annual yield for financial viability (t p.a.)	Minimum viable size (ha)
1 raft	7.0	1.7	800	30	24 000	41	500	12
5 ha	4.5	2.7	10	10 000	100 000	53	500	9

Sources: (Ferreira, 2016), *(F. Endemann, personal communication, 2021)*

Industry experience indicate that a mussel farm with 30 rafts, harvesting 1000 t p.a., could support the cost of one boat and 17 staff members, and could support an additional 100 jobs at a processing factory (Ferreira, 2016). For long line systems, industry experience indicates that a 15-ha mussel farm with 30 long lines could support one boat (F. Endemann, personal communication, 2021).

2.10 Conclusion

The hypothesis of this study states that the development of self-sustainable aquaculture enterprises is not adequately supported by the enabling environment for the aquaculture sector in South Africa. The literature shows that the challenges facing small enterprises in general, and aquaculture enterprises, are well understood. Many initiatives have been launched over the years to address the development of small enterprises, increase the sustainability of enterprises and address challenges in the development of the aquaculture sector. However, business sustainability remains low, and the aquaculture sector has not met all the development targets set through its development programmes.

Considering the legacies of past discriminatory policies (resulting in poverty, limited education, inequality etc.), it is understandable that current policies and investment of public funding are underpinned by the need to address social issues. This led to a perceived confusion between enterprise development and community development and contributed to the problem of enterprises that do not grow and become self-sustainable and remain dependent on donor funding.

Chapter 3 -Methodology

3.1 Research approach

This study took an empirical, phenomenological research approach because it was based on the results of experiments or observation (as opposed to contemplative, of the mind/intellectual faculties), and addressed Why/How questions (as opposed to positivist How much/When questions) (Remenyi *et al.*, 2010).

The underlying philosophy of positivism includes assumptions such as that the researcher is independent, there are independent causes leading to observed effects, that it should be possible to generalise or model the observed phenomena, and that quantifiable observations lend themselves to statistical analyses. In contrast, a phenomenological researcher is not independent, sees each situation as unique with meaning derived from the circumstances and individuals involved, and believes that the world can be modelled especially in a verbal, diagrammatic or descriptive way (Remenyi *et al.*, 2010).

This study was aimed at studying people and their organisations and understanding the phenomenon of self-sustainability in aquaculture agribusinesses, including those that were public funded (Why). It was also aimed at development of a model for the creation of self-sustainable aquaculture agribusinesses (How).

3.2 Research design

A research design is defined as "a *logical plan for getting from here to there*, where *here* may be defined as the initial set of questions to be answered, and *there* is some set of conclusions (answers) about these questions". Between "here" and "there" may be a number of major steps including the collection and analysis of relevant data (Yin, 2009).

The five major research methods available to researchers include experiments, surveys, archival analysis, history, and case study. A case study can be used in three different ways – as a teaching and learning device, to develop a framework for evidence collection or as a research tactic. In research, the case study is aimed at providing a detailed and multi-dimensional view of the situation under study. It can be used to "illustrate relationships, corporate political issues and patterns of influence in particular contexts" (Remenyi *et al.*, 2010).

The case study approach as a scientific research method in its own right, and generator of context-dependent knowledge, is described by several researchers (Flyvbjerg, 2006; Yin, 2009; Remenyi *et al.*, 2010). The case study approach was selected as the most suitable for this study,

as the research questions were mostly how/why questions, the study did not require control of behavioural events and it focused on contemporary events. It also provided the researcher with the opportunity to make comparisons, build theory and propose generalizations about aquaculture agribusiness projects.

A "case" is commonly associated with a geographical location such as an organization. A case study design is focused on a bounded situation or system or a phenomenon with identifiable boundaries (Henning, van Rensburg and Smit, 2013; Bryman and Bell, 2014). In this study, the "case" or "unit of analysis" was defined as self-sustainability in aquaculture agribusiness enterprises in South Africa. The "case" was further bounded by selecting mussel farming enterprises in the bivalve shellfish farming industry located in Saldanha Bay, Western Cape Province.

Quantitative studies commonly use statistical analyses as benchmarks. However, case study analysis does not rely on statistics; hence other criteria for interpreting the findings need to be identified. An important strategy in this regard is to identify and address rival explanations for findings, and include data about them as part of data collection (Yin, 2009).

There are four major types of case study research designs including single-case (holistic), single-case (embedded), multiple-case (holistic) and multiple-case (embedded) designs (Yin, 2009). Examples can be found in the literature describing single-case studies, as described in (Adewumi, Falola and Odunlade, 2016). A multiple-case study approach, as described by several researchers (Mishna, 2004; Mannion, Davies and Marshall, 2005; Wilson, Cooney and Stinson, 2005), was used to develop a framework for evidence collection.

3.2.1 Study tools

Several research tactics/study tools are available for use in social science, business, and management studies. As described in (Remenyi *et al.*, 2010), the case study approach, in-depth surveys and focus groups were deemed suitable tactics for this study. The case study approach allowed the researcher to "make comparisons, build theory and propose generalizations about public-funded aquaculture agribusiness projects". During in-depth surveys, the researcher "obtains in-depth evidence from a small number of informants through a series of interviews, which can be analysed quantitatively or qualitatively to demonstrate the importance of issues". In focus groups, "the researcher collects evidence from a highly specialised group of individuals/experts to debate an issue of interest; it can be used at the outset to formulate a research question or at the end to validate the research conclusions".

In-depth surveys in the form of semi-structured interviews, and focus group were selected as appropriate study tools to conduct interviews with farmers and role players, and to validate research conclusions. A qualitative approach was followed to conduct the research.

3.2.2 Methods flow chart

The research design is illustrated in the flow chart in Figure 3.1. The five research objectives underpinned the design of the measuring instrument, identification of case studies, and identification of respondents. Results from semi-structured interviews were presented in three research papers. Two of these papers were published in accredited journals. The results from these papers were used to develop a draft aquaculture enterprise development model, combined with inputs from consultations with enterprise development experts. The model was discussed with and validated by sector stakeholders during focus group sessions. These inputs were used to finalise the model and prepare a fourth paper for publication.

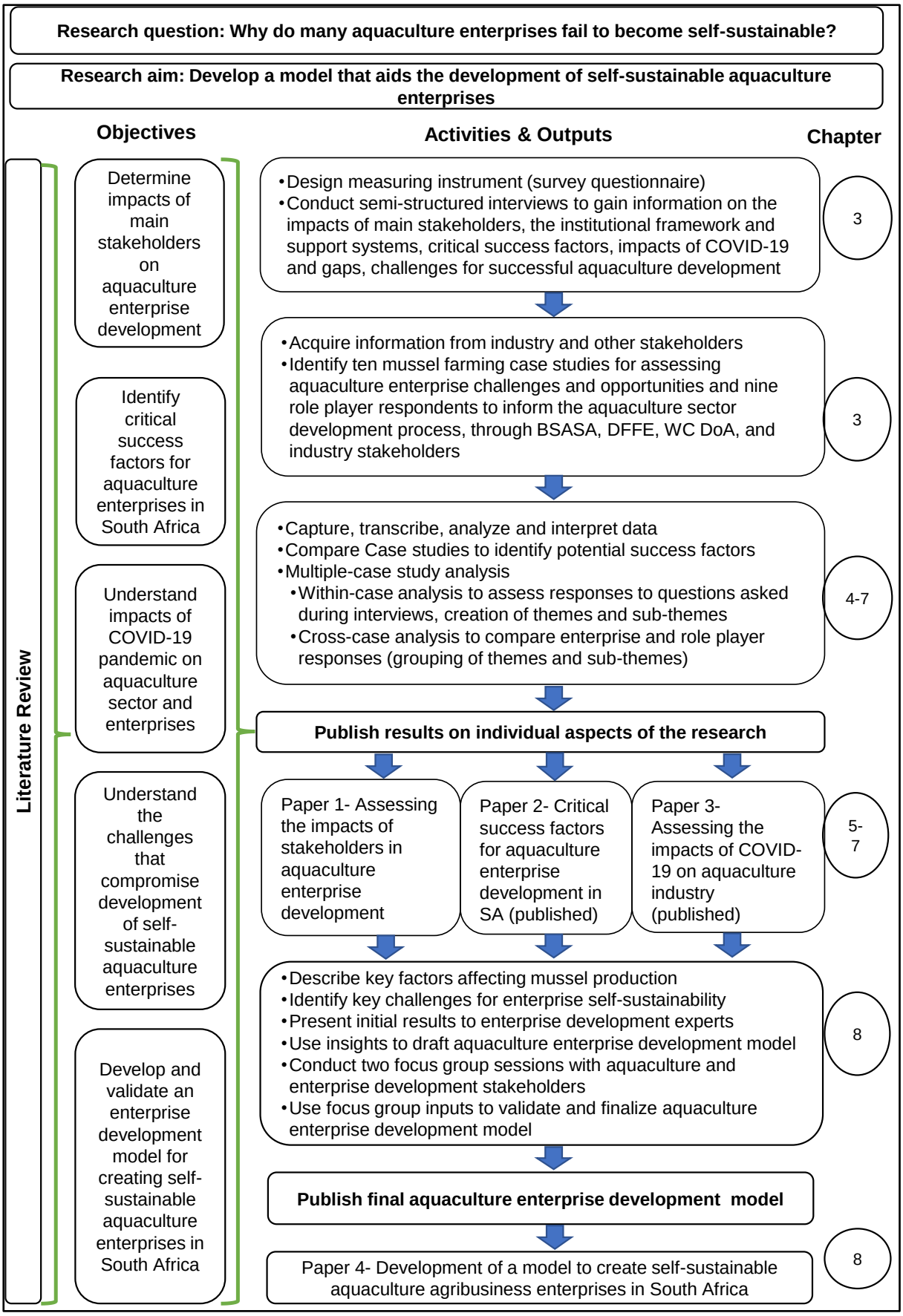

Figure 3.1: Research design flow chart

3.3 Study area

The study area is in Saldanha Bay, on the west coast of South Africa, specifically the marine mussel farmers and all related stakeholders. The farms are part of the Saldanha Bay Aquaculture Development Zone (ADZ), which include sea-based aquaculture areas identified, registered, and monitored as part of Operation Phakisa. The stakeholder groups included government, industry, research and academic institutions, finance institutions, and others. The study also included the wider South African aquaculture sector (including freshwater and marine sub-sectors).

The Saldanha Bay Municipality is one of five local municipalities located in the West Coast District, has a population of about 122 000 people and the highest population density (61 people/km^2) of the five municipalities. Matric pass rates were around 80 % from 2017 to 2019. In 2018, the GDP per capita was R49 000, the economy of the municipality was valued at R9.3 billion and about 52 000 people were employed. The main economic drivers that contributed to growth in the tertiary sector were the finance, insurance, real estate and business services (R1.4 billion), wholesale and retail trade, catering and accommodation (R1.4 billion) and general government (about R1 billion). The agriculture, forestry and fishing sector was valued at R1.6 billion and employed about 19 000 people, while the manufacturing sector was valued at R2.1 billion and employed 5000 people. Although the agriculture, forestry and fishing sector is one of the main sources of employment, a provincial drought contributed to a 2.3% contraction and loss of 458 jobs in 2019. The unemployment rate in 2019 was 17.5%, which was the highest in the district yet lower than the provincial rate of 19.4% (Western Cape Government, 2020).

Within Saldanha Bay, bivalve shellfish (mussel and oyster) farming takes place in three subsections of the Bay (Small Bay, Big Bay, and Outer Bay North), totalling 460 ha (as indicated in Figure 3.2.

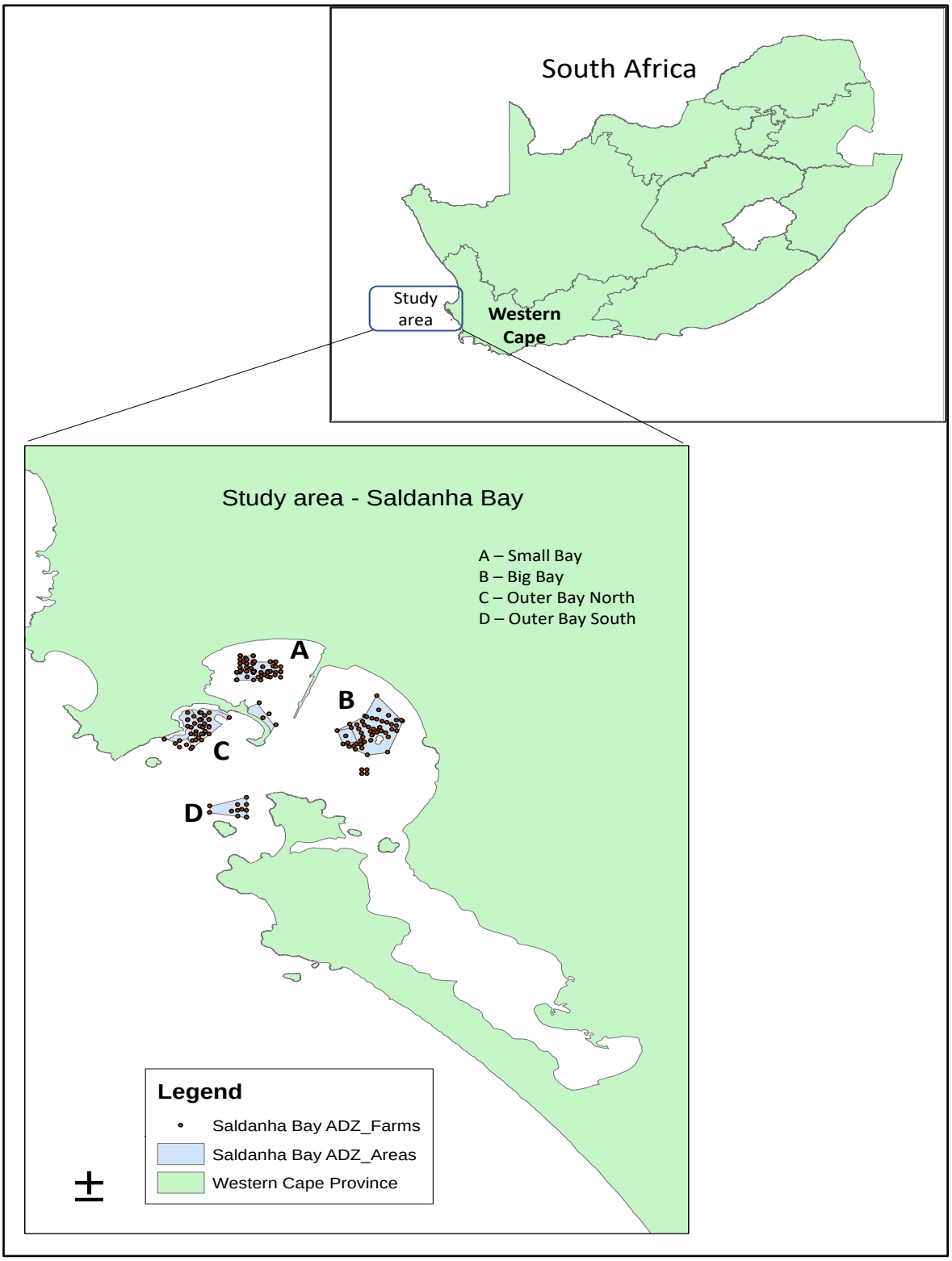

Figure 3.2: Map of study area indicating aquaculture farms in the Saldanha Bay ADZ

Source: Bivalve Shellfish Farmers Association of South Africa (BSASA)

3.4 Interviews/surveys

Semi-structured interviews were conducted with the owners or managers of mussel farming enterprises selected as case studies, and with a selection of role players representing various organisations in the agribusiness, aquaculture, and enterprise development domains. This allowed the researcher to obtain detailed evidence about the research phenomenon and theories generated. During interviews, the researcher asked questions using a measuring instrument based on the research questions. These questions were communicated to each participant before interviews, as part of the Participant Consent Forms (as described in the template listed in Appendix A). Based on the responses provided during interviews, the researcher asked additional questions related to the propositions and rival explanations identified.

Focus groups including selected role players were used to gauge industry perceptions, and to validate the proposed aquaculture enterprise development model developed through the study.

3.4.1 Interviews with farmers

Interviews were conducted with the owners or managers of each farm, and each interview lasted between one and two hours. Due to the implementation of coronavirus disease 2019 (COVID-19) regulations during 2020, most of these interviews were conducted via videoconferencing or cell phone platforms.

The study sample included one mussel farm that had ceased operations around 2006. A representative involved in this enterprise was identified and interviewed. All other bivalve shellfish aquaculture enterprises (27 in total) were approached through the relevant industry association (Bivalve Shellfish Farmers Association of South Africa) and the Western Cape Provincial Department of Agriculture.

3.4.2 Interviews with role players

Further interviews were conducted with representatives of role players in the aquaculture or enterprise development domains. Two individuals were selected based on their experience or expertise in a specific aspect, and they did not represent any specific organisation. The role player sectors, and number of interviews are listed in Table 3.1. Due to the implementation of COVID-19 regulations during 2020, most of these interviews were conducted via videoconferencing or cell phone platforms.

Table 3.1: Role player sectors and number of interviews

Role Player Category	Number of persons interviewed	Sphere of influence or representation
National and provincial Government departments with responsibility for aquaculture or agriculture	2	1. National aquaculture sector (freshwater and marine) 2.Western Cape provincial aquaculture sector (freshwater and marine)
Aquaculture associations	3	1. Aquaculture stakeholders in Southern Africa 2. Seven freshwater and marine aquaculture producer associations in South Africa 3. All bivalve shellfish producers in South Africa
Universities	2	1. Agricultural Sciences including Aquaculture research, training, and development; Commercial aquaculture development expertise 2. Social dimensions of the fishing, aquaculture, and coastal sectors
Individual - Experienced aquaculture farming mentor	1	South African commercial aquaculture and development expert with practical experience in mentoring of emerging aquaculture farmers
Individual - Enterprise development expert	1	Expert in enterprise development, technology transfer, business incubation and strategy/programme design and implementation in South Africa
Total	9	

The results from semi-structured interviews were used to identify the gaps/needs that should be addressed for aquaculture enterprises to become self-sustainable.

3.4.3 Interviews with enterprise development experts

Further consultations were conducted with six enterprise development experts from various organisations and background as described in Table 3.2. Their selection was based on reputation and willingness to be involved in the study. Their insights were used to develop a draft Aquaculture Enterprise Development Model.

Table 3.2: Consultations with enterprise development experts

Expert organisation	Number of experts	Background
Enterprise development agency	1	Expert in technology transfer and support
Research council	2	Experts in enterprise development, technology transfer, SMME and incubation development, technology localisation and management of technology programmes, policy formulation in SA
Independent	3	Experts in enterprise development, technology transfer, business incubation and strategy/programme design and implementation in SA

3.4.4 Focus Group sessions

During September 2021, the researcher conducted two Focus Group sessions with representatives from various stakeholder groups. The purpose was to obtain their validation of conclusions regarding the enterprise development model. Invitations were sent to representatives of 30 stakeholder organisations including aquaculture enterprises, industry associations, government departments, government agencies, development finance institutions, universities, research councils, enterprise development agencies, and the private sector. Seven stakeholder representatives attended the first session, and eight attended the second session. The description of stakeholder organisations, number of representatives and their backgrounds are described in Table 3.3.

Table 3.3: Summary of focus group attendees

Stakeholder organisation	Number of representatives	Background
National and provincial departments with a mandate for agriculture and aquaculture development	6	Aquaculture economic development, technical services, and extension services
Enterprise development agency	1	Agribusiness, cooperatives, community-private partnerships
National department with a mandate for trade and industry development	1	Trade and industry
Aquaculture industry	3	Farmers, processors, and industry association

Stakeholder organisation	Number of representatives	Background
Research/academic organisations	2	Aquaculture research, teaching, and technology transfer
Provincial tourism, trade & investment agency	1	Agribusiness promotion
Food & Beverage industry	1	Enterprise and supplier development
Total	15	

The draft enterprise development model was presented to stakeholders during the focus group sessions. Their responses to the following questions were used to finalise the enterprise development model:

a) Have the most prominent needs of the sector been correctly identified?
b) Does the proposed model address the needs of the sector?
c) Are the proposed elements of the model optimum to address the needs identified? If not, what are the alternatives?
d) Could the model be expanded to other aquaculture species and geographical areas?
e) Which stakeholders should drive the implementation of the model, and what resources would they need?
f) Which other stakeholders could assist with implementation of the model?
g) How can the model be used to deliver much-needed post Covid-19 pandemic support?
h) Should the model be implemented as a pilot in Saldanha Bay, focusing on the bivalve shellfish sub-sector?

3.4.5 Propositions

In case study research, propositions are used instead of hypotheses as part of theory building, and direct attention to something that should be examined within the scope of the study (Yin, 2009). The propositions for research questions 2 to 4 are summarised in Table 3.4. In case study research, rival or alternative explanations are used instead of alternative hypotheses. The alternative explanations for research questions 2 to 4 are listed in Table 3.5.

Results from case study and role player interviews were used to identify the most important gaps, needs and challenges to self-sustainability of aquaculture enterprises.

Table 3.4: Study propositions

Research question	Propositions
1. How do the motivations, contexts, and key drivers of the main role players impact on aquaculture enterprise development in South Africa?	• The institutional framework for aquaculture does not create an enabling environment for aquaculture enterprises • The current institutional framework favour collective-group or community-based projects more than entrepreneurial/commercially oriented ventures • The institutional support systems do not create an enabling environment for aquaculture enterprises • Current enterprise development pursues government socio-economic policy and strategy, possibly in isolation from market forces. • The main role players in aquaculture enterprise development are driven by different political, economic, social, or environmental mandates, which conflict with the needs of agribusiness/aquaculture enterprises • The main role players in aquaculture enterprise development have a top-down approach to establish enterprises instead of letting commercial/market forces stimulate demand.
2. What are the critical success factors for aquaculture agribusiness enterprises in South Africa, and why?	• Partnerships with established commercial aquaculture enterprises for market access, skills transfer, and mentorship is a critical success factor for start-ups and small-scale aquaculture enterprises • Investment of sweat equity into the enterprise, in addition to investment of public and/or private funds, is a critical success factor • Emerging and small-scale enterprises do not have sufficient access to the technologies, funding, market, expertise, and production inputs they require • Collective-group or community-based aquaculture enterprises are not economically or financially sustainable • The development and economic growth potential of the aquaculture sector is limited by environmental and social sustainability constraints • There is too much emphasis on compliance with environmental legislation and regulations, which is unaffordable for small-scale and emerging enterprises • Public-funded enterprise failures are common because none of the role players (including beneficiaries, implementation agents, funding agencies and others) are held accountable when these enterprises fail.
3. How did the global COVID-19 pandemic impact on aquaculture enterprises, and what is	• Aquaculture enterprises are used to preparing for events that could pause operations for months at a time and are therefore resilient enough to overcome the negative effects of COVID-19.

Research question	Propositions
needed to overcome these impacts?	

Table 3.5: Rival explanations

Research question	Rival explanations
1. How do the motivations, contexts, and key drivers of the main role players impact on aquaculture enterprise development in South Africa?	• There is a disconnect between policy makers and ordinary citizens regarding policy and strategy formulation and implementation • Aquaculture ventures with social motives provide more opportunities for transformation and poverty alleviation than commercial ventures, and therefore need to be promoted • Current enterprise development pursues government socio-economic policy and strategy, but is not properly implemented • The different and potentially conflicting mandates of various role players lead to confusion and divergent interpretation of policy, strategy, and regulations • The education system is not producing enough people with the required skills to run businesses • Role players focus too much on environmental sustainability issues, possibly in isolation of economic/financial and social sustainability.
2. What are the critical success factors for aquaculture agribusiness enterprises in South Africa, and why?	• Partnerships are critical throughout different growth stages but need to be adapted to changing needs • Responding effectively to the changing needs and requirements of each of its development/growth stages is critical for the economic and financial sustainability of the enterprise • Enterprise owners and managers must have a good technical background • Emerging and small-scale enterprises do not know how to access all the resources available for aquaculture enterprise set-up, development, and growth • Collective-group or community-based aquaculture enterprises can succeed with continuous public funding support and intervention or if they transition to a commercial focus • Individual ownership and entrepreneurship are critical success factors however these qualities are not promoted in the social environment • Continuing inequality, low education levels and poverty in historically disadvantaged communities limit

Research question	Rival explanations
	transformation and economic inclusion in terms of development of staff and entrepreneurs
3. How did the global COVID-19 pandemic impact on aquaculture enterprises, and what is needed to overcome these impacts?	• The COVID-19 pandemic is an extra-ordinary event that most aquaculture enterprises will not be able to overcome without assistance from stakeholders.

3.5 Study population and sampling

Primary data was collected in the form of semi-structured interviews with owners or managers of case study enterprises, key informants of role player organisations, enterprise development experts, and representatives of aquaculture and enterprise development stakeholders.

3.5.1 Case studies

Multiple case studies could be compared to multiple experiments. However, replication logic is used instead of sampling logic. Each case must be selected so that each individual case study either predicts similar results (a literal replication) or contrasting results for anticipatable reasons (a theoretical replication). If all individual case study findings are in line with predictions, the studies in the aggregate would have provided sufficient support for the initial propositions related to the overall multiple-case study. However if the individual case study results are contradictory to what was predicted, the initial propositions must be revised (Yin, 2009).

The study population for case studies included aquaculture agribusiness enterprises in the bivalve shellfish farming sub-sector in South Africa. All existing and new bivalve shellfish farming enterprises (27 in total) were approached through the Bivalve Shellfish Farmers Association of South Africa (BSASA), which is the relevant industry association, and the Western Cape Provincial Department of Agriculture. At the time of the study in 2020, there were 20 mussel farming enterprises operating in Saldanha Bay, which is an increase from four in 2015. The bivalve shellfish farmers fell into three different categories, namely existing (operating for three or more years), new (operating for less than three years), or newly acquired/no Marine Aquaculture rights, as reflected in Table 3.6. There were 13 existing and eight new farmers. Five farmers had newly acquired Marine Aquaculture rights but had not yet started production or were waiting for final rights approval. Twenty shellfish farmers farmed

only with mussels, four only with oysters and three with a mix of mussels and oysters. Four enterprises had multiple sites across the three Bay areas.

Of the survey population of 28 farms, 10 were included in the study. This represents a sample size of 36% of the survey population.

Table 3.6: Saldanha Bay bivalve shellfish farmer statistics

Category	Survey population	Sample	Percentage
Existing (more than 3 years)	13	7	54%
New (less than 3 years)	8	2	25%
Newly acquired or no Marine Aquaculture rights yet	5	0	0
No longer in existence	1	1	4%
Total	28	10	36%

Source: Bivalve Shellfish Association South Africa (BSASA)

All enterprises that indicated willingness to participate, were included in the study. A representative of an enterprise that had closed, were identified through discussions with role players and mussel farmers. In the case of enterprises still in operation, the owners or managers were approached, and their written consent obtained to be a part of the study. Secondary data (in the form of marketing materials, financial reports, management reports etc.), were requested from informants. Very few were willing to provide information or reports that could compromise their business, such as financial, technical or market information. Where available, secondary data in the public domain, such as company websites, media articles and published reports, were collected.

3.5.2 Farmer interviews

Data was collected through semi-structured, recorded interviews with the owners or managers of 10 aquaculture agribusinesses in the mussel farming sub-sector in Saldanha Bay, Western Cape Province. The sample included some enterprises that were deemed self-sustainable, some that were not yet self-sustainable and one enterprise that was deemed not to have been self-sustainable (closed).

3.5.3 Stakeholder interviews

A non-random, judgment sampling approach, as described in (Willemse and Nyelisani, 2015), was used to draw a sample from subsets of the role player population (government departments, implementing agents, research institutions, etc.). This led to semi-structured interviews with nine role player representatives.

3.5.4 Model development

A non-random, judgment sampling approach was used to identify six experts with known expertise in the enterprise development sector in South Africa. This led to consultations in which the researcher presented initial results from the study and obtained expert inputs on how an enterprise development model could be developed, to assist aquaculture enterprises in becoming self-sustainable.

A stratified random sampling approach was used to draw focus group participants from strata of the aquaculture and enterprise development stakeholder population. Invitations were sent to stakeholder groups, and this led to 15 stakeholder representatives attending two focus group sessions. The draft aquaculture enterprise development model was presented to these respondents, and their inputs used to validate and finalize the model.

3.6 Triangulation

As described in the literature, dataset or investigator bias can be introduced into a study if only one research method is used. This can be reduced by using triangulation, referring to the use of multiple data sources, different evaluators, different perspectives or different methods (Oppermann, 2000; Yin, 2009). For this study, multiple data sources included interviews with enterprise informants and role player informants, consultations with enterprise development experts and focus group discussions with a selection of stakeholder representatives. In addition, although the research was mainly executed by the researcher, a different investigator assisted with data transcription and analysis.

3.7 Data analysis

In case study research, data analysis typically consists of examining, categorizing, tabulating, testing, or recombining evidence, to draw empirically based conclusions. Case study analysis could follow four general analytic strategies such as relying on theoretical propositions, developing case descriptions, using both qualitative and quantitative data and examining rival explanations. Any of these strategies can be used in applying five specific techniques for

analysing case studies (Yin, 2009). For this study, relying on theoretical propositions was the preferred analytic strategy applied.

Analytic techniques representing ways of linking case study data to propositions include pattern matching, explanation building, time-series analysis, logic models and cross-case synthesis (Yin, 2009). Pattern matching and cross-case synthesis were used as the preferred analytic techniques.

The interviews were recorded and transcribed verbatim. Multiple-case study analysis consisted of two stages. Firstly, within-case analysis, where the qualitative data was analysed by identifying and copying responses from each individual transcription that were relevant to each of the questions asked during the interview. These responses were further analysed to create themes and sub-themes (or codes). MS Excel was used for the second stage of analysis, cross-case analysis where grouping of themes and sub-themes as well as summarising of codes was completed. Secondary data were analysed and used to enrich case study descriptions and cross-case analyses.

3.8 Ethical considerations

Before interviews, informants were provided with Participant Consent forms, setting out the themes around which questions would be asked, and the type of information and documentation that may be requested. A template Participant Consent form is provided in Appendix D. Due to confidentiality concerns; all data capturing, analysis and reporting was done on an anonymous basis. Informants were advised that they could refuse to answer any question or provide any information requested, that participation in the project was on a voluntary basis and they could withdraw from the study at any time.

Confidentiality was ensured through withholding of names and contact details in written material and from outside parties. Respondents were informed that these details would only be divulged to university examiners for confirmation of interviews and other interactions claimed.

Permission was sought before recording of interviews and discussions and capturing or publication of photographs. The use of codes in computerized data analysis ensured confidentiality.

Chapter 4 -Mussel enterprise case studies in Saldanha Bay

This is the first chapter on findings of the study, and deals with the structure of the mussel aquaculture industry in South Africa, the self-sustainability of the ten mussel enterprise case studies selected, and the factors contributing to their self-sustainability or lack thereof.

This chapter, and the following four chapters, have been written in an article format, to facilitate ease of reading. Although ethical clearance and permissions were obtained beforehand, it became clear during the data collection stage that some enterprise informants were uncomfortable with sharing of sensitive information, even on an anonymous basis. Due to these sensitivities, the researcher compiled case study summaries on an anonymous basis, limited the number of case studies used for in-depth analysis, and does not intend to publish individual case studies or the findings of Chapter 4.

The findings of Chapter 4 were used to enrich the analysis and interpretation of the findings presented in Chapters 5, 6, 7 and 8.

4.1 Introduction

The South African mussel farming industry started in the 1980's with farming initiatives in Saldanha Bay, Knysna Lagoon and Port Elizabeth. The Mediterranean mussel (*Mytilus galloprovincialis*) is not indigenous, possibly having been introduced through ship traffic (Grant and Cherry, 1985) and subsequently spreading to the western and southern coasts. Development of the mussel industry focused on this species rather than on the indigenous black mussel (*Choromytilus meridionalis*) and brown mussel (*Perna perna*) due to its better growth rates and adaptability. Saldanha Bay became the focus for mussel aquaculture due to its sheltered bays, nutrient-rich water and good logistics infrastructure and services (Safriel and Bruton, 1984; Grant and Cherry, 1985; DAFF, 2017c).

By 2020, there were 23 mussel farmers with total allocated water space of 336 ha in the Saldanha Bay Aquaculture Development Zone (ADZ), and an estimated production of 6000 t (F. Endemann, personal communication). Much of the industry growth occurred after implementation of Operation Phakisa, with an almost 6-fold increase in the number of farmers between 2015 and 2020.

Due to the need for social and economic development of economic sectors, public and private funding was used to establish new or expand existing aquaculture farmers especially in the mussel farming industry. For the sustainable growth of the industry, it is important that

aquaculture enterprises become self-sustainable and able to fund their operations from sales of goods and services, without depending on external funding.

This study aimed to investigate selected mussel farming enterprises to understand the structure of the mussel industry, whether selected enterprises are self-sustainable, and the factors that contributed to their success or failure.

4.2 Materials and methods

4.2.1 Study Area

The study focused on the marine mussel aquaculture industry in South Africa. The study area was Saldanha Bay, on the West Coast of South Africa, and included three bivalve shellfish (mussel and oyster) farming areas totalling 460 ha. The survey population included 27 bivalve shellfish farming enterprises in the study area that were approached through the Bivalve Shellfish Farmers Association of South Africa (BSASA) and the Western Cape Provincial Department of Agriculture.

4.2.2 Data Collection

An empirical, phenomenological approach was followed. The study followed a multiple-case study approach, which is a scientific research method and can generate context-dependent knowledge. The original replication design required at least three case studies including a base study, a literal replication (predicting similar results) and a theoretical replication (predicting contrasting results), as described in the literature (Flyvbjerg, 2006; Yin, 2009; Remenyi *et al.*, 2010).

Semi-structured interviews were conducted with the owners or managers of bivalve shellfish farming enterprises selected as case studies. This was supplemented with analysis of available documentation. A qualitative approach was followed to conduct the research. Due to the implementation of COVID-19 restrictions on movement during 2020, when primary data collection commenced, interviews mostly took place via video-conferencing or cellular phone platforms. Interview questions were structured around the background and history of the enterprises, self-sustainability, and potential reasons for success or failure. This information was communicated before interviews as part of the Participant Consent forms.

4.2.3 Sampling Procedure

The sample included nine enterprises currently operating, and one that had ceased operations. Selection was mainly based on willingness to be involved in the study, and availability. The mix of enterprises included commercial and community-based/collective-type initiatives.

4.2.4 Data Analysis

Multiple-case study analysis consisted of summarising three stages. The researcher assessed whether enterprises were self-sustainable, based on primary data collected during interviews, and available secondary information. The characteristics of all case study enterprises were summarised to identify commonalities and differences, and to describe them in terms of the structure of the mussel aquaculture industry.

Four of the case studies were then selected to satisfy the replication design, and summarised for further analysis, comparison and identification of potential success factors or reasons for failure. Characteristics used for selection included perceived self-sustainability and type of ownership. These case studies were as follows:

a) Base study: Case study 1 (self-sustainable in 2020), vertically integrated with a private holding company, wholly owned by HDIs
b) Literal replication: Case study 2 (self-sustainable in 2020), wholly owned by a vertically integrated multinational holding company
c) Literal replication: Case study 3 (self-sustainable in 2020), partly owned by HDIs, vertically integrated with a multinational holding company
d) Theoretical replication: Case study 4 (not self-sustainable – ceased operations in 2006), wholly owned by HDIs.

4.3 Results and discussion

Case study respondents provided information, insights and opinions about the background and history of their enterprises, self-sustainability, and potential reasons for their success or failure.

4.3.1 Structure of the mussel farming industry

A summary of the structure of the marine mussel farming industry in 2020 is presented in Figure 4.1. The nine enterprise case studies still in existence, are marked in yellow. Seven (32%) farms (average farm size 29.3 ha) have access to 51% of the total 401 ha allocated to 22 enterprises listing mussel cultivation as a primary or secondary activity. These seven farms are all vertically integrated into holding companies with interests in fishing, aquaculture, food production and Fast-Moving Consumer Goods (FMCG). The other 16 farms (average farm size 12.3 ha) share 196 ha and are mostly privately owned small, micro, or medium enterprises (SMMEs). All the operational case study enterprises are categorised as SMMEs with commercial motives. Six had been in production since before 2015. The prevalence of vertical integration in the industry is similar to the mussel farming industry in New Zealand. According to Stimpson and Company (2007), as cited in (Stenton-Dozey *et al.*, 2021), consolidation happened especially with regard to processing and marketing, with many independent farms growing under contract to the larger processing firms. It is also similar to the mussel farming industry in Chile, where larger firms are mostly owned by companies and there are high levels of concentration in terms of production and product export (Gonzalez-Poblete *et al.*, 2018).

There are three processing facilities that process most of the mussels produced in Saldanha Bay. These are owned by three of the vertically integrated holding companies (I, II and IV), and have a combined raw material processing capacity of about 14 000 t p.a. Although mussel farmers compete for the same markets, mentoring of new farmers by established or experienced farmers has been ongoing since the 1990s. Farm A (Case study 2) was involved in mentoring and assisting Farm B (Case study 3), Farm G (Case study 1) and Case study 4.

Farm C acts as a "hub" to 11 of the new, small mussel farms owned by HDIs, through a formalised "mentorship model". This entails three-year supply and services agreements with the following objectives:

a) To provide a benchmark for best practice and managing costs
b) To provide expertise to new, inexperienced farmers
c) To provide a route-to-market

d) To provide access to high capital items including a processing factory and harvesting infrastructure.

Farm C benefits from these relationships through increased access to the quantity and quality of mussels needed for their processing facility, and to diversify markets. However, responses from some of the case study enterprises involved in the "mentorship model" indicated frustration with being dependent on outside companies, and their inability to service their own farms. Contract farming or out-grower schemes such as these agreements are recognized as a form of inclusive business model (IBM), or specific contractual relation or mechanism aiming to integrate poor people into value chains, as described in the literature (Kaminski *et al.*, 2020). Some of the farmers have indicated that they would like to be more involved in the value chain, and that this is not achieved to their satisfaction by the mentoring model (contract farming). To this end, some of the other IBMs described by Kaminski (micro-franchising, joint ventures, farmer-owned businesses such as cooperatives, public-private partnerships, and certification schemes) could be investigated to achieve increased inclusiveness and integration of new entrants in the value chain.

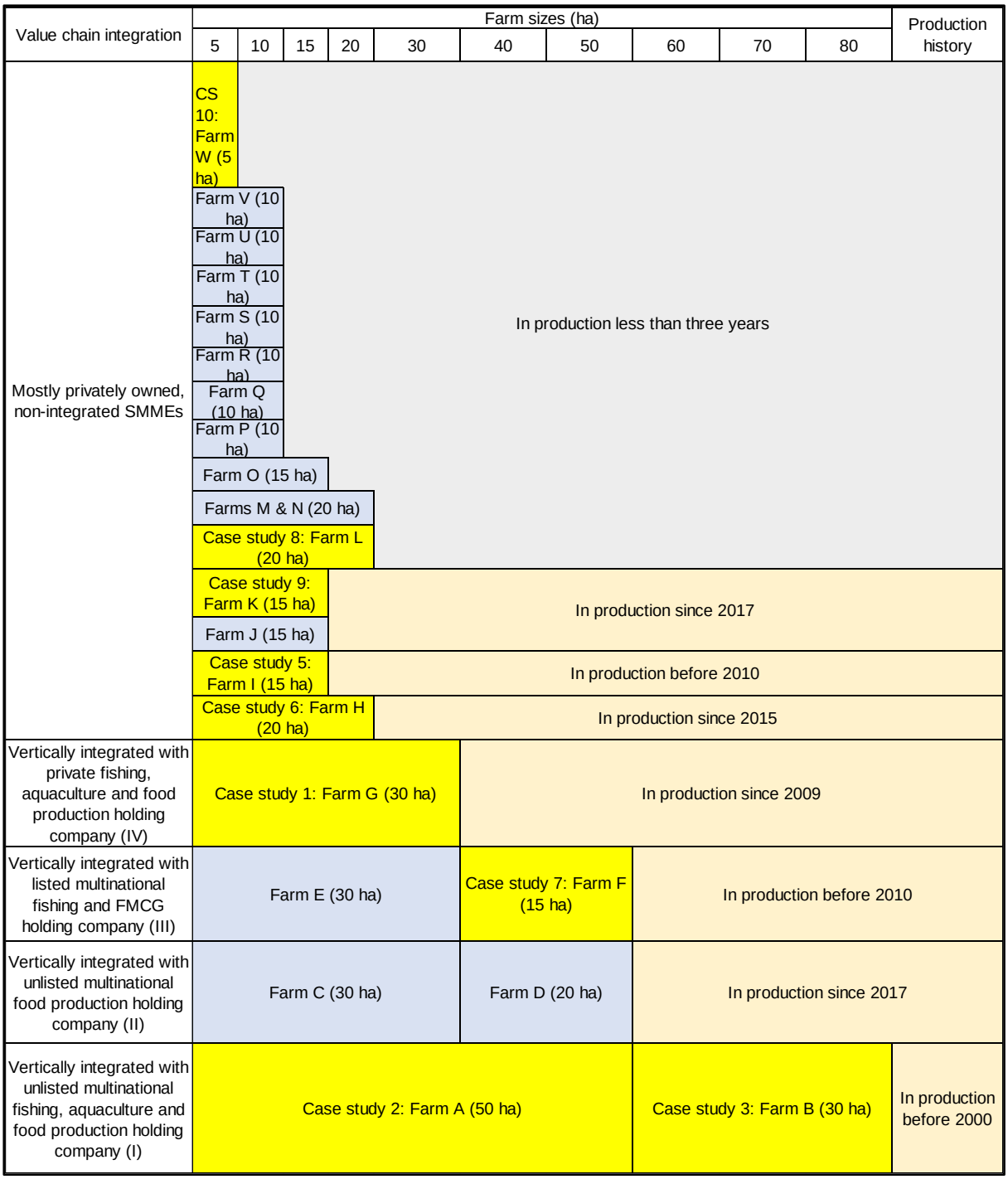

Figure 4.1: Profile of mussel aquaculture industry in Saldanha Bay in 2020

Sources: Diagram constructed by researcher using information provided by BSASA and case study respondents

The current structure of the marine mussel farming industry reflects the rapid expansion since 2015, from six farms with total annual production of 1 758 t (DAFF, 2016b), to 23 farms with estimated production of 6 000 t (F. Endemann, personal communication 2021). This introduced the risk of over-supply and reduced prices in the small local market. Those mussel farms

integrated with holding companies that own processing facilities, have an advantage over other farms in terms of product off-take into the commercial value chain.

4.3.2 Self-sustainability

The researcher attempted to obtain sufficient financial information (such as financial reports) from the ten enterprise informants to confirm whether the enterprises can be regarded as self-sustainable. Most informants declined to provide such documentation or information. Due to the small size of the industry, there is strong competition for the same markets, and potentially damaging consequences if sensitive information is abused. The researcher thus made subjective assessments of enterprise self-sustainability, based on informant self-assessment, limited financial information and readily available information such as the number of years the company was in operation. As set out in Table 4.1, five of the case studies were regarded as self-sustainable, one was not self-sustainable (closed), in one case it was not possible to make an assessment, and three were not yet self-sustainable.

The enterprise case studies regarded as self-sustainable (case studies 1, 2, 3, 5 and 6), had the following characteristics in common:

a) Farm sizes were 15 ha or bigger
b) Enterprises had been in production for at least five years
c) Enterprises were governed along commercial principles
d) Enterprises had strong leadership.

Three of the self-sustainable enterprises were vertically integrated with holding companies, and two were SMMEs with private ownership.

Those enterprises regarded as not yet self-sustainable (case studies 8, 9 and 10), had the following characteristics in common:

a) Farm sizes were 20 ha or less
b) Enterprises had been in production for less than five years
c) Enterprises were non-integrated SMMEs with private ownership.

Table 4.1: Assessment of self-sustainability of case studies

Case Studies	Self-sustainable
Case studies 1, 2, 3, 5, 6	Yes
Case study 4	No
Case study 7	Not sure
Case studies 8, 9, 10	Not yet

4.3.3 Characteristics of ten case study enterprises

The key characteristics of the ten case study enterprises are summarised in Table 4.2. Only one enterprise (Case study 4) had closed operations. However, many of the mussel farmers involved in that initiative, continued their aquaculture activities by forming new companies, or getting absorbed into other initiatives that are still operational (including Case studies 1 and 7). Two enterprises farmed with mussels and oysters. The nine enterprises still in existence, support about 337 jobs including permanent and seasonal jobs, on-farm and in processing facilities.

The backgrounds of the enterprises are summarised as follows:

a) Sizes of enterprise currently in operation ranged from micro (3), small (5) to medium (1)
b) Enterprise ages ranged from 3 years to 30 years (although some enterprises went through structure and/or name changes through their lifetimes)
c) Nine enterprises had received public funding.

Table 4.2: Description of case study enterprises

Case study number	Enterprise Size	Aquaculture activities	Number of years in existence	Number of years in production	Number of employees	Sources of funding
1	Small	Mussel production	11	11	23	CASP; own; loan, non-financial support
2	Medium	Mussel production and processing	30	30	200	Holding company loan & investment, ADEP
3	Small	Mussel production	8	8	17	CASP; NEF; private funding; non-financial support

Case study number	Enterprise Size	Aquaculture activities	Number of years in existence	Number of years in production	Number of employees	Sources of funding
4	Assumed small	Mussel production	No longer operational	6 (estimated)	33 (estimated)	Land Bank
5	Small	Oyster, and mussel production; direct sales to wholesalers & retailers	23	11	18	Own; IDC (SPII); CASP; (ADEP)
6	Small	Mussel and oyster production and supply	8	5	22 permanent, 35 seasonal	Own funding; Matching govt grant; CASP grant
7	Small	Mussel production	Not provided	Not provided	10	Private - from holding company
8	Micro	Planning mussel production	4	Not yet	1	Public grant
9	Micro	Mussel production	5	2	11	CASP; Own;
10	Micro	Mussel production	3	Not yet	0	CASP; Own; Services support from Processor

The farming activities of case study enterprises are described in Table 4.3, and are summarised as follows:

a) Farm sizes ranged from 10 ha to 50 ha of sea water space; Although the informant for Case study 4 indicated that they utilised 25 ha, other sources suggest they had access to 50 ha.
b) Two enterprises had received approval and funding for mussel farming but had not yet started production.
c) One enterprise had access to its own processing facility, and three were subsidiaries of holding companies that owned a processing facility.
d) Three enterprises had service and uptake agreements with a local processor ("mentorship model").
e) One enterprise had recently bought processing infrastructure and one was in the process of negotiating a processing agreement with a local processor.

Table 4.3: Summary of case study enterprise farming activities in Saldanha Bay

Case study #	Farm Size (ha)	Technology	Full Production capacity (t p.a.)	Current production (t p.a.)	Service/harvest/ production/ uptake agreement
1	30	HDPE rafts	1400	600-1000	Processing agreement with holding company
2	50	HDPE rafts	3500	800-1000	Own processing
3	30	HDPE rafts	900	600-1000	Processing agreement with holding company
4	25	Wooden rafts	1000	0	Agreement with commercial partner, and own sales
5	15	Long lines; raft	Oysters 1 million (90 t); mussels 200 t	Mussels 9 long lines; Oyster 12 long lines; 1 raft	Bought infrastructure from existing processor; paying off as harvests are processed
6	20	Long lines (mussels); baskets (oysters)	Mussels 800 t; oysters 1 million pa	Full capacity	Processing agreement (not signed)
7	15	Long lines	Not provided	250-300	Uptake agreement through holding company; management agreement with aquaculture company
8	15	Long lines	1800	0	Service agreement (harvesting); uptake agreement (local processor)
9	15	Long lines	1000	11 lines (360 t p.a.)	Service agreement (harvesting, share costs & crew); uptake agreement (local processor)
10	10	Long lines	1000	0	Service agreement (harvesting, processing); uptake agreement (local processor)

4.3.4 Description of selected case studies

Information about the four case study enterprises selected for more in-depth analysis was collected mainly through interviews with informants, and supplemented with readily available information such as reports, publications, websites, promotional material, and media sources. Due to the sensitivities and paucity of information, the researcher prepared brief summaries of these case study enterprises on an anonymous basis.

Case study 1

Information about this enterprise was obtained mostly from two informants, and confidential records and reports at the CSIR that the researcher accessed with permission from the owners.

This enterprise started in 2003 when one of the project beneficiaries from an empowerment project (Case study 4), decided to break away and set up a separate enterprise. The company entered into an agreement with an established mussel farming enterprise (Case study 2) whereby they rented sea water space, obtained services such as transportation and testing, and supplied their mussel produce to the processing facility that were integrated with Case study 2. They received mentorship and technical assistance from one of the most experienced mussel farming experts in the country.

The enterprise went through a series of growth and contraction periods between 2003 and 2013. Between 2009 and 2011 they obtained public funding for two HDPE rafts, and a lease for 5 ha sea water space. Unfortunately, they could not get to the economies of scale needed to become self-sustainable. In 2013 the enterprise entered an equity partnership with an investor, who implemented a turnaround strategy that helped the company become self-sustainable. By 2018, this was the largest 100% black-owned mussel farm in South Africa, with access to the full value chain through shareholding in a seafood processing facility. They reached break-even point before they had fifteen rafts and regarded themselves as self-sustainable. They could pay their own overheads, generate profit, and had built enough resources to carry the business for six months in case of crisis. At that stage, the farm comprised of 18 mussel rafts in 30 ha of water space leased from the TNPA. Mussel species include the Mediterranean mussel *Mytilus galloprovincialis* and the indigenous black mussel *Choromytilus meridionalis*. The maximum capacity of the farm was 35 rafts from which about 1 400 tonnes of mussels could be harvested per annum. The enterprise still used a servicing barge, and manual labour to lift out, de-clump and re-hang the mussel lines (illustrated in Figure 4.2).

Figure 4.2: Case study 1 - mussel raft, servicing barge, and harvesting and reseeding equipment and processes

The company's journey from start-up to a self-sustainable enterprise is marked by several key events (described in Figure 4.3) that helped it to overcome specific challenges and take the next step in its development.

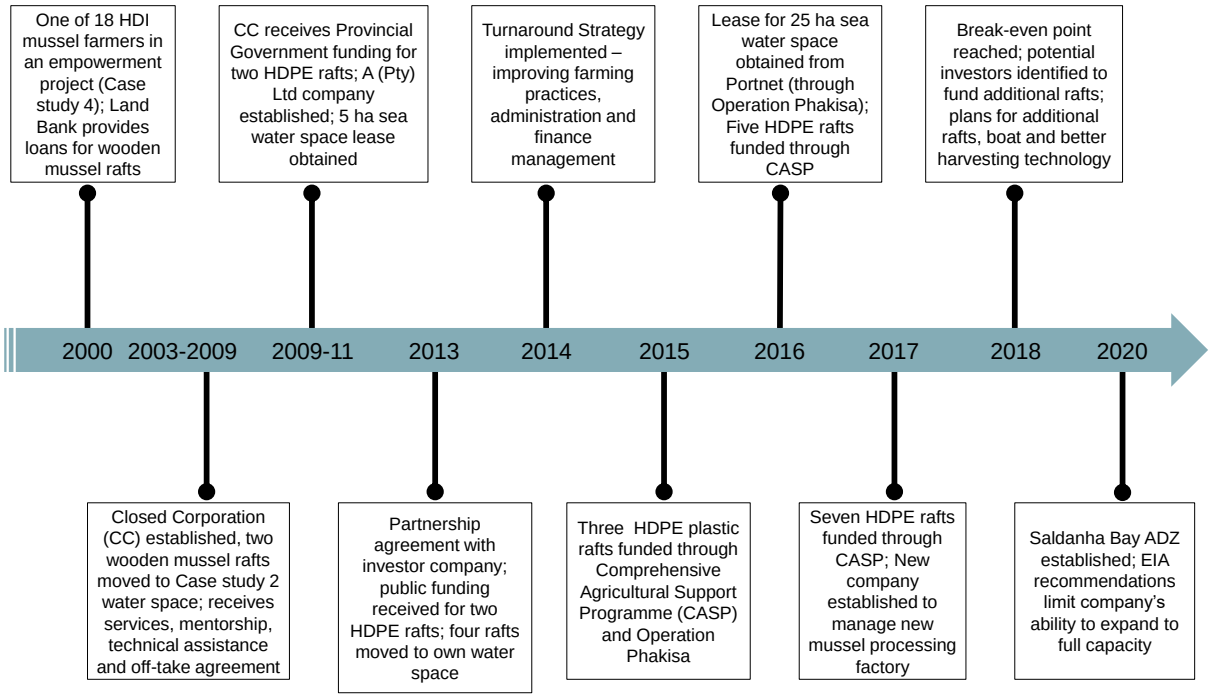

Figure 4.3: Timeline for development of Case Study 1

In 2018, the owners planned to obtain a boat with a crane such as those used by some of the other mussel farmers, which would make the completion of these tasks much faster and more efficient. The company also decided to start obtaining funds through other means than government grants and identified potential investors to fund 14 additional rafts. Eventually, they aimed to fill the available water space to full capacity, yielding about 1 400 t p.a. They also planned to increase marketing efforts and create awareness of their mussels as a quality South African product, increase their market share of locally produced mussels to more than 10%, and contribute to import substitution in the long run.

However, environmental authorisation was granted for the establishment of an Aquaculture Development Zone (ADZ) in Saldanha Bay in 2018. This included all aquaculture farms in the Bay. Recommendations from the Environmental Impact Assessment (EIA) for the ADZ included the reduction of the total area for aquaculture to 884 ha, and a phased approach to expansion of bivalve shellfish production activities to a maximum of 27 600 t p.a. (DAFF, 2017e). These conditions meant that existing farmers (including Case study 1) were unable to implement their expansion plans in the time frames they planned.

The potential reasons for the company's ability to become self-sustainable included the following:

a) Mentorship by an experienced mussel farmer who provided technical advice, ropes, seed, and assistance with their application for the first 5 ha sea water space
b) Faith and perseverance of the shareholders, in the face of multiple challenges
c) Trust between the shareholders
d) Financial investment from an equity partner that helped the struggling enterprise to stay in business
e) Partnership with the right investor who shared their religious beliefs and values
f) Implementation of a turnaround strategy that improved technical, financial, and administrative management
g) Having access to its own processing facility that uses Good Manufacturing Practices (GMP) and Hazard analysis and critical control point (HACCP) principles, and could process mussels, fish, and abalone.
h) Obtaining a lease for 25 ha additional sea water space in 2016
i) Obtaining funding for 15 more rafts between 2015 and 2017
j) Not paying dividends until the company became profitable
k) Philosophy of helping others, helping each other, and mentoring others.

l) The enterprise is managed on a professional, commercial, and profit basis.

Case study 2

Information about this enterprise was obtained from an interview with the informant, and publicly available secondary information. The timeline for development of Case study 2 is illustrated in Figure 4.2. The enterprise started as a research project in Saldanha Bay, which developed into the first mussel farm by 1987. The farm was purchased by an unlisted multinational fishing, aquaculture and food production investment holding company around 1991. By the late 1990s, the holding company had set up a processing facility in Velddrift to process the product. Around 2000, there was a management buyout of the farming operation. One of the conditions of sale was to set up an empowerment component, which led to the establishment and development of Case study 3. In addition, they were involved in assisting the first empowerment mussel farm (Case study 4) with marketing administration, and they assisted Case study 1 with technical support, mentoring and services.

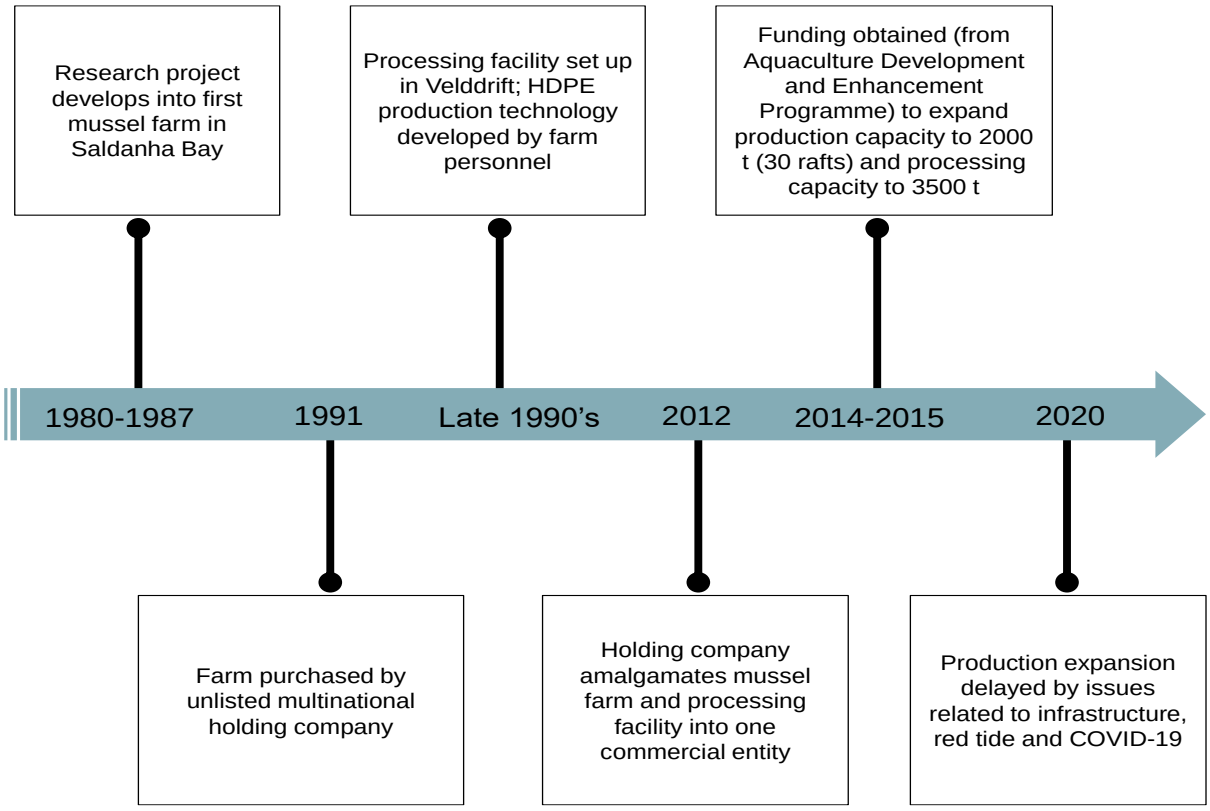

Figure 4.4: Timeline for development of Case study 2

The management team of Case study 2 was responsible for the development of a new type of floating mussel raft made from high density polyethylene (HDPE). These were more durable and could accommodate more mussel ropes. Each mussel raft can be serviced by a moving barge or boat. Figure 4.5 illustrates the raft, boat with crane, and servicing barge with mussel harvesting and processing infrastructure. This became the production technology of choice for many years, with longline production becoming more popular after implementation of Operation Phakisa.

Figure 4.5: Case study 2 -boat with crane, HDPE raft and harvesting barge

In 2012, the holding company joined the processing facility and mussel farm into one commercial entity. This enterprise (Case study 2) is 100% owned by the holding company and has access to 50 ha sea water space (the biggest mussel farm in Saldanha Bay). The full production capacity is 2000 t and processing capacity is 3500 t, but production expansion was delayed by issues around getting the infrastructure installed, red tide and the COVID-19 pandemic.

As Case study 2 is wholly owned by a holding company, profits, and losses of all portfolios in the group are combined. This means that the enterprise is operationally self-sustainable, but in some years the retained/accumulated earnings could be negative. During these times, support

from the holding company ensures that the enterprise continues operating until its retained earnings become positive again.

The potential reasons for the success of Case study 2 can be summarised as follows:

a) This is the oldest mussel farm in South Africa, which was developed from a research project into a commercial farm over three decades
b) The management team refined and optimized the mussel farming processes and production technology
c) Through the holding company, they had access to the industry experience, product development abilities and facilities, and markets needed to develop the mussel value chain
d) The enterprise is wholly owned by an investment holding company, which combined the farming and processing activities into one entity
e) The enterprise has been instrumental in developing other mussel farms, especially empowerment projects and enterprises owned by HDIs
f) Through its holding company, the enterprise is ensured of access to the entire value chain including processing facilities, marketing, and distribution of its products to end consumers
g) Being a subsidiary of a holding company ensures that the enterprise has access to financial and non-financial support during difficult times, such as the COVID-19 pandemic.
h) The enterprise is managed on a professional, commercial, and profit basis.

Case study 3

Information about this enterprise was obtained from the interview with the informant, publications, and information available in the public domain. It is widely regarded as a successful empowerment project, and has been described in several studies (Botes, Thompson and Louw, 2006b; Hara, Njokweni and Semoli, 2017), and media articles (Peters, 2007; Ferreira, 2016; FINSA reporter, 2019). The enterprise is a private (for-profit) commercial company with black majority shareholding. It originated from a mussel farming empowerment project with six individuals, established as a partnership by a commercial mussel enterprise in Saldanha Bay in 2000. After years of technical, financial, and business mentoring of the individuals, the company was established as a commercial undertaking. The enterprise was accountable to its shareholders which included the original six workers, a Development

Finance Institute (DFI), and the commercial partner. A mixture of government and donor grants, and private loans were utilised to build the enterprise.

The timeline for development of Case study 3 is illustrated in Figure 4.6. Six individuals (HDIs) each received a raft in 2000, and they started farming mussels for their own account. They established a (Pty) Ltd company in 2003 and obtained loans for additional rafts from a commercial bank. Between 2004 and 2011, they received mentorship and training from the commercial farm. In 2011, they changed the company structure to a Closed Corporation, to become eligible for public funding from the National Empowerment Fund (NEF) for further expansion. In 2012, the CC became the major shareholder in a new (Pty) Ltd company, with other shareholders including the NEF, the commercial company that originally set up the project, a workers trust and the managing director. Funding was used for additional infrastructure such as rafts and boats, and the company obtained a 30-ha sea water lease from TNPA. The new company reached break-even within a year and was profitable by 2020.

Case study 3 produces 600-1000 t p.a. and sell their mussels to two processing facilities. They employ 17 people on the farm, including the MD and original six shareholders. The farm also supports about 150 jobs in the processing facilities. The company is vertically integrated into an unlisted, multinational fishing, aquaculture, and food production company through the shareholding of the commercial company that originally established the empowerment project.

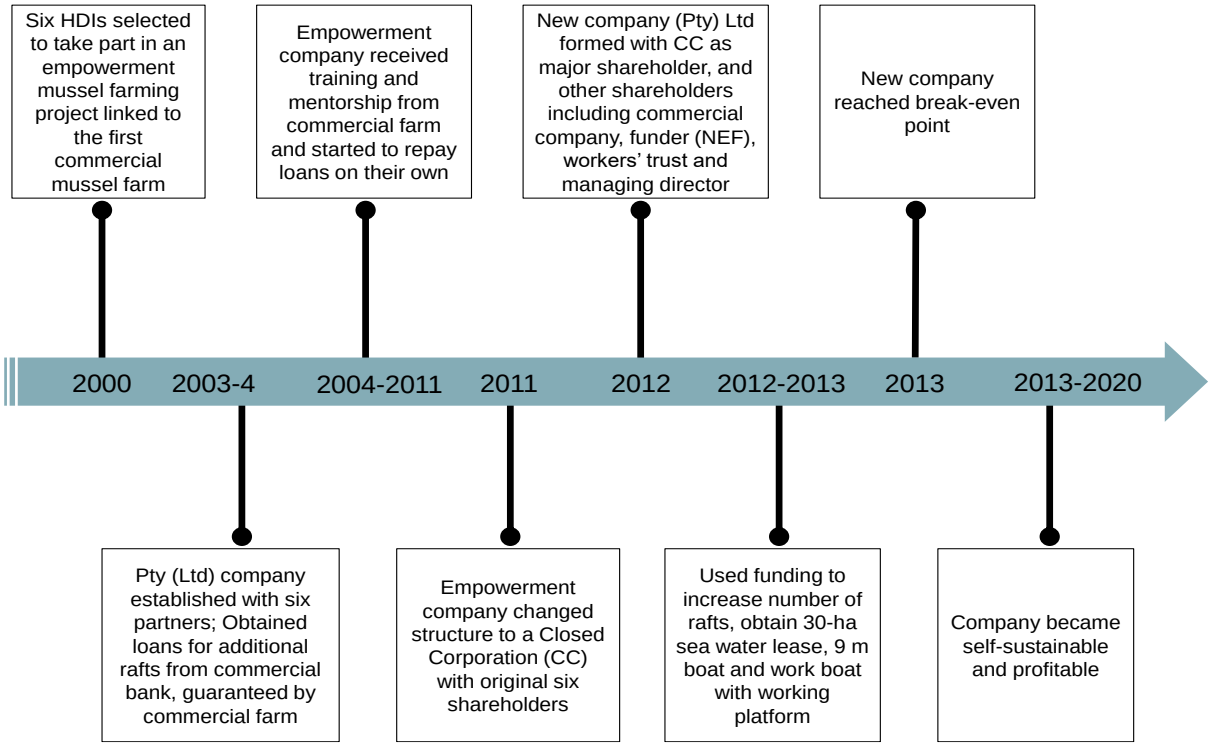

Figure 4.6: Timeline for development of Case study 3

The potential reasons for the company's success can be summarised as follows:

a) Continuous mentorship and training provided by the commercial company that set up the original empowerment project
b) Willingness of the original six beneficiaries to work together and learn the required skills
c) Partnerships with the right organisations and individuals that could provide financial and non-financial support, and manage the company competently
d) Focusing on commercial aquaculture with a profit motive
e) Production processes are managed well to ensure harvest takes place seven months after reseeding, and harvests take place throughout the year
f) Preparing and budgeting for times when harvesting is disrupted (e.g., during red tide and adverse weather conditions)
g) Postponing payment of dividends until loans were paid back
h) Management of the company by an individual with the required experience and expertise
i) Setting up the enterprise as a commercial undertaking, accountable to the rest of the shareholders
j) Structuring the funding in a way that built accountability and independence from grant funding from the start.
k) The enterprise is managed on a professional, commercial, and profit basis.

Case study 4

Most information about Case study 4 was obtained from one informant who was involved in the company in the beginning stages. Efforts to engage with other ex-beneficiaries revealed persisting sensitivities and mistrust. Although this summary mostly reflects the perspectives of one ex-beneficiary, information obtained through available secondary sources was used to provide a more complete understanding of the project (Brierly, 2003; Botes, Thompson and Louw, 2006b). The project started with a public participation and awareness process to identify prospective growers for a pilot and expanded after a few years into a company with 18 beneficiaries. It was driven by a non-governmental organisation and a corporate fishing company. The fishing company also farmed mussels and provided the rafts (on a cost recovery basis), extension services, guaranteed markets, inputs on account, and other logistical assistance.

As illustrated in Figure 4.7, the origin of the enterprise was an empowerment mussel farming project in Saldanha Bay. In 1997, a non-governmental organization (NGO) implemented an 18-month pilot project based on the principle of "one raft per family", to promote small-scale productive enterprises in the mussel farming industry. This led to a decision by 18 farmers involved in a farmers' association at the time, to become "aqua farmers". In 2002, a Section 21 (Not for profit) company was established with 18 HDI mussel farmers as beneficiaries. The Land Bank provided loans of R80 000 per farmer for the establishment of wooden rafts, from which lines of mussels were suspended in sea water. The company leased 25 ha sea water space from Portnet (currently known as the Transnet National Ports Authority).

The rafts (as illustrated in Figure 4.8) rotted easily, were not able to withstand inclement weather and were prone to breaking. Mussels were harvested twice a year, and one raft generated about R50 000 p.a. from 28 t. The beneficiaries struggled to pay back their loans. In the beginning they had no formal markets and sold mussels door-to-door. This changed when an existing commercial mussel farming enterprise assisted them with the marketing process. The company had no servicing barge or platform, but later obtained a boat and de-clumping machine. They also rented a small factory from the Department of Public Works, where harvested mussels were cleaned and packaged for sale.

Due to internal disagreements and mistrust, the company split around 2003, with some farmers and the project manager leaving. The remaining farmers continued farming for about two more years. The company's income was not enough to cover expenses such as the sea water lease, diesel, loan repayments or salaries. The company did not apply for the required mariculture rights. In addition, the farmers applied for but did not receive mussel farming permits. This led to the department responsible for marine and coastal management accusing farmers of "poaching" (farming without permits), which led to the closure of the company.

The positive outcome of this initiative is that it gave rise to at least two other mussel farming enterprises. One of the beneficiaries created a private mussel farming enterprise that is still in existence (Case study 1), and a group of the other shareholders sold their stake to a different enterprise that is still involved in mussel farming (Case study 7).

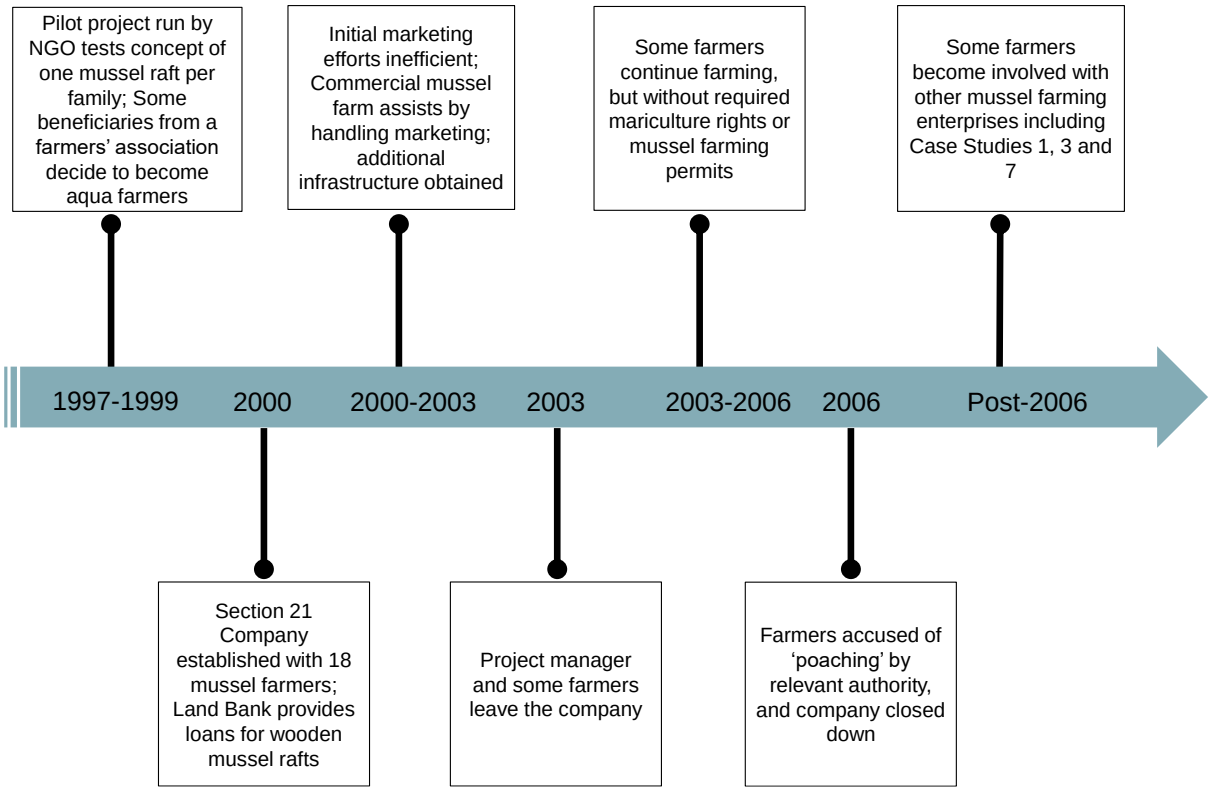

Figure 4.7: Timeline for development of Case study 4

Figure 4.8: Case study 4 – wooden rafts used for mussel production

This enterprise was one of the first aquaculture agribusinesses in South Africa owned by HDIs. Some of the main reasons cited for its failure include:

a) Lack of requisite skills and knowledge needed by beneficiaries and implementing agent
b) Strained relationships between farmers, project manager and implementing agent
c) Accusations of withholding of information or disclosure of decisions
d) Distrust and in-house fighting
e) Failure to obtain mariculture rights and farming permits
f) Failure to generate enough income to cover expenses
g) Lack of capital
h) Lack of business support mechanisms
i) The production technology was not optimal
j) The enterprise had a social rather than commercial focus and was set up as a Not-for Profit company.

4.3.5 Summary

The assessment of ten case study enterprises and further analysis of four selected case studies highlighted common and enterprise specific factors that contributed to their self-sustainability, and common reasons for lack of self-sustainability or failure. These are set out in Figure 4.9.

Case study 1 (base study) provided a good example of a self-sustainable enterprise, and success factors. Results from Case studies 2 and 3 (literal replications) yielded similar results as predicted and confirmed most of the success factors identified. Results from Case study 4 (theoretical replication) yielded the contrasting results expected.

Some of the most important success factors include focus on commercial and profit principles, good management and leadership skills, and access to finance from the right partners. Important reasons for failure include a focus on social rather than commercial principles, inadequate management and leadership skills, and lack of access to finance.

Case studies 1, 3 and 4 started as empowerment projects with HDI ownership. However, Case studies 1 and 3 became self-sustainable, while Case study 4 failed. The main reasons for self-sustainability seem to be the focus on commercial and profit principles and having good leadership and management. These insights are critical for the future development of new or existing aquaculture enterprises.

Common success factors	Enterprise specific success factors	Common reasons for failure
• Enterprise governed and managed on professional, commercial and profit principles • Having the required technical, management and other skills • Strong enterprise leadership • Financial investment from supportive partners • Having access to processing, distribution and marketing systems and facilities • Planning and saving for crisis periods • Minimum farm size of 15 ha • Minimum time in production five years	• Mentorship, training and support by experienced commercial company • Vertical integration with holding company • Trust between shareholders, and willingness to work together • Postponing of dividend payments until debts are paid or company is profitable • Faith and perseverance when faced with challenges • Continuous research, development, and innovation • Philosophy of mentoring and supporting new entrants in the industry	• Enterprise governed and managed on social rather than commercial principles • Lack of technical and business skills and experience • Strained relationships between beneficiaries, management, and stakeholders • Distrust and fighting amongst beneficiaries • Lack of access to capital and business support mechanisms • Failure to meet regulatory requirements • Sub-optimal production technology

Figure 4.9: Case study enterprise success factors and reasons for failure

4.4 Conclusions and recommendations

The marine mussel aquaculture industry provided a good case study for understanding the issues facing aquaculture in the country. The industry developed over more than three decades, and the industry value chain and structure are well developed and commercialized. Consolidation and vertical integration are prominent features of the industry.

Processing facilities provide a ready market for new entrants, although new farmers would like to become more involved in the value chain. Different forms of inclusive business models may need to be considered in future, to ensure that new entrants are integrated in all aspects of the value chain.

The most common success factors for mussel aquaculture enterprises include a focus on commercial and profit principles, good leadership and management, access to finance, economies of scale, and the perseverance to develop enterprises over a long period of time. As expected, enterprises typically fail when these success factors are not in place. Of the three enterprises owned or started by HDIs, the only one that failed was the community-based/collective type enterprise, that had more social than commercial motives. Other important success factors include the willingness to postpone dividend payments until debts were settled or the enterprise was profitable, and mentorship by more experienced companies.

These insights should be used to develop support mechanisms that emphasize the development of characteristics that helped enterprises become self-sustainable. Such mechanisms should build on the culture of mentorship and skills transfer from experienced mussel farmers to new entrants, that has been a feature of the industry from the beginning.

Chapter 5 - The impacts of stakeholders in aquaculture enterprise development

This chapter, and the following three chapters, have been written in the format of articles for publication, for ease of reading and to make it easier for the publication of papers.

This chapter addresses the first research objective, which was to determine the motivations, contexts, key drivers, and impacts of the main stakeholders in aquaculture enterprise development in South Africa.

This chapter describes the findings of the investigation of how key aquaculture sector stakeholders, the institutional framework in which they operate, and the support systems they are responsible for, impact on the development and self-sustainability of aquaculture enterprises in South Africa. It sets out the results from interviews with informants for ten enterprise case studies of bivalve shellfish producers, and nine role player representatives.

Assessing the impacts of stakeholders in aquaculture enterprise development in South Africa

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Abstract. The enabling environment for the South African aquaculture sector has been improved through interventions such as policy development and investment programmes. Due to socio-economic pressures, investment of public funding comes with expectations for job creation, transformation, and empowerment. This study investigated the impacts of key aquaculture sector stakeholders, the institutional framework, and support systems on the sector and aquaculture enterprises. The study was conducted in the Western Cape, South Africa, and a multiple-case study approach was followed. Semi-structured interviews were conducted with the owners or managers of ten aquaculture enterprises in the marine bivalve shellfish farming industry in Saldanha Bay, and with nine representatives of role players in the aquaculture, agriculture, or enterprise development sectors. Government was recognised as the most important stakeholder. Key stakeholder impacts include a socio-economic approach to enterprise development, promotion of community-based or collective ventures, and different stakeholder mandates. Institutional framework challenges include the lack of aquaculture specific legislation, and complex application processes for rights, permits, leases and financial support. Support system challenges include insufficient access to appropriate support, communication and market development, and inadequate skills development. The paper argues that although the enabling environment for the sector has been improved, there is insufficient focus on interventions that could assist enterprises in becoming financially self-sustainable. Proposed interventions include the resourcing of aquaculture industry associations, development of a focused aquaculture enterprise and supplier development programme,

streamlining of application processes, and development of aquaculture specific legislation. These interventions could assist aquaculture enterprises in becoming financially self-sustainable, further improve the enabling environment for the sector and make growth and development targets more achievable.

Key words: Aquaculture, enabling environment, key stakeholders, impact, institutional framework, support systems

5.1 Introduction

South Africa is one of the most unequal societies globally, with low economic growth, high poverty and high unemployment levels. The development and support of small businesses is an important tool for addressing these challenges. This is reflected in policy instruments such as the National Small Enterprise Act No. 102 of 1996, as amended, and the establishment of a Small Enterprise Development Agency (Seda). In 2016, there were an estimated 2.2 million small enterprises in South Africa, supporting more than 8.5 million jobs and contributing 46% to Gross Domestic Product (GDP) (DSBD, 2017). However, it is known that small businesses in South Africa struggle to maintain sustainability, and have a high business discontinuation rate (Herrington and Kew, 2018).

Aquaculture development could also be a contributor for addressing socio-economic challenges such as economic growth, wealth creation and job creation. The growth and development of the sector and the success of individual enterprises depend on a supportive enabling environment, that should be provided by government. Over the last few decades, several government initiatives were implemented to improve the environment for aquaculture growth. These include but are not limited to the Aquaculture Benchmarking Surveys in 2006 and 2009 (Botes, Thompson and Louw, 2006a; Britz, Lee and Botes, 2009), the National Aquaculture Strategic Framework (NASF) (DAFF, 2012a), the National Aquaculture Policy Framework (NAPF) (DAFF, 2013c), and an aquaculture development programme called Operation Phakisa: Aquaculture Workstream (Operation Phakisa, 2014). In 2015, there were 189 freshwater and marine aquaculture farms in South Africa, with annual production of 5418 tonnes (valued at USD 52.3 million), and supporting 3826 jobs (DAFF, 2017a). By 2018, this had grown to 229 farms with annual production of 6365.8 tonnes (valued at USD 84.2 million), supporting about 6500 jobs across the aquaculture value chain (DEFF, 2021a).

Sector development initiatives have resulted in increases in private and public investment, the number of farms, production and jobs in the aquaculture sector (DAFF, 2018b). The investment of public funding into aquaculture brought with it expectations of addressing socio-economic challenges such as contribution to national food security, wealth and job creation, contribution to fish supply, increased livelihood opportunities and broadening participation by disadvantaged groups (DAFF, 2012a, 2013c; Olivier, Heinecken and Jackson, 2013). Investments were made into enterprises with a commercial focus, and into enterprises and projects with a socio-economic focus, in various sub-sectors including mussels, trout, catfish, oyster and dusky cob (Brierly, 2003; Rouhani and Britz, 2004b; Botes, Thompson and Louw,

2006b; DAFF, 2017a; Hara, Njokweni and Semoli, 2017). Although some of these initiatives have been hailed as success stories, many have struggled to become self-sustainable (able to sustain its own operations from income from the sale of its goods and services, without continued external financial support). The relative success of commercially oriented aquaculture projects, as opposed to the problems experienced by projects with a socio-economic focus, is well known, as described in the literature (Rouhani and Britz, 2004b; Hara, Njokweni and Semoli, 2017). These examples highlight the fact that key stakeholders, especially government, do not operate in a vacuum and their contexts and mandates impact on sector and enterprise development in specific ways.

Although the Department of Forestry, Fisheries, and the Environment (DFFE) is the lead agency for aquaculture development, there are many inter-governmental stakeholders involved. The different mandates and motivations from various governmental and other stakeholders could have both positive and negative impacts on the development of the sector in general, and aquaculture enterprises specifically.

The main purpose of this paper was to investigate the impacts of key aquaculture sector stakeholders on the development and self-sustainability of aquaculture enterprises in South Africa. This included the institutional framework in which they operate, and the support systems they are responsible for.

5.2 Materials and methods

An enabling environment for the sustainable growth of the aquaculture sector should comprise economic, legal, social and physical components to ensure 'fair access to resources, mechanisms for conflict resolution and access to information, credit and markets' (Shehadeh, 1999). The terms stakeholder or role player describe individuals or groups who hold some interest or stake in a resource. The interest of stakeholders in a fishery can be either directly (because they are involved in exploitation of a resource) or indirectly (because they are concerned with managing the resource or depend at least partially on wealth or business generated by the resource) (Townsley, 1998).

The Food and Agriculture Organization (FAO) definition of an institutional framework for fishery governance is "the sets of principles, rules, conditions, agreements, processes, mechanisms, and organizations used for the development and management of fisheries. Its functioning and outcome are influenced by the set of ideas, values, beliefs and assumptions under which the people concerned operate" (Manning, 2016). In this study, support systems

for aquaculture development are taken to include research and technology support, extension services, enterprise development support, industry associations, education and training, access to finance, access to markets and other support systems.

Commercial aquaculture is described as "the rearing of aquatic organisms with a profit motive, is done mainly by the private sector and does not need direct assistance from donor or government sources. It also has a business orientation and uses labour instead of relying on family members" (Percy and Hishamunda, 2001). In contrast, community-based aquaculture (CBA) is described as "situations whereby communities are empowered through skills, financial investment and the legal authority to practice aquaculture". The rationale for CBA is to "increase fish production for local consumption (and thus contribute towards protein security, create local employment, generate income and reduce poverty)" (Hara, Njokweni and Semoli, 2017).

A co-operative is a type of collective business system. The South African Co-operatives Act (No. 14 of 2005) defines a co-operative as "an autonomous association of persons united voluntarily to meet their common economic, social or cultural needs and aspirations through a jointly owned and democratically controlled enterprise organised and operated on co-operative principles". This study therefore differentiates between commercial aquaculture ventures with profit motives and community based/collective aquaculture ventures with social motives.

The study was mainly based on semi-structured interviews with marine mussel producers and role players in the sector. The mussel farming industry provided a good case study of these impacts, as it is the largest contributor to aquaculture production in South Africa (DAFF, 2017a).

5.2.1 Study Area

The study focused on the marine mussel aquaculture industry in South Africa. The study area was Saldanha Bay, on the West Coast of South Africa, and included three bivalve shellfish (mussel and oyster) farming areas totalling 460 ha. The survey population included 27 bivalve shellfish farming enterprises in the study area that were approached through the Bivalve Shellfish Farmers Association of South Africa (BSASA) and the Western Cape Provincial Department of Agriculture.

The survey population also included role players in South Africa with responsibility or experience in aquaculture, agriculture, or enterprise development, as set out in Table 5.1. The role player categories included two national and provincial government departments with

responsibility for aquaculture, three aquaculture associations, two universities and two individuals with experience or expertise in aquaculture farming and enterprise development. These role players were therefore able to provide insights on aquaculture and enterprise development from Southern African, government, industry, research, education, and practitioner perspectives.

Table 5.1: Role player categories with their associated spheres of influence

Role Player Category	Sphere of influence or representation	Number of persons interviewed
National and provincial Government departments with responsibility for aquaculture or agriculture	1. National aquaculture sector (freshwater and marine) 2. Western Cape provincial aquaculture sector (freshwater and marine)	2
Aquaculture associations	1. Aquaculture stakeholders in Southern Africa 2. Seven freshwater and marine aquaculture producer associations in South Africa 3. All bivalve shellfish producers in South Africa	3
Universities	1. Agricultural Sciences including Aquaculture research, training, and development; Commercial aquaculture development expertise 2. Social dimensions of the fishing, aquaculture, and coastal sectors	2
Individual - Experienced aquaculture farming mentor	South African commercial aquaculture and development expert with practical experience in mentoring of emerging aquaculture farmers	1
Individual - Enterprise development expert	Expert in enterprise development, technology transfer, business incubation and strategy/programme design and implementation in South Africa	1
Total		**9**

5.2.2 Data Collection

An empirical, phenomenological approach was followed, as described in the literature (Remenyi *et al.*, 2010). A case study approach was selected as a suitable method, as it is a scientific research method in its own right and can generate context-dependent knowledge as described by several researchers (Flyvbjerg, 2006; Yin, 2009; Remenyi *et al.*, 2010). Semi-structured interviews were conducted with the owners or managers of bivalve shellfish farming

enterprises selected as case studies, and with the representatives of role players selected. A qualitative approach was followed to conduct the research. Due to the implementation of COVID-19 restrictions on movement during 2020, when primary data collection commenced, interviews mostly took place via video-conferencing or cellular phone platforms. Interview questions were structured around the themes of impacts of key aquaculture sector stakeholders, the institutional framework, and support systems. This information was communicated before interviews as part of the Participant Consent forms.

5.2.3 Sampling Procedure

The sample included nine enterprises currently operating, and one that had ceased operations. Selection was mainly based on willingness to be involved in the study. The mix of enterprises included commercial and community-based/collective initiatives. The role player sample included nine representatives from national and provincial government departments with responsibility for aquaculture, aquaculture associations, and universities, and individuals with experience or expertise in aquaculture farming and enterprise development. Selection was based on willingness to be involved in the study, and availability.

5.2.4 Data Analysis

Multiple-case study analysis consisted of two stages. Firstly, within-case analysis was conducted, where the qualitative data was analysed by identifying and copying responses from each individual transcription that were relevant to each of the questions asked during the interview. These responses were further analysed to create themes and sub-themes (or codes). MS Excel was used for the second stage of analysis (cross-case analysis) where grouping of themes and sub-themes as well as summarising of codes was completed.

5.3 Results and discussion

Respondents were asked for their opinions and insights regarding key aquaculture sector stakeholders, their contexts and impacts, and the impacts of the institutional framework and support systems. The responses of enterprise case study respondents reflect the experiences of owners or managers at the producer level, whereas role player responses reflect a broader, industry-wide perspective. This must be kept in mind when analysing the results, as the two groups had different perspectives on the same subjects.

5.3.1 Key stakeholders

Aquaculture sector development in South Africa is supported and influenced by numerous key stakeholder groups, as described in a legal guide to aquaculture sector development (DAFF, 2013a). Respondents were asked to describe the key stakeholders, and their contexts, that are relevant to their own enterprises and organizations. They identified ten key stakeholder groups, categorized into government, government owned entities, non-governmental organizations (NGOs), industry support and associations, private and public partnerships (PPPs), research institutions, learning/training institutions, producers and staff, and markets. These are summarised in Table 5.2.

The importance of government in creating an enabling environment for aquaculture development is recognised and described in the literature (Hishamunda, Ridler and Martone, 2014; FAO, 2017). The South African government, including the DFFE as the lead department for aquaculture development, was recognised as the most important key stakeholder group. Government also provides critical support in times of crisis, such as the COVID-19 pandemic, when DFFE and industry developed an aquaculture industry recovery and growth plan (DEFF, 2020). Government stakeholders include the following:

a) National departments such as the DFFE, the Trade, Industry and Competition (the DTIC), Labour (DoL); Public Works (DPW), Water and Sanitation (DWS), and Health (DoH)
b) Provincial departments such as the Western Cape Department of Agriculture.
c) Local government departments as the Saldanha Bay and West Coast Municipalities.

Governments in other parts of the world play a dominant role in the development and/or management of aquaculture, for example the sustainable aquaculture development initiatives of the Chinese government, the aquaculture sector in Turkey and the development of cod farming in Norway (Yu and Yin, 2019; Çoban, Demircan and Tosun, 2020; Puvanendran *et al.*, 2021).

Government owned entities have regulatory and developmental responsibilities such as health certification, providing access to sea water space, development of staff rules and regulations, or implementation of grant funding. The Transnet National Ports Authority (TNPA) was cited as the cause of challenges related to obtaining access to sea water space, including high water lease fees. These difficulties have been experienced for a long time, as reflected in a 2013 study on the potential of mussel and oyster culture in Saldanha Bay (Olivier, Heinecken and Jackson, 2013). Other government owned entities include the following:

a) The National Regulator of Compulsory Specifications (NCRS)
b) The South African Maritime Safety Authority (SAMSA)
c) The South African Revenue Services (SARS)
d) The Cape Agency for Sustainable Integrated Development in Rural Areas (CASIDRA).

NGOs develop and promote the sector through services such as certification of aquaculture products, and development of empowerment aquaculture projects. The following NGOs were identified:

a) The Marine Stewardship Council (MSC)
b) The Aquaculture Stewardship Council (ASC)
c) The Centre for Integrated Rural Development (CIRD), although no longer in existence, assisted with the development of one of the earliest community-based mussel farms.

Industry support groups provide services and support to the sector, and were listed as follows:

a) The Western Cape Aquaculture Development Initiative (WCADI), although no longer in existence, provided support to emerging and commercial aquaculture ventures
b) Laboratories (for services such as water testing)
c) Chambers of Commerce
d) Private sector business incubators and accelerators such as Aurick, RaizCorp, and Edge Growth.

Industry associations represent and promote industry interests. They are voluntary associations established under common law, and can apply for voluntary registration as registered non-profit organisations (ICNL, 2020). Aquaculture industry associations do not receive support from government or other institutions and are dependent on membership fees. In general, they do not have the resources to fulfil their potential in terms of driving industry development. The following key industry associations were identified:

a) The Bivalve Shellfish Farmers Association of South Africa (BSASA)
b) Aquaculture South Africa (AquaSA), representing numerous marine and fresh water aquaculture producers
c) The Aquaculture Association of Southern Africa (AASA).

PPPs are important mechanisms in which entities can combine resources to assist enterprises. The following PPPs were identified:

a) The National Empowerment Fund (NEF) is one of the public partners in an enterprise that started as an empowerment project and developed into an independent commercial producer.
b) One of the established commercial producers entered into partnership agreements with new mussel farmers to assist them with technology transfer, training and mentoring, servicing, and product off-take.

Historical and current research institutions contributed to the development of the sector for the last few decades, by generating the knowledge and technologies required for successful farming. Teaching and learning institutions such as universities and colleges are instrumental in providing the skills and training needed by staff.

The industry sector includes producers, processors, staff, owners, and suppliers who all contribute to the successful operation of the value chain for the sector. Producers and their markets are key elements of the value chains that underpin the aquaculture sector. Without local and export markets, the industry cannot be sustainable.

Public and private financial institutions and programmes contribute to the development of the sector and enterprises by providing grant, loan, or co-funding to start-ups and established companies. The following key financial institutions and programmes were identified:

a) The Land Bank
b) The Comprehensive Agricultural Support Programme (CASP)
c) The Aquaculture Development and Enhancement Programme (ADEP)
d) The NEF
e) Private funders such as commercial banks and other institutions.

The key stakeholder groups identified by respondents correspond with most of the stakeholder groups identified in the legal guide for the aquaculture sector (DAFF, 2013a). Although mentioned by one respondent for future collaboration, stakeholders with specific mandates for enterprise development, such as the Department of Small Business Development (DSBD) and the Small Enterprise Development Agency (SEDA) and Small Enterprise Finance Agency (SEFA), were not identified in the guide or by study respondents as key stakeholders. This indicated an insufficient focus on the development of aquaculture entrepreneurs and

enterprises. Informants also did not mention any organised labour organisations such as the Food and Allied Workers Union (FAWU) as key stakeholders.

The complexities around managing multiple stakeholder perspectives and impacts on an aquaculture sector is not unique to South Africa. In the fish farming industry in Central Mexico, complex relationships between stakeholders including fish producers, government representatives, and civil and academic associations led to less-than-ideal management of the industry in an environmentally sustainable manner (Kanchi, Wehncke and López-Medellín, 2022).

Table 5.2: Key stakeholder groups and associated percentages

Key stakeholder groups	Number of respondents (n=10 Enterprise case studies)	% Of enterprise responses	Number of respondents (n=9 Role players)	% Of role player responses
1. Government	10	100%	6	67%
2. Government owned entities	6	60%	3	33%
3. NGOs	1	10%	2	22%
4. Industry support and associations	5	50%	4	44%
5. Private public partnerships	4	40%	1	11%
6. Research institutions	2	20%	3	33%
7. Learning/ training institutions	0	0%	2	22%
8. Funding/ financial institutions	7	70%	4	44%
9. Industry sector	4	40%	3	33%
10. Markets	5	50%	1	11%

5.3.2 Impacts of key stakeholders

Informants were asked for their insights and experiences of the impacts of key stakeholders on their businesses, and the aquaculture sector. As illustrated in Figure 5.1, the main areas of impact were categorized as the approach to enterprise development, community-based/collective ventures, different stakeholder mandates, and the enabling environment.

One respondent commented that government motives with regards to enterprise development is based on the 'triple-bottom approach' which includes commercial (GDP contribution), socio-economic and transformation focus. However, 30% of enterprise respondents and 56% of role player respondents felt that enterprise development is driven by the need to achieve socio-economic benefits (including job creation, economic transformation, food security, and social upliftment), rather than by market forces or commercial principles. Supporting quotes were: "Job creation and transformation is forced before the company is developed", and "First develop the company and then job creation and transformation will automatically follow".

Some respondents commented that the perceived need to meet socio-economic goals led to a top-down approach to the establishment of enterprises. The importance of having a commercial rather than socio-economic focus in aquaculture development projects is supported in the literature (Rouhani and Britz, 2004b; Hara, Njokweni and Semoli, 2017). As part of Operation Phakisa, an ADEP was established in partnership with the DTIC, to address the need for enterprise development. However, challenges such as access to funding and delays with the process, impacted negatively on the Programme's objective to stimulate investment by commercially viable enterprises (DEFF, no date; Operation Phakisa, 2014).

Community-based or collective aquaculture ventures were generally not viewed in a positive light. Some commented that these ventures are favoured or incentivised because government provides money for co-operatives, or that some enterprises are forced into co-operatives because of a lack of resources. 56% of role player respondents felt that co-operatives or community-based projects, micro subsistence type of production or community small-scale projects do not work and are not self-sustainable. Some noted that there is political pressure to make co-operatives or community-based projects work but they mostly felt these projects are bound to fail. The most important reasons cited for failure of such projects were insufficient leadership, business skills, mentorship, discipline, resources, and in-fighting and conflict within communities. A supporting quote is "You can't just take you know, rural people and expect them to run sophisticated business that are going into export markets".

Although there were a lot of negative comments about community-based or co-operative ventures, some felt that such projects could be successful if they are designed as profit-making businesses, are supported in the early stages through mentorship and linkages to the market, are managed correctly and have commercial rather than socio-economic motives. This supports the literature that says that commercially oriented rural or community-based aquaculture could contribute towards food security and income and job creation under specific conditions (Rouhani and Britz, 2004b; Hara, Njokweni and Semoli, 2017). In Ghana, investigations indicated fish farming households have higher food security than non-fish farming households, and that households' probability of attaining high food security increases with fish farming as an extra source of income assuming the household is engaged in other non-fish farming related ventures (Quagrainie *et al.*, 2018). It is interesting to note, however, that in countries such as Bangladesh where there is a high level of informal small businesses and fish farming households, there has been a rapid increase in commercialization (as opposed to subsistence farming) and domestic sales of fish in recent years (Hernandez *et al.*, 2018).

There were different opinions about the impacts of stakeholder mandates. Although some respondents felt there was no real conflict and good communication between the commercial sector and government, others commented that stakeholders do not always work together because of their different mandates. There were also mixed opinions about the change of lead agency for aquaculture from DAFF to DFFE. For some respondents, this meant that aquaculture (an agricultural activity) is now regarded as a fishery, with the focus on regulations and permits. There was also a feeling that moving aquaculture from agriculture to fisheries would add duplication and costs, and loss of skills to the industry. One respondent noted that no one is held accountable and suggested a single entity to oversee management and alignment of stakeholders (a role which DFFE is unable to fulfil due to bureaucracies and departmental politics). The literature supports this observation, as one of the principles for effective aquaculture governance is accountability by industry and governments (Hishamunda, Ridler and Martone, 2014).

Opinions were divided about whether the enabling environment for aquaculture development is supportive. 30% of the enterprise respondents felt that environment was supportive. One quoted that government has got the industry where it is today, saying "That's how the business grew and become sustainable" and another mentioned that frameworks such as EIAs allowed aquaculture activities to go ahead in a structured and environmentally responsible manner. Others felt it was not supportive or has not added value due to over-regulation, red tape, and

increased costs, and too many approved projects (leading to newcomers getting water space that were too small to be sustainable). A supporting quote is "Institutional framework doesn't create an enabling environment; government is trying but regulations are too strict".

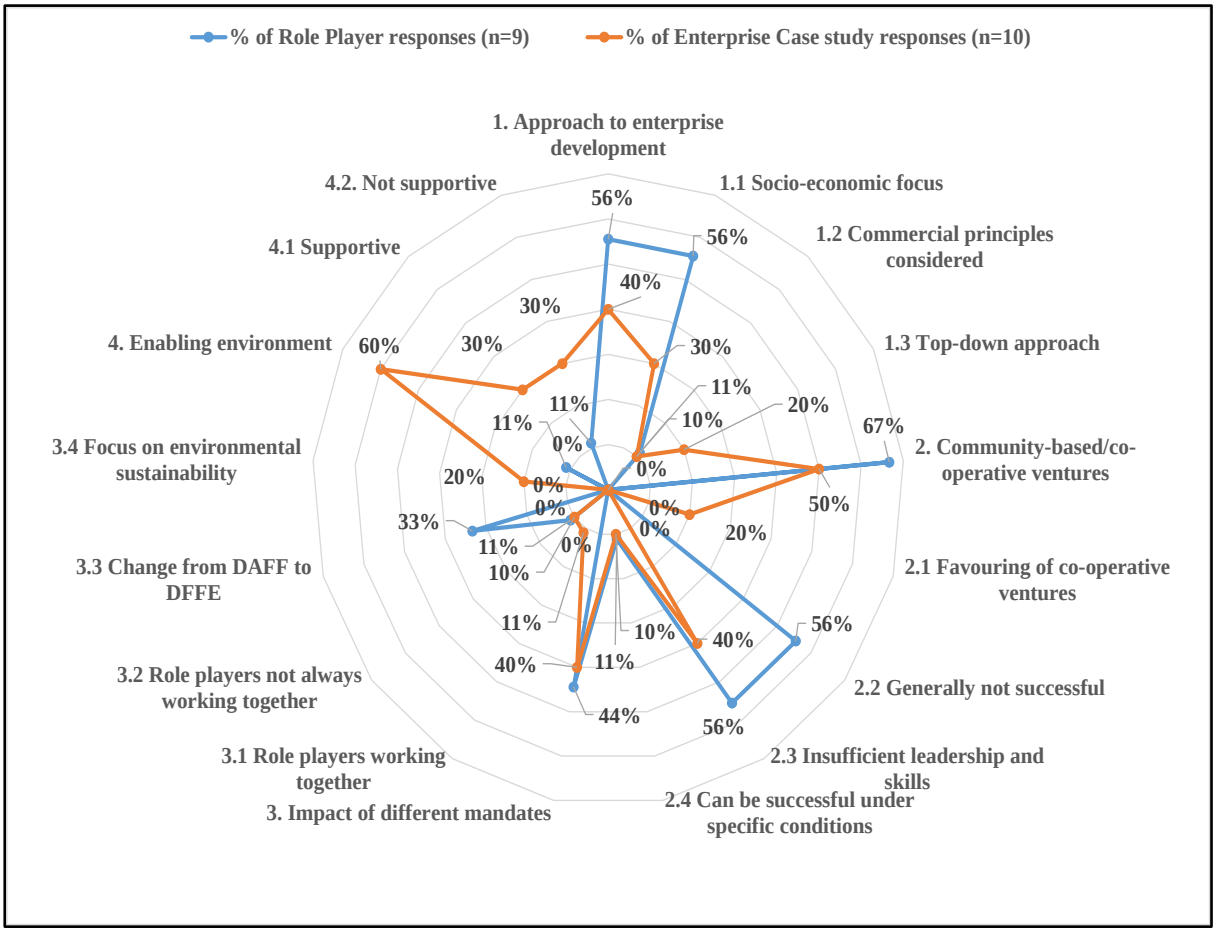

Figure 5.1: Responses about impacts of key stakeholders and their associated percentages

5.3.3 Impacts of the institutional framework

A country-wide Strategic Environmental Assessment (SEA) resulted in identification of several Aquaculture Development Zones (ADZs). To ensure sustainable aquaculture expansion, an Environmental Impact Assessment (EIA) was conducted in Saldanha Bay, resulting in the establishment of an 884 ha ADZ. This contributed to aquaculture development by providing access to long term leases through TNPA, streamlining the process of applying for marine aquaculture rights and easing the process of obtaining environmental authorization for individual farmers. However, environmental authorisation required the limitation of shellfish production to 10 000 tonnes per annum (TPA) for the first two years, and annual

incremental increases by 5000 TPA thereafter to a maximum of 27 600 TPA (DAFF, 2017). The resulting constraint on shellfish production capacity, echoes the problem of finding a balance between responsible regulation and optimal production levels experienced in other countries, for example in Norway's salmon aquaculture industry (Osmundsen, Almklov and Tveterås, 2017). The mussel farming industry in Greece suffered from inefficient implementation of legislation, which led to investigation of the use of hydrodynamic models for the development of more effective environmental legislation (Konstantinou and Kombiadou, 2020).

As part of Operation Phakisa, an Aquaculture Development Bill was drafted to address the development and regulation of marine and freshwater aquaculture as an agricultural activity and presented to Parliament. The Bill was withdrawn for rework and further engagement in 2020 (DEFF, no date). The results of this study indicate that some legislative changes are needed to better address the needs of the sector. This supports the literature that finds that aquaculture requires a specific legislative framework as a basis for long-term and sustainable growth, and its absence could cause legal challenges (Young *et al.*, 2019).

The change in the structure of the lead department for aquaculture development from DAFF, to DFFE in 2019 means that aquaculture is no longer managed as an agricultural activity. This introduced uncertainty amongst stakeholders about governance and future development of the sector. The five-year review of Operation Phakisa recognised these issues and listed recommendations for improving implementation of the Aquaculture Operation Phakisa Strategy during the next phase (DEFF, no date).

Respondents were asked about the impacts of the institutional framework on the aquaculture sector and individual enterprises. As illustrated in Figure 5.2, responses were categorised into the regulatory framework, and complex application processes. The two informant groups had different perspectives about the nature of impacts for each theme.

In terms of the regulatory framework, enterprise respondents felt most strongly about the impacts of the environmental processes (60%), while the role player respondents were most concerned with aquaculture specific legislation (56%). Enterprise concerns were mostly related to the EIA recommendations related to the Saldanha Bay ADZ. This caused limitations on farmers' ability to expand to their full capacity whilst having to pay for unutilised water space.

Most respondents agreed about the need for aquaculture specific legislation to guide aquaculture development. However, not everyone agreed with the need for a separate Act. One

respondent suggested that clausal changes in existing legislation would be better than a separate piece of legislation that will require additional infrastructure and people at extra cost. Some of the reasons cited for the Bill was the need to avoid a fragmented approach to aquaculture (requiring 36 pieces of legislation), and to develop the whole aquaculture sector (including freshwater and marine sectors). However, some respondents felt the Bill was more regulatory than developmental. A supporting comment was "Modelled on environmental legislation like the Marine Living Resources Act; insists that an aquaculture business can only be granted under licence from government".

Over-regulation was a concern because of the high administrative burden and costs related to sea water leases, compliance with permit applications and renewals, environmental monitoring and data collection, and food safety monitoring. This negatively impacted smaller companies. One respondent mentioned that "Most small enterprises were disappearing because they couldn't keep up with the regulatory requirements".

Complex and lengthy application processes (for rights, permits, leases and financial support) remains one of the most important constraints on development of the sector. This is in spite of efforts made through Operation Phakisa, including the establishment of an Inter-departmental Authorisations Committee (IAC) to simplify application processes and reduce processing time (DEFF, no date; Operation Phakisa, 2014; DAFF, 2018b). Implementation problems were related to leases with TNPA and DPW, delays in the implementation of Operation Phakisa, delays in the EIA for the Saldanha Bay ADZ, and the series of legislation that companies must comply with. A supporting quote was "Getting signed leases from TNPA is a lengthy process".

Only enterprise informants commented about insufficient feedback or communication (40%) regarding applications, and a disconnect or insufficient understanding and communication between stakeholders (70%). This included the perceived inability of officials and policy makers to understand the impacts of their decisions on industry, confusion amongst applicants about what is required and lack of alignment between stakeholders. A supporting quote was "Difficult to understand what is required; assistance regarding legislation would be beneficial".

Similar issues were experience in other countries e.g. the challenges to the development of the Irish oyster industry because of dysfunctional licensing arrangements (Renwick, 2018). In Mexico, a study of the institutional dimension of fish farming yielded comparable results. Multiple stakeholder perspectives, inconsistent application of policies and management procedures, and lack of organization were some of the issues identified. Producers were also

unhappy with government agencies due to their high technical and environmental requirements, however there was general stakeholder awareness of the threats posed by lack of health and safety on farms (Kanchi, Wehncke and López-Medellín, 2022).

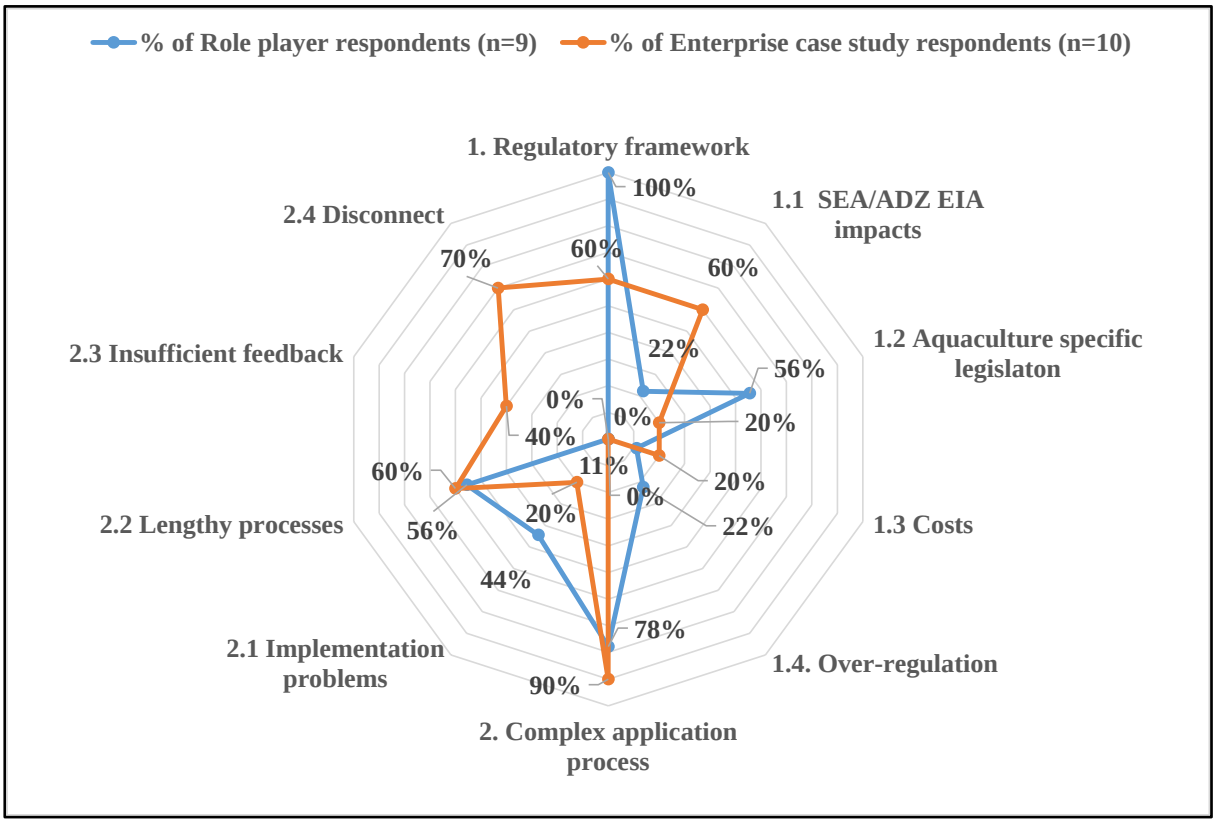

Figure 5.2: Responses about the institutional framework and their associated percentages

5.3.4 Impacts of support systems

The Operation Phakisa programme was implemented between 2014 to 2019 and addressed the development of the sector through nine initiatives that targeted the removal of specific obstacles to aquaculture development. The Programme's achievements include the development of a Public Awareness and Marketing Strategy (PAMS), a Small-scale Aquaculture Development Framework (SSADF), and an Aquaculture Transformation Strategy (ATS). However, the programme did not achieve all its goals. Remaining challenges include the retraction of the Aquaculture Development Bill, slow roll-out of planned production and slow development of export markets (DAFF, 2019b, 2019c, 2020).

An assessment of the performance of the Aquaculture Operation Phakisa Strategy (AOPS) in 2019 indicated that DAFF (Branch Fisheries Management) was negatively affecting the strategy implementation as the leadership, culture and structures are in place in the Chief

directorate for Aquaculture Economic Development but not in the support functions of the Department (Halley, 2019). During 2019, DFFE embarked on a process to develop an Oceans Economy Master Plan, which will include Aquaculture and Fisheries as a sub-sector. Due to the COVID-19 pandemic, this process was halted in 2020, and resumed in 2021. The Master Plan will incorporate the lessons learnt from Operation Phakisa.

Respondents were asked about the impacts of support systems for aquaculture enterprises. As summarised in Figure 5.3, responses were categorised into access, policies and programmes, and the education system and skills.

Some respondents indicated that there was sufficient access to funding, water space and technology through mentorships. While some commented that new aquaculture farmers did not know how to access the available support, others commented that available support systems are either misaligned to different parts of the country or to the environments available, or they are too generic to support established enterprises. Supporting comments included:

a) "Support is more focused on projects than the industry as a whole (not sustained); You get people start up and they don't necessarily get pulled through"
b) "Generic support is available for 'survivalist businesses'"; "'Established businesses' require highly specialised support".

Funding for aquaculture enterprises is available through programmes such as ADEP (mainly for established/medium sized players) and CASP (mainly for small farmers). However, challenges include the requirement for applicants to provide a portion of the funding first, splitting available funds across too many small projects, the lack of operational funding, the shortfall in available funding vs the demand, and an assumption that grant beneficiaries in general are equipped to run their own businesses. Although grants were available for infrastructure, new entrants also needed working capital support for operational costs. These findings support the literature that highlights the importance of overcoming regulatory and financial constraints for development of an aquaculture sector and meet its growth targets, as in the case of the oyster industry in Ireland (Renwick, 2018). In a study of fish farming activities in Mexico, financial and technical support was recognized as the main opportunity to develop the sector (Kanchi, Wehncke and López-Medellín, 2022).

Responses about policies and programmes included insufficient consideration of industry, a communication gap/disconnect between parties, Operation Phakisa and market support. Some respondents mentioned that industry is not sufficiently consulted, or their inputs are not

considered by policy makers. The main challenge for enterprise respondents was a perceived communication gap or disconnect (70%) between policy makers and the public. There was a perception that policy makers do not take the realities of aquaculture limitations into account. Some of the supporting comments were:

a) "A large, energetic and costly effort to drive the industry is disproportionate to this limited potential (disconnect between support systems and reality)"
b) "ADZ assists with water lease and mussel farming but when the time comes to sell there are insufficient markets (hence, the disconnect)"

Role player respondents commented on the impacts Operation Phakisa on aquaculture development (56%). Although most of the comments were positive, there was a concern that the goals related to job creation and economic development were over-ambitious. The programme stimulated investment, increased transformation, and increased production of aquaculture products. The development of a monitoring and certification system was aimed at opening export markets however, the implementation of the programme was hampered because of challenges with certification of tests. In the case of bivalve shellfish, the local market is small (e.g., mussel demand is 3500 TPA). Therefore, the potential increase in bivalve shellfish production to almost 30 000 TPA requires increased access to export markets, and concerted efforts to increase local demand.

Some respondents commented that there is insufficient focus on aquaculture education or skills on secondary and tertiary level. However, others indicated that the required skills can be obtained through technology transfer, mentoring, online learning, and on-the-job training. Concerns about insufficient middle management supports the findings of a 2006 baseline study of the aquaculture sector, which found less representation of jobs in the skilled and middle services (Botes, Thompson and Louw, 2006a). One of the achievements of Operation Phakisa was the development and approval of "Aquaculture farmer" and "Aquaculture farm assistant" qualifications (DAFF, 2018b). In addition, an Aquaculture Skills Inventory and Needs analysis recommended interventions addressing key challenges such as low levels of formal schooling amongst workers, training of more supervisors and improving management skills (Chrysalis, 2017).

Respondents placed a lot of emphasis on the importance of the correct mind set, government training and extension services, improved technologies, technology transfer and mentoring of new entrants (for example a mentorship arrangement between an established commercial

producer and 11 new mussel farming entrants). A supporting quote was “Vision is more important, and passion and drive”.

The growth of the Chilean blue mussel farming industry from 25 000 to 200 000 tons between 2000 and 2009 was due in part to investment by Chilean fishing companies, and also to the establishment of an Integrated Territorial Program for the mussel industry which aimed to position the country as a world producer by 2012. In addition, a Technological Institute for Mussel Aquaculture was set up for research and development purposes (Gonzalez-Poblete *et al.*, 2018). This example highlights the importance of industry involvement, together with government efforts, in the development of an aquaculture sector.

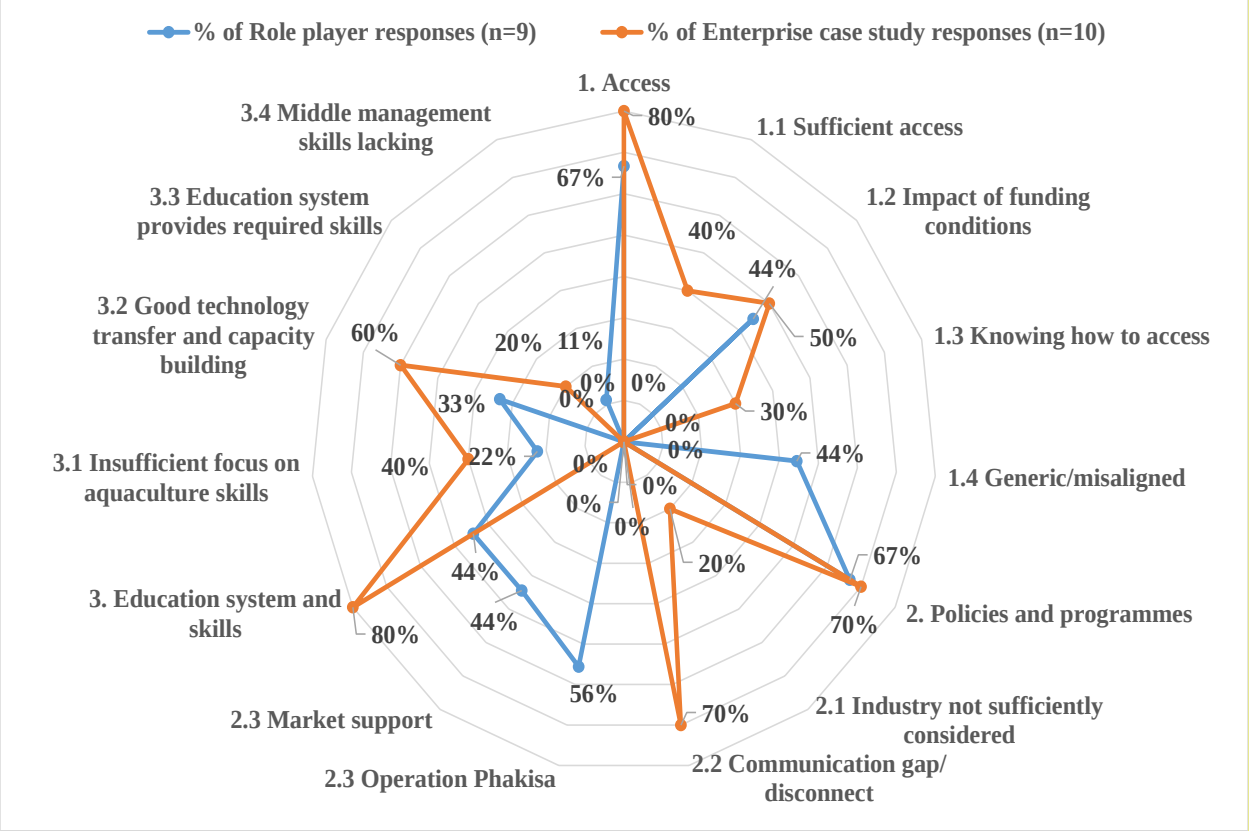

Figure 5.3: Responses about support systems and their associated percentages

5.3.5 Summary

The positive aspects and gaps/challenges related to the impacts of key stakeholders, the institutional framework and support systems on the sector and aquaculture enterprises, are summarised in Figure 5.4. Although there is widespread appreciation for the improved enabling environment for the aquaculture sector, several key constraints and concerns were highlighted.

Considering the challenges related to key stakeholders and their impacts, the following needs were identified:

a) There should be a mechanism to streamline and simplify applications processes including all relevant stakeholders, such as an online portal.
b) Industry associations should be strengthened and fully resourced so they could play a more meaningful role in the development of the sector and enterprises, improvement of communications and alignment of stakeholders.
c) There should be closer collaboration with DSBD and their implementation agencies to develop and implement enterprise and supplier development interventions.
d) Government and industry should focus more on investing in and development of commercially focused aquaculture enterprises rather than socio-economic development projects or programmes.
e) An aquaculture enterprise development strategy should be developed to assist aquaculture enterprises in becoming financially self-sustainable.
f) Community-based or collective-type ventures that are not financially self-sustainable, should be assessed to identify potential interventions that could improve their potential for financial self-sustainability.
g) DFFE should roll out and publicise the Oceans Economy Master Plan to improve their visibility, and stakeholders' confidence and support.
h) The development of aquaculture-specific legislation that supports development, should be fast-tracked.
i) Existing aquaculture farmers in the various industry sub-sectors should be assisted to ensure they reach viable economies of scale and become financially self-sustainable, before approving new entrants to that industry.

Considering the challenges related to the institutional framework, the following needs were identified:

a) Industry associations should be resourced so they could drive initiatives with potential to help aquaculture farmers diversify and generate additional income streams.
b) The re-development of the Aquaculture Development Bill should be fast-tracked through the Master Plan development process, to address coherent development of both marine and freshwater aquaculture sectors.

c) The roles of different government departments and agencies in development of the whole sector should be clarified as part of a mechanism to improve and simplify application processes.
d) Industry associations should be resourced to play a more pronounced role in interconnecting relevant role players, improve communication and align stakeholders in mechanisms that streamline and simplify applications processes.

Considering the challenges related to the support systems, the following needs were identified:

a) There should be a mechanism that provides focused financial and non-financial support to address the needs of aquaculture enterprises during start-up, establishment, and growth phases.
b) Support interventions should take the differences between industry sub-sectors and geographical areas into account.
c) Industry bodies should be strengthened and resourced to improve communication between stakeholders, hold stakeholders to account, and implement enterprise development and incubation interventions.
d) Industry bodies should be resourced so that they could assist with the development of industry level market development programmes.
e) Capacity building and training interventions should emphasise the importance of having the correct mind set (including vision, passion, and drive), and mentorship.
f) Industry bodies should be strengthened and resourced to develop guidelines for financial and non-financial incentives to providers and participants in enterprise mentoring and coaching programmes.

Industry associations do not receive support from government or other institutions and are dependent on membership fees. In general, they do not have the resources to fulfil their potential in terms of driving industry development. If fully funded, these associations could provide more services to their members or the sector, and link to national and international programmes and projects to improve sustainability. An example of such a programme is the All Atlantic Ocean Sustainable, Profitable and Resilient (ASTRAL) project, which is a European Union Horizon 2020 collaborative project focusing on integrated multi-trophic aquaculture (IMTA) farming. In 2021, BSASA received funding from the Foreign, Commonwealth & Development Office of the Government of the United Kingdom to investigate the potential of commercial kelp farming as an IMTA platform in the Saldanha Bay

ADZ (Barend Stander, personal communication). These examples highlight the potential of industry associations to fast-track the development of the aquaculture sector.

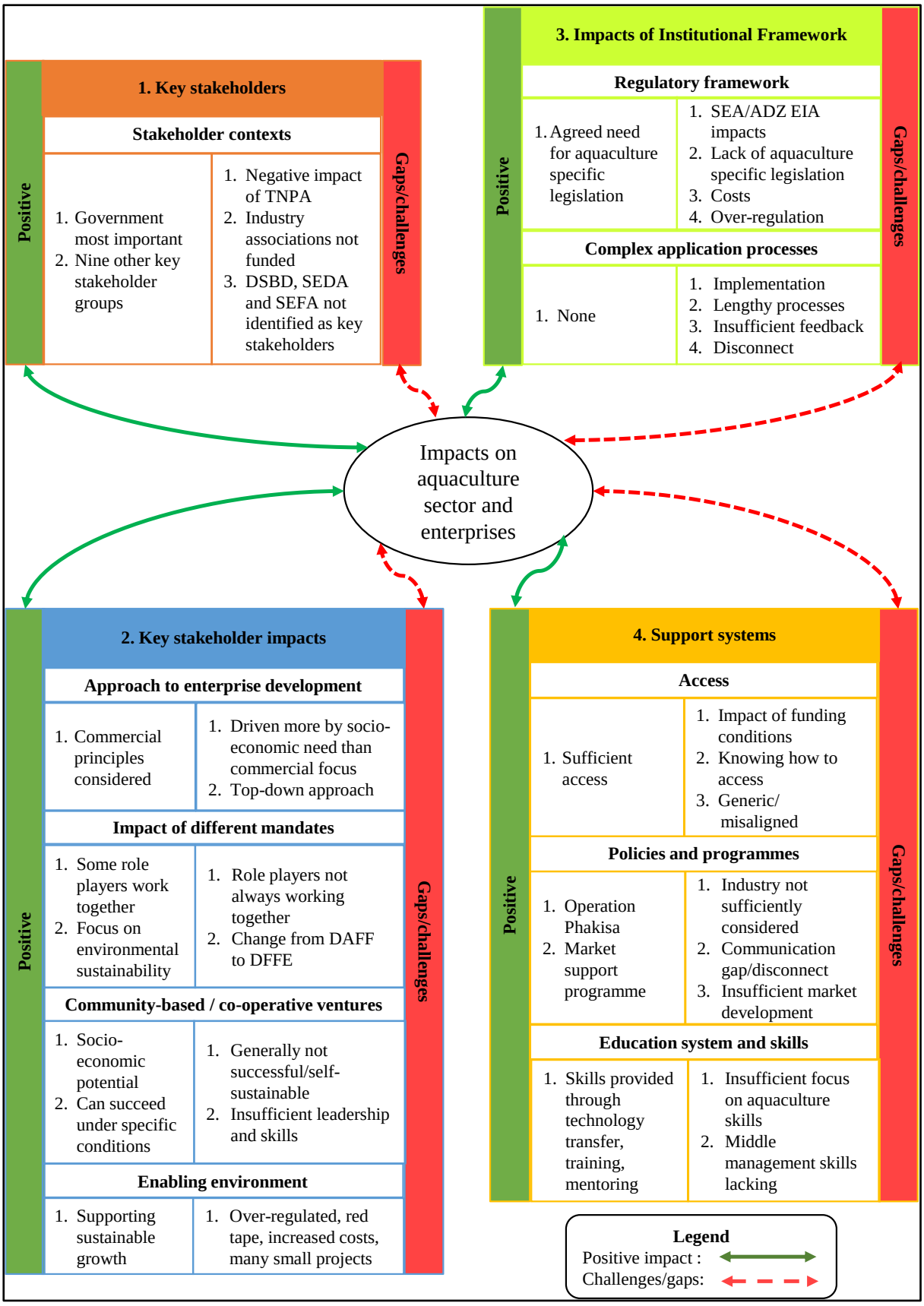

Figure 5.4: Summary of stakeholder impacts on aquaculture sector and enterprises

5.4 Conclusions and recommendations

The enabling environment for aquaculture sector development in South Africa has been greatly improved in the last decade, especially through interventions such as Operation Phakisa. However, challenges remain. While sector development initiatives resulted in increased investment, production expansion and job creation, the development of aquaculture enterprises did not receive sufficient attention. To assist with the development of financially self-sustainable enterprises, recommendations cover the following four main areas of intervention:

a) Strengthen and fully resource aquaculture industry associations
b) Develop a focused aquaculture enterprise and supplier development (ESD) strategy and programme
c) Streamline application processes
d) Finalise and roll-out the Oceans Economy Master Plan, including development of aquaculture specific legislation.

The most critical aspect is the strengthening and resourcing of aquaculture industry associations. If they are fully funded and supported, they could launch an integrative project to pilot the recommendations from this study, potentially catapulting the industry into the future. To this end, relevant funding organisations should be identified and approached for assistance.

Industry associations could assist with development of a focused aquaculture ESD strategy and programme that promotes the development of financially self-sustainable enterprises. This should include mentoring, coaching and capacity building through relationships with established commercial partners, the research community, financial partners, and other stakeholders. It should focus on a development path for new and established enterprises that would enable them to become financially self-sustainable. This could be achieved through a formal ESD programme such as an aquaculture sector incubator programme. It could be set up with the support of institutions such as DSBD and Seda, in collaboration with private sector business incubators and accelerators.

An ESD strategy and programme could also include an assessment of community-based or collective aquaculture ventures in South Africa. Such a study could assess the financial and non-financial investment into such ventures, whether they are or could become financially self-sustainable, and whether they are or could become investment ready. If not, recommendations should include potential interventions that could assist such ventures in becoming financially self-sustainable.

Fully resourced industry associations could also assist with the streamlining of application processes through mechanisms such as an online applications portal and help desk to assist new entrants and walk applicants through the process. In addition, they could assist with improved co-ordination and communication between relevant stakeholders and enterprises.

Lastly, the finalisation and implementation of the Oceans Economy Master Plan should be used as a platform for DFFE to improve its visibility and increase confidence in its ability to address the aquaculture sector challenges identified. The Plan should include the re-development and roll-out of aquaculture-specific legislation (e.g., an Aquaculture Development Act or changes to existing legislation) with sufficient focus on development of the whole sector (including freshwater and marine aquaculture).

Addressing the challenges identified through this study could expand the positive impacts of the initiatives implemented to date, further improve the enabling environment for the sector and assist aquaculture enterprises in becoming financially self-sustainable

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Chapter 6 – Critical success factors for aquaculture enterprises

This chapter describes the findings on the critical success factors for aquaculture agribusiness enterprises in South Africa. It sets out the results from interviews with informants for ten enterprise case studies of bivalve shellfish producers, and nine role player representatives.

This chapter has been written in the format of an article for publication, for ease of reading and to make it easier for the publication of papers. This chapter was published as a paper in the Technium Social Sciences Journal, Vol. 29, 2022 (pp. 438-457).

Assessing the Critical Success Factors for Aquaculture Enterprise Development in South Africa

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Abstract. In South Africa, small enterprise development is an important strategy for the economic growth, transformation and eradication of poverty and inequality. The government also promotes the development of the aquaculture sector to provide food security, contribute to wealth and job creation, provide livelihood opportunities, and contribute to transformation. South African businesses unfortunately have a low rate of business sustainability. This study investigated the critical success factors enabling aquaculture enterprises in South Africa to become self-sustainable, and the potential reasons for failure including those enterprises that received public funding. The study was conducted on the West Coast of the Western Cape, South Africa. A multiple-case study approach was followed, focusing on the marine mussel farming sub-sector in Saldanha Bay. Semi-structured interviews were conducted with the owners or managers of ten mussel farming enterprises, and with nine representatives of role players with responsibility or experience in aquaculture, agriculture, or enterprise development.

The results of the study indicated that aquaculture farmers and role players have a similar understanding of the concept of self-sustainability in aquaculture agribusinesses, especially the need for profitability and independence. The most critical success factors for self-sustainable aquaculture enterprises include environmentally responsible and sustainable farming practices, efficiently addressing economic challenges and opportunities, cultivating good business leadership and management, and a supportive business and enabling environment. The main reasons for failing to become self-sustainable include environmentally unsustainable farming

practices, economic challenges, weak business leadership and management, and challenges related to the business and enabling environment. The paper argues that commercially focused aquaculture ventures could achieve social benefits, however, socially-focused ventures are unlikely to achieve commercial benefits. The study recommends interventions that could assist aquaculture enterprises in addressing the critical factors described in this paper, to achieve self-sustainability in the long term.

Keywords. Aquaculture, enterprise, success factors, self-sustainable

6.1 Introduction

In South Africa, the development of the small, medium, and micro-sized enterprises (SMMEs) is an important strategy for the development and growth of the economy, transformation, and eradication of poverty and inequality. Supporting initiatives include the implementation of a National Small Business Act (No. 102 of 1996), as amended, setting up of the national Department of Small Business Development, the establishment of the Small Enterprise Development Agency (SEDA), and establishment of the Small Enterprise Finance Agency (SEFA). The development and growth of the aquaculture sector are seen to provide a stable source of food, contribute to wealth and job creation, provide livelihood opportunities and contribute to transformation(DAFF, 2012a, 2013c). Therefore, the government supports the creation and development of SMMEs in this sector, through financial and non-financial support measures. The implementation of an initiative called Operation Phakisa: Ocean's Economy (Aquaculture workstream) in 2014 led to an investment of more than R1.2 billion private and public funding into 35 aquaculture projects by 2017. Of these, 28 projects were SMMEs (DAFF, 2018b).

Enterprises need to be successful or sustainable in the long term to contribute to sector growth expectations and targets. However, data collected by the Global Entrepreneurship Monitor (GEM) points to a 5-fold loss of South African businesses from start-up to established business ownership, a high business discontinuation rate, and thus a problem in maintaining business sustainability (Herrington and Kew, 2018). Start-ups, therefore, struggle to reach a point where they are self-sustainable (able to sustain their operations from income derived from the sales of their goods and services, without external financial support). To increase participation of historically disadvantaged or marginalised individuals and communities, aquaculture development projects include enterprises with a commercial focus, social focus or a mix of the two (such as community-based aquaculture). Commercial aquaculture differs from rural or subsistence aquaculture in that it entails the rearing of aquatic organisms with a profit motive, is done mainly by the private sector and does not need direct assistance from donor or government sources. It also has a business orientation and uses labour instead of relying on family members. However, it is understood that operations that began for subsistence, could develop into small-scale commercial ventures under the right conditions (Percy and Hishamunda, 2001)

The sustainable growth and development of the aquaculture sector depend on an enabling environment, and the success of individual enterprises. However, even with financial and non-

financial support, many small enterprises still struggle to become self-sustainable. The main purpose of this paper was to investigate critical success factors for aquaculture enterprises in South Africa and to understand the potential reasons for the failure of especially public-funded aquaculture agribusiness enterprises.

6.2 Material and Methods

The concept of sustainability is broadly derived from the United Nations definition of sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987). It is not grounded in a rigorous theoretical foundation and is context-specific (Purvis, 2019). Although the concept of sustainability in aquaculture is not clearly defined (Boyd *et al.*, 2020), for this study sustainable aquaculture is understood to integrate environmental protection with social responsibility and economic gain.

Similarly, there are many interpretations for the concept of a viable, sustainable, or successful business or enterprise. A financially viable business is deemed to be profitable, meaning it brings in more revenue than it is spending on the costs of running the business. The term self-sustaining refers to the ability to maintain oneself by independent effort. Therefore, considering the complexities and context of enterprise development in South Africa, this study assumes that enterprises should aim to become financially self-sustainable in the long term. A self-sustainable enterprise is defined as one that can sustain its operations from income derived from the sales of goods and services, without external financial support.

Success factors are those things that affect the chances of an enterprise being successful. The concept of critical success factors was originally developed as a method for managers to determine what information they need to fulfil their roles and responsibilities. A detailed definition is "the limited number of areas in which satisfactory results will ensure successful competitive performance for the individual, department or organization" (Bullen and Rockart, 1981). The concept evolved over time and for this study, is understood as the key areas that a business should focus on and try to get right, to achieve its goals. It is also understood that critical success factors are subjective and different for each organization.

This study, therefore, aimed to understand the critical success factors that would enable aquaculture enterprises to achieve their sustainability goals. The study was mainly based on semi-structured interviews with marine mussel producers and role players in the sector. The

mussel farming industry provided a good case study of these impacts, as it is the largest contributor to aquaculture production in South Africa (DEFF, 2021a).

6.2.1 Study area

The study focused on the marine mussel aquaculture industry in South Africa. The study area was Saldanha Bay, on the West Coast of South Africa, and included three bivalve shellfish (mussel and oyster) farming areas totalling 460 ha. The survey population included 27 bivalve shellfish farming enterprises in the study area that were approached through the Bivalve Shellfish Farmers Association of South Africa and the Western Cape Provincial Department of Agriculture. The sample size included nine of the existing enterprises listing mussel cultivation as a primary or secondary activity and one that had ceased operations. The selection was mainly based on willingness to be involved in the study. The mix of enterprises included commercially focused, empowerment and community-based/collective-type initiatives.

The survey population also included role players in South Africa with responsibility or experience in aquaculture, agriculture or enterprise development. The selection was based on willingness to be involved in the study, and availability. The role player categories, as described in Table 6.1, included two national and provincial government departments with responsibility for aquaculture, three aquaculture associations, two universities and two individuals with experience or expertise in aquaculture farming and enterprise development. These role players were, therefore, able to provide insights on aquaculture and enterprise development from Southern African, government, industry, research, education, and practitioner perspectives.

Table 6.1: Role player categories with their associated spheres of influence

Role Player Category	Sphere of influence or representation	Number of persons interviewed
National and provincial government departments with responsibility for aquaculture or agriculture	1. National aquaculture sector (freshwater and marine) 2. Western Cape provincial aquaculture sector (freshwater and marine)	2
Aquaculture associations	1. Aquaculture stakeholders in Southern Africa; 2. Seven freshwater and marine aquaculture producer associations in South Africa 3. All bivalve shellfish producers in South Africa	3
Universities	1. Agricultural Sciences including Aquaculture research, training	2

Role Player Category	Sphere of influence or representation	Number of persons interviewed
	and development; Commercial aquaculture development expertise 2. Social dimensions of the fishing, aquaculture and coastal sectors	
Individual - Experienced aquaculture farmer and mentor	South African commercial aquaculture and development expert with practical experience in mentoring emerging aquaculture farmers	1
Individual - Enterprise development expert	Expert in enterprise development, technology transfer, business incubation and strategy/programme design and implementation in South Africa	1
Total		**9**

6.2.2 Data collection

An empirical, phenomenological approach was followed, as described in the literature (Remenyi *et al.*, 2010). A case study approach was selected as a suitable method, as it is a scientific research method in its own right and can generate context-dependent knowledge as described by several researchers (Flyvbjerg, 2006; Yin, 2009; Remenyi *et al.*, 2010). Semi-structured interviews were conducted with the owners or managers of bivalve shellfish farming enterprises selected as case studies, and with the representatives of role, players selected. A qualitative approach was followed to conduct the research. Due to the implementation of COVID-19 restrictions on movement during the time the study was conducted, interviews mostly took place via video-conferencing or cellular phone platforms. Interview questions were structured around the themes of informants' definition of self-sustainability, critical success factors for aquaculture enterprises and the potential reasons for the failure of public-funded agribusiness and aquaculture enterprises. This information was communicated before interviews as part of the Participant Consent forms.

6.2.3 Sampling procedure

The sample size included nine of the enterprises in existence and one that had ceased operations. The selection was mainly based on willingness to be involved in the study. The mix of enterprises included commercially focused, empowerment and community-based/collective-type initiatives. The role player sample included two representatives from national and

provincial government departments with responsibility for aquaculture, three aquaculture associations, two universities and two individuals with experience or expertise in aquaculture farming and enterprise development. The selection was based on willingness to be involved in the study, and availability. Nine role player interviews were conducted.

6.2.4 Data analysis

Multiple-case study analysis consisted of two stages. Firstly, a within-case analysis was conducted, where the qualitative data were analysed by identifying and copying responses from each transcription that were relevant to each of the questions asked during the interview. These responses were further analysed to create themes and sub-themes (or codes). MS Excel was used for the second stage of analysis (cross-case analysis) where a grouping of themes and sub-themes as well as summarising of codes was completed.

6.3 Results and Discussion

Respondents were asked for their opinions and insights regarding the definition of self-sustainability, the critical success factors for aquaculture enterprises and potential reasons for the failure of aquaculture ventures, including those that were publicly funded. The responses of enterprise case study respondents reflect the experiences of owners or managers at the producer level, whereas role player responses reflect a broader, industry-wide perspective. This must be kept in mind when analysing the results, as the two groups had different perspectives on the same subjects.

6.3.1 Definition of self-sustainability

The emphasis on profitability and independence in self-sustainable aquaculture enterprises points to a commercial or profit motive. Enterprise informants, as well as role players, understood self-sustainable aquaculture enterprises as those that could sustain their operations from income derived from sales of its goods and services without external financial support and make enough profit to realise shareholder objectives. A case study of aquaculture farmers in the Pacific adopted the concept of economic viability, described as “profitability without taking shortcuts” which is “being socially responsible” as the measure of farm or firm success (Bueno and Pongthanapanich, 2014).

South African marine mussel farming is a commercial sector with well-established links into the food processing, wholesale, and retail nodes. Mussels have a short shelf-life, are aimed at the high-end/premium market segment and are sold in fresh and frozen form (WCADI, 2012).

Mussel farming is therefore not suitable for subsistence or small-scale farming with social (subsistence or food security) motives. The importance of a commercial rather than a social motive in the success of emerging or community-based ventures in different aquaculture value chains in South Africa is supported in the literature. (Brierly, 2003) described the difficulties of turning a small-scale mussel farming project in Saldanha Bay (with social and commercial motives) into a sustainable business.

The poorer performance of aquaculture projects with "food security" motives, in comparison to those with commercial motives, were described in a baseline study in 2004 (Rouhani and Britz, 2004a). The challenges around building a profitable business and having a developmental agenda are described in a case study of an emerging trout-farming cooperative (Salie, 2011). Similarly, a study on the involvement of communities in commercial aquaculture projects (community-based aquaculture) points to the importance of developing investment-based businesses, rather than social programmes (Hara, Njokweni and Semoli, 2017). Given that public funding is a limited resource, investment of public funding must focus on commercially motivated ventures that have a chance of becoming self-sustainable, rather than socially motivated ventures that may need unlimited funding support to stay in operation.

The researcher solicited the opinions and insights of informants about their definition of self-sustainability. Most agreed with the researcher's definition of a self-sustainable enterprise as "An enterprise that can sustain its operations from income derived from the sales of its goods and services without external financial support".

External financial support was understood to mean public or private funding needed to continue normal day-to-day operations. It, therefore, does not include public or private funding obtained for purposes of company growth or expansion. Informants also proposed several additions to the definition. These are listed in Table 6.2. The responses indicated a common understanding of what it means to be a self-sustainable enterprise, with an emphasis on profitability and independence. One informant described the model for a sustainable mussel farming enterprise as being one unit with a 30-ha water lease, 1000 tonnes harvest 16-18 workers and one boat. Their opinion was that sustainable expansion should take place one whole unit at a time.

Table 6.2: Informants' proposed additions to definition of self-sustainable enterprise

Enterprise informant additions	Role player informant additions
"There must be money left over once everything has been paid"	"Must manage all its costs and be profitable"
"Self-fund through sales of your products"	"Able to sell its product at a price that gives it enough margin to cover all costs and grow the organisation"
"Makes profit over a long period"	"Having the capabilities to take advantage of the opportunities"
"Not being dependent on outside companies"	"It needs to be able to deliver a return on the equivalent invested capital"
"Being able to service your farm, at the same time the farm being profitable"	"Can run on its own without government support, can source its capital and produce a product at profit"

6.3.2 Critical success factors

Respondents were asked to describe the critical success factors for aquaculture enterprises. Enterprise case study responses are listed in Figure 1. Saldanha Bay provides an ideal environment for farming filter-feeding bivalve shellfish, due to the upwelling of cold, nutrient-rich water from the Benguela Current that stimulates plankton growth. This contributes to premium quality products and rapid organism growth and makes the natural environment a great asset for the bivalve shellfish farmer (Olivier, Heinecken and Jackson, 2013).

The mussel farmers understand this and believe it gives them a competitive edge in terms of product quality and production. Within the sites approved for mussel farming, there are also differences between areas in terms of depth of water, circulation, exposure and other characteristics. Therefore, each farmer needs to understand the unique characteristics of their allocated water space, to maximise efficiencies of seeding, grow-out, harvest and re-seeding. Farmers need to acquire practical experience and keep good records to build this understanding. Market demand for its products should be the main reason for developing an aquaculture venture. The importance of having a market-oriented instead of a production-driven approach to aquaculture development is reflected in a Western Cape aquaculture market analysis (WCADI, 2012). Various government marketing efforts such as completing a globally recognised monitoring and certification framework were aimed at stimulating market demand for aquaculture products (DEFF, no date). In a comparative study of key players in African aquaculture (Egypt, Nigeria, and Uganda), market demand (high per capita consumption of fish) was also found to be one of the critical success factors (Adeleke *et al.*, 2020).

The rapid expansion of mussel production between 2015 and 2020, from six farms with a total annual production of 1758 t (DAFF, 2016b), to 23 farms with an estimated production of 6000t (F. Endemann, personal communication 2021), introduced the risk of over-supply in the small local market. This requires the development of alternative and export markets, which could be addressed through a structure that could stimulate and increase market demand for South African mussels/bivalves, or aquaculture products in general. It would also require cooperation amongst industry players, who currently compete for the same markets. An analysis of the Mediterranean mussel farming industry indicated that the organization of local production and marketing activities into larger schemes could decrease production costs and add value to the final product (Theodorou and Tzovenis, 2017). Both formal and informal forms of cooperation have been found to contribute significantly to the survival of small-scale mussel farming in Ireland (Cush and Varley, 2013).

Funding sources for aquaculture infrastructure is readily available, however, some producers mentioned that it is difficult to obtain funding for operational support. Having a financial partner or access to funding is especially critical during the start-up years and in times of crisis such as during the COVID-19 pandemic. A study into the potential of mussel and oyster culture in Saldanha Bay pointed to the importance of access to private and public funding to increase production and economies of scale, and assist the sector in difficult times (Olivier, Heinecken and Jackson, 2013). Those mussel farms integrated with holding companies that own processing facilities, have an advantage over other farms in terms of access to markets, mentoring, funding, and support during difficult times. This is supported in the literature. Vertically integrated catfish farms in Vietnam were shown to have higher yields and revenue per hectare than non-integrated farms (Trifković, 2016). Vertical integration in the Zambian aquaculture sector has been identified as a defining commercial trend benefiting larger commercial companies more than the small-scale subsistence sector (Kaminski *et al.*, 2018).

The minimum viable size of water space for mussel farming is difficult to pinpoint, as it depends on the production system and several ropes, production efficiencies and environmental limitations. Studies to estimate the carrying capacity for bivalve shellfish cultivation in Saldanha Bay put total potential annual production over a 1000 ha area at 45 000-60 000 t y^{-1} fresh weight (Probyn, Atkins and Pitcher, 2015), and indicated that production in 2015-2016 was below the carrying capacity of cultivation areas (Santa Marta *et al.*, 2020). Based on a final Basic Assessment Report for the Saldanha Bay Aquaculture Development Zone, the area for aquaculture development was restricted to 884 ha and shellfish production increase limited to

10 000 tonnes per annum for the first two years. Subsequent increases were limited to 5000 t y^{-1} to a maximum of 27 600 t y^{-1} (DAFF, 2017e).

These limitations meant that farmers were not able to maximise the production potential of their farms in the expected time frames, with potentially negative impacts on the viability of especially new and smaller farms. An alternative view of a viable mussel farm is the production scale (t y^{-1}) needed to be financially viable. This has been estimated at 500 t y^{-1} (DAFF, 2017c), and would require about 20 ha for raft cultivation and 15 ha for longline cultivation (F. Endemann, personal communication, 2021). This indicates that mussel farms of less than 15 ha may not be financially viable on their own. Good business leadership and management is the most important success factor, as a sustainable enterprise should be driven by entrepreneurs or managers with the business and technical skills required. Most of the producers exhibited a strong entrepreneurial spirit. They understood the value of good management practices, passion and commitment to their business, and industry knowledge in building sustainable enterprises.

The importance of partnering with established farms or mentorships is supported by the literature. One of the common themes amongst emerging agribusinesses these businesses was the requirement for connections with partners in the existing agriculture sector and agribusiness supply chains (Mabaya *et al.*, 2011). A different study of community-based aquaculture projects found that partnerships could be used for skills transfer and training (Hara, Njokweni and Semoli, 2017). The findings on critical success factors are supported by the findings of a comparative study of selected African countries that listed market demand, optimal environment, infrastructure, technology, commercialization, provision of an enabling environment and skills development as critical success factors driving aquaculture development and production output (Adeleke *et al.*, 2020).

A study of four aquaculture enterprises in the Pacific indicated four measures or strategies that enabled them to remain economically viable. These measures are comparable to the findings of this study and include the management of production risks and improvement of efficiency, management of marketing risks and better market access, environmental responsibility and social responsibility (Bueno and Pongthanapanich, 2014). Responses about the key success factors were categorised into environmental (mentioned by 80%), economic (90%) and business leadership factors (100%). The most important environmental factors were the ideal farming site (60%), constant monitoring of water (40%) and producing a good quality product (30%). In terms of the ideal farming site, respondents specifically mentioned the availability of nutrients, distance from harbours and shelter from rough waters or wind as important.

As indicated in Figure 6.1, the most important economic factors were the market (70%), having a financial partner or funding (70%), the minimum viable farm size (40%) and investing sweat equity (40%). One of the respondents felt that having their processing plant was critical. Market-related issues included the need to develop a business around a market, to diversify markets as the local mussel market is oversubscribed, and to do sufficient market research before starting an enterprise. Many of the respondents had a mix of private and public loans and grant funding. Funding sources included the Comprehensive Agricultural Support Programme (CASP), Aquaculture Development and Enhancement Programme (ADEP), Industrial Development Corporation (IDC), National Empowerment Fund (NEF) and Land Bank. One farmer specifically mentioned the importance of vertical integration in terms of access to funding and expertise to help the enterprise grow. Another mentioned that their financial partner was more than just a partner, who provided them with a moratorium on loan repayments during unforeseen events and disasters. Investment of sweat equity was seen as critical by some, as it made them more credible to other potential investors. Respondents did not have the same idea of the minimum viable farm size required for a sustainable mussel farming enterprise. One informant felt that 30 ha is the minimum size for a sustainable enterprise.

Another felt that 10 ha is not viable, however, one farmer's personal experience indicated that 10 ha was the "tipping point" (after which they started making a profit). However, this was before the Environmental Impact Assessment (EIA) for the Saldanha Bay Aquaculture Development Zone (ADZ) that resulted in a temporary limitation on the maximum production allowed per hectare. All of the respondents emphasised good business leadership as a critical success factor. The most important aspects include good management (60%), passion and commitment (60%) and industry knowledge (60%). Other important business leadership traits include having entrepreneurial/ business skills, a hands-on approach, strong leadership, and a long-term vision for the business.

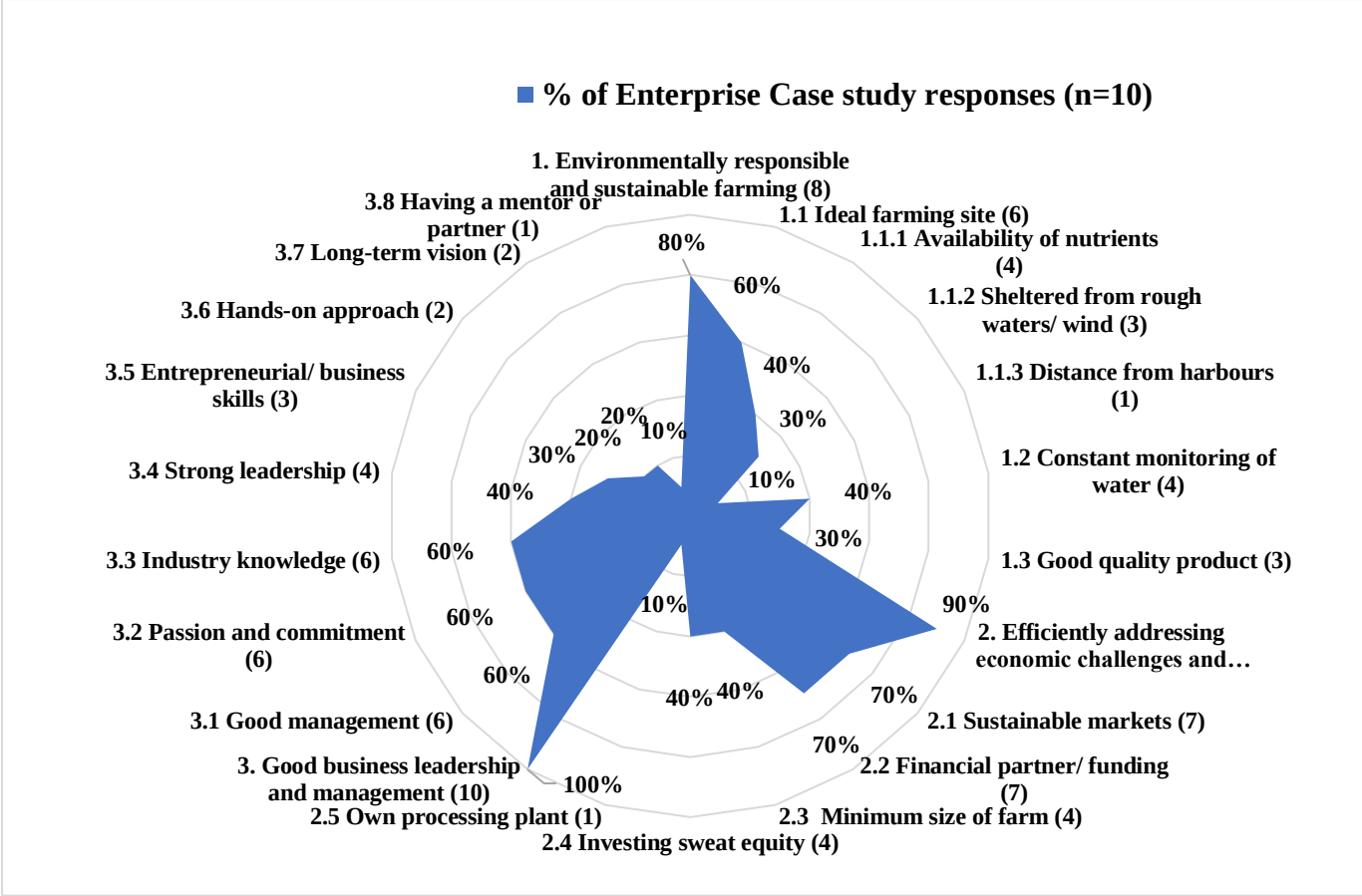

Figure 6.1: Enterprise case study responses on critical success factors and their associated percentages

The responses of role player informants about the critical success factors in aquaculture enterprises are summarised in Figure 6.2. The key success factors they identified, were categorised into environmentally responsible and sustainable farming (78%), efficiently addressing economic opportunities and challenges (89%), good business leadership and management (100%) and a supportive business and enabling environment (11%). The environmental factors included environmental sustainability (56%), a conducive environment (22%) and good quality products. Although climate change and droughts were highlighted as environmental risks, aquaculture was regarded as environmentally sustainable if the correct species were selected for a particular environment.

The green classification of all aquaculture products by the Southern African Sustainable Seafood Initiative (SASSI) was proof that the sector is sustainable, well-managed and does not harm the environment. Cultivating a species in an altered environment also costs money, whilst competing with people producing that same species in a conducive environment.

There was also a feeling that the environmental situation will force farmers to farm smarter and more efficiently. Having a sustainable market (67%) was identified as the most important economic factor. Specific issues included the need for market diversification and increased export (which would involve product standards and certification), and sector-level promotion and awareness (which would require firms to work together). Market support would require price support, promotions and protection against imports. One role player mentioned that enterprises should make sure that the markets for their product are sustainable and in the long-term, there is an opportunity to grow that market.

Having a financial partner or funding was the second most important economic factor (44%). This was critical especially for historically disadvantaged entrants into the sector, and during the start-up phase. Two respondents thought that a commercial or profit motive was critical to ensure that a sustainable, profitable enterprise is set up from the start. In terms of business leadership, the most critical success factors included good management (67%), partnering with established farmers/processors or mentorships (56%), entrepreneurial or business skills (44%), industry knowledge (33%) and good, strong leadership (33%). Good management practices were critical in making the aquaculture sector a good employer, with many long-term benefits for workers including wages that are double the minimum agricultural wage. It also required good technical and managerial skills, ensured economies of scale, and international competitiveness.

Partnering with established farmers was regarded as important to small farmers who would benefit from the expertise of the established farmers, especially in terms of technical and business development know-how, managing product quality and improving each business' efficiencies. One respondent mentioned that the only developmental way forward is once a value chain is established by pioneer farmers, and to use those existing commercial players as development agents. Farmers were lacking entrepreneurial or business skills, especially in terms of inability to draw up good business plans and having the right skills and tools to develop successful ventures. It was mentioned that the Department of Small Business Development would do a needs analysis to determine project needs in this regard.

Industry knowledge was being built based on trial periods of research and development, growing the industry incrementally from a small scale, testing technologies and markets and getting to a proof of concept. The abalone industry was mentioned specifically as an example of an industry that started small (10 t) in the 1990s and grew to more than 1600 t. The mussel industry was also mentioned as a successful industry where pioneer farmers started farming,

processing, developing markets, developing health systems and training people. This developmental path combined public money, partnerships with existing industry and value chains and mentorships to a point where diversification is possible and niche enterprises can be established. One role player mentioned that good support systems should include funding, information and extension services that feed the enterprise with the intelligence needed. This was categorized as a critical business and enabling environment factor.

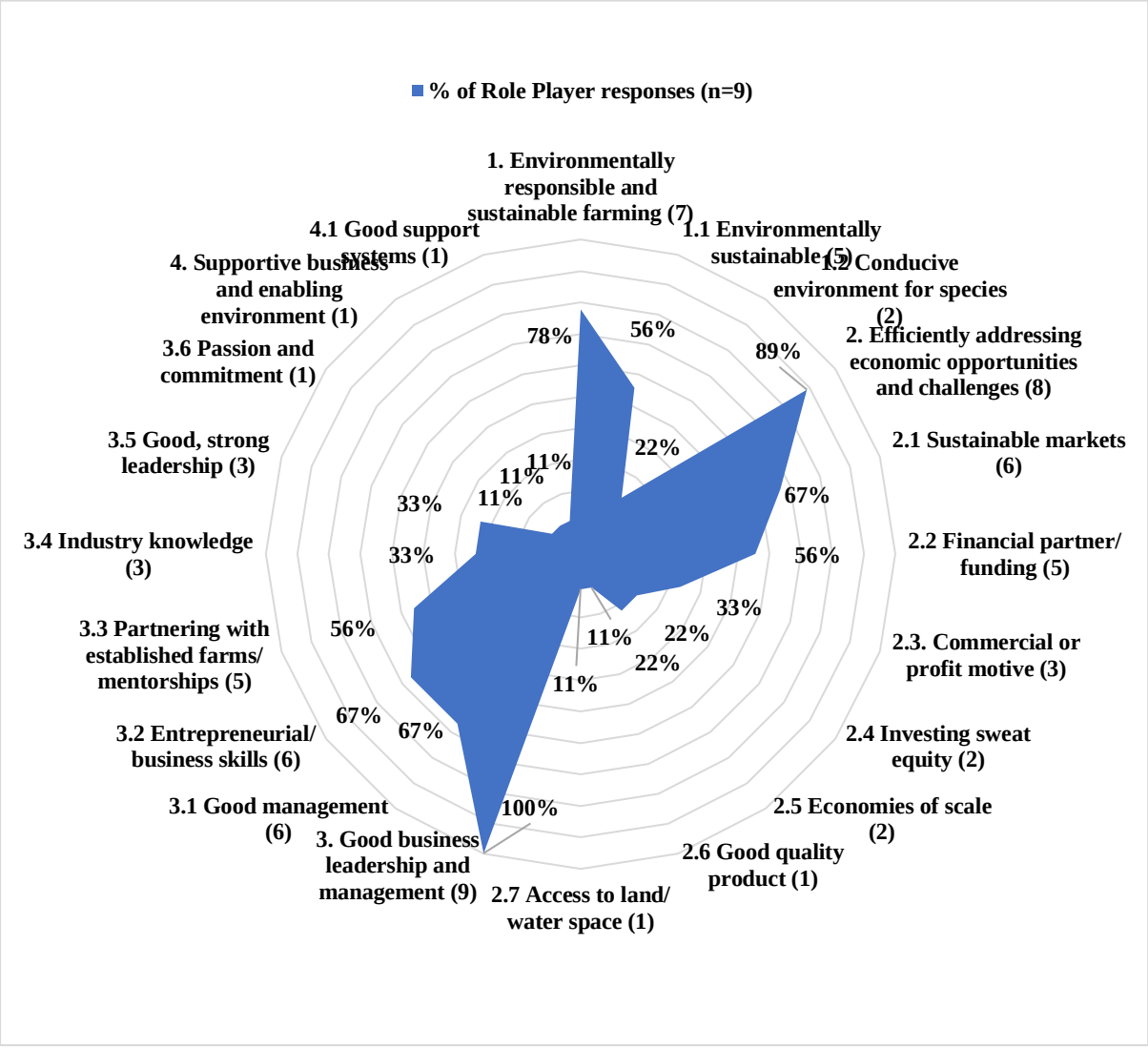

Figure 6.2: Role player responses about critical success factors and their associated percentages.

As illustrated in Figure 6.3, both enterprise case study and role player informant groups placed similar importance on environmental, economic, and business leadership factors as the most critical for success. However, enterprise case study respondents identified environmental

factors directly impacting mussel farming whereas role players referred to the environmental sustainability of aquaculture in general. Both groups identified the market and having a financial partner or funding as the most important economic factors, however only the enterprise case study respondents referred to the minimum viable size of a farm as a critical success factor.

Both informant groups listed good management, industry knowledge, entrepreneurial/business skills, and passion and commitment as critical business leadership qualities required. However, role-player respondents placed more importance on partnering or mentorships with established farms than enterprise case study respondents.

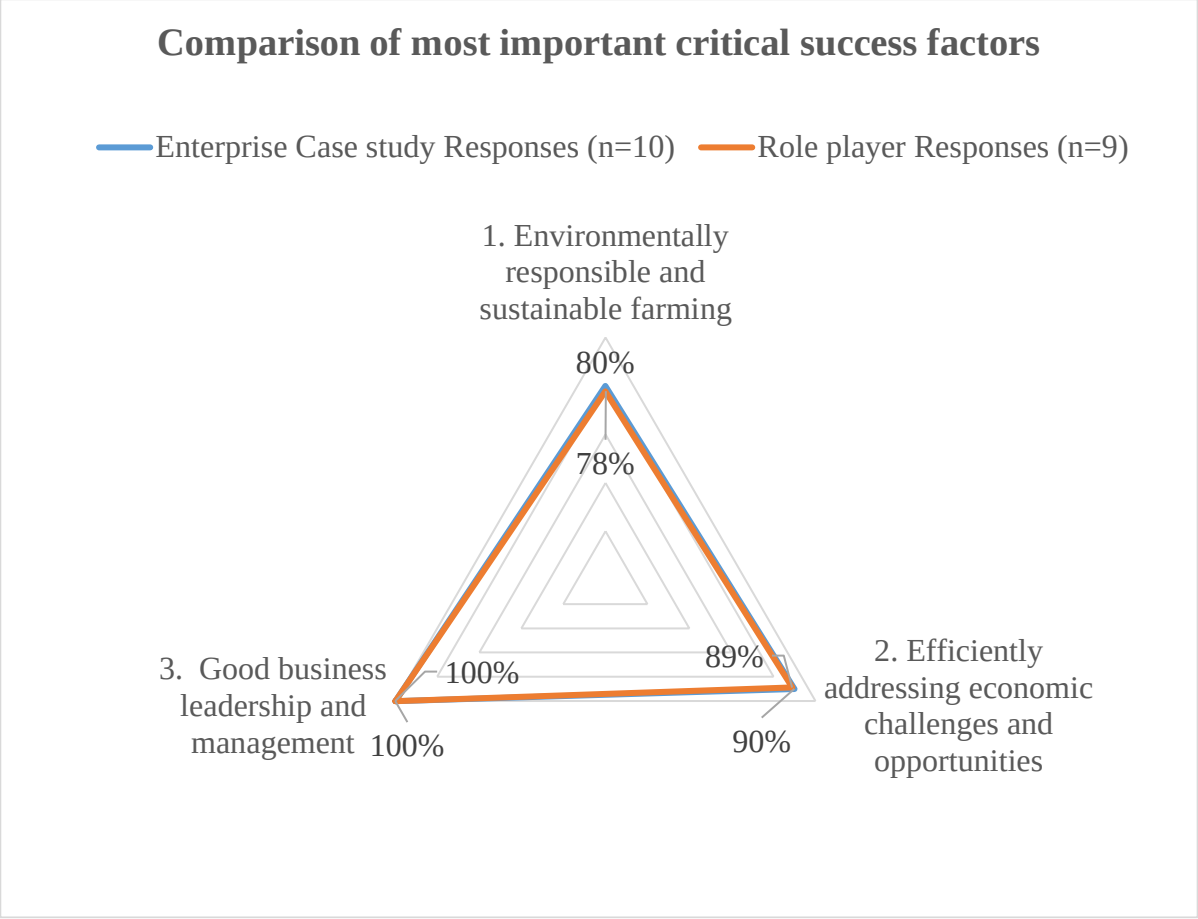

Figure 6.3: Comparison of responses about most critical success factors

6.3.3 Reasons for failing to become self-sustainable

The emphasis on the absence of good business leadership and management as one of the main reasons for failure to become self-sustainable supports the finding that this is a critical success factor. The importance of having the right attitude is reflected in the findings of a study on emerging farmers, that found one of the common themes is serendipity (farming or agribusiness

presented lower risk than existing sources of income), which may point to a questionable commitment to farming and agribusiness (Mabaya *et al.*, 2011). The finding that lack of relevant skills and knowledge (especially financial and business skills) is one of the most important reasons why enterprises fail, is consistent with the findings in a study of aquaculture entrepreneurs in Ghana, where low technical, business and entrepreneurial skills and knowledge contributed to business failure (Adobor, 2020). The importance of technical and management skills was also identified as critical in the success or failure of three commercial community-based aquaculture projects (Hara, Njokweni and Semoli, 2017).

Respondents were asked for their insights into the potential reasons why some enterprises, including public-funded enterprises, fail to become self-sustainable. Figure 6.4 shows that the main reasons cited by enterprise case study informants could be categorized into weak business leadership and management (100%) and challenges related to the business and enabling environment (80%). Key issues related to business leadership and management factors were the wrong motivation (60%), lack of strong leadership (60%), lack of accountability (50%), lack of business and technical skills (50%), reckless spending (40%) and in-fighting (20%).

Wrong motivation included misconceptions about how much money could be made in the industry, wanting to get rich quick, taking things for granted or using the money for different reasons than those provided. Lack of strong leadership referred to lack of purpose or determination, insufficient management, lack of a good person in charge ("jockey"), lack of discipline and commitment and lack of passion. It was specifically mentioned that community-based projects need to have management contracts with existing successful aquaculture companies to succeed. Respondents also felt that there is a lack of accountability on the side of stakeholders who invest public funding, as well as beneficiaries who do not have a complete understanding of the mussel business. There was also a feeling that there is less accountability for the money that is obtained for free, and that it is easier to give up if money does not have to be paid back. In addition to this, it was felt that beneficiaries of some publicly funded projects spent money recklessly.

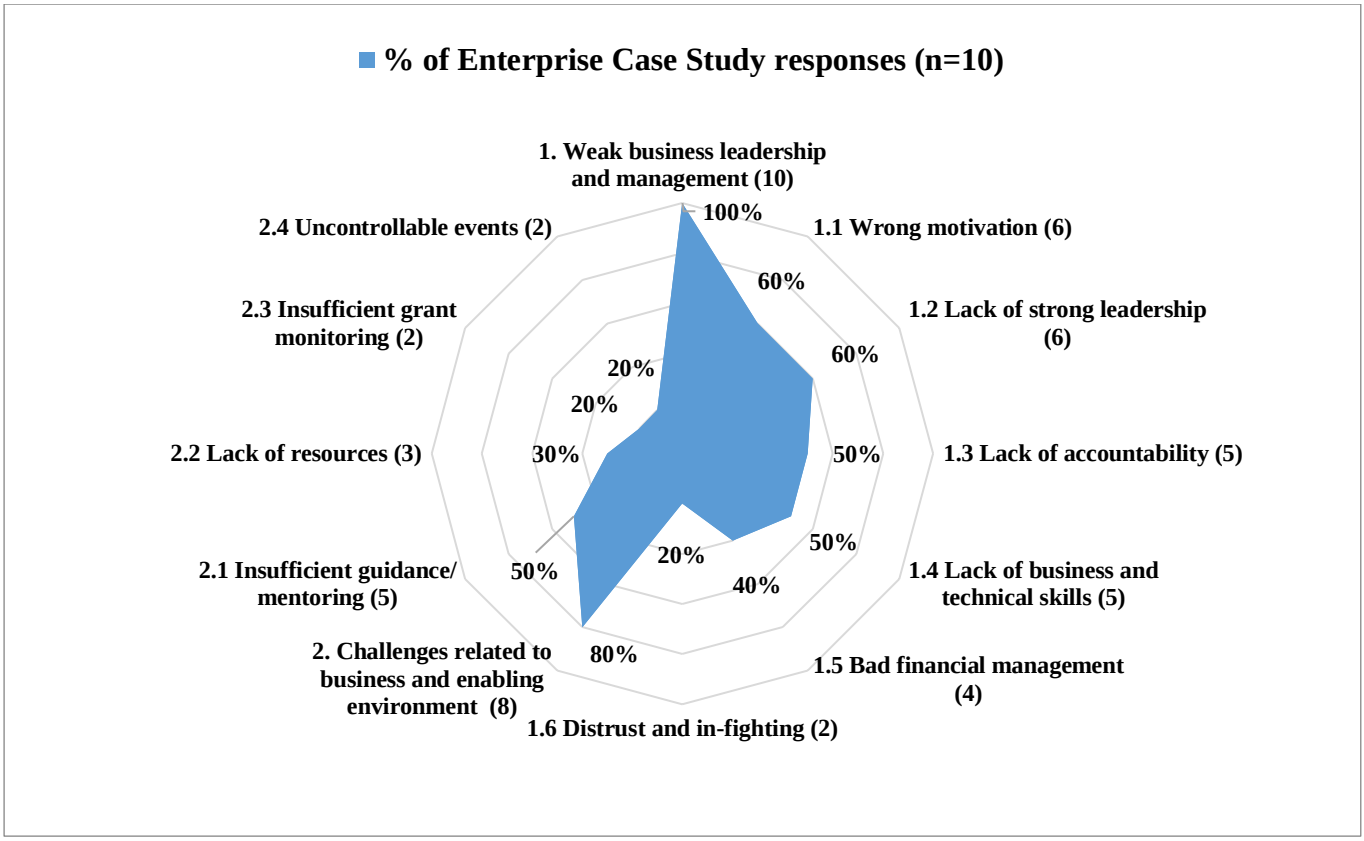

Figure 6.4: Enterprise case study responses and their associated percentages - reasons for failing to become self-sustainable

Respondents provided detailed descriptions of the essential skills and knowledge lacking in failed enterprises. The lack of financial, business administration, market-related and technical skills was most critical (50%). This is related especially to poor business plans and poor business skills, for example by not providing customers with a product on schedule. Most of these skills can be acquired through training. The most critical aspect of the business and the enabling environment was that there was not enough guidance or mentoring (50%). Some of the explanations provided were that aquaculture is a non-mature industry with not many support structures and no long-term mentors.

Some felt that government lack the resources and funding required to help the industry grow or to assist with costs such as tests. Some felt that the process of accessing grants or support was problematic, while others felt that grants were not sufficiently monitored. Uncontrollable events refer to events such as storms, changes in markets and the COVID-19 pandemic.

Role player responses about the reasons why enterprises fail to become self-sustainable are summarised in Figure 6.5. The main reasons were categorized into environmentally unsustainable farming (44%), economic challenges (56%), weak business leadership and

management (100%), and challenges related to the business and enabling environment (33%). Environmental challenges referred to issues such as farming with species that were not suited to the environment (leading to high production costs and lack of competitiveness), and exposure to natural risks such as red tide, diseases, and changes in oceanic conditions. Economic challenges included funding access (especially lack of working capital) and conditions tied to funding that led to projects being set up for social rather than commercial reasons, or people forced into partnerships where their interests may not be aligned. In some instances, markets were unstable or not receptive to the species being farmed. One respondent mentioned that some ventures failed because they could not reach the economies of scale needed for economic viability. One of the key issues related to business leadership and management was a lack of business (including finance and marketing) and technical skills. This was apparent from poor business plans, and lack of client orientation resulting in issues such as unreliable scheduling of product deliveries. The wrong attitude included lack of desire from emerging farmers to start working on their projects, the desire to create something where it is not naturally existing, lack of determination and the perception that funding from the government is considered "free".

In addition, lack of strong leadership pointed to farmers not keeping up with the latest technology, farmers not taking advantage of opportunities, the disempowerment of project participants and financial abuse. One respondent mentioned that the strong and entrepreneurial eventually buys up the weak. Lack of awareness of the realities referred to some farmers relying on others to run their farms without knowing what is happening, not having the right inputs at the right time, and lack of patience. One respondent specifically mentioned that commercial aquaculture (for example abalone) takes decades to become profitable. Regarding the business and enabling environment, there were conflicting opinions about how long government should support enterprises. One respondent felt that the duration of funding support was too short (two to three years), which prevented enterprises from becoming sustainable.

This reflected a short-term view by the government, resulting in many small enterprises being supported from one year to the next instead of them benefiting from long-term commitments of support. This respondent's opinion was that enterprises needed an incubation period of seven to ten years. In contrast, another respondent felt that in some cases, especially where projects were set up as social enterprises and not as profit entities, there was no time limit on government support. This contributed to the projects failing to become self-sustainable. Inadequate extension and support services referred to inadequate monitoring and evaluation of

projects by extension staff, and service providers who manage projects on behalf of beneficiary groups, not possessing the specialised aquaculture skills required.

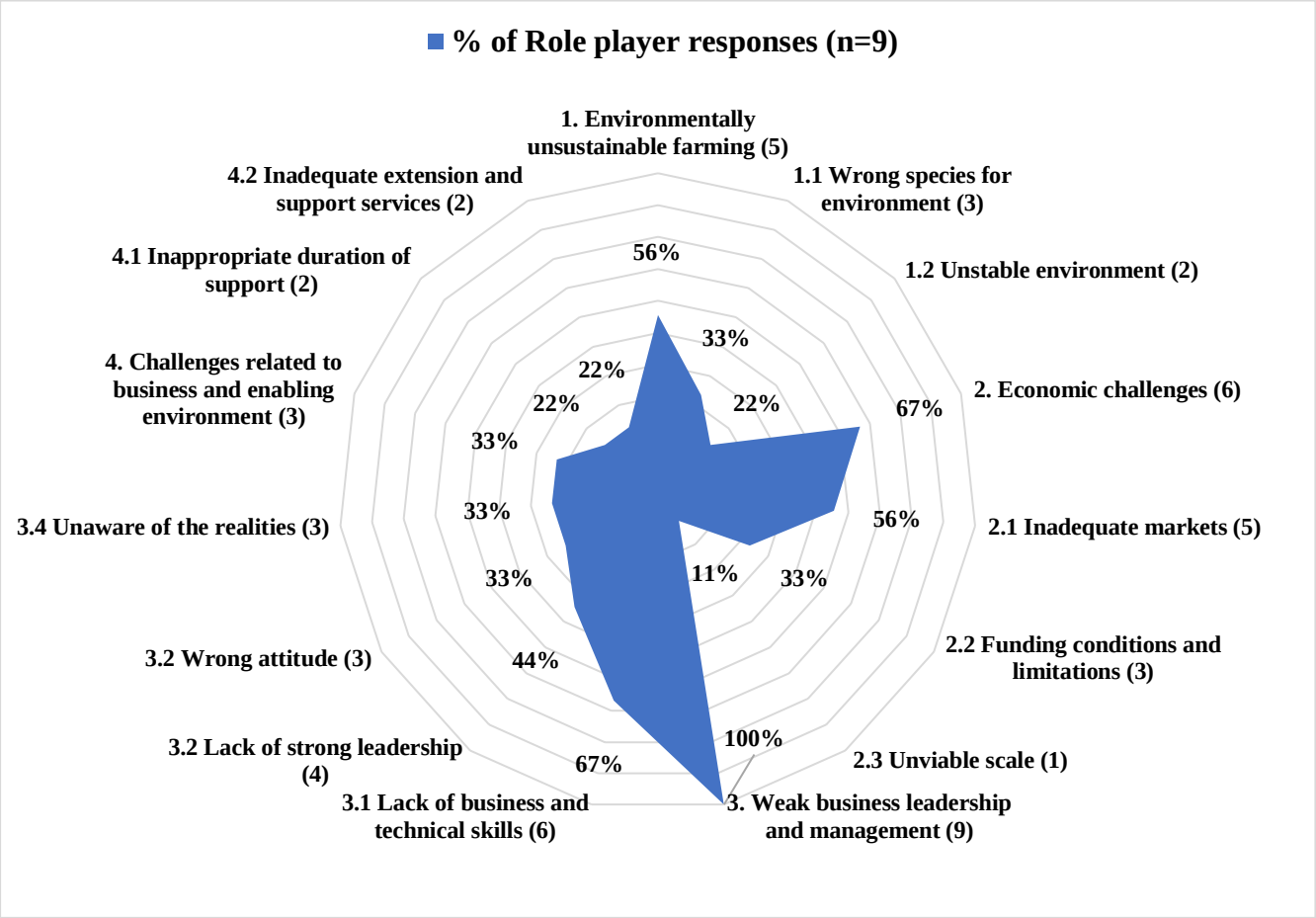

Figure 6.5: Role player responses and associated percentages on reasons for failing to become self-sustainable

As illustrated in Figure 6.6, both enterprise and role player informant groups placed the greatest emphasis on weak business leadership and management as the most important reason why enterprises, including those receiving public funding, fail to become self-sustainable. Enterprise informants placed greater emphasis on challenges related to the business and enabling environment and did not comment on environmental or economic challenges. Role player informants identified environmentally unsustainable farming and economic challenges as additional reasons for potential failure.

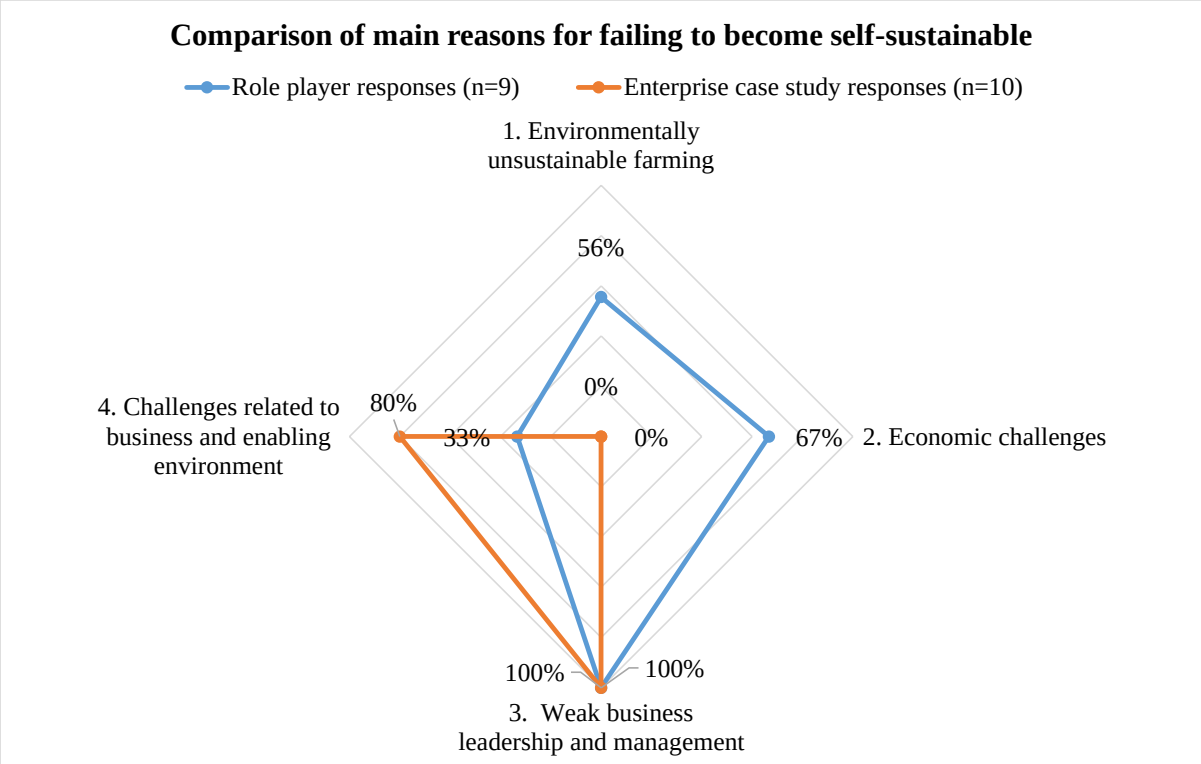

Figure 6.6: Comparison of main reasons for not becoming self-sustainable

6.3.4 Summary of critical success factors and reasons for failure

The summaries of critical success factors (Figure 6.7) and potential reasons for failure (Figure 6.8) indicate four main areas of intervention that should be addressed to assist aquaculture enterprises in becoming self-sustainable:

a) Ensuring environmentally responsible and sustainable farming practices
b) Efficiently addressing economic opportunities and challenges
c) Cultivating good business leadership and management
d) A supportive business and enabling environment.

The results from the study indicate that mussel farmers and role-players understand and agree with the importance of having a commercial motivation and making a profit to become self-sustainable. This requires the selection of species with market demand, development of products meeting market expectations and standards, and development of sustainable markets for those products. This requires a market development mechanism that could centralise product development, marketing, and networking, develop common branding and stimulate market demand.

There is also a need for a focused aquaculture development programme such as an incubator programme that could build a culture of business leadership, impart the technical and business

skills needed by farmers and staff, assist new entrepreneurs with developing industry knowledge, and provide liaison and networking between farmers and other stakeholders. There is also a need for an integrated research and development programme, steered by the aquaculture industry needs, that could support the market development mechanism and development programme. Such a programme could address trends such as climate change effects on aquaculture and fast-track the development of value chains from research to pilot and commercial stages.

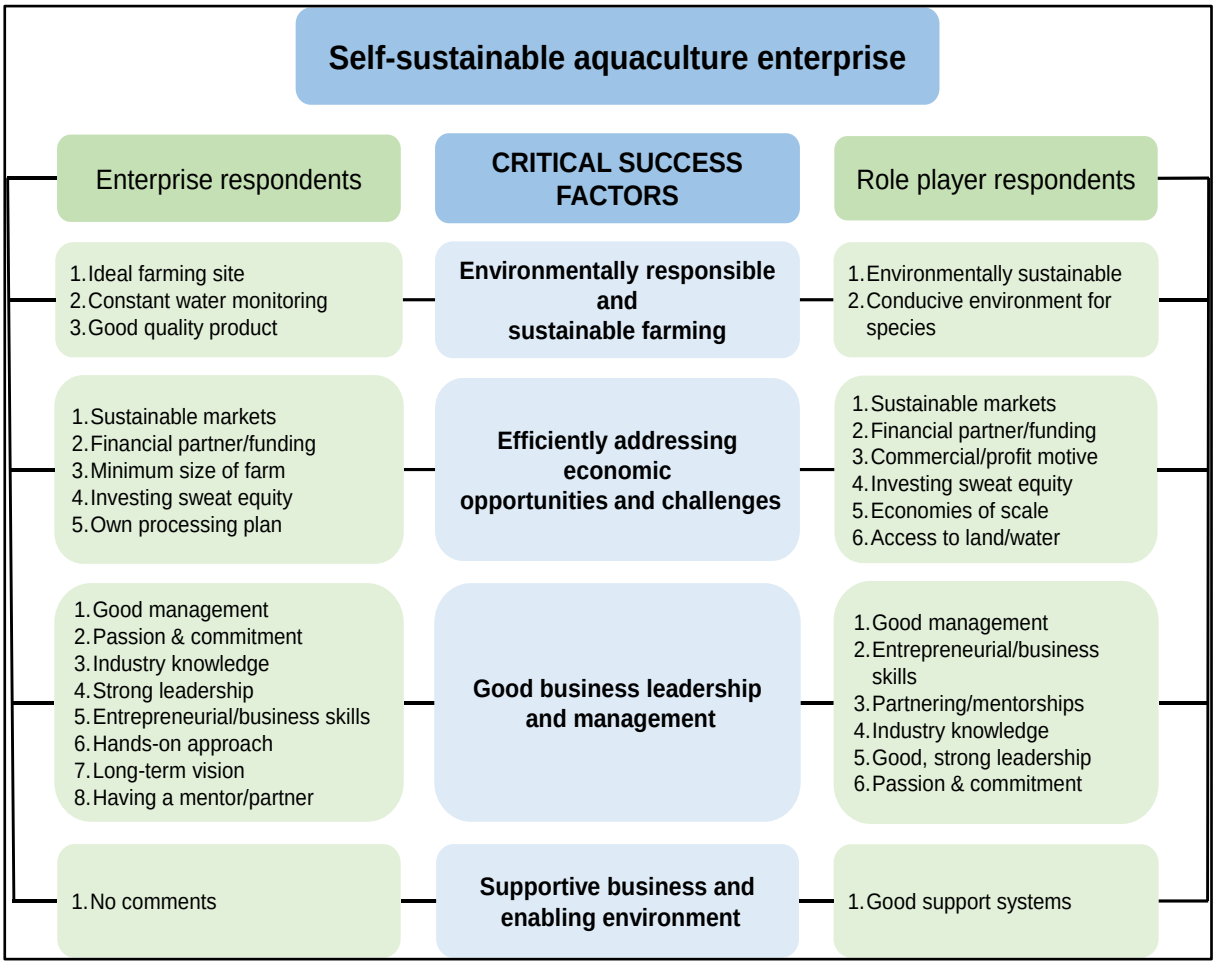

Figure 6.7: Summary of critical success factors to become self-sustainable

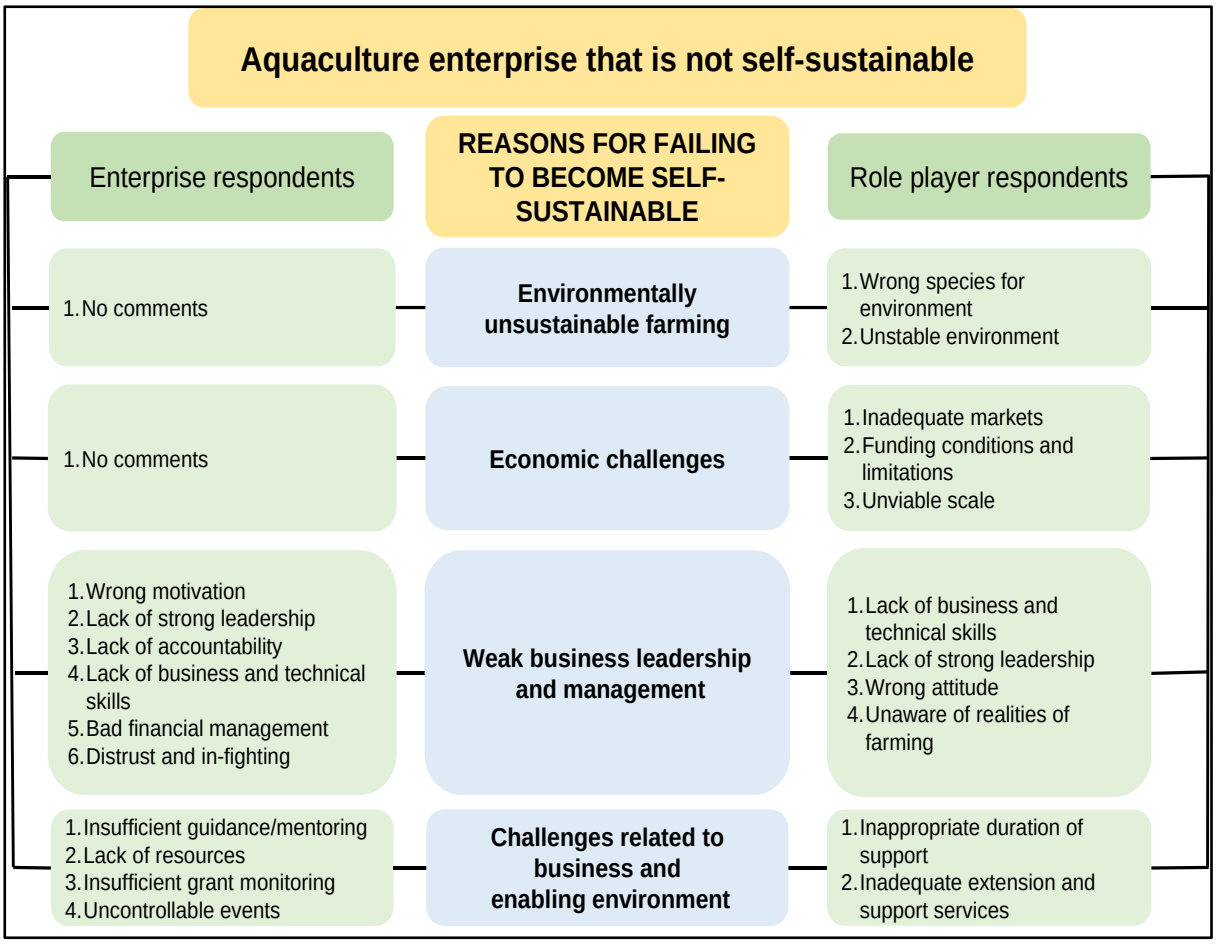

Figure 6.8: Summary of potential reasons for failing to become self-sustainable

Conclusion

Commercially focused aquaculture ventures, if correctly driven, could achieve social benefits such as job creation and transformation. However, socially-focused aquaculture ventures are unlikely to achieve commercial benefits. Commercial ventures that only focus on financial gain and do not address the environmental, social, and other aspects of sustainability, are also not likely to achieve social benefits. The most important critical success factor is good business leadership and management. A focused aquaculture development programme such as an incubator could address these issues in the development of new and emerging aquaculture entrepreneurs and farmers. Such a programme could also address issues around environmentally responsible and sustainable farming.

The second most important critical success factor is the ability to efficiently address economic opportunities and challenges. The development of sustainable markets is critical for the development of self-sustainable enterprises. A market development mechanism such as a co-operative or association could address this need. Setting up an integrated aquaculture research

and development programme could provide a competitive edge to the aquaculture sector. This study identified the most important critical success factors for the development of self-sustainable aquaculture enterprises in South Africa. Addressing these factors through the proposed mechanisms could assist new and emerging aquaculture entrepreneurs and farmers in becoming financially self-sustainable in the long term.

Chapter 7 – The impacts of COVID-19 on the South African aquaculture industry

This chapter deals with the findings on the effects of the COVID-19 pandemic on aquaculture agribusiness enterprises in South Africa. The overall aim of the research study is to create a model to develop self-sustainable aquaculture enterprises, using marine mussel farming as a case study. When the researcher conceptualised the study and data collection instruments, the pandemic did not yet exist. The first interview was arranged for 19 March, before the declaration of a State of Disaster on 15 March 2020. After the country went into full lockdown on 26 March, and the potential devastation on all economic sectors became clear, the researcher adapted the data collection instruments to include a section on the effects of COVID-19. This necessitated the collection of additional data from those respondents who had been interviewed before the adaptation.

This chapters sets out the results from interviews with informants for nine mussel farming enterprises that were in operation in 2020, and nine role player organisations.

This chapter and the following chapters have been written in the format of articles for publication, for ease of reading and to make it easier for the publication of papers. This chapter was published as a paper in the Technium Social Sciences Journal, Vol. 29, 2022 (pp. 363-380).

Assessing the impacts of COVID-19 on the aquaculture industry in South Africa, using the marine mussel farming sector as a case study

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Abstract. This study investigated the impacts of COVID-19 on the aquaculture sector in South Africa. The study was conducted on the West Coast of the Western Cape, South Africa. A multiple-case study approach was followed, focusing on the marine mussel farming sub-sector in Saldanha Bay. Semi-structured interviews were conducted with the owners or managers of nine mussel farming enterprises, and with nine representatives of role players with responsibility or experience in aquaculture, agriculture, or enterprise development. The results of the study focussed on the impacts of COVID-19 on the aquaculture sector and role player organizations; COVID-19 support; initiatives for preparation, survival, and rebuilding; factors promoting resilience, survival, and rebuilding; and requirements to survive and rebuild the sector. The main impact on the aquaculture sector was the closure of markets, which led to cascading impacts on all aspects of the value chain. Role players were affected through impacts on programmes, projects, and staff. Various COVID-19 relief schemes were made available however these could not address all the needs of the sector. Enterprises prepare for the pandemic and the future through long term planning. The main factors contributing to resilience were subsidisation from shareholders, having reserve funds and multiple streams of revenue. The most critical requirements to survive and rebuild the sector was financial support and the opening of markets. The study recommends follow up assessments of the aquaculture industry to fully understand and quantify the effects of the prolonged pandemic and provide tailor-made solutions for each sub-sector to stabilise, revive and grow the aquaculture sector in the medium to long term. Aquaculture enterprises that have closed or are at risk of closure should be prioritised first before any investment in new ventures is considered. In addition, the development of an aquaculture industry-based Business Continuity Strategy and the Ocean

Economy Master plan should be prioritised to assist enterprises until the pandemic is over, to prepare for normalisation of operations thereafter, and to prepare the sector and individual enterprises to be more resilient in case of future global crises and disasters.

Keywords. Aquaculture, COVID-19, bivalve shellfish, mussel, resilience

7.1 Introduction

The coronavirus disease 2019 (COVID-19) is a global pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The disease was identified for the first time in China in December 2019 and thereafter spread rapidly throughout the world. COVID-19 was declared a pandemic in March 2020.

Due to the absence of a vaccine at the time and the potential of the virus to cause massive mortalities, the World Health Organisation recommended a Global Strategy for the disease, which included physical distancing and restrictions on travel (WHO, 2020). Countries responded with measures aligned to this Strategy, which caused a drastic reduction in travel, freight movement and individual freedom of movement, and had a devastating effect on economies worldwide.

The South African government responded by declaring the State of Disaster on 15 March 2020, and measures that curbed social and economic activities, including travel restrictions and five levels of lockdowns. The country went into full lockdown (Alert Level 5) on 26 March for 35 days. Thereafter restrictions were progressively eased to Alert Level 1 by 21 September 2020. These measures caused varying levels of devastation in different economic sectors, affecting all provinces. In response, the South African government put together a 3-phase, 18-month approach to economic interventions aimed at preserving the economy, recovery from the immediate effects of the crisis and building a stronger economy post-COVID-19.

This included an R500 billion financial support package and monetary financial regulatory policies such as reduction of interest rates, to the value of R300 billion (National Treasury, 2020). One of the policies developed included a Corona Virus Temporary Employer-Employee Relief Scheme (COVID19TERS) administered through the Unemployment Insurance Fund (UIF), (Department of Labour, 2020). In response to the pandemic, Statistics South Africa conducted three experimental surveys aimed at providing early indicators on the impact of the pandemic on South African businesses, spanning the period between 30 March and 20 May 2020. The first two surveys covered the period during Lockdown Level 5, and the third was done after restrictions had been eased to Level 4. All three surveys indicated negative impacts on turnover, trading activity, workforce, input prices and financial assistance. The second survey indicated that 8.6% of respondents had permanently ceased trading, and the third survey indicated that 55% of respondents could survive between one and three months without any turnover. Although these surveys provided near-real-time early indicators, measurement of the

actual impact of the pandemic is dependent on the identification of critical variables including the duration of the pandemic, and its intensity in terms of infection rates (Stats SA, 2020a, 2020b, 2020c).

During the five years before the COVID-19 pandemic, the South African government and private sector invested more than R1.2 billion into the aquaculture sector, through interventions such as Operation Phakisa: Ocean's Economy (Aquaculture workstream). This included investment into 35 catalytic projects, 28 of which were Small, Medium, and Micro-sized Enterprises (SMMEs). Twelve of these were new or expansion of existing bivalve shellfish (mussel and oyster) production enterprises in Saldanha Bay (DAFF, 2018b). Aquaculture production (freshwater and marine) was 6366 tons in 2018, valued at R1.12 billion (DEFF, 2021a).

The South African aquaculture sector was regarded as an essential industry sector under COVID-19 restrictions and allowed to continue operations. However, due to disruptions in other industry sectors such as the travel and tourism industry, the markets for aquaculture products were affected. The Department of Forestry, Fishing and the Environment surveyed the aquaculture industry shortly after the start of the pandemic, in April 2020. At that stage, respondents reported an average 54% loss in sales compared to the previous year. Total anticipated loss in sales/income up to October 2020 was estimated at R402 billion (representing 39% of entire sector sales), with an anticipated impact on more than 1200 jobs.

The survey indicated that without cash reserves, an estimated 70% of aquaculture farms were at high risk of closure. The most common support required was soft loans and other finance (R137.2 million), deferred finance (R9.1 million) and feed support. Several short-term (0-6 months) and medium-term (6 months+) support interventions were proposed to support farms in distress (DEFF, 2020). This survey formed the basis of a COVID-19 response plan, to be incorporated into the responsible department's annual performance plan. The main purpose of this paper was to understand the impacts of the COVID-19 pandemic on aquaculture enterprises in South Africa after April 2020, what is needed to recover from these impacts and how this understanding could be incorporated into a model for the development of self-sustainable aquaculture enterprises in South Africa.

7.2 Methodology

This study was included in a wider research project investigating self-sustainability in aquaculture enterprises in South Africa. The marine mussel farming industry was used as a case study, as it is the largest contributor to aquaculture production in South Africa (DAFF, 2017a). The study was mainly based on semi-structured interviews with marine mussel producers in the bivalve shellfish (mussel and oyster) sector, and role players in the aquaculture and enterprise development sectors. Interviews were conducted between 19 March (just before the country went into full lockdown Level 5) and 12 October 2020, when restrictions had been eased to Lockdown Level 1. Therefore, responses reflected an evolving situation over various levels of lockdown and restrictions. This should be considered in the analysis and interpretation of results.

7.2.1 Study area

The study focused on marine mussel producers in South Africa's bivalve shellfish (mussel and oyster) aquaculture industry. The study area was Saldanha Bay, on the West Coast of South Africa, and included three bivalve shellfish farming areas totalling 460 ha. The survey population included 27 bivalve shellfish farming enterprises in the study area that were approached through the Bivalve Shellfish Farmers Association of South Africa and the Western Cape Provincial Department of Agriculture. The sample size for this study included nine of the existing enterprises listing mussel cultivation as a primary or secondary activity. The selection was mainly based on willingness to be involved in the study.

The mix of enterprises included established commercially focused and empowerment enterprises, and new or emerging, commercially focused enterprises. The survey population also included role players in South Africa with responsibility or experience in aquaculture, agriculture, or enterprise development. The selection was based on willingness to be involved in the study, and availability. The role player categories, as described in Table 7.1, included two national and provincial government departments with responsibility for aquaculture, three aquaculture associations, two universities and two individuals with experience or expertise in aquaculture farming and enterprise development. These role players were, therefore, able to provide insights on aquaculture and enterprise development from Southern African, government, industry, research, education, and practitioner perspectives.

Table 7.1: Role player categories with their associated spheres of influence

Role Player Category	Sphere of influence or representation	Number of persons interviewed
National and provincial Government departments with responsibility for aquaculture or agriculture	1. National aquaculture sector (freshwater and marine) 2. Western Cape provincial aquaculture sector (freshwater and marine)	2
Aquaculture associations	1. Aquaculture stakeholders in Southern Africa 2. Seven freshwater and marine aquaculture producer associations in South Africa 3. All bivalve shellfish producers in South Africa	3
Universities	1. Agricultural Sciences including Aquaculture research, training, and development; Commercial aquaculture development expertise 2. Social dimensions of the fishing, aquaculture, and coastal sectors	2
Individual - Experienced aquaculture farmer and mentor	South African commercial aquaculture and development expert with practical experience in mentoring of emerging aquaculture farmers	1
Individual - Enterprise development expert	Expert in enterprise development, technology transfer, business incubation and strategy/programme design and implementation in South Africa	1
Total		**9**

7.2.2 Data collection

An empirical, phenomenological approach was followed, as described in the literature (Remenyi *et al.*, 2010). A case study approach was selected as a suitable method, as it is a scientific research method in its own right and can generate context-dependent knowledge as described by several researchers (Flyvbjerg, 2006; Yin, 2009; Remenyi *et al.*, 2010). Semi-structured interviews were conducted with the owners or managers of bivalve shellfish farming enterprises selected as case studies, and with the representatives of role, players selected.

A qualitative approach was followed to conduct the research. Due to the implementation of COVID-19 restrictions on movement during the time the study was conducted, interviews mostly took place via video-conferencing or cellular phone platforms. Interview questions were structured around the themes of the impact of COVID-19 on the aquaculture sector, support received, mechanisms for coping, factors contributing to resilience and requirements to survive the pandemic. This information was communicated before interviews as part of the Participant Consent forms.

7.2.3 Sampling procedure

The sample size included nine bivalve shellfish aquaculture enterprises that were in operation before the onset of the pandemic. The selection was mainly based on willingness to be involved in the study. The mix of enterprises included commercially focused empowerment, and new or emerging, commercially focused enterprises. The role player sample included two representatives from national and provincial government departments with responsibility for aquaculture, three aquaculture associations, two universities and two individuals with experience or expertise in aquaculture farming and enterprise development. The selection was based on willingness to be involved in the study, and availability. Nine role player interviews were conducted.

7.2.4 Data analysis

Multiple-case study analysis consisted of two stages. Firstly, within-case analysis was conducted, where the qualitative data were analysed by identifying and copying responses from each transcription that were relevant to each of the questions asked during the interview. These responses were further analysed to create themes and sub-themes (or codes). MS Excel was used for the second stage of analysis (cross-case analysis) where a grouping of themes and sub-themes as well as summarising of codes was completed.

7.3 Results and Discussions

South African aquaculture products are marketed locally and internationally, depending on the species. Most of the new entrants sell to local retailers, and more advanced businesses use distributing agents, marketing companies or in-house marketing experts. Some producers sell to processing plants that sell processed products in the local or international market. Primary processors have developed their cold storage and distribution networks, and there are also fully integrated marketing and merchandising operations responsible for distribution to the retail sector.

In 2018, total aquaculture production was 6366 tons, valued at R1.1 billion. About 3191 tons (mostly tilapia) were exported, with an estimated value of R199.3 million. The remainder was sold locally. Most farmed mussels (2182 tons in 2018) were sold locally. The mussel export market was estimated at 66 tons valued at R2.8 million (DAFF, 2017a; DEFF, 2021a). It is therefore not surprising that the aquaculture sector was severely impacted through the COVID19 lockdown closures of both at local and international markets, as it had ripple effects throughout the value chains for all species (freshwater and marine). To understand the impacts of the global COVID-19 pandemic on aquaculture enterprises in South Africa, and what is needed to recover from these impacts, the researcher solicited opinions and insights from the enterprise case study and role player respondents about the effects of COVID-19 on their businesses or organisations; COVID-19 support provided or received; initiatives to prepare, survive and rebuild; factors promoting resilience, survival and rebuilding; and requirements to survive and rebuild businesses. The responses of enterprise case study respondents reflect the experiences of owners or managers in the bivalve shellfish value chain, whereas role player responses reflect a broader, industry-wide perspective. This must be kept in mind when analysing the results, as the two groups had different perspectives on the same subjects.

The responses from enterprise case study informants were grouped into five main themes including the impact on operations and production, COVID-19 and other support, initiatives to prepare, survive and rebuild, factors promoting resilience, survival and rebuilding, and requirements to survive and rebuild the business. These themes are presented in Figure 7.1.

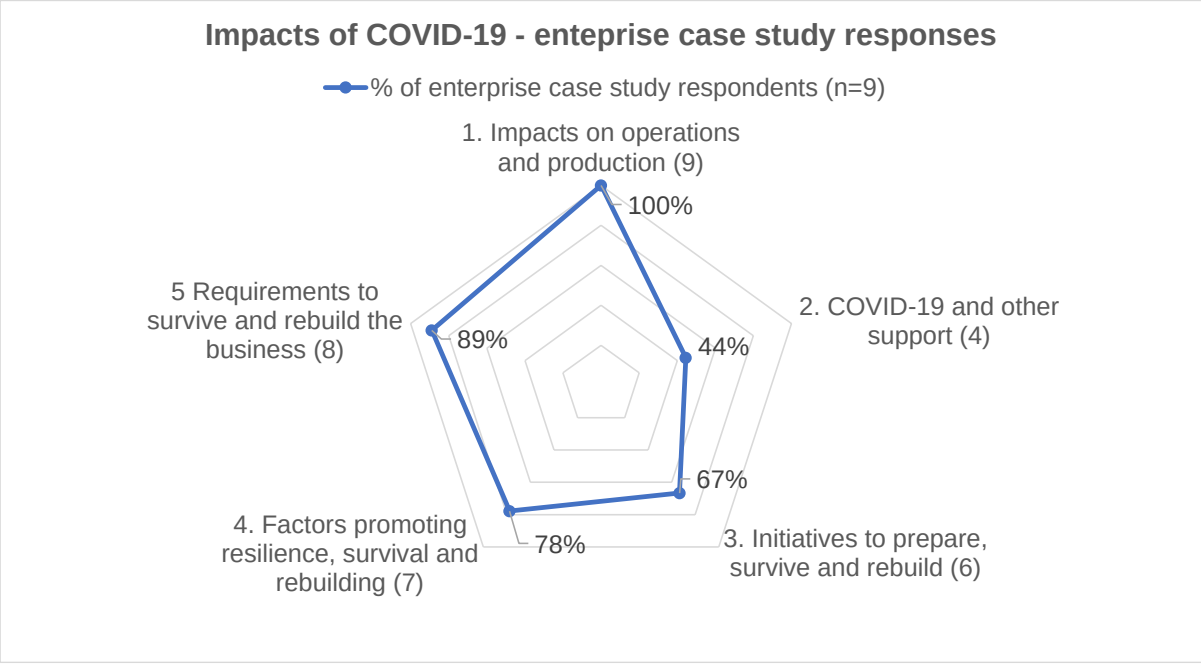

Figure 7.1: Enterprise case study respondents on COVID-19 areas of impact

As illustrated in Figure 7.2, the responses from role player informants were grouped into five main themes including the impacts of COVID-19 on their organisation; impacts on the aquaculture sector; COVID-19 support; factors promoting resilience, survival, and rebuilding; and requirements to survive and rebuild. They offered perspectives and insights for the wider aquaculture and agribusiness sectors.

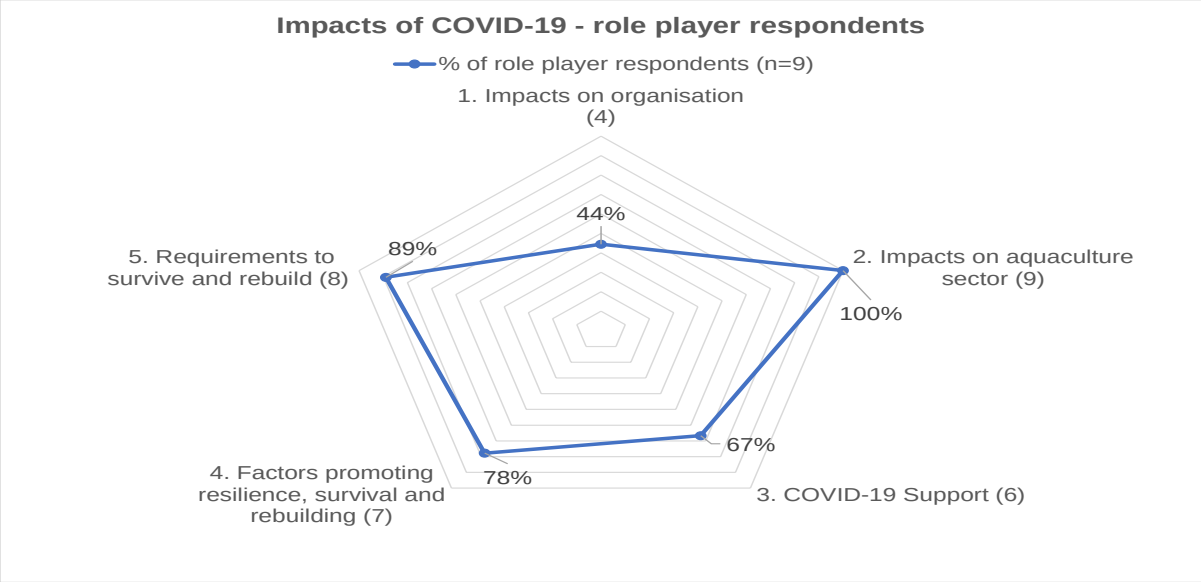

Figure 7.2: Role player respondents on COVID-19 areas of impact

7.3.1 Impacts on aquaculture operations

Responses from enterprise case study informants are summarised in Figure 7.3. The main impacts were temporary closures (33%), closure of markets (89%), reduced harvest and excess product (44%), no or delayed production (44%), impact on employment and staff (67% and inability to pay costs (33%). Aquaculture was regarded as an essential service and therefore could continue during the lockdown. However, at the start of Alert Level 5, some enterprises closed to get the correct COVID-19 procedures in place. Many enterprises already had plans in place for quieter production periods (especially due to red tide). The effects of temporary closures varied between companies. Whilst some enterprises shut down for the first few weeks of lockdown for reasons varying from preparation of COVID-19 management plans to red tide, others reported periodic closures tied to the continuous risks of infection amongst staff.

The biggest effect of COVID-19 on the bivalve shellfish sector was the closure of markets and a drop in sales. This was because most bivalve shellfish products are sold into the local hotel, restaurant, and catering (HoReCa) industry, which was severely affected by the restrictions on movement. Exports were halted because of the restrictions on travel and freight and became

very expensive when shipping and flights resumed. Oyster producers were especially hard hit as oysters were regarded as a “luxury” product, sold life, and typically consumed with alcohol. Alcohol sales were banned or restricted, and the HoReCa industry operations were curtailed under most Alert Levels. The closure of markets and reduced income resulted in reduced or delayed production activities, reduction in harvests and an excess of product. Two respondents mentioned that some producers harvested and processed their raw material, which had to be stored until markets opened.

Besides increased storage costs, this led to concerns about overproduction and potential price wars in an already saturated market. Reduced operations also led to the loss of or unmarketable raw material, as the animals continued growing. One producer estimated a loss of at least 160 t of raw material for the year. The impact on production also meant that new, emerging farmers were delayed in starting their production or fell behind with their planned production schedules. Although 67% of respondents reported that employment and staff were affected, the specific impacts varied. One producer reported dismissals because of non-adherence to company COVID-19 rules, and an expected 10% reduction in staff numbers as a result. Others reported negative effects on staff morale, especially due to job uncertainty. In some cases, where companies were unable to pay salaries, staff were able to access the COVID19TERS benefits through the UIF for a few months. Unfortunately, some staff misinterpreted the benefit as an additional payment on top of their normal salaries, which affected relationships between staff and managers.

The loss of income meant that some producers were unable to pay normal operational costs such as maintenance or lease fees. One company simply used the lease money to pay more urgent operational costs, whilst another tried to negotiate with Transnet National Ports Authority (TPNA) for suspension or reduction of water lease fees.

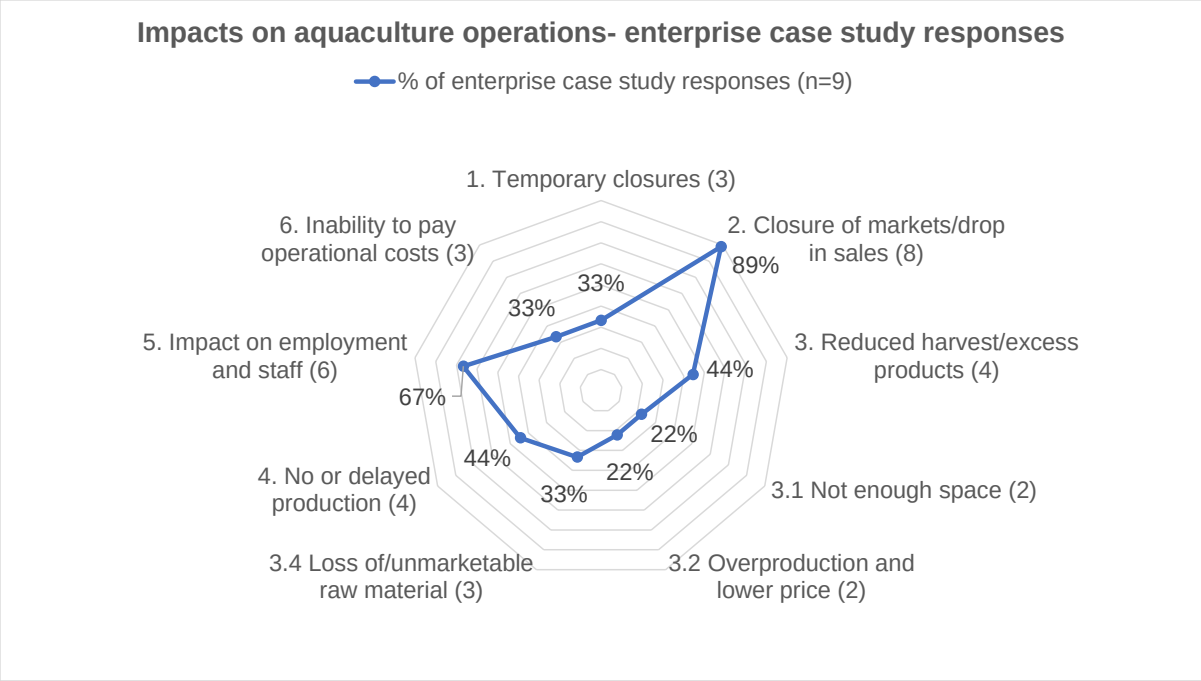

Figure 7.3: Enterprise respondents on COVID-19 impacts on aquaculture operations

As illustrated in Figure 7.4, role players identified the main impacts as reduced operations (33%), loss of production (33%), overstock (56%), lower prices (44%), market closures (89%), financial difficulties (67%), cost-cutting (67%), the opportunity for mergers (11%), improved communication (11%) and reduced investment (11%). The main impact was the closure of markets and loss of sales and income. Sub-sectors such as mussels and oysters were especially hard hit because most of their local sales went into the HoReCa industry, which was shut down for long periods. Those with access to processors could harvest, process and store products however, they did not have unlimited storage facilities.

Access to export markets (e.g., in China) was also curtailed due to freight and logistical challenges. The abalone export market to China had collapsed before 2019 due to political issues, and COVID-19 added further pressures to this industry sector. One respondent estimated that producers were selling only 30% of what they were able to sell in 2019. The overstock of products affected the whole value chain with hatcheries and nurseries unable to move stock, and producers unable to harvest. In the mussel sector, this led to shake-offs, which also led to mussels lying on the bottom sediments with potentially negative effects. The lack of harvesting also meant a loss of production, which one respondent estimated would amount to about 500 t for the year. Because animals keep growing, in many sectors the closure of markets meant that aquaculture products grew outside the traditional size brackets preferred by specific markets. For example, bigger and older mussels were less desirable and fetched lower

prices. In the trout industry, farmers culled fish and sold them into the cat food market as it was too expensive to keep feeding them. Because of stockpiling, there were fears of oversupply and lower prices when markets did open.

Knock-on effects of market closures were financial difficulties and potential business closures, cutting costs such as energy and labour, and overstock across the value chain. One respondent estimated that most of the bivalve shellfish producers only had cash reserves for two months, after which they would need business rescue or close their businesses. They estimated that at least 20% of these businesses may need to close.

The bigger companies with processors could sell processed and frozen products into the retail sector however most of the smaller companies sold directly to the food services sector. It was specifically mentioned that some of the companies selling fresh mussels were already going out of business, and some abalone farms were experiencing financial difficulties. Whilst businesses received little or no income, they still had to pay operating costs such as feed, energy, and labour. Whilst a survey at the initial stages of the pandemic indicated minimal staff reductions, there was recognition that further surveys at a later stage may reveal a different picture. Some respondents did indicate that aquaculture had "gone into survival mode", and some companies coped through retrenchments, sending staff home without pay, working with 10% skeleton staff, temporary business closures, and reductions in remuneration packages. Staff, infections also meant that people had to self-isolate for 14 days, which affected productivity. One respondent estimated a 10% reduction in total employment in the aquaculture sector for the year. One respondent mentioned that there was a reduced investment in new sectors such as marine finfish and tilapia, as investors such as big corporates with cash reserves stopped investing in innovation and development. Some respondents identified positive effects such as the opportunity for mergers or joint ventures, and improved communication between government and industry.

The results of this study echo the findings of studies worldwide regarding the impacts of COVID-19 on the aquaculture sector in general (marine and freshwater), specific sub-sectors/species, and fisheries. The biggest impact on aquaculture enterprises, production and operations were the closure of markets and disruptions of travel and freight, leading to disruption of traditional marketing channels and supply chains. This, in turn, caused loss of turnover; financial losses; problems with obtaining input supplies; overstock of animals and low prices due to low demand and oversupply; disruption of production schedules and loss of raw material; and loss of employment and income for workers (Jamwal and Phulia, 2021;

Kumaran *et al.*, 2021; Lebel *et al.*, 2021; Manlosa, Hornidge and Schlüter, 2021; van Senten, Engle and Smith, 2021). In India, the pandemic caused an estimated economic loss of USD1.5 billion in the shrimp farming sector alone (Kumaran *et al.*, 2021).

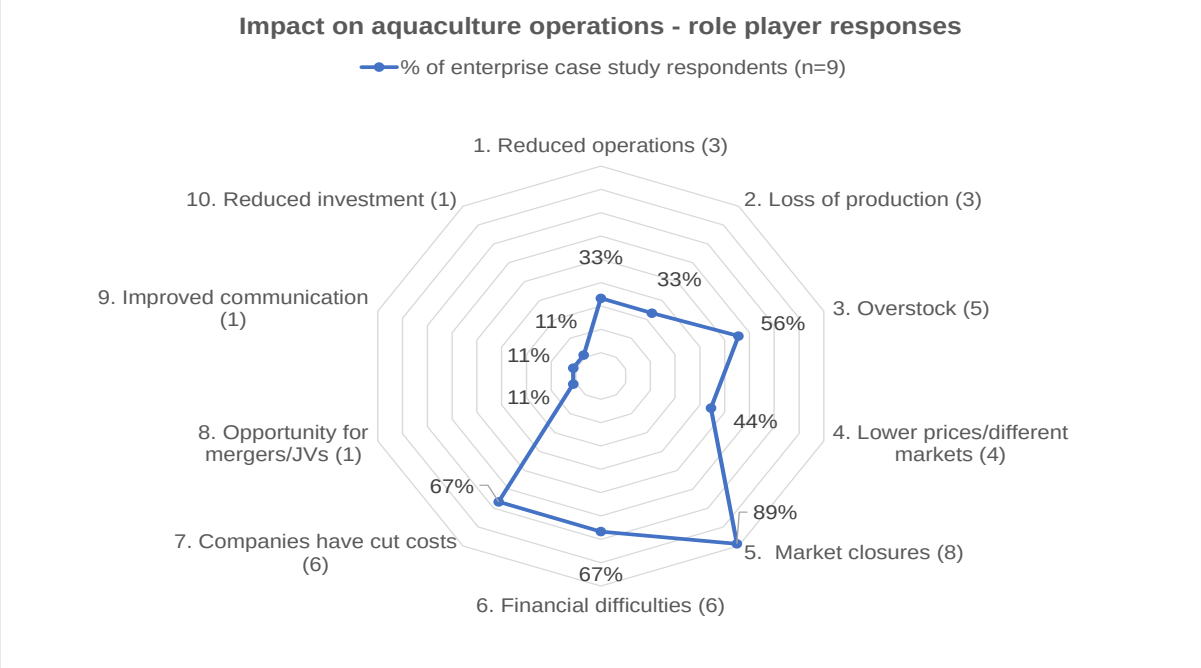

Figure 7.4: Role player responses on COVID-19 impacts on aquaculture operations

7.3.2 Impacts on role player organisations

Role player organisations experienced negative impacts related to their projects and programmes (44%), staff (33%) and restriction of movement (22%), as summarised in Table 7.2. Whilst one respondent stated that support programmes are being implemented, as usual, others reported negative impacts on programmes such as small-scale producer support, enterprise and supplier development, and bankruptcy of an association. The pandemic showed weaknesses in systems, such as internet communication, the flow of information and the completion of administrative tasks. Staff had to start working remotely on a rotational basis and cancel site meetings to projects. Some respondents reported negative staff morale and elevated levels of anxiety due to infections, self-isolation, and reductions in salaries and benefits such as pension and leave allocations.

Table 7.2: Thematic impacts on organisations of role players and their associated percentages

Themes	Number of role players responded (n=9)	Percentage (%) of respondents
1. Impacts on projects and programmes	4	44%
2. Restriction of movement	2	22%
3. Impacts on staff	3	33%

7.3.3 COVID-19 support

As indicated in Table 7.3, four enterprise case study respondents (44%) and six role player respondents (667%) commented about COVID-19 related support. Only one enterprise case study respondent reported that they received no support and that it was difficult to get through to government employees. Two were able to access the COVID19TERS benefit through the UIF scheme, which assisted with the payment of workers for a few months. One respondent commented that disaster aid is costly, unproductive, and selective: "benefits accrue to selected suppliers/recipients". Others reported that they were able to access grant or long-term loan funding through government or financial institutions, or that they were able to negotiate for payment relief for water lease fees ("TNPA were a bit lenient").

One of the six role player respondents was a government department that had developed a COVID-19 response plan based on surveys and identification of critical needs. This was planned to become part of their annual performance plans and would address interventions such as negotiating for deferral of rentals, implementation of longer time frames for the Aquaculture Development and Enhancement Programme (ADEP), promotion of the drive to buy local, and development of recipes for aquaculture products. One role player respondent felt that the current relief schemes were either not readily available, or some companies did not qualify. Most companies made use of the COVID19TERS benefit through the UIF scheme.

Another government department mentioned that they provided support to farmers in the short-term, across all commodities, not only in aquaculture. They also provided social relief to communities such as masks and assistance with grant applications. Another respondent mentioned that they did not receive any COVID-19 support but were applying for a loan through a bank. There was also a comment made by one respondent about the long-time government took to sort out the Corona Virus Temporary Employer-Employee Relief scheme (COVID19TERS) funding and other relief programs. This led to their organisation helping suppliers through advances based on expected future business.

Table 7.3: Number of respondents that receives COVID-19 support and their associated percentages

COVID-19 support	Number of respondents	Percentage (%) of responses
Enterprise case study responses (n=9)	4	44%
Role player responses (n=9)	6	67%

Worldwide, many governments and organisations also provided support to enterprises such as assisted access to domestic markets, easier loan conditions, direct financial assistance, information on coping strategies, securing passes for mobility and connections with new markets (Lebel *et al.*, 2021; Manlosa, Hornidge and Schlüter, 2021). Social support included food aid and emergency subsidy programmes for households. In the Philippines, the two largest telecommunication networks provided free Facebook access for subscribers which aided with online selling and buying (Manlosa, Hornidge and Schlüter, 2021).

7.3.4 Initiatives for preparation, survival, and rebuilding

Only enterprise case study respondents commented about initiatives they had taken to prepare for, survive, and rebuild after the pandemic, as summarised in Table 7.4. The most important initiative was long term planning (44%). These respondents regarded the closures as an opportunity to build stock for the future through reseeding on new lines or to obtain finance to get the infrastructure ready for when markets re-opened. They were looking towards the future and felt that they should be patient until they reached their desired production level, as they felt certain that things will go back to normal. One respondent had prepared a COVID-19 management plan, and another had cut down costs as much as possible so they could just survive.

Table 7.4: Initiatives undertaken for preparation, survival, and rebuilding after the pandemic with their associated percentages

Themes	Number of Enterprise Case Studies responded (n=9)	Percentage (%) of responses
1. COVID-19 management plan	1	11%
2. Long term planning	4	44%
3. Lean operation	1	11%

The initiatives implemented by South African aquaculture enterprises included Covid-19 management plans, long term planning, and making their operations as lean as possible. These are echoed in some of the recommendations for addressing all aspects of the aquaculture sector,

including development of Sector Operational Plans for reducing operational costs, and several long-term strategies, to make aquaculture more resilient in future (Jamwal and Phulia, 2021).

7.3.5 Factors promoting resilience, survival, and rebuilding

As reflected in Figure 7.5 for enterprise case study informants the most important factor contributing to resilience and survival was subsidisation or support from associated companies or shareholders (56%). This was especially true in cases where companies were wholly or partly owned by holding companies that provided financing, or individual shareholders that used their savings. Open communication with staff and stakeholders was also important to stabilise operations. Two respondents reported that their ability to build reserve funds in previous years contributed to their resilience and survival. Two others mentioned that being smaller companies meant fewer expenses, which contributed to their resilience and ability to survive.

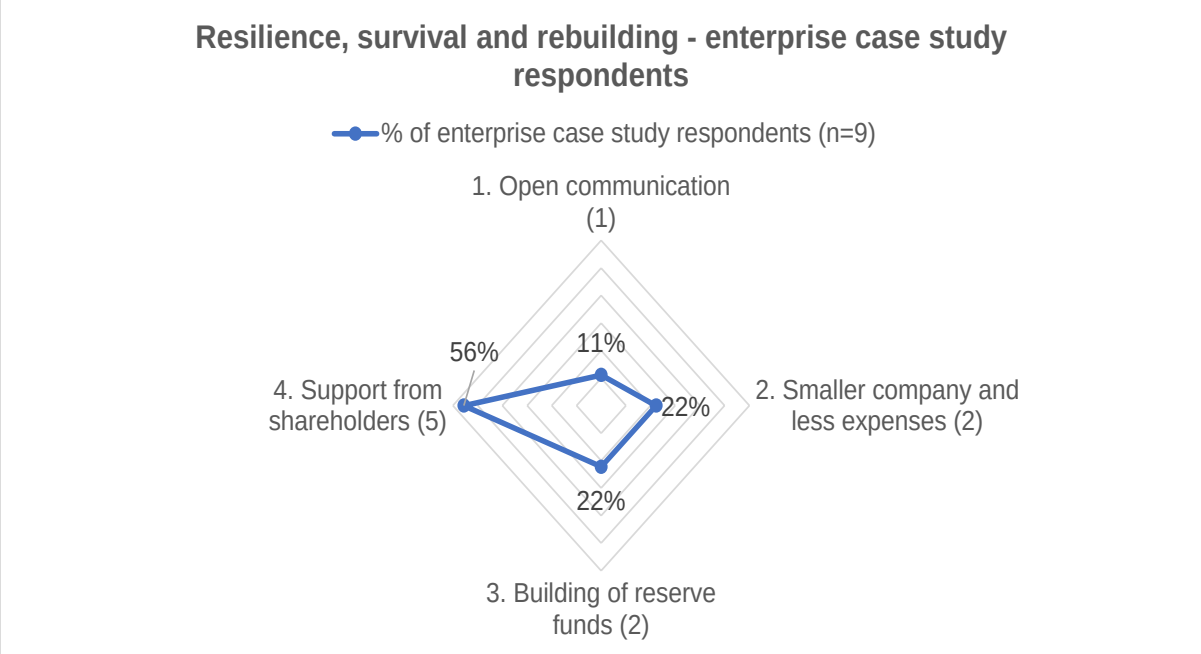

Figure 7.5: Enterprise case study responses on factors promoting resilience, survival, and rebuilding

Role player responses regarding factors promoting resilience, survival, and rebuilding after the pandemic are indicated in Figure 7.6. The most important factor was having cash reserves (44%) with one role player stating, “if you cannot fund the losses, you cannot survive”. This referred to companies having intrinsic financial resources and a strong balance sheet based on retained earnings. One respondent mentioned that tax structures need to be changed to incentivise businesses to hold more cash reserves.

Vertical integration and multiple streams of revenue (33%) also contributed to resilience and survival, as large-scale companies usually were integrated, well managed and well capitalised. Good management, innovation, and creativity were also important for long term resilience and survival (44%). Respondents specifically mentioned that some companies were in existence for decades and had "weathered many storms" through good management and that entrepreneurs must be flexible, innovative, and creative in overcoming problems. Another felt that critical success factors should be defined, and that grant funding must be mixed with pure capitalist business drivers to make businesses more sustainable in the long term.

Having diverse markets and species mix, and outside support such as the UIF relief and borrowing from financial institutions also helped. Economies of the scale were identified as an additional factor, where larger, well-managed enterprises had a better chance of survival than smaller community, village, or family-based enterprises. One respondent specifically mentioned the examples of large-scale salmon farms in the North Sea and clustered small-scale enterprises integrated with significant government support such as those found in East Asian countries like China. Another felt that it will only be the "really big" abalone suppliers that will survive in that sector.

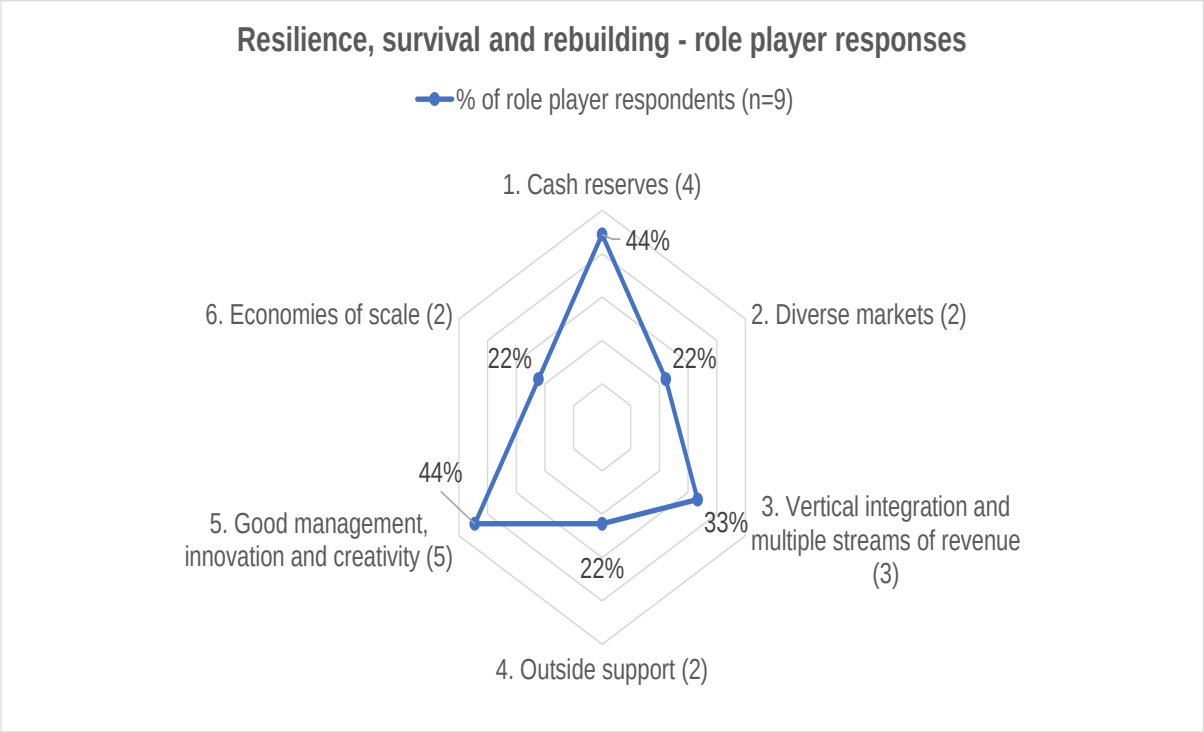

Figure 7.6: Role player responses on factors promoting resilience, survival, and rebuilding

On a global scale, coping strategies by producers and fishers included online buying and selling, peddling caught fish in communities, diversifying income and growing their food, marketing and financial measures, changes to crop calendars and rearing practices, seeking new markets, adoption of post-harvest processing, borrowing money, drawing on savings or assets, reducing labour costs, adjusting stocking practices (Lebel *et al.*, 2021; Manlosa, Hornidge and Schlüter, 2021). In the Philippines, the ability of fish farmers and fishers to organise, mobilise and adapt, was an important source of resilience. This was possible because of long-established relationships between the farmers, fishers, and state actors (Manlosa, Hornidge and Schlüter, 2021).

7.3.6 Requirements to survive and rebuild businesses

Enterprise case study responses on the requirements to survive and rebuild businesses are shown in Table 7.5. Almost all enterprise case study respondents (89%) noted that financial support is essential to survive and rebuild businesses.

Although some were leaning on holding companies for support, they were investigating alternatives such as low-interest loans offered by the Public Investment Corporation (PIC) or Industrial Development Corporation (IDC) as part of COVID-19 relief programs. Others received moratoriums on existing loans, applied for UIF funding, applied for working capital grants, or were investigating private funding based on using their aquaculture infrastructure as collateral. Although only 33% specifically mentioned access to markets as a requirement to survive, it is assumed that this is an implicit requirement for all enterprises due to the severe impacts of market closures on all enterprises interviewed. Besides the opening of markets (especially the HoReCa industry), respondents mentioned the importance of targeting new export markets, and for government intervention in re-entering or gaining access to new markets.

Table 7.5: Enterprise case study responses on the requirements to survive and rebuild businesses

Themes	Number of Enterprise Case Studies respondents (N=9)	Percentage (%) of responses
1. Financial support	8	89%
2. Access to markets	3	33%

As illustrated in Figure 7.7, for role player respondents the most critical requirement for businesses to survive and rebuild after the pandemic, was financial support (78%).

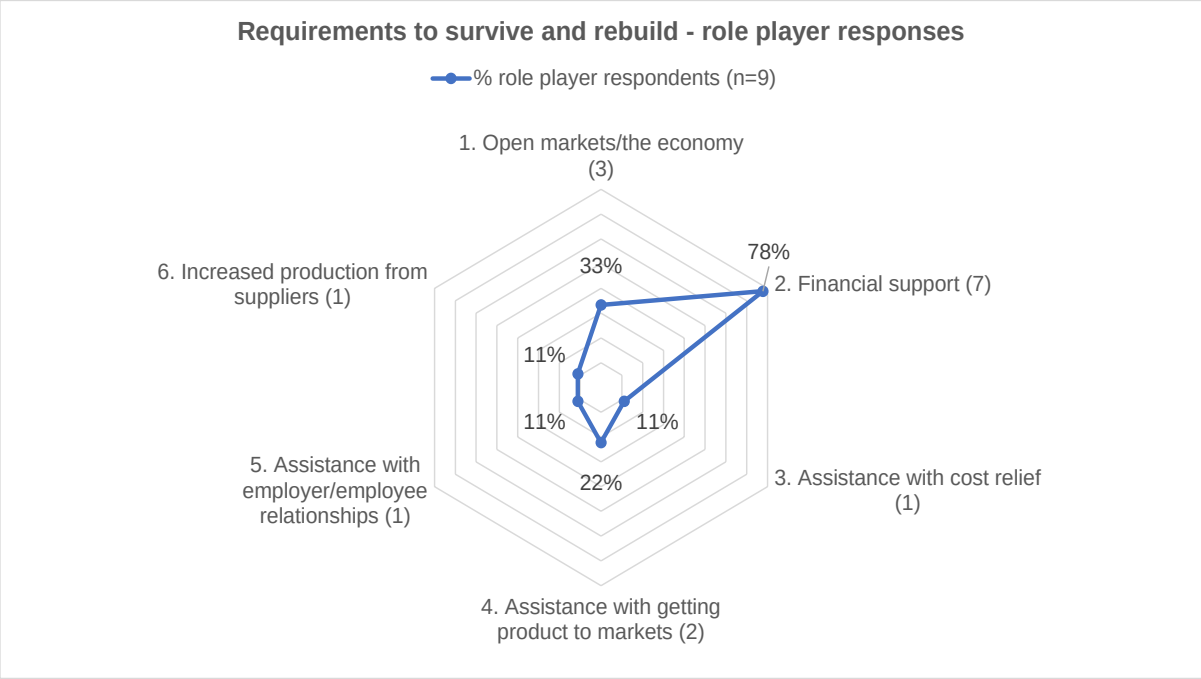

Figure 7.7: Requirements to survive and rebuild businesses – role player responses

Some of the suggestions included the rescheduling of current short-term business debt (2% per annum or less interest, over 5-15 years), through Treasury, Reserve Bank or commercial banks credit arrangements, subsidisation of salaries, changing of tax structures and continuation of grant schemes. Although only three respondents specifically mentioned the opening of markets, it is assumed that it is a vital requirement, due to the severity of impacts of market closures on businesses. Other suggestions included government assistance with getting the product to markets (e.g., helping with freight and finding markets for surplus products), assistance with cost relief, assistance with employer/employee relationships and helping suppliers to increase their production.

Both informant groups listed loss or closure of markets and resultant loss of sales as the most important impact of COVID-19 on the aquaculture sector. This had various knock-on effects such as overstock, lower prices, loss of raw material, staff reductions and inability to pay operational costs. The most important factors promoting resilience were subsidisation by shareholders and having access to cash reserves.

Similarly, both groups listed financial support and access to markets as the most critical requirements for aquaculture businesses to survive the pandemic and rebuild their businesses. The situation across the world remains dynamic as the pandemic had not been brought under control by October 2021. Despite the development and worldwide roll-out of vaccines, most countries experienced successive waves of infection flare-ups since March 2020, resulting in numerous cycles of increases and decreases of lockdown levels. Therefore, the most important requirement for survival and rebuilding of aquaculture sectors worldwide, the complete re-opening of markets for aquaculture products, remains a moving target. In the interim, the aquaculture industry, supported by the government and other sectors, need to devise and implement strategies to continue surviving, and to rebuild the industry and societies once the pandemic is over. In addition, the threat of future pandemics and global crises such a climate change requires a re-think of how to prepare the aquaculture sector for future shocks.

(Jamwal and Phulia, 2021) describe the COVID-19 pandemic as a One Health issue (a collaborative approach including professionals from various disciplines to address all aspects of the sector including biological and socio-economic issues). Their recommendations (some of which could be considered by the South African industry and government) include identification of free transit of disease-free fish and fish-related products during an epidemic or pandemic, increased trade transparency and traceability, limiting exposure to the international market and catering to local demand, reduction of fishing effort/production, development of Standard Operating Procedures (SOPs) for reducing operational costs, self-reliance in the production of essential items of input, declaration of minimum support price or fair price, protection policies and monetary welfare packages for more vulnerable Small-scale Fisheries (SSFs) and communities that practice sustenance fishing, and leveraging technology to manage farm activities. They also propose the introduction of Internet of Things (IoT) based solutions, strengthening of local markets, innovations in marketing strategies, product traceability and online fish purchasing.

Although the Indian government implemented immediate measures to assist the aquaculture industry, a study on the shrimp farming industry led to further suggestions for short-term

(current year) and medium-term (2-5 years) mitigation measures to support seed production, shrimp farming, processing, and marketing, and labour and social system (Kumaran *et al.*, 2021). According to the Food and Agriculture Organization of the United Nations (FAO), COVID-19 related cuts in trade of bivalve shellfish are higher than for other types of seafood, because bivalves are mostly marketed in live form. Lower prices were obtained due to lower demand.

Contrary to most countries, the Spanish mussel processing industry grew in 2020 due to its ability to adapt to the change in consumer patterns to retail marketing of canned mussel products, by diversifying from live mussel products to ready meals and canned products. Bivalve producers and traders worldwide should learn from this example and invest in value addition beyond frozen half shelves to products that can be offered for sales in supermarkets and through home delivery services (FAO, 2021). These and other strategies for the rebuilding of economies and aquaculture sectors worldwide will require access to funding. The World Bank is making available up to USD160 billion especially in developing countries, to strengthen their pandemic response and overcome the health, economic and social difficulties caused by the pandemic (The World Bank, 2021). However, individual countries still need to provide or enable access to financial support.

7.4 Conclusions

The COVID-19 pandemic is an extraordinary, once-in-a-lifetime crisis with devastating impacts on economies and societies worldwide. The pandemic exposed the vulnerability of aquaculture enterprises to disasters and crises with such wide-ranging impacts. Enterprises with the potential to be self-sustainable under normal circumstances needed to adapt in extraordinary ways to stay in business. This study identified the main impacts on the aquaculture sector as the closure of markets and drop in sales, which led to many other challenges such as loss of production, reduction in staff, financial difficulties, and business closures. The pandemic impacted the ability of role player organisations to continue with their operations and programmes, especially through restrictions on movements and impacts on staff. Although various COVID-19 support schemes were made available, there were challenges and some companies could not readily access such schemes. Enterprises prepare for the pandemic and the future mainly through long-term planning such as getting production structures ready. Some of the main factors contributing to resilience were subsidisation from shareholders, reserve funds and multiple streams of revenue. The most critical requirements to survive and rebuild the sector was financial support and the opening of markets.

7.5 Recommendations

Considering the predictions that there may be more frequent pandemics, the lessons learnt during this and other studies can be used for the development of interventions aimed at surviving and rebuilding the sector to be more resilient in future. These lessons should be taken into consideration in the formulation of policy and strategy, especially during the current process to develop an Oceans Economy Master Plan to build on the achievements of Operation Phakisa. This includes the stabilisation, revival and growth of Aquaculture and Fisheries as a sub-sector. Considering the estimation that at least 70% of aquaculture farms risk closure, drastic interventions from stakeholders will be required to revive closed businesses and rebuild the surviving ones. These businesses should be prioritised first before any investment in new aquaculture ventures is considered. Follow-up assessments of the aquaculture industry should be conducted to better understand and quantify the full impacts of COVID-19 on the sector and provide tailor-made solutions for each sub-sector to stabilise, revive and grow the aquaculture sector in the medium to long term. The development of an aquaculture industry-based Business Continuity Strategy should be prioritised to assist existing enterprises with strategies for survival until the pandemic is over, to prepare for normalisation of operations thereafter, and to prepare the sector and enterprises to be more resilient in case of future global crises and disasters.

Chapter 8 - Development of a model to create self-sustainable aquaculture enterprises

The previous chapters addressed results from investigation of specific aspects of this research study, which included understanding the success factors for case study enterprises in the mussel industry, understanding the impacts of key stakeholders on aquaculture enterprise development, identification of critical success factors for aquaculture enterprises and understanding the impacts of the coronavirus disease 2019 (COVID-19) pandemic on the sector. Three papers have been prepared for publication including:

a) Paper 1- Assessing the impacts of stakeholders in aquaculture enterprise development (currently under review for submission to a suitable journal)
b) Paper 2- Critical success factors for aquaculture enterprise development in SA (published in an accredited journal)
c) Paper 3- Assessing the impacts of COVID-19 on the aquaculture industry (published in an accredited journal).

This chapter builds on the results of Papers 1 to 3 for an understanding of the factors affecting mussel production, challenges that compromise development of self-sustainable aquaculture enterprises, and an enterprise development model that could address those challenges for the creation of self-sustainable aquaculture enterprises.

This chapter has been written in the format of an article for publication, for ease of reading and to make it easier for the publication of a paper based on this research.

Developing a model to create self-sustainable aquaculture enterprises in South Africa, using marine mussel farming as a case study

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Abstract. The global aquaculture sector is expected to contribute 53% to fish production by 2030, and 59% to fish food consumption. The development of the aquaculture sectors in many countries has therefore become an important strategy for many countries, including South Africa. The development of self-sustainable aquaculture enterprises is important for the achievement of development goals set for the sector. Unfortunately, South Africa does not have a good track record in terms of business sustainability. The business environment is complex, and it is critical that financial and non-financial support must be in place to help new and existing aquaculture businesses to become self-sustainable. The purpose of this paper is to describe the key factors affecting mussel production, identify the key challenges that compromise self-sustainability in aquaculture enterprises, and to describe an aquaculture enterprise development model that could address those challenges to and create self-sustainable aquaculture enterprises.

The study was conducted in the West Coast of the Western Cape, South Africa. A multiple-case study approach was followed, focusing on the marine mussel farming sub-sector in Saldanha Bay. Results from semi-structured interviews with enterprise and role player informants, and an analysis of case studies were used to identify key factors affecting mussel production, and key challenges to enterprise self-sustainability. Insights obtained from consultations with enterprise development experts were used to prepare a draft model for discussion and validation during focus group sessions with relevant stakeholder representatives.

The goals of the proposed enterprise development model are to develop aspirant aquaculture entrepreneurs into industrialists, increase the number of entrepreneurs that succeed, and shorten the time frame from entry to sustainability. The model contains five main components including a vision for the sector or sub-sector, a mechanism to drive implementation of the model, an aquaculture incubator that forms the core of the model, an integrated research and development programme and a market development mechanism. The paper concludes with a proposal for the implementation of a pilot aquaculture enterprise development model in the Saldanha Bay Aquaculture Development Zone, to test assumptions and refine the model for wider applicability in other ADZs or sub-sectors.

Keywords: Aquaculture, enterprise development model, self-sustainable, Saldanha Bay Aquaculture Development Zone, mussel cultivation

8.1 Introduction

The global fisheries sector produces about 179 million tonnes (t) with total first sale value estimated at US$401 billion, of which 156 million t is used for human consumption (equivalent to about 20.5 kg annual supply per capita). Aquaculture accounts for 46% of total production, and 52% of fish used for human consumption. By 2030, global aquaculture production is expected to contribute 53% to global fish production, and 59% to global food fish consumption (FAO, 2020b). In addition, about 99% of global seaweed production is grown in aquaculture, accounting for more than 35 million t valued at about US$15 billion (Cottier-Cook *et al.*, 2021). The development of the aquaculture sector is therefore an important strategy for food security and revenue generation for many countries.

The establishment of a successful aquaculture industry typically takes decades to achieve, requires committed involvement and investment in research and development from government and industry, and efficient responses to challenges such as diseases, efficient production of inputs, market development and environmental management. Such issues have been faced in the development of global aquaculture industries such as salmon and blue mussel farming in Chile (Perlman and Juárez-Rubio, 2010; Gonzalez-Poblete *et al.*, 2018), the aquaculture industry in New Zealand (Stenton-Dozey *et al.*, 2021), tilapia farming in China (Xu and Ming, 2018), shrimp farming in Bangladesh (Islam *et al.*, 2020) and salmon farming in New Brunswick, Canada (Chang, Coombs and Page, 2014).

The development of the South African aquaculture sector is following a similar path. Although the sector is small in comparison to the rest of the world (0.01% and 0.3% of 2018 world aquaculture production and value respectively), it is deemed to have great potential for food (protein) security, revenue and job creation, and transformation. The Operation Phakisa (Aquaculture) Strategy launched in 2014 resulted in increased private and public investment, increased production of more than 3500 t, 2400 additional jobs, and additional contribution of more than R580 million to the gross domestic product (GDP) (DEFF, no date). However, statistics indicate that much still needs to be done to meet targets for production, revenue, and job creation, that were set in 2014. The development of aquaculture farms and enterprises that can meet sector goals requires an understanding of, and long-term commitment of resources to, development of their potential and addressing their needs.

In 2016, micro and small enterprises contributed about 48% to the gross domestic product (GDP), employed over 8.5 million people (53% of employed persons), and contributed about

55% to employment in the agriculture sector (Stats SA, 2017b) (DSBD, 2017). The development of small enterprises in South Africa is therefore also an important strategy in achieving national objectives related to revenue growth, job creation, and economic transformation. However, the country does not have a good track record in terms of business sustainability, with statistics indicating a 5-fold loss of businesses from start-up to established business ownership (Herrington and Kew, 2018).

The main purpose of this paper is to describe the key factors affecting mussel production (as a case study of the aquaculture sector), identify the key challenges that compromise self-sustainability in aquaculture enterprises, and to develop a model that could address those challenges to create self-sustainable aquaculture enterprises in South Africa.

8.2 Materials and Methods

This paper incorporated the results from the initial stages of the research study, which included the following activities:

a) Analysis of ten mussel aquaculture enterprises to identify potential success factors and reasons for failure.
b) Identification of the impacts of key aquaculture stakeholders, the institutional framework and support systems on the sector.
c) Identification of the critical success factors for aquaculture enterprises.
d) Identification of the impacts of the COVID-19 pandemic on the sector.

Results were used to identify key factors affecting mussel production, and the challenges to the development of self-sustainable aquaculture enterprises. The Cambridge dictionary defines a factor as “a fact or situation that influences the result of something. The adjective “key” is defined as “very important and having a lot of influence on other people or things”. The term “key factor” can be defined and used in different ways. Synonyms for the term that are relevant to this study include “important element”, “fundamental aspect”, “basic ingredient” and “vital component”. In the context of this study, key factors refer to the most important factors that influence the results of mussel production.

A sustainable or successful business is generally accepted to be financially viable and profitable, meaning it brings in more revenue than it is spending on the costs of running the business. The term self-sustaining refers to the ability to maintain oneself by independent effort. The researcher defines a self-sustainable enterprise as “An enterprise that can sustain its

operations from income derived from the sales of its goods and services without external financial support".

The study was mainly based on semi-structured interviews conducted during 2020 with marine mussel producers and role players in the aquaculture sector, consultations with enterprise development experts in 2021, and focus group discussions with selected stakeholders in 2021 for validation of a draft enterprise development model. The marine mussel farming industry provided a good case study for the investigation and conceptualisation of a model for enterprise development, as it is the largest contributor to aquaculture production in South Africa (DAFF, 2017a).

8.2.1 Study Area

The study focused on the marine mussel aquaculture industry located in Saldanha Bay, on the West Coast of South Africa. The study area included three bivalve shellfish (mussel and oyster) farming areas totalling 460 ha. The survey population included 27 bivalve shellfish farming enterprises in the study area that were approached through the Bivalve Shellfish Farmers Association of South Africa and the Western Cape Provincial Department of Agriculture. The sample size included nine of the existing enterprises listing mussel cultivation as a primary or secondary activity and one that had ceased operations. The selection was mainly based on willingness to be involved in the study.

The survey population also included role players in South Africa with responsibility or experience in aquaculture, agriculture, or enterprise development. The selection was based on willingness to be involved in the study, and availability. The role player categories included two national and provincial government departments with responsibility for aquaculture, three aquaculture associations, two universities and two individuals with experience or expertise in aquaculture farming and enterprise development. These role players were, therefore, able to provide insights on aquaculture and enterprise development from Southern African government, industry, research, education, and practitioner perspectives.

The results from semi-structured interviews were used to identify the key factors affecting mussel production, and the challenges that compromise development of self-sustainable aquaculture enterprises. During 2021, consultations were conducted with six enterprise development experts from various organisations and background as described in Table 8.1. Their selection was based on reputation and willingness to be involved in the study. Their

insights were used to conceptualise a draft aquaculture enterprise model that could address the challenges identified and create self-sustainable enterprises.

Table 8.1: Enterprise development experts and their backgrounds

Expert organisation	Background	Number of experts
Enterprise development agency	Expert in technology transfer and support	1
Research council	Experts in enterprise development, technology transfer, SMME and incubation development, technology localisation and management of technology programmes, policy formulation in SA	2
Independent	Experts in enterprise development, technology transfer, business incubation and strategy/programme design and implementation in SA	3
Total		**6**

During September 2021, the researcher conducted two focus group sessions with representatives from various stakeholder groups. The purpose was to present the initial study conclusions and draft aquaculture enterprise development model, for discussion and validation. Invitations were sent to representatives of 30 stakeholder organisations including aquaculture enterprises, industry associations, government departments, government agencies, development finance institutions, universities, research councils, enterprise development agencies, and the private sector. Seven stakeholder representatives attended the first session, and eight attended the second session. The description of stakeholder organisations, number of representatives and their backgrounds are described in Table 8.2.

Table 8.2: Focus group stakeholder categories and their backgrounds

Stakeholder category	Background	Number of representatives
National and provincial departments with a mandate for agriculture and aquaculture development	Aquaculture economic development, technical services, and extension services	6
Enterprise development agency	Agribusiness, cooperatives, community-private partnerships	1
National department with a mandate for trade and industry development	Trade and industry	1

Stakeholder category	Background	Number of representatives
Aquaculture industry	Farmers, processors, and industry association	3
Research/academic organisations	Aquaculture research, teaching, and technology transfer	2
Provincial tourism, trade & investment agency	Agribusiness promotion	1
Food & Beverage industry	Enterprise and supplier development	1
Total		**15**

The stakeholders' responses to the following questions were used to finalise the enterprise development model:

a) Have the most prominent needs of the sector been correctly identified?
b) Does the proposed model address the needs of the sector?
c) Are the proposed elements of the model optimum to address the needs identified? If not, what are the alternatives?
d) Could the model be expanded to other aquaculture species and geographical areas?
e) Which stakeholders should drive the implementation of the model, and what resources would they need?
f) Which other stakeholders could assist with implementation of the model?
g) How can the model be used to deliver much-needed post Covid-19 pandemic support?
h) Should the model be implemented as a pilot in Saldanha Bay, focusing on the bivalve shellfish sub-sector?

8.2.2 Data Collection

An empirical, phenomenological approach was followed, as described in the literature (Remenyi *et al.*, 2010). A case study approach was selected as a suitable method, as it is a scientific research method in its own right and can generate context-dependent knowledge as described by several researchers (Flyvbjerg, 2006; Yin, 2009; Remenyi *et al.*, 2010). During the first part of the study, semi-structured interviews were conducted with the owners or managers of ten bivalve shellfish farming enterprises selected as case studies, and with nine representatives of role players. A qualitative approach was followed to conduct the research.

The purpose for consultations with enterprise development experts was to obtain their insights regarding preliminary conclusions from the results of the semi-structured interviews and test the researcher's ideas for the conceptualisation of an aquaculture enterprise development

model. These insights were used to draft the model for presentation to and validation by a limited selection of aquaculture and enterprise development stakeholder representatives during two Focus Group sessions.

A briefing document and Participant Consent forms were circulated as part of the invitations to the Focus Group sessions. These documents communicated the preliminary conclusions and insights, and the themes around which questions would be asked.

8.2.3 Sampling Procedure

The enterprise development expert sample included six individuals with experience and expertise in the enterprise development domain, identified through a non-random, judgment sampling approach. Selection was based on reputation and willingness to be involved in the study. A stratified random sampling approach was used to draw focus group participants from the stakeholder population. The focus groups were attended by fifteen representatives of stakeholders in the aquaculture, economic and enterprise development sectors. Selection was based on willingness to attend the sessions.

8.2.4 Data Analysis

The results of the initial stages of the research study were further analysed for identification of the key factors affecting mussel production, and the challenges that aquaculture enterprises face on their journey to self-sustainability.

The responses from expert consultations were analysed and the key themes identified to prepare a draft model for presentation to and validation by stakeholders. The responses from stakeholders during the focus group sessions were analysed to refine the main themes. These themes were used to improve and finalise the components of the Aquaculture Enterprise Development Model and make recommendations regarding its implementation.

8.3 Results and discussion

Results from the case study analyses (described in Chapter 4), impacts of stakeholders (described in Chapter 5), critical success factors (described in Chapter 6) and impacts of the COVID-19 pandemic (described in Chapter 7) were used to identify key factors affecting mussel production, and the challenges affecting self-sustainability of aquaculture enterprises.

8.3.1 Key factors affecting mussel production

The key factors affecting mussel production are summarised in Figure 8.1, and include the following:

a) Supportive regulatory framework
b) Favourable environmental conditions
c) Appropriate species and technologies
d) Efficient farm and enterprise management
e) Favourable economic conditions.

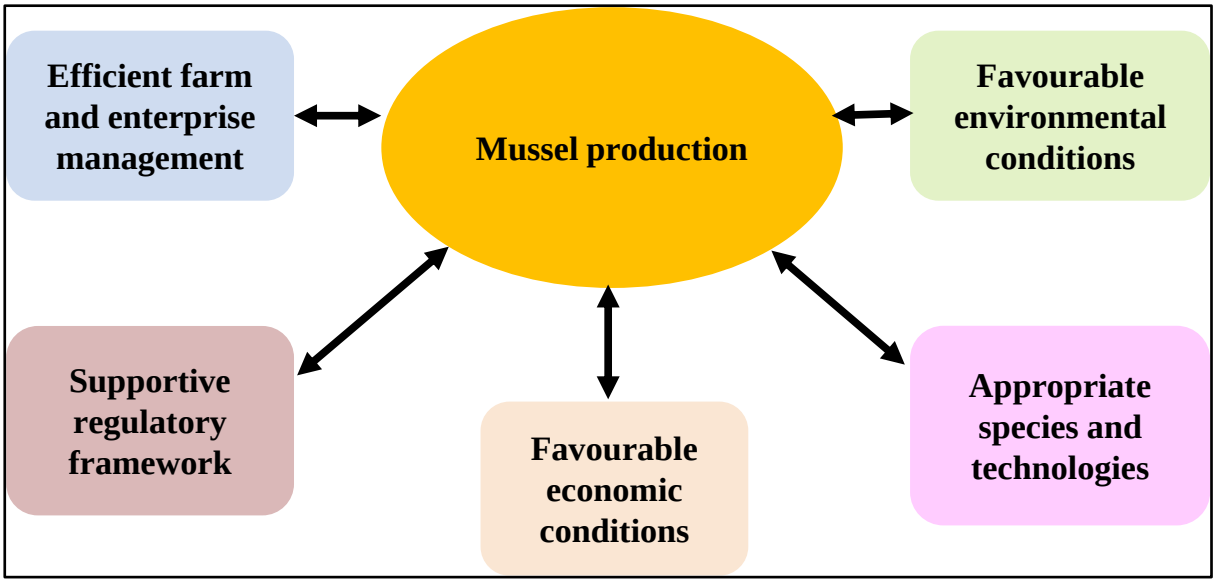

Figure 8.1: Key factors affecting mussel production

Source of figure: Researcher's own

The requirements related to each key factor, and measures in place to meet those for bivalve shellfish (mussel and oyster), are summarised in Table 8.3. The key factors affecting mussel production are well understood, and the requirements are addressed through various measures or support by industry, government, or other stakeholders.

Although these key factors have been identified and described for mussel production, they are applicable to most aquaculture industries, in both the marine and freshwater sectors. However, there will be differences in the specific requirements and existing support in place for individual industries.

Table 8.3: Requirements and measures already in place for bivalve shellfish production

Key factor	Requirements/Desired state	Measures/support in place
Supportive regulatory framework	• Legislation, policies, and strategies that supports aquaculture development • Marine aquaculture right • Various operation specific permits and licenses • Environmental authorisation • Import and export permits • Sea water lease	• Draft Aquaculture Development Bill developed • Inter-departmental Authorisations Committee set up to simplify application process • South African Shellfish Monitoring and Control Programme (SASMCP) in place • Aquaculture Strategic Environmental Assessment completed • Aquaculture Development Zones declared, including Saldanha Bay • Various aquaculture frameworks, policies & strategies developed • Oceans Economy Master Plan under development – includes Aquaculture and Fisheries as a sub-sector
Favourable environmental conditions	• Suitable sea water site with limited exposure • Acceptable water temperature & salinity • Good water quality – preferably outside Harmful Algal Bloom (HAB) areas, pollution free • Nutrient rich water • Located close to transport network	• Three sheltered areas in Saldanha Bay suitable for bivalve shellfish production • Nutrient rich sea water from Benguela current • Saldanha Bay ADZ with 400+ ha for bivalve shellfish farming • Potential to produce 15000 t p.a. of graded bivalve shellfish • Shellfish monitoring programme in place • HAB monitoring and warning system in place
Appropriate species and technology	• Species with commercial value and market potential • Suitable species for the environment • Suitable farming and processing technologies and infrastructure	• Mediterranean and black mussel species have established markets, and are suitable for the environment in Saldanha Bay • Well researched and understood raft & longline farming systems • Well-understood farming processes • 30+ years of collective industry knowledge of mussel farming • Suitable space and authorization to increase production of bivalves • Service, off-take and mentoring agreements between some new

Key factor	Requirements/Desired state	Measures/support in place
		entrants and larger, experienced farmer
Efficient farm and enterprise management	• Efficient, cost-effective farming practices • Efficient animal health and hygiene management practices • Efficient business management practices and systems • Owners, managers, staff with suitable technical and business skills • Adherence to regulatory requirements	• Mentoring of new entrants by existing commercial farmers • Decades of industry knowledge and understanding of efficient farm & processing practices • Cooperation amongst farmers for water & animal health monitoring • Skills needs analysis & assessment, approval of aquaculture farmer/farm assistant qualifications • Aquaculture Technology Development Centre for training & development • Industry association – BSASA looking after bivalve shellfish sector • Aquaculture South Africa – overarching industry association looking after interests of whole sector
Favourable economic conditions	• Sufficient market demand for species and products • Access to local and export markets • Good logistics network – farm to factory to market • Access to funding for set-up, operations, expansion, adverse events • Economies of scale	• Local SA market for mussel products • Fully developed value chain and supply chain • Developing export market • Three processing facilities with enough capacity to absorb current production • Market access for new entrants through processing facilities • Aquaculture Marketing Working Group • Globally recognized Monitoring & Certification scheme • Aquaculture Development Fund Working Group • Feasibility studies done for commercial species including bivalves • Funding available through various programmes including CASP and ADEP

Sources: (DAFF, 2017e, 2018a, 2019c, 2019b, 2020; DEFF, 2021c), *case study enterprise and role player informants*

Although measures are in place to meet the requirements for each key factor, many challenges remain. The gaps and needs identified for each key factor related to mussel production are summarised in Table 8.4.

Table 8.4: Gaps or challenges related to the key factors affecting mussel production

Key factor	Gaps or challenges identified
Supportive regulatory framework	• Aquaculture Development Bill withdrawn for revision • Costs related to adhering to regulatory requirements • Applications processes still complex for aspirant farmers
Favourable environmental conditions	• Ongoing occurrence of HABs & farm closures • Pollution from other industries and users • Weather events – storms etc. • Potential climate change effects – e.g., ocean acidification, water temperature changes
Appropriate species and technology	• Not all new farmers physically farming yet • Limited practical experience and knowledge amongst new farmers • Not all new farmers have own infrastructure for servicing and harvesting farms
Efficient farm and enterprise management	• Frustration amongst some of the new farmers related to mentorship, servicing, and off-take agreements with commercial farmer/processing company • Limited practical technical knowledge, experience of farming, and industry knowledge amongst new entrants • Limited business leadership and management skills and experience amongst new entrants • Industry associations have resource and capacity constraints
Favourable economic conditions	• Negative effect of COVID-19 on market demand • Competition for small local market • Limited participation in full value chain for new entrants • Problems with validation of laboratories and diagnostic tests for monitoring & certification scheme hampering export efforts • Competition from imports • Limited economies of scale for some farmers • Funding for new farmers may only be for infrastructure

Sources: (DAFF, 2017e), *case study enterprise and role player informants*

8.3.2 Key issues affecting self-sustainability of aquaculture enterprises

The challenges faced by small businesses are well understood, and include mainly limited access to finance, credit and physical infrastructure, low levels of research and development, onerous labour laws, an inadequately educated workforce, inefficient government bureaucracy, high levels of crime, and an inability to access markets (BER, 2016). Enterprises in the aquaculture sector face specific technical, production, market, environmental and other

challenges such as aquatic animal health management, maximising outputs to get economies of scale, small local markets, suppressed export markets, lack of an enabling legislative environment, and managing effects of harmful algal blooms (HABs) (DEFF, 2021a).

The business environment is very complex, with many interrelated components impacting on each other. This complexity is illustrated in Figure 8.2. Some of these components are internal and can be controlled, and some are external factors outside the control of a business. However, businesses must manage most of these components efficiently to become self-sustainable. The complex nature of business is applicable to enterprises in all economic sectors, including the aquaculture sector.

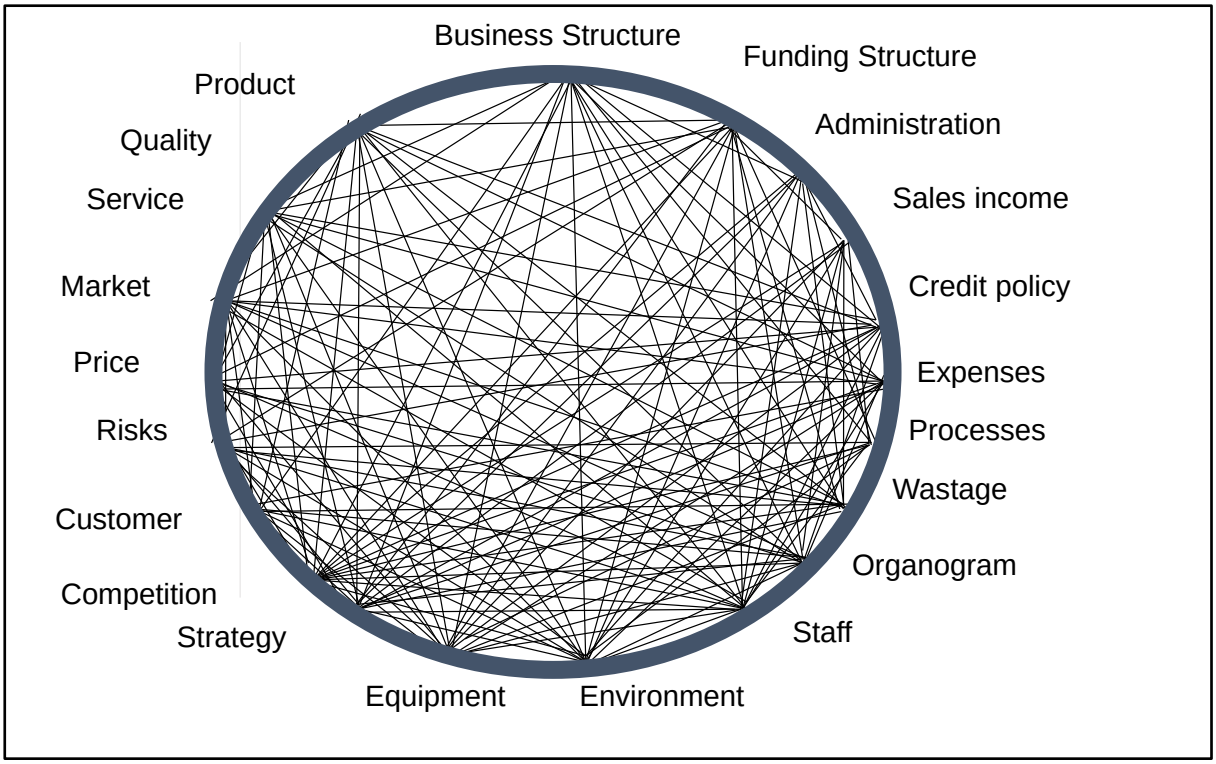

Figure 8.2: Illustration of the complicated nature of businesses

Source: Reproduced with permission from AGE Webb (CSIR)

The main issues affecting the ability of aquaculture enterprises to become self-sustainable, are summarised in Table 8.5. Internal challenges are under the control of enterprises, and include issues related to business leadership, business management and administration. Challenges related to the external environment and outside the control of enterprises, include issues related to the enabling and business environments. More detailed descriptions of these challenges are described elsewhere (Brown-Webb *et al.*, 2022a, 2022b).

On a global scale, enterprises in various aquaculture industries face similar challenges on their development path. In Ghana, the tilapia aquaculture industry needs to overcome challenges such as poor standards, inadequate regulations and veterinary services, inadequate inputs and lack of skilled personnel to access regional and international export markets (Asiedu, Failler and Beyens, 2016). The Chilean blue mussel industry grew from 7% (volume) and 17% (value) of world mussel production in 2005, to 13% (volume) and 63 (value) in 2014 (7th to 2nd place), due to market incentives and investment in medium and large mussel farms and firms, and government efforts to regulate and strengthen private sector coordination and the institutional environment (Gonzalez-Poblete *et al.*, 2018). Efforts to integrate small-scale producers as productive and active agents in the food value chain in Chile included the promotion of innovation such as adaptation of inexpensive technologies to different environmental conditions and developing new products. Factors promoting innovation were identified as levels of formal education, larger farm sizes, land ownership, commercialization of production, direct selling into markets, participation in organizations and networking, and financial and government support (Salazar *et al.*, 2018).

Table 8.5: Challenges affecting self-sustainability of aquaculture enterprises

Challenges	
Issues within the control of enterprises (internal environment)	
Business leadership	**Business management and administration**
• Effective use of partnerships and agreements related to mentoring, servicing, and product off-take • Limited leadership skills and experience especially amongst new entrants • Having the right mind set and vision: • Community-based/collective ventures are generally perceived as unsuccessful, mainly because of lack of leadership, skills, resources, and mentorship, and conflict within communities • Efficient leadership responses to crises such as the COVID-19 pandemic such as long-term planning, crisis management plans and operating in survival mode	• Use of appropriate species and technologies for the environment and markets • Efficient farm and enterprise management • Efficient responses to markets challenges • Dealing with limited economies of scale due to small farm sizes and EIA restrictions on production expansion • Efficiently accessing funding and coping with limiting funding conditions • Efficient management responses to crises such as the COVID-19 pandemic • Preparation for crises including building financial/cash reserves in good years, diversified species and market mix and vertical integration
Issues outside the control of enterprises (external environment)	

Challenges	
Enabling environment	**Business environment**
• Regulatory Framework causing over-regulation, red tape & increased costs • Complex application processes for rights, permits, funding etc. • Support systems too generic or misaligned, or people not knowing how to access these • Policies and programmes not taking all industry inputs into account, or not addressing all challenges • Negative impacts of some stakeholders, under-resourcing of industry associations and under-utilisation of enterprise development institutions • Government approach to enterprise development seen as driven by socio-economic need • Stakeholders not always working together • Change of aquaculture lead agency from agricultural to environmental department viewed as problematic • Insufficient technical, leadership, and middle management skills training	• Adverse environmental conditions such as HABs, pollution, weather events and climate change • Macro-economic conditions e.g., competition from imports • Limited participation in full value chain for new entrants • Challenges with validation of laboratories and diagnostic tests for monitoring & certification scheme • Impacts of COVID-19 pandemic on farms and firms • Limitations of COVID-19 support

Sources: (DEFF, 2021a; Brown-Webb et al.*, 2022b, 2022a), case study enterprise and role player informants*

Given South Africa's poor track record in terms of business sustainability, it is critical that support must be in place to help new and existing aquaculture businesses navigate the different components of their businesses efficiently and become self-sustainable, to help meet sector and national goals for job creation, GDP growth and transformation. It has long been identified that such support should include a balance of financial and non-financial interventions (Rogerson, 2001).

Some of the needs and challenges identified, are being addressed to some extent through the efforts of various stakeholders, programmes, and different levels of government. This includes Operation Phakisa (2015-2019) which brought the focus from high-level plans to detailed programmes. The programme will be succeeded by an Oceans Economy Master Plan, which is currently under development. The Master Plan framework is driven by the Department of Trade, Industry and Competition (the DTIC). The role of master plans is to help create conducive conditions for industries to grow, including assisting companies to improve

industrial capacities and sophistication, focus on exports and reclaiming domestic markets lost to imports (The dtic, 2021).

The results of this study indicated that, although the enabling environment for the aquaculture sector has greatly improved, the development of aquaculture enterprises now needs to be taken to the next level. Operation Phakisa and the Oceans Economy Master Plan need to be supplemented by more detailed programmes or mechanisms at industry level, to strengthen enterprises in the aquaculture sector.

8.4 The proposed solution: an aquaculture enterprise development model

This paper proposes an aquaculture enterprise development model that addresses specific challenges preventing aquaculture enterprises from becoming financially self-sustainable. Such a model should be based on an integrated approach with various components or elements working together to address the needs in the sector, and it should guide the implementation of those various elements. It could be one structure with different mechanisms addressing different needs, or several structures working together to achieve a common vision. Furthermore, it should be driven from within the aquaculture sector, or through individual sub-sectors, with support from other stakeholders.

The goals of the model are:

a) To take aspirant aquaculture entrepreneurs on individual journeys through the system to develop them from inexperienced/aspirant entrepreneurs to industrialists
b) To reduce the number of entrepreneurs/enterprises that will fall by the wayside
c) To shorten the timeframe for entrepreneurs from when they enter the system until they are successful and sustainable.

Based on the challenges and principles described, five main components of an enterprise development model were identified, as illustrated in Figure 8.3:

a) There must be an exciting, galvanising vision with targets for the sector that stakeholders, especially industry, support and that drives the implementation of all components of the model
b) There should be an entity that drives the implementation of all aspects of the model and takes responsibility for meeting the targets set as part of the vision.
c) There should be a mechanism such as an incubation programme to develop and support entrepreneurs through all phases of enterprise development, and draws on the knowledge

and intelligence created through industry, the market mechanism, and the research programme

d) There should be an integrated research and development programme that addresses industry needs, is informed by market intelligence, drives innovation and feeds into the incubation programme for transfer of knowledge and technologies

e) There should be a market development mechanism that can drive market and product development and drive increased sales, informs the research programme, and informs the support and development programme.

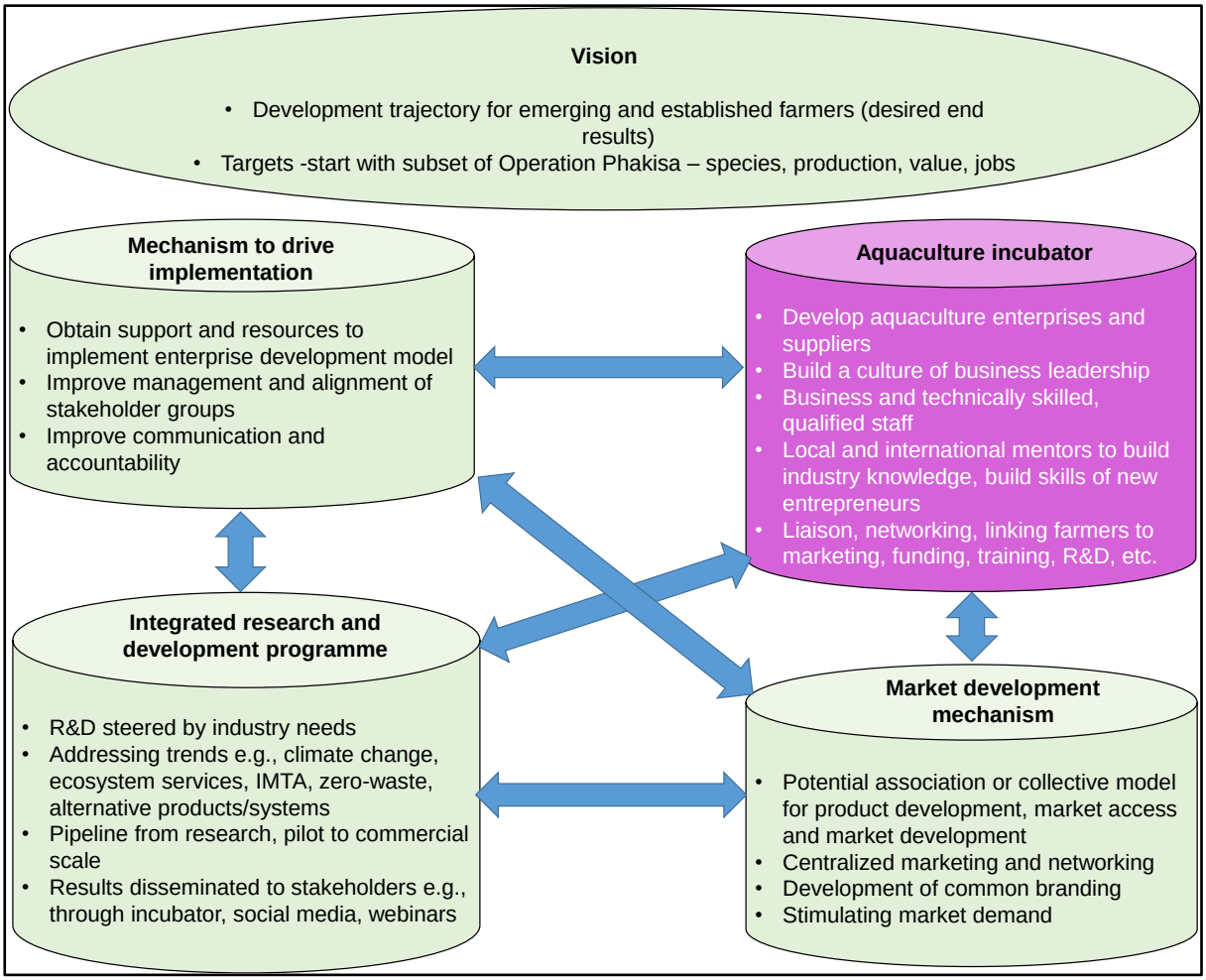

Figure 8.3: Proposed aquaculture enterprise development model

8.4.1 Vision

The vision should explain how stakeholders see the development trajectory of new/emerging and established enterprises and entrepreneurs, from start to end point. This should be a guide to address the following questions:

a) What would be the journey of an aspirant farmer through the whole development process?
b) How will this journey be managed, and what would be achieved at each step?

There should also be a common vision for the growing of markets and expanded participation of new entrants in the value chain, with the understanding that the growth of small players does not mean the destruction of existing players. Targets should start with a sub-set of Operation Phakisa/Oceans Economy Master Plan targets for aspects such as job creation, transformation, production expansion, small business development etc., that are based on current realities and appropriate to the specific sub-sector.

New Zealand provides an example of a vision for the aquaculture industry in which the export earnings are anticipated to increase about 6-fold from 2019 to 2035, and integrated multi-trophic aquaculture (IMTA) is expected to play an important role in demonstrating sustainable practices and provide valuable secondary products (Stenton-Dozey *et al.*, 2021). The Irish Seafood Development Agency (Bord Iascaigh Mhara) developed a five-year strategy (2022-2026) for the seafood sector which includes seafood catching, farming and processing. The strategy is driven by a vision of partnering with the Irish seafood sector to meet the challenges posed mainly by Brexit and climate change (Bord Iascaigh Mhara, no date).

8.4.2 Aquaculture Incubator

An aquaculture incubator, as illustrated in Figure 8.4, should form the core or engine room for the model. This mechanism should address the critical success factors needed to help enterprises become financially self-sustainable, and the key technical, enterprise specific challenges experienced by aquaculture entrepreneurs. It should address enterprise and supplier development (ESD) in specific aquaculture value chains. It should develop programmes that are tailor-made for enterprises in different stages of their life cycle, whether start-up or established. It should also make provision for education and awareness creation amongst the wider community, to stimulate interest and provide pre-application support to interested entrepreneurs.

There are several options for structures to drive this component, including incubators or development programmes. The DTIC supports incubation as a tool for industrial development and economic inclusion and define incubators as physical and/or virtual facilities. Incubators support the development of early-stage SMMEs through a combination of business development services, funding, and access to the physical space necessary to conduct business.

The idea is to meet the development needs of SMMEs so they can grow independently once incubation ends, and services are delivered through programme or product delivery models. "Business building" programmes are structured and typically lasts for 18 months, while product offerings such as financial literacy work on a subscription, first-come-first served basis (The dti, 2014).

The types of incubators include variation by sector focus, geographical focus, target group of SMMEs, operational model, revenue-generating model, and mix of public/private support. Technology-based business incubators look at accelerating commercialisation of technology and promoting development of technology-based firms and are characterised by institutional links to knowledge bases such as universities, technology-transfer agencies, or laboratories. Government provides funding for the development of incubators through the Enterprise Incubation Programme (EIP) for public-private partnership incubators, while the SEDA Technology Programme (STP) set up 72 public sector incubators around the country. There are also private sector incubators established without government support.

The Timbali Technology Incubator is an example of a successful incubator. It addresses its objectives of coordinated production, product support chain and coordinated market supply through clustering of small-scale vegetable or flower farms, connection to sophisticated markets through a product supply chain, and providing an enabling environment through Agri-Parks. The incubator has multiple sponsors and funders including the STP, Syngenta, National Youth Development Agency (NYDA) and the Jobs Fund (Timbali Technology Incubator, 2020). In the automotive sector, Original Equipment Manufacturers (OEMs) develop their suppliers because they benefit from economies of scale if suppliers operate in the most efficient manner. If successful, an incubator supplier development component could also provide working capital from retained profits to ensure suppliers do not go out of business.

A potentially suitable option for the aquaculture enterprise development model is a new technology business incubator that concentrates on the aquaculture sector and has institutional links to knowledge bases, and that identifies opportunities for linking businesses with markets. The DTIC prepared a handbook that describes the key activities and goals, and a 17-step process for starting a new incubator in South Africa. Government support is available through the DTIC EIP, implemented by the DSBD. Funding of R5-R10 million will be a 100% subsidy for the pilot year, with cost sharing at a ratio of 90:10 between DSBD and the applicant thereafter. The STP also provides Technology Business Incubation services and has set up 72 incubators to date. Incubator clients (SMMEs) can apply for 100% subsidies of up to R150

000, or 90% subsidies for amounts between R150 001 and R600 000. Funding is also available from entities such as SEFA, which provides direct loans to SMMEs and co-operatives from R50 000 to R5 million, and others such as the National Empowerment Fund. Private support is available through institutions such as Angel Investors, Venture Capital funds and others (The dti, 2014).

Public sector incubators in South Africa have been around for a long time (since at least 2001), whilst private incubators started making an appearance much later. However, a 2014 study on the state of business incubators indicated that private sector incubators supported more SMMEs, created more jobs and graduated more SMMEs from their programmes than those in the public sector (Masutha and Rogerson, 2014). It would therefore be important to investigate the role those private incubators could play in the proposed model. The Aquaculture Incubator will need to conceptualise and develop a business model to ensure its sustainability and be held accountable if they receive public funding, as recommended in the literature (Hewitt and van Rensburg, 2020). The OceanHub Africa is a Pan-African Ocean-Impact accelerator based in Cape Town, that provides support to ocean-minded start-up businesses. They also provide consultation services and ecosystem support (OceanHub Africa, 2022). Although they are an accelerator (with an eight-month program) and not an incubator (with programs typically spanning multiple years), their business model could provide a good example to learn from.

There is not much literature available in accredited sources about the implementation of business incubators in the aquaculture sector. One possible reason may be because of affordability linked to publication in accredited sources, as there were some examples of work done by business incubators. For example, the Uganda Industrial Research Institute (UIRI) business incubator assisted an entrepreneur to build a successful business based on the development and sale of fish sausages (Cadilhon and Kobusingye, 2014). The Agribusiness Incubation Program of the International Crops Research Institute for the Semi-arid Tropics (ICRISAT) in India is involved in commercialization and handholding of aquaculture technology ventures (Jayasankar, Mohanta and Ferosekhan, 2018).

In other global aquaculture sectors there are also examples of stakeholders assisting in the development of small-and medium-scale producers, although it may not be labelled as incubation. In Chile, organisations such as the Chilean Corporation for Development, the Solidarity and Social Investment Fund, the Artisanal Fisheries Development Fund, and the Universidad Austral de Chile contributed to technical transfer and development of producers (Gonzalez-Poblete *et al.*, 2018).

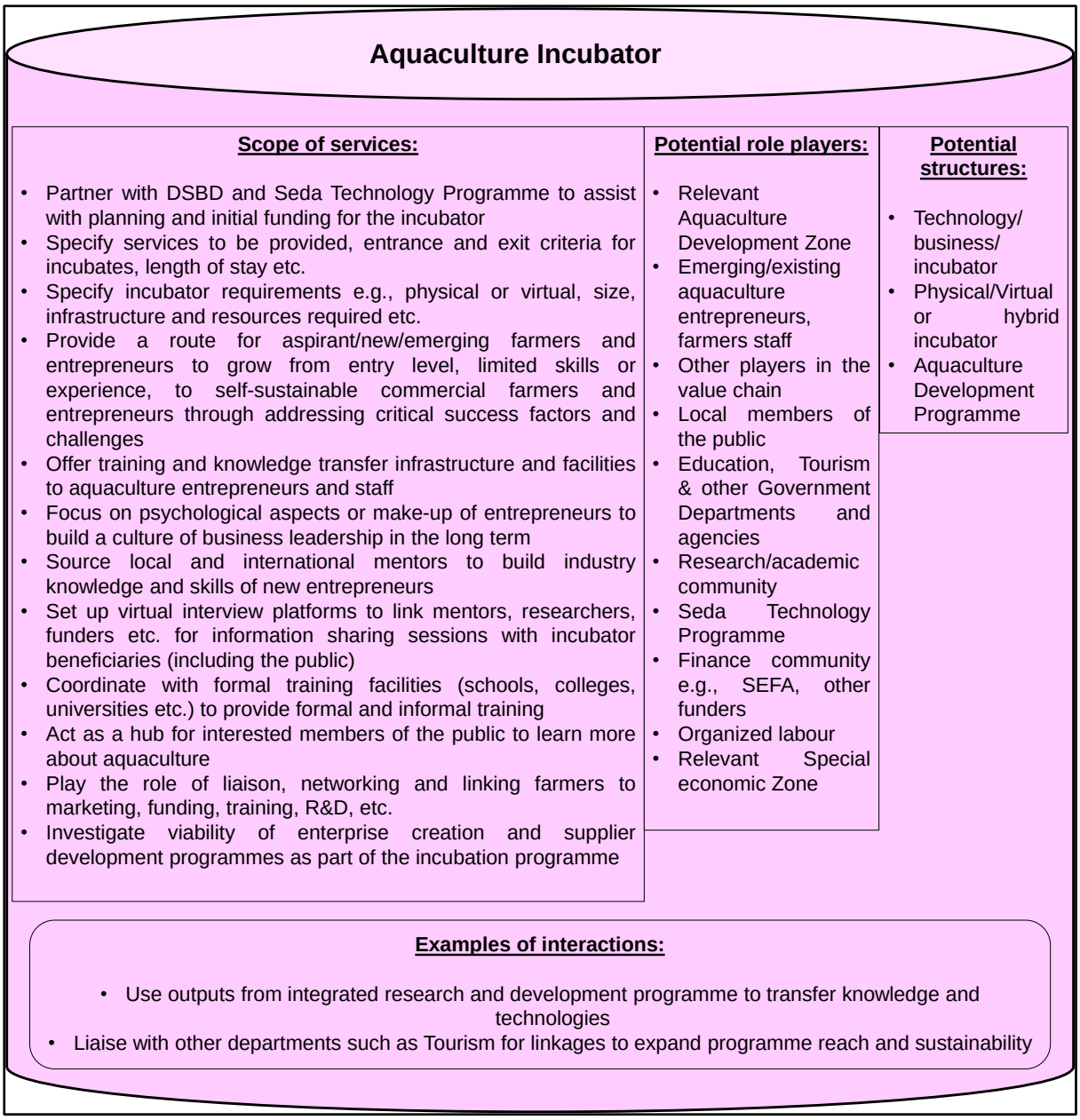

Figure 8.4: Proposed aquaculture incubator component

8.4.3 Mechanism to drive model implementation

A potential mechanism to drive implementation of the model is set out in Figure 8.5. There are several options for potential structures to drive implementation of the model. Industry bodies include Aquaculture South Africa (AquaSA) which represent producers in different industries including the marine and freshwater sub-sectors, and industry-specific associations for specific sub-sectors such as bivalve shellfish, marine finfish, trout, abalone, tilapia etc. Most of these associations are under-resourced and staffed on a voluntary basis by persons employed in the industry. Co-operatives are not highly regarded by many stakeholders. This is mainly because government has promoted the establishment of co-operatives through financial incentives,

which led to many failed co-operative projects because the motivation for their establishment was wrong. However, a collective structure could be considered if there is sufficient trust and cooperation amongst the industry role players. As a starting point, a committee representing all relevant stakeholders such as industry associations, government, funding agencies and the research/academic community should be established to drive implementation of the model. A more formal structure could be established at a later stage.

The development of the salmon industry in Chile provides a relevant example of structured organization of production, where two key organizations (Fundacion Chile and Salmon Chile) organized and represented the sector, and played a role in the creation and transfer of technology (Perlman and Juárez-Rubio, 2010). Producer associations were also key role players in the development of small and medium producers in the blue mussel aquaculture industry in Chile, through efforts to improve negotiation and marketing skills of producers (Gonzalez-Poblete *et al.*, 2018).

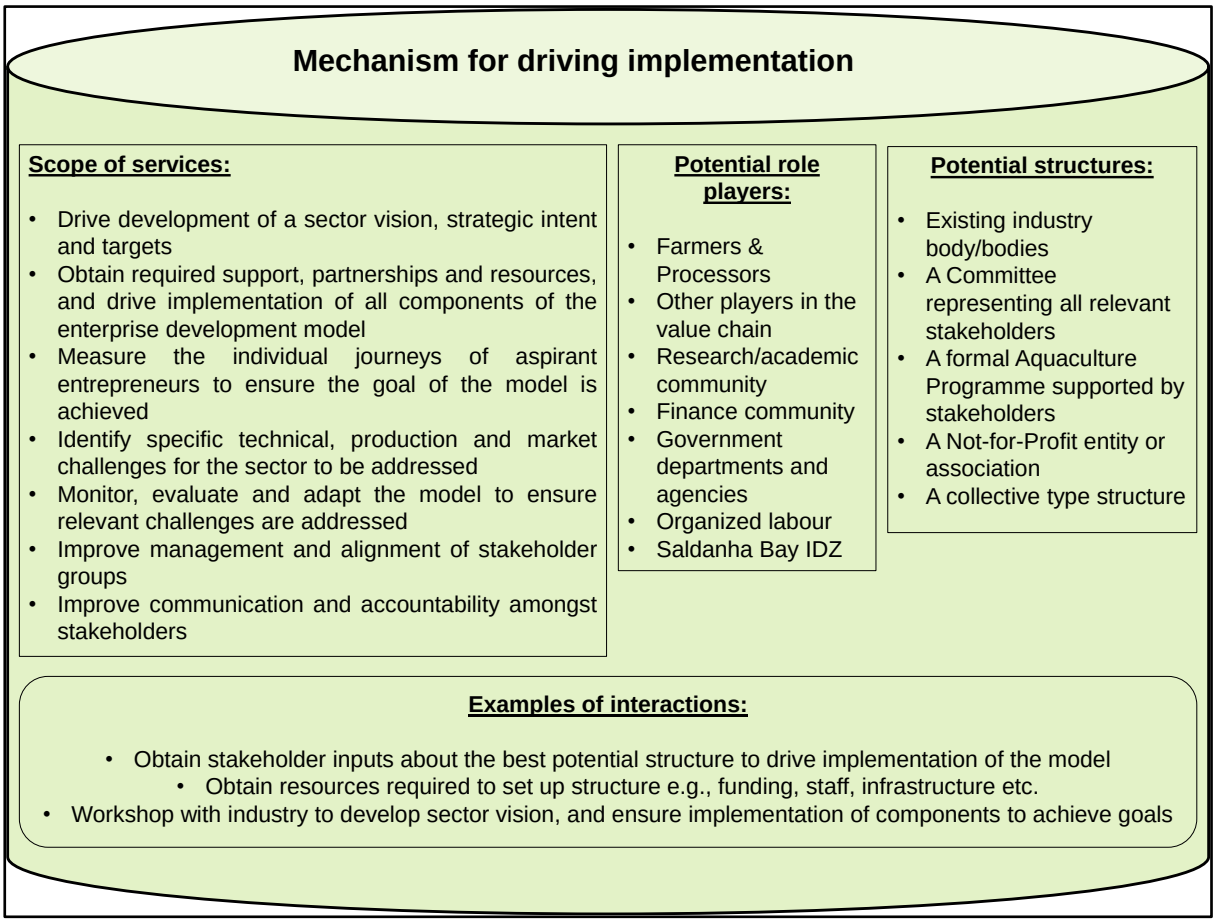

Figure 8.5: Potential mechanism to drive model implementation

8.4.4 Market development mechanism

One of the most important components of the model is a market development mechanism. Enterprises must first be commercially viable before they can provide sustainable social benefits. A potential market development mechanism is illustrated in Figure 8.6.

There is potential for a collective model for centralised marketing and networking, where companies that compete on some levels, can cooperate and pool together resources on other levels. The structure should have a dedicated marketing function and ensure quality standards such as Good Management Practices (GMPs), Hazard Analysis Critical Control Point (HACCP) and other accreditations. They should also use market intelligence to identify new trends, new potential products and markets, and new routes to market. The structure should be measured on tonnages sold.

Examples of growers forming marketing structures abound in South Africa. Tru-Cape Marketing, which is equally owned by the growers of Ceres Fruit Growers and Two-a-Day, is the largest exporter of South African apples and pears (Tru-Cape, 2021). Clover S.A (Pty) Ltd is an example of a co-operative formed by a group of dairy farmers in KwaZulu-Natal in the 19th century, which grew into a corporate business listed on the Johannesburg Stock Exchange in 2010. Their corporate strategy is to build onto existing competencies within its group of companies to establish a culture of exceptional performance and set a platform for future market expansion (Clover SA (Pty) Ltd, no date).

The mechanism should also investigate alternative marketing and distribution channels such as online platforms. The COVID-19 pandemic highlighted the importance of digital marketing channels. There are several examples of such platforms including ABALOBI, a registered Non-profit and Public Benefit organisation that developed a mobile application to elevate small-scale fisheries through data and technology. The model enables small-scale fishing communities to activate Community-Supported Fisheries (CSF) that promote fair market access, transparent supply chains and broader food security (ABALOBI ICT4FISHERIES, 2021). Farm-to Plate is an online platform that represent family farmers and suppliers around the country who supply fresh meat directly to customers (Strauss & Sons, 2020).

There are also examples of global aquaculture market development initiatives. New Zealand is well known for its trademark Greenshell^{TM} mussels, and additional marketing takes place through the Smart + Connected aquaculture forum (Stenton-Dozey *et al.*, 2021). The Chilean Corporation for the Promotion of Production (CORFO) created a Mussel Aquaculture Center,

and an Integrated Territorial Program for the mussel industry to position the country as a world aquaculture producer (Gonzalez-Poblete *et al.*, 2018).

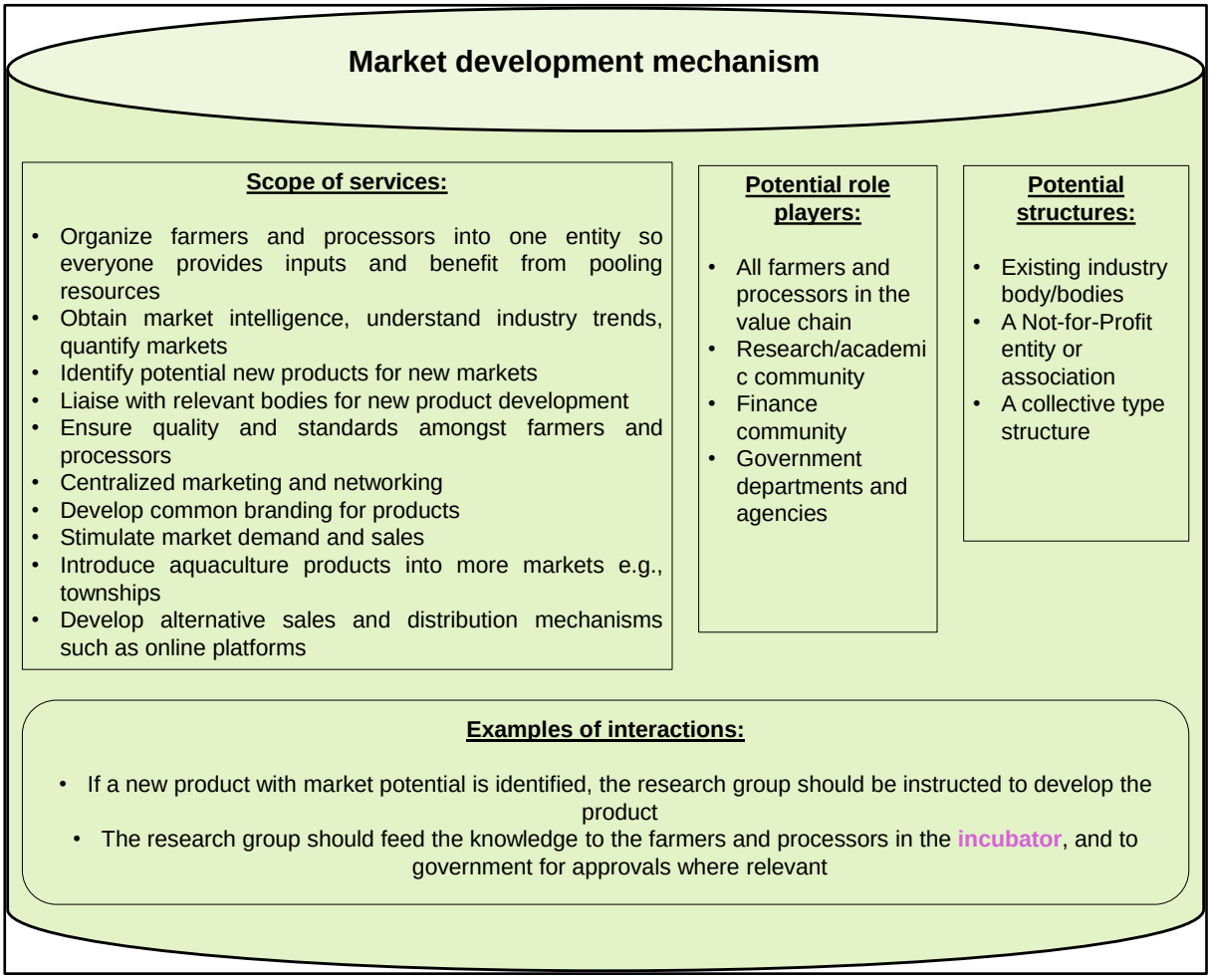

Figure 8.6: Potential market development mechanism

8.4.5 Integrated research and development component

An integrated research and development component is illustrated in Figure 8.7. Various universities, research councils and government bodies conduct aquaculture related research, some in collaboration with industry. The Department of Forestry, Fisheries and the Environment (DFFE) research projects range from culturing of marine yeast for mass production of rotifers in marine finfish hatcheries, echinoculture development, microorganisms associated with *Ulva* grown in abalone effluent water, and others (DEFF, 2021a). Universities such as Stellenbosch, Pretoria, Rhodes, Cape Town, Western Cape, and Limpopo conduct aquaculture related research and teach undergraduate and postgraduate students. Research councils such as the Agriculture Research Council (ARC) or the Council for Scientific and

Industrial Research (CSIR) conduct industry-driven or funded research such as genetic improvement of tilapia, development of diagnostic testing kits for fish health testing, etc. The ARC also offers aquaculture and aquaponics training courses. Some of the research programmes and projects are driven by industry needs (e.g., development of aquafeed, an HAB monitoring tool and others).

However, there is a need for more integrated, industry-directed, and driven research, informed by the needs of the aquaculture sector, or by each sub- sector. The industry needs to identify the research relevant to their needs and growth trajectory. There should be provision for instructions from industry to the research community on relevant issues such as alternative onshore production systems, alternative energy etc. The research should also make provision for the development of guidelines, standards, and training mechanisms on practical implementation of research outcomes.

The incubator or marketing mechanisms could be used for driving the research programme. The South African Avocado Growers' Association (SAAGA) is an example of a grower-run entity that carries out research, have research carried out and coordinate such research concerning the production and marketing of avocados (SAAGA, 2020). Funding for the programme could be obtained from government research funding programmes and industry. The sharing of the cost of doing research could give industry a competitive advantage.

The importance of collaboration between industry, government and the research community are reflected in the development of global aquaculture industries. In New Zealand, the emergence of aquaculture for a including industry, research and regulators regularly meet to discuss future research and development and increased interest in diversification of the sector (Stenton-Dozey *et al.*, 2021). This has also been the case in the development of the salmon industry in New Brunswick (Chang, Coombs and Page, 2014), the tilapia farming industry in China (Xu and Ming, 2018), and the blue mussel industry in Chile (Gonzalez-Poblete *et al.*, 2018).

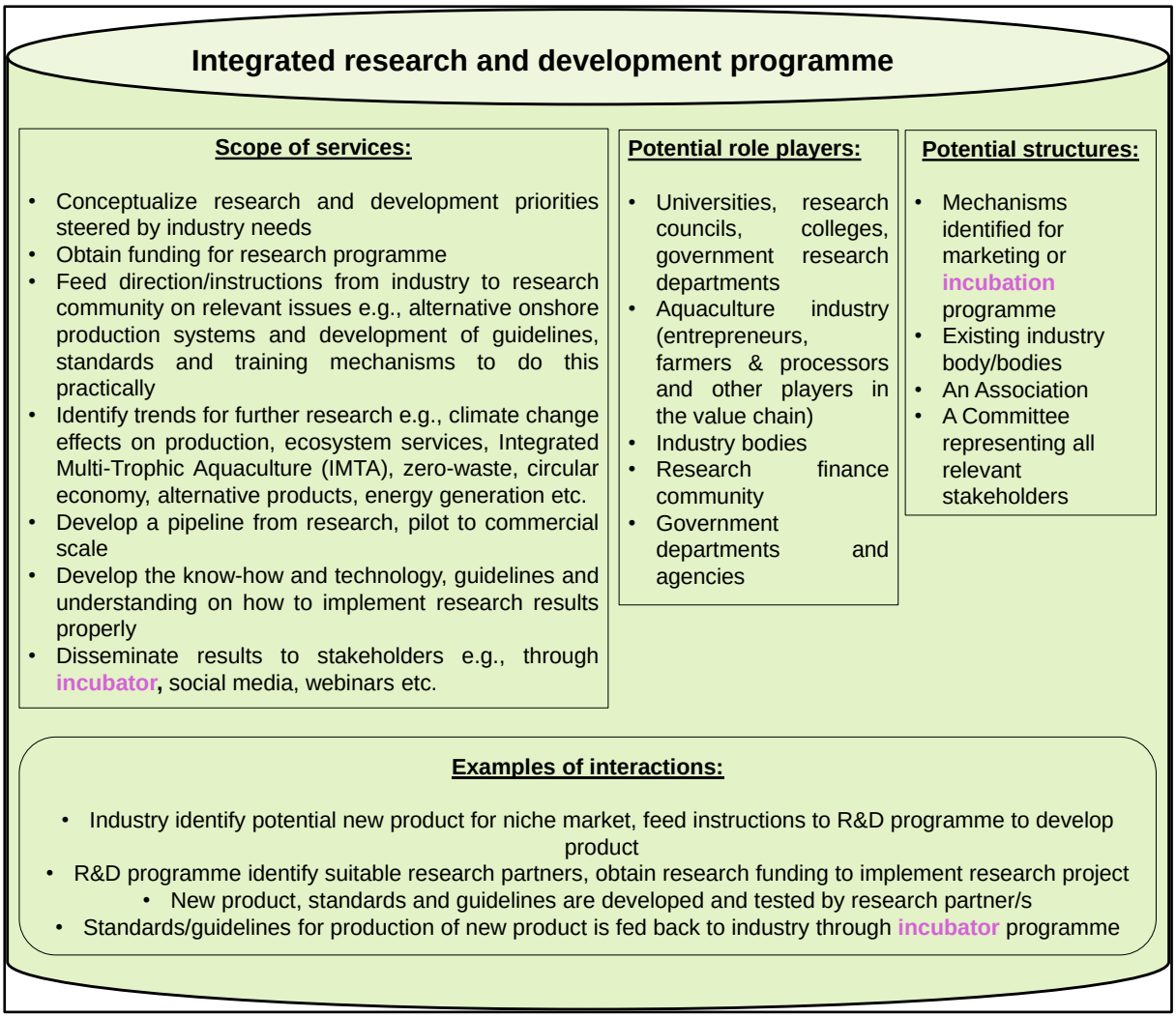

Figure 8.7: Potential mechanism for integrated research and development programme

8.4.6 Summary

There are many examples of structures locally or globally, that perform one or several of the functions identified for the enterprise development model. In the macadamia nut value chain, the Marquis group is the world's largest macadamia grower, processor, and marketer. It is 100% grower owned, with processing capacity of 22 000 tonnes per annum through Marquis Macadamias in Australia, and 11 000 tonnes per annum through Marquis Macadamias Africa. The production from these facilities is sold through the jointly-owned company Marquis Marketing, which also sells product from other processors around the world (Marquis Group, no date). Marquis Macadamias Africa was established in 2018 and uses industry-leading technology including HACCP and BRC (Brand Reputation through Compliance) food safety systems to ensure the highest quality products. The group is an example of competing growers with individual processing facilities who started working as a collective, formed a vertically

integrated entity and improved their competitive edge in terms of farming, processing and marketing of macadamias (ENCA, no date).

The SAAGA was established in 1967 and is described as “run by avocado growers for avocado growers”. Membership is open to all persons with an interest in the industry. SAAGA aims to maximise grower returns through promoting efficiency, increasing demand, and improving sustainability. They achieve this through voluntary cooperation, facilitation of communication and provision of pertinent information. Their activities include information dissemination, research coordination, quality recommendations, marketing and promotion (SAAGA, 2020).

In many aquaculture sectors around the world, one or more of the proposed components of the AEDM has been implemented in some form. The model therefore proposes to build on existing knowledge and practices in the aquaculture sector, as well as other sectors. It proposes the integration of key elements aimed at supporting the specific needs identified in the study.

8.5 Why do we need an Aquaculture Enterprise Development Model?

The model will address the following key needs for the development of self-sustainable enterprises:

a) Without a sustainable market, enterprises cannot become self-sustainable; therefore, there is a need to further develop and expand local and export markets for South African aquaculture products
b) New aquaculture ventures need to focus on species that have market demand, that can be competitively produced in the selected environment and for which value chains have been developed
c) There is a need for focused, tailor-made financial and non-financial support and development services for aquaculture enterprises that are appropriate to start-up, established and growth phases
d) There is a need for a mechanism to improve management and alignment of stakeholder groups, and improve communication and accountability amongst stakeholders
e) Development of a viable aquaculture sub-sector value chain needs to be based on the long-term research, innovation, technology development and transfer efforts of industry, government, the research community, and other stakeholders
f) Aquaculture ventures need to address four critical success factors to help enterprises become self-sustainable in the long term:
    i. Environmentally responsible and sustainable farming

ii. Addressing economic opportunities and challenges efficiently
iii. Good business leadership and management
iv. Efficient response to opportunities and threats in the business and enabling environments

g) Given the severity of the COVID-19 pandemic and its long continuation, the following should be considered:
i. Interventions to help enterprises survive until the pandemic is over
ii. Interventions to rebuild the industry and individual enterprises once the pandemic is over
iii. Interventions to prepare the sector and individual enterprises to be more resilient in case of future global crises and disasters.

8.6 Conclusions and recommendations

The next step for the enterprise development model as described above, is to be implemented as a pilot project in real life, to test assumptions, to test its applicability across different aquaculture subsectors and value chains, and to refine the model. The Saldanha Bay ADZ is proposed as the ideal site for piloting the model, as it is the focus of numerous aquaculture and maritime related initiatives, and has good logistical and bulk infrastructure available.

The ADZ was approved in 2019, with 884 ha of sea water space approved for farming of bivalve shellfish, shellfish, indigenous and alien finfish and seaweed (DAFF, 2017e). Most of the Operation Phakisa expansion projects were focused on Saldanha Bay, which was already a hub for bivalve shellfish farming. Saldanha Bay also hosts the first Special Economic Zone (the Saldanha Bay IDZ Licencing Company SOC Ltd) to be located within a port, and that caters specifically to the energy and maritime industries. This IDZ provides potential synergies for cooperation in areas such as renewable energy, boat building, and SMME development infrastructure.

In the bivalve shellfish sector, a mentoring model is being used to assist new farmers. A commercial company with farming and processing facilities have multi-year agreements with eleven emerging farmers to assist them with technical knowledge and practical training, servicing of their farms, and off-take agreements. In essence, this could be seen as a supplier development model, as the commercial company must ensure that raw material produced, meet the quality standards required for processing. This model could be expanded or adapted as part of the Aquaculture Incubator services.

The Bivalve Shellfish Farmers Association of South Africa (BSASA), supported by the DFFE, recently launched a project to conduct a pre-feasibility study to assess the potential for commercial kelp cultivation along the Southern African West Coast, with potential links to other aquaculture activities in Saldanha Bay (CSIR, 2022). In addition, the University of Stellenbosch (Division of Aquaculture) developed a project to set up an Aquaculture Institute for Vocational Training and Business Development in Saldanha Bay. The project aims to provide incubation model services and roll out two Quality Council for Trades Occupations (QCTO) approved training courses (for Aquaculture Farm Assistant and Aquaculture Farmer) on a learner accommodation basis. The Saldanha Military Academy was identified as a potential site to house an 8-ha facility which will include training facilities and a farm site for testing facilities for abalone, Atlantic Salmon, mussels, and tilapia/aquaponics (Mr Henk Stander, personal communication). This project, if funded, could be expanded into a technology business incubator that could form the foundation for an integrated, pilot enterprise development model.

As described above, there are already several complimentary projects and initiatives underway in the Saldanha Bay area, that could be harnessed and built on. The model will not replace these or any other initiatives from Operation Phakisa, the aquaculture industry, research and academia, or any other stakeholders. On the contrary, it will build on a good foundation that has already been put in place, to take the development of the sector to the next level.

A technical business incubator, building on the proposed Aquaculture Institute, is proposed as the heart of the model, with BSASA or a committee set up by BSASA, as the driving mechanism to implement the pilot. The components of the proposed pilot are set out in Figure 8.8.

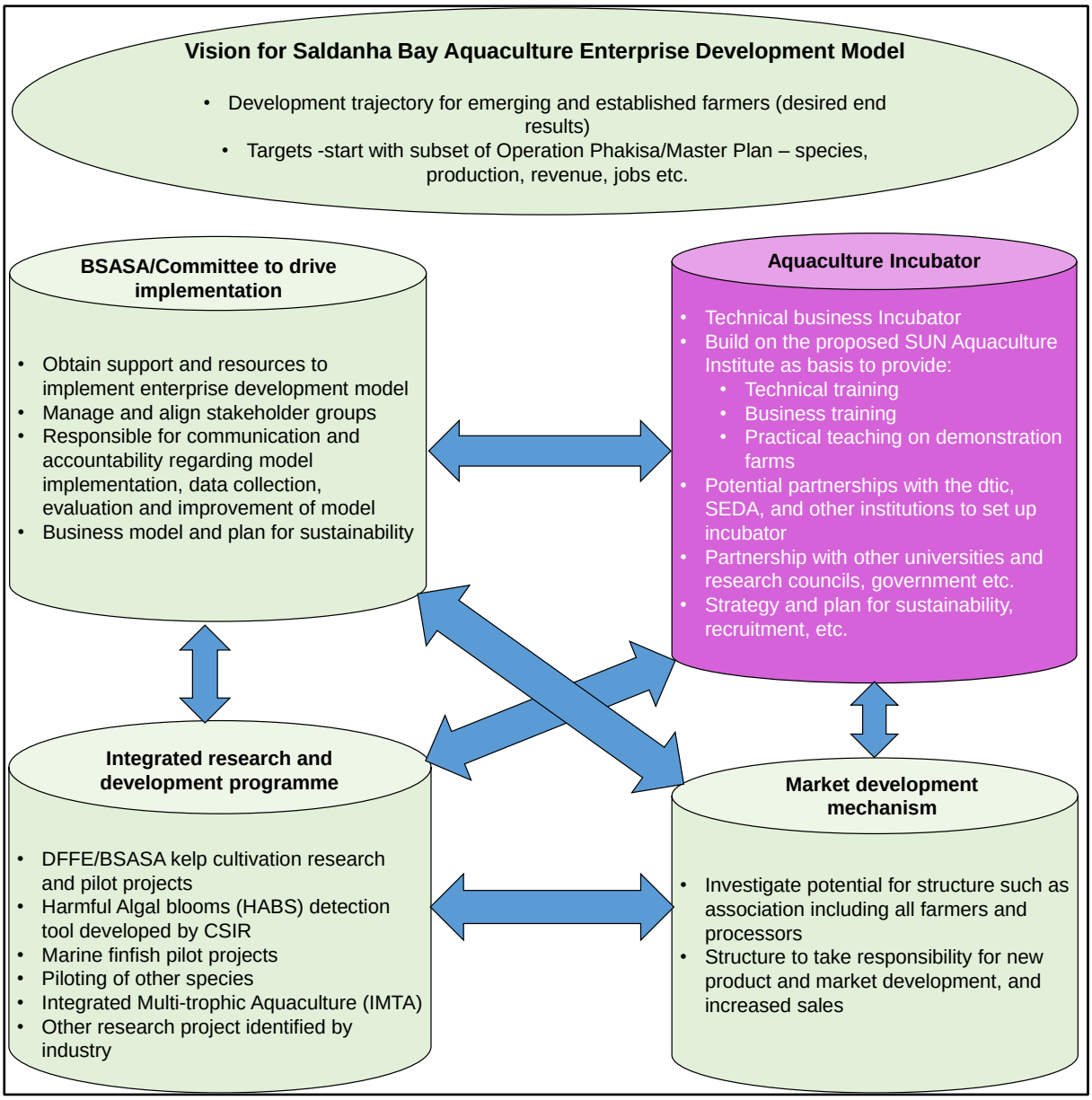

Figure 8.8: Proposed pilot for Saldanha Bay Aquaculture Enterprise Development model

The implementation of the model as a pilot project in the Saldanha Bay ADZ will enable the testing of assumptions, refinement of the model and adaptation for implementation in different sub-sectors and ADZs. An aquaculture enterprise development model that is tailor-made for each ADZ, sub-sector or species value chain could increase the chances of aquaculture enterprises to become self-sustainable and meet the development targets of the sector.

Chapter 9 - Summary, conclusions, and recommendations

9.1 Introduction

This study set out to investigate the problem that many aquaculture enterprises in South Africa, including those that were public funded, fail to become self-sustainable after the financial support ends. The researcher hypothesized that the development of self-sustainable aquaculture enterprises is not adequately supported by the enabling environment for the aquaculture sector in the country. The researcher then set out to identify the factors inhibiting or promoting self-sustainability in aquaculture enterprises, and to develop an aquaculture enterprise development model, covering all relevant aspects and stakeholders, to support the creation of financially self-sustainable aquaculture enterprises.

The study focused on aquaculture enterprises with a commercial focus, including those that are considered emerging, small-scale or start-up. Primary data were collected through semi-structured interviews with managers or owners of enterprises in the marine mussel (bivalve shellfish) aquaculture sub-sector, and representatives of role players in the aquaculture and enterprise development sectors. Experts in the enterprise development sector were consulted to discuss initial results and ideas for the conceptualisation of an enterprise development model. The draft model was then presented to stakeholder representatives during focus group sessions, for discussion and validation.

The study sought to understand the factors that encourage or inhibit self-sustainability in aquaculture enterprises, and the challenges that need to be addressed to promote financial self-sustainability. Some of the issues looked at included the following:

a) How do the motivations, contexts, and key drivers of the main role players impact on aquaculture enterprise development in South Africa?
b) What are the critical success factors for aquaculture agribusiness enterprises in South Africa, and why?
c) How did the global COVID-19 pandemic impact on aquaculture enterprises, and what is needed for enterprises to overcome these impacts?
d) What are the most important gaps, needs and challenges that compromise successful aquaculture enterprise development?
e) How can an enterprise development model be developed, that could assist aquaculture enterprises in becoming self-sustainable?

9.2 Summary of findings

9.2.1 Findings pertaining to the mussel enterprise case studies

These findings are based on secondary data and semi-structured interviews with ten enterprise case study respondents. The data generated were used to understand the structure of the mussel farming industry, whether case study enterprises were self-sustainable, and identify the factors that contributed to their success or failure.

The current structure of the mussel industry reflects a high level of vertical integration and concentration. The industry is dominated by four enterprises that are vertically integrated with holding companies with ties in the fishing, food production, and FMCG industries. One of these enterprises has formalised supply and service agreements with 11 of the new, small mussel farms owned by HDIs.

Five of the ten enterprise case studies were regarded as self-sustainable. Common characteristics included a minimum farm size of 15 ha, being in production for at least five years, governing of enterprises along commercial principles, and having strong leadership.

Of the four enterprise case studies selected for further analysis, three were still in operation and self-sustainable, and one had ceased operations. The following common success factors were identified for self-sustainable enterprises:

a) Enterprise governed and managed on professional, commercial and profit principles
b) Having the required technical, management and other skills
c) Strong enterprise leadership
d) Financial investment from supportive partners
e) Having access to processing, distribution and marketing systems and facilities
f) Planning and saving for crisis periods
g) Minimum size of 15 ha
h) Minim time in production five years.

The following were identified as common reasons for failure:

a) Enterprise governed and managed on social rather than commercial principles
b) Lack of technical and business skills and experience
c) Strained relationships between beneficiaries, management, and stakeholders
d) Distrust and fighting amongst stakeholders
e) Lack of access to capital and business support mechanisms

f) Failure to meet regulatory requirements
g) Sub-optimal production technology.

Recommendations include the development of support mechanisms that use understanding of the success factors to help aquaculture enterprises to become self-sustainable. These mechanisms should build on the foundation of mentorship and skills transfer from experienced to new farmers, that is already a feature of the industry.

9.2.2 Findings pertaining to the impacts of stakeholders

These findings were based on semi-structured interviews with ten mussel enterprise case study and nine role player respondents. The main finding was that although the enabling environment for aquaculture sector development has improved, challenges remain. Negative impacts were described in terms of the following categories:

a) Impacts of key stakeholders:
    i. Problematic approach to enterprise development
    ii. Impacts of different stakeholder mandates
    iii. Community-based/collective type ventures
    iv. Enabling environment
b) Impacts of the institutional framework
    i. Regulatory framework
    ii. Complex application processes
c) Support systems:
    i. Issues with accessing support
    ii. Policies and programmes
    iii. Education system and skills.

To address these challenges and assist with the development of financially self-sustainable enterprises, the following recommendations were made:

a) Aquaculture industry associations should be strengthened and fully resourced.
b) A focused aquaculture enterprise and supplier development (ESD) strategy and programme should be developed.
c) Application processes should be streamlined.

d) The Oceans Economy Master Plan should be finalised and rolled out as soon as possible, with emphasis on development of aquaculture specific legislation.

9.2.3 Findings pertaining to critical success factors

These findings were based on semi-structured interviews with ten mussel enterprise case study and nine role player respondents. Respondents provided insights about their perception of enterprise self-sustainability, critical success factors and the reasons for failure of aquaculture enterprises.

Most respondents agreed with the researcher's definition of a self-sustainable enterprise as "An enterprise that can sustain its own operations from income derived from the sales of its goods and services without external financial support". Proposed additions to the definition indicated a common understanding of what it means to be a self-sustainable enterprise, with emphasis on profitability and independence.

The critical success factors for self-sustainable enterprises were categorized as environmentally responsible and sustainable farming, efficiently addressing economic opportunities and challenges, good business leadership and management, and a supportive business and enabling environment. The main reasons for failing to become self-sustainable were described as environmentally unsustainable farming, economic challenges, weak business leadership and management, and challenges related to the business and enabling environment.

The main conclusions pertaining to this part of the study include the following:

a) Correctly driven commercially focused aquaculture ventures are more likely to achieve social benefits such as job creation, than socially driven ventures are to achieve commercial benefits
b) The most important critical success factor for aquaculture enterprises is good business leadership and management
c) A focused aquaculture development programme such as an incubator could address the development of new and emerging aquaculture entrepreneurs and farmers, and issues around environmentally responsible and sustainable farming
d) The second most important critical success factor is the ability to efficiently address economic opportunities and challenges. The development of sustainable markets is critical for the development of self-sustainable enterprises. A market development mechanism such as an association could address this need

e) Setting up an integrated aquaculture research and development programme could provide a competitive edge to the aquaculture sector.

9.2.4 Findings pertaining to the impacts of COVID-19

These findings were based on semi-structured interviews with nine mussel enterprise case study and nine role player respondents. It also used secondary information based on a government survey of the aquaculture sector at the beginning stages of the pandemic.

The main impact of the pandemic was the closure of markets worldwide, due to restrictions on travel and people movement. This had devastating consequences for sales, income generation, production, excess product, lower prices, and employment. Government developed a COVID-19 response plan to address critical needs and assist with interventions such as negotiating for deferral of rentals and promoting the drive to buy local.

The main conclusions pertaining to this part of the study include the following:

a) The COVID-19 pandemic exposed the vulnerability of aquaculture enterprises to disasters and crises with wide-ranging impacts.
b) The main impacts were the closure of markets and drop in sales, which led to many other challenges such as loss of production, reduction in staff, financial difficulties, and business closures.
c) The pandemic impacted the ability of role player organisations to continue with their operations and programmes, especially through restrictions on movements and impacts on staff.
d) Although various COVID-19 support schemes were made available, there were challenges, and some companies could not readily access such schemes.
e) Enterprises prepare for the pandemic and the future mainly through long-term planning such as getting production structures ready.
f) Some of the main factors contributing to resilience were subsidisation from shareholders, reserve funds and multiple streams of revenue.
g) The most critical requirements to survive and rebuild the sector was financial support and the opening of markets.

The following recommendations were made:

a) Considering the predictions that there may be more frequent pandemics, the lessons learnt during this and other studies can be used for the development of interventions

aimed at surviving and rebuilding the sector to be more resilient in future. These lessons should be taken into consideration in the formulation of policy and strategy, especially during the current process to develop an Oceans Economy Master Plan to build on the achievements of Operation Phakisa.

b) Considering the estimation that at least 70% of aquaculture farms risk closure, drastic interventions from stakeholders will be required to revive closed businesses and rebuild the surviving ones. These businesses should be prioritised first before any investment in new aquaculture ventures is considered.
c) Follow-up assessments of the aquaculture industry should be conducted to better understand and quantify the full impacts of COVID-19 on the sector and provide tailor-made solutions for each sub-sector to stabilise, revive and grow the aquaculture sector in the medium to long term.
d) Development of an aquaculture industry-based Business Continuity Strategy should be prioritised to assist existing enterprises with strategies for survival until the pandemic is over, to prepare of normalisation of operations and to prepare the sector and enterprises to be more resilient to future global crises and disasters.

9.2.5 Findings pertaining to an aquaculture enterprise development model

The results of the studies of the mussel enterprise case studies, impacts of stakeholders, critical success factors and impacts of COVID-19 were use identify key factors affecting mussel production, and challenges to the development of self-sustainable enterprises. Consultations and discussion of initial results with enterprise development experts resulted in a draft enterprise development model, which was discussed and validated during two focus group sessions with stakeholders.

Key factors for mussel production included a supportive regulatory framework, favourable environmental conditions, use of appropriate species and technologies, efficient farm and enterprise management and favourable economic conditions. The requirements, existing measures and remaining challenges pertaining to these factors were identified.

The key issues affecting self-sustainability of aquaculture enterprises were categorized in terms of the internal environment under the control of enterprises (business leadership, business management and administration), and the external environment outside the control of enterprises (related to the enabling and business environments). Enterprise self-sustainability

depends on how well the internal aspects are managed and controlled, and efficient responses to opportunities and threats in the external environment.

The results indicated that Operation Phakisa and the Oceans Economy Master Plan, although important in terms of setting the scene for aquaculture development, need to be supplemented by more detailed programmes or mechanisms at industry level, to strengthen enterprises in the aquaculture sector. An aquaculture enterprise development model was proposed to address specific challenges preventing aquaculture enterprises from becoming financially self-sustainable, with the following goals:

a) To take aspirant aquaculture entrepreneurs on individual journeys through the system to develop them from inexperienced/aspirant entrepreneurs to industrialists
b) To reduce the number of entrepreneurs/enterprises that will fall by the wayside
c) To shorten the timeframe for entrepreneurs from when they enter the system until they are successful and sustainable.

Five main components of an enterprise development model were identified, as follows:

a) There must be an exciting, galvanising vision with targets for the sector that stakeholders, especially industry, support and that drives the implementation of all components of the model.
b) There should be an entity that drives the implementation of all aspects of the model and takes responsibility for meeting the targets set as part of the vision.
c) There should be a mechanism such as an incubation programme to develop and support entrepreneurs through all phases of enterprise development and draws on the knowledge and intelligence created through industry, the market mechanism, and the research programme.
d) There should be an integrated research and development programme that addresses industry needs, is informed by market intelligence, drives innovation and feeds into the incubation programme for transfer of knowledge and technologies.
e) There should be a market development mechanism that can drive market and product development and drive increased sales, informs the research programme, and informs the support and development programme.

The main recommendation was the implementation of a pilot Aquaculture Enterprise Development Model in the Saldanha Bay ADZ, to test assumptions, refine the model and adapt it for implementation in different sub-sectors and ADZs.

9.3 Conclusions

This study was done to investigate the problem that many aquaculture enterprises in South Africa, including those that were public funded, fail to become self-sustainable after the financial support ends. The hypothesis stated that the development of self-sustainable aquaculture enterprises is not adequately supported by the enabling environment for the aquaculture sector in the country. The objectives of the research were to understand the impacts of key stakeholders on aquaculture enterprise development, identify critical success factors for aquaculture enterprises, understand the impacts of the COVID-19 pandemic on the sector, understand the challenges that compromise the development of self-sustainable aquaculture enterprises, and to develop and validate a model that could create self-sustainable aquaculture enterprises, including those that are public funded.

The study provided sufficient understanding of the nature of impacts of key stakeholders on aquaculture enterprise development, the critical success factors for aquaculture enterprises, the impacts of the COVID-19 pandemic and the challenges that need to be addressed in an enterprise development model that could create financially self-sustainable aquaculture enterprises. The research objectives were therefore met.

The following conclusions about the hypothesis can be drawn from the research:

a) Although many initiatives have been launched to improve the enabling environment for aquaculture sector development, this has not resulted in adequate aquaculture enterprise development. There is insufficient focus on initiatives that address the critical success factors for aquaculture enterprises, resulting in especially new and emerging enterprises struggling to become financially self-sustainable.
b) The (legitimate) requirements for transformation and economic empowerment in aquaculture sector development is perceived to have led to promotion of aquaculture ventures with more focus on socio-economic rather than commercial motives.
c) Enterprise development seem to be confused with community development, especially where investment of public funding in aquaculture ventures in rural, marginalised or historically disadvantaged communities is involved.
d) Stakeholders agreed that an integrated aquaculture enterprise development model (AEDM) with a sector vision, a mechanism for implementation of the model, an aquaculture incubator, an integrated research and development programme and a market

development mechanism could promote the development of financially self-sustainable aquaculture enterprises.

The goals of the AEDM are as follows:

- To shorten the time frame from entrepreneurs' entry into the industry to financial self-sustainability
- To increase the number of aquaculture entrepreneurs that succeed, and
- To develop aspirant aquaculture entrepreneurs into industrialists.

The model's main components are illustrated in Figure 9.1 below. The model is described in more detail in Chapter 8. The Aquaculture Incubator will form the core of the model, to develop new and existing entrepreneurs by addressing their individual challenges. The inputs and results from the other components will be addressed through the Incubator to meet external challenges.

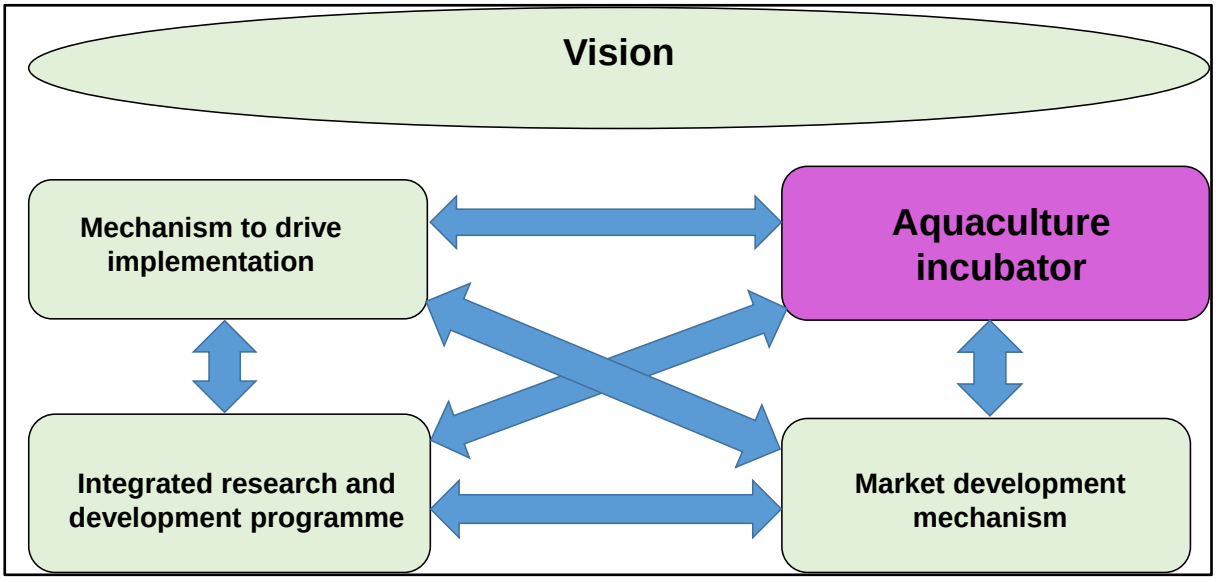

Figure 9.1: Main components of the AEDM

9.4 Recommendations for implementation

The results of this study could be applied through at least two main initiatives, as follows:

a) The results of this study should be considered as inputs during the development of the Oceans Economy Master Plan, especially as part of the Aquaculture sub-sector implementation plan.
b) The aquaculture enterprise development model should be implemented as a pilot in the Saldanha Bay ADZ to test assumptions and refine the model before implementation in

other value chains or ADZs around the country. This will build on several initiatives already underway, including the following:

i. The Saldanha Bay ADZ makes provision for the cultivation of several species including marine shellfish, finfish, and seaweed in 884 ha of sea water
ii. Most of the Operation Phakisa expansion projects were implemented in Saldanha Bay, which was already the centre of the bivalve shellfish industry
iii. The Saldanha Bay IDZ caters for the energy and maritime industries, and offers potential for cooperation in areas such as renewable energy, boat building and small business development infrastructure
iv. In 2022, the Bivalve Shellfish Farmers Association of South Africa (BSASA), supported by DFFE, implemented a pre-feasibility study on the potential for commercial cultivation of kelp along the west coast of South Africa; this could build on existing aquaculture activities in Saldanha Bay
v. The University of Stellenbosch developed a proposal for a project to set up an Aquaculture Institute for Vocational Training and Business Development in Saldanha Bay; this project aims to provide theoretical and practical aquaculture training through testing facilities for marine and freshwater aquaculture species.

9.5 Contribution of the study to the body of knowledge/Summary of contributions

This research investigated enterprise development in the aquaculture sector in general, and the marine mussel farming sub-sector as a case study. Findings relate to agribusiness enterprises in the aquaculture sector only. The research and conclusions added to the body of knowledge in this field in the following ways:

a) The key challenges inhibiting enterprises from becoming financially self-sustainable include internal challenges related to business leadership, management and administration, and external challenges related to the business and enabling environment.
b) The critical success factors for aquaculture enterprises have been identified as the following:
   i. Environmentally responsible and sustainable farming
   ii. Addressing economic opportunities and challenges efficiently
   iii. Good business leadership and management
   iv. Efficient response to challenges and opportunities in the business and enabling environment.

c) To become financially self-sustainable, aquaculture enterprises need focused, tailor-made financial and non-financial support appropriate to their growth phases.
d) The COVID-19 pandemic showed that enterprises that have built cash reserves from previous financial years, are vertically integrated, and/or have a diversified mix of income streams are more likely to be resilient to crises such as the pandemic.
e) An integrated aquaculture enterprise development model could help to create financially self-sustainable aquaculture agribusiness enterprises, if it addresses the following needs:
    i. A vision for the sector
    ii. An aquaculture incubator as the core of the model
    iii. A mechanism for implementation of the model
    iv. A market development mechanism
    v. An integrated research and development programme based on industry needs.

The theoretical and practical implications of the work address the consequences for previous work, and confirmation of work and theories that were already known. The following theories and work are supported by this study:

a) The importance of having a commercial motive in the establishment of aquaculture agribusiness ventures
b) The increased risk for failure if aquaculture ventures are set up with more focus on social than commercial motives
c) New aquaculture ventures should be based on farming of species with commercial value, within established value chains
d) The development of a value chain for an aquaculture species with commercial value could take decades to achieve and requires long-term commitment and investment by government, industry, academia, and other stakeholders.

The significance of this study lies in the use of previously known and new knowledge generated, to develop an industry-level enterprise development model that can be practically implemented, monitored, and revised to develop emerging and established aquaculture entrepreneurs. If successful, the model could increase the success rate of aquaculture start-ups, and the ability of aquaculture enterprises to become financially self-sustainable.

9.6 Recommended areas for further research

The areas recommended for further research are based on lessons learnt during this study, current initiatives in South Africa and national and global trends in aquaculture. It is not an exhaustive list, but some of the most important areas for further research are briefly described below.

9.6.1 Understanding the post-COVID-19 pandemic impacts on the sector

This study was concluded during the COVID-19 pandemic, when the full impacts of the disease on the South African aquaculture sector was not yet clear. A follow-up study should investigate how many farms and businesses survived and what enterprises did to survive the pandemic and strengthen their business models for the future. These lessons could be used to help other businesses prepare for extraordinary shocks in future. Such a study could also investigate how the structure of the industry was affected, e.g., through buyouts and consolidation.

9.6.2 Investigation of integrated multi-trophic aquaculture (IMTA)

IMTA utilising shellfish, finfish and aquatic plants is a global trend finding increasing local application in the aquaculture sector. It could increase the financial and environmental sustainability of existing aquaculture farms. Current initiatives include the ASTRAL Project, which focuses on IMTA in the Atlantic area, and includes an abalone-*Ulva*-sea urchin IMTA system in the Cape South Coast (ASTRAL Consortium, 2022). Another initiative is the South African Kelp Project, which is investigating the use of naturally occurring kelp species in the Saldanha Bay region to improve the commercial and environmental sustainability of existing aquaculture operators (UK in South Africa, 2022). The AEDM pilot should link with such initiatives to incorporate IMTA into its roll-out and refinement.

9.6.3 Investigation of additional inclusive business models (IBMs) in commercial aquaculture development

The importance of participation of historically disadvantaged individuals in all economic sectors is supported by government policies and programmes. The commercial development of the aquaculture sector should be done in a way that integrates HDIs (including new and small-scale aquaculture farmers, consumers and other HDIs) into the value chain. During the study, some aquaculture farmers indicated that the mentoring model (contract farming) is not enabling their involvement in the entire value chain to the extent that they would like. Further studies

could therefore include investigation of other potentially suitable inclusive business models (IBMs) for the commercial development of the South African aquaculture sector.

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APPENDIX A

Sample Questionnaire – Case study respondents

SEMI-STRUCTURED INTERVIEW QUESTIONS – CASE STUDY ENTERPRISE OWNERS/MANAGERS

Semi-structured interviews will focus on getting information that is not possible to extract from secondary sources and company documents.

The information to be recorded and discussed during the semi-structured interview, is set out below.

A.1 Interview background information

Date and venue of interview: _____

Researcher name and contact details: _____

Enterprise Pseudonym: _____

Informed Consent Form and details pertaining to the study (topic, university, ethical clearance reference etc.):

_____

Any requests/instructions from the informant regarding anonymity, privacy, confidential information etc.:

Any other relevant information: _____

A.2 Case Study background information

1. What is the specific role and responsibilities of the informant?
2. Agricultural Enterprise description according to National Small Business Act:

Size or class of enterprise	Total full-time equivalent of paid employees	Total annual turnover
Medium	51-250	≤ R35 million
Small	11-50	≤ R17 million
Micro	0-10	≤ R7 million
Large	>250	>R35 million

3. Category/class of aquaculture activity according to Aquaculture Development Bill

Category	Primary purpose	Number of Employees	Production
Subsistence	Providing food	Not specified	Not specified
Small-scale	Profit-making	<10	<20 tonnes per annum
Commercial	Profit making	≥10	≥20 tonnes per annum
Other			

4. Please complete the background information table below:

Case study code/pseudonym:	
Category of company (Profit or Non-profit)	
Type of enterprise (e.g. private company)	
History of company/ operations – Year established, Number of years in existence/in business, how did it evolve etc.?	
All aquaculture activities in the aquaculture value chain that the enterprise is involved in (e.g. Input supply, Production technology, Processing, Distribution and sale, Research and development)	
Description of Ownership: Individual and corporate (names and %)	
BEE ownership %	

Case study code/pseudonym:	
Ownership in other companies (e.g. processing factory)	
Number of employees (all aquaculture related activities and entities)	
Size of farming activities (ha)	
Leasing authority	
Farming technology, infrastructure, and production (e.g. type, number, size of rafts, technologies used, production cycle etc.)	
Production capacity of farm and factory (tonnes p.a.); current and potential; yields achieved, wastage, etc.	
Description of products and services (e.g. all species cultivated, processed products etc.)	
Markets – e.g. live, frozen, local, export etc.	
Product pricing range	
Details related to Testing, safety, quality e.g. NRCS/ SALMSMCP, HAB frequency, testing frequencies etc.	
Accreditation, Certification, industry membership e.g WWF-SASSI, MSC, BSASA, SANHA etc.	
Sources of funding and non-financial support – e.g. public, private, purposes, financial, non-financial	
Any other relevant information	

A.3 Institutional framework and support systems (enabling environment)

1. How does South Africa's current institutional framework and support systems for agribusiness or aquaculture development impact the sector and individual enterprises? Potential probing questions:
    a. Do you think the institutional framework and support systems create an enabling environment for aquaculture enterprises and the development of the sector?
    a. In your experience or opinion, do emerging and small-scale enterprises have sufficient access to the appropriate technologies, funding, appropriate market/s, expertise, and production inputs to serve its needs?
    b. If yes, do they know how to access all the resources that are available for enterprise set-up, development, and growth?
    c. What is your opinion in terms of current enterprise development; does it pursue socio-economic policy and strategy in isolation from market forces? Or is it sufficient but not properly implemented?
    d. In your experience, does the institutional framework and support favour collective-group or community-based projects over entrepreneurial or commercially oriented ventures?
    e. Do you think that ventures with social motives provide more opportunities for transformation and poverty alleviation than commercial ventures? If so, does this justify their promotion?
    f. In your experience, do policy makers take into account the needs and inputs of ordinary citizens regarding policy and strategy formulation and implementation, or is there a disconnect?
    g. Are there any other ways in which the institutional framework and support system impact on the sector and on enterprises?
2. Which role players have been or are important to your enterprise?
    a. What are the motivations, contexts, and key drivers of these role players?
3. How do these role players impact on the sustainable development and growth of the agribusiness/aquaculture sector and of enterprises in the sector? Potential probing questions:
    a. In your experience, do role players have a top-down approach to the establishment of enterprises, or do they let commercial and market forces stimulate demand?
    b. Various role players have different and potentially conflicting mandates; what has been your experience in terms of how this impacts on interpretation of policy, strategy and regulations?
    c. Do you think that the education system produces enough people with the required skills to run aquaculture businesses?
    d. In your opinion, do role players focus too much on environmental sustainability issues? How does this impact on economic/financial and social sustainability?
    e. Are there any other ways in which role players impact on the sector and on aquaculture enterprises?

A.4 Critical success factors

A.4.1. Economic and financial sustainability

1. The researcher's definition of a self-sustainable enterprise is: 'An enterprise that can sustain its own operations from income derived from the sale of its goods and services, without external financial support':
    a. What is your own definition, and do you think your enterprise is self-sustainable?
    b. Is that different from being economically or financially sustainable? If so, how do you define economic and financial sustainability?
    c. Are you willing to disclose financial information that will allow the researcher to verify self-sustainability of your enterprise e.g.:
        i. Annual reports/financial statements? Alternatively:
            - What is the typical monthly turnover of the enterprise?
            - What are the typical monthly costs? What cost items are included in this figure?
            - What are the typical % of cost items (e.g. labour, lease, testing/certification, transportation and other costs) in relation to total costs?
        ii. How does the enterprise define break-even point? Has this been achieved yet? If yes, how long after start of operations?
        iii. How do you define or measure profitability? Are you willing to disclose if the company is profitable or not? If so, what is the profit in a typical month?
        iv. How does your company define and measure investor returns? Are you willing to elaborate on the investor returns for this enterprise?
2. What are the critical success factors for economic and financial sustainability in your enterprise? Potential probing questions:
    a. Please elaborate on the partnership (if any) that you have with established commercial aquaculture enterprises and the impact that these partnerships have had on your success. Is it your experience that partnerships need to be adapted as business needs change?
    b. What were your main challenges in terms of markets for your products and services, and how did you address these?
    c. What were your main challenges in terms of production of your products and services, and how did you address these?
    d. Talk me through the development/growth stages of the enterprise and the responses to the changing needs and requirements of each stage.
    e. What is your opinion on the importance of investing sweat equity into the enterprise, as a critical success factor?
    f. What is the technical background of the owners and managers of the enterprise, and how did this impact on the enterprise?
    g. Are there any other economic and financial factors critical to the success of your enterprise?

A.4.2. Social sustainability and socio-economic aspects

1. What are the critical success factors relating to social sustainability and socio-economic aspects in this enterprise? Potential probing questions:
    a. Do you think that collective-group or community based aquaculture enterprises are economically or financially sustainable?
    b. Can collective-group or community-based enterprises succeed with continuous public funding support and intervention? If so what would be the conditions for success?
    c. In your experience, is it important for an enterprise to have individual and/or entrepreneurial ownership? Are these qualities promoted in the social environment?
    d. How do the socio-economic characteristics in historically disadvantaged communities (e.g. inequality, low education levels, poverty etc.) impact on transformation and economic inclusion in your enterprise?
    e. Do you think that the development and economic growth potential of the aquaculture sector is limited by social sustainability constraints?
    f. Are there any other success factors related to the social aspects specific to your enterprise, that are not addressed above?

A.4.3. Ecological and environmental sustainability

1. What are the critical success factors related to ecological and environmental sustainability in this enterprise? Potential probing questions:
    a. What is your opinion on compliance with environmental legislation and the impact on aquaculture enterprises, especially small-scale and emerging enterprises?
    b. Do you think that the development and economic growth potential of the aquaculture sector is limited by environmental sustainability constraints?
    c. How do the different needs of stakeholders in the same area impact on further development of your sector?
    d. How does climate change impact on your aquaculture activities (e.g. water temperature changes, seasonal weather changes, species health, harmful algal blooms (HABs), other diseases, wave changes, extreme events changes)? Do you think there is sufficient institutional understanding or support to ensure long term sustainability for the sector or for your enterprise?
    e. Are there any other ecological/environmental factors critical to the success of your enterprise?
2. Would the informant be willing to provide the researcher with company documents or records such as:
    a. Environmental sustainability policies & reports
    b. Corporate Social Responsibility policies & reports
    c. Environmental policy and reports
    d. ISO14001 processes and documentation
    e. Best Management Practices policies and reports

f. Human resource policies and reports
g. Sustainability Reporting policy and reports
h. Any other documentation relevant to sustainability of the enterprise.

A.5 Reasons for failing to become self-sustainable

1. Why do some public-funded enterprises fail to become self-sustainable after financial support ends? Potential probing questions:
    a. In your opinion, should role players in failed initiatives (including beneficiaries, implementing agents, funding agencies etc.) be held accountable? Will it contribute to more successful ventures in future?
    b. Do you think public funding and support is too easy access or extend if you are already a recipient; If so, does it contribute to dependence instead of self-sustainability in enterprise development initiatives?
    c. In your opinion, does public support (financial and non-financial) have enough depth to fully develop businesses?
    d. What do you think of the theory that beneficiaries of public-funded enterprises generally do not have the appropriate commercial/business experience or background?
    e. Are there any other possible explanations why public funded enterprises fail to become self-sustainable after the end of financial support?

A.6 Effects of the Coronavirus Disease 2019 (COVID-19) on the enterprise

The World Health Organization (WHO) declared COVID-19 a Public Health Emergency of International Concern on 30 January 2020. This was followed by emergency measures instituted in most countries around the world to limit or stop the spread of the disease. South Africa declared a national state of disaster followed by a national lockdown in March 2020.

1. What are the current effects of COVID-19, and the resulting national lockdown from 27 March 2020, on the enterprise? Potential probing questions:
    a. How has it affected operations and production, sales and income, employment of staff, and other aspects relating to sustainability of the business?
    b. What are the effects on morale and health of staff and owners?
    c. What COVID-19 support are you receiving?
    d. What are your company's needs in terms of assistance to survive and rebuild the business during and after the pandemic?
    e. What is your company doing to prepare, survive and rebuild the business?
    f. Any other issues related to the pandemic not covered above.
2. What are the potential longer term effects of the disease and the national lockdown?
    a. What assistance would your enterprise require to overcome the long term effects of the pandemic?

Is your enterprise resilient enough to survive the national lockdown and global effects of the pandemic, and why? What makes your enterprise more resilient?

APPENDIX B

Sample Questionnaire – Role Player respondents

SEMI-STRUCTURED INTERVIEW QUESTIONS – ROLE PLAYER REPRESENTATIVES

Semi-structured interviews will focus on getting information that is not possible to extract from secondary sources and company documents.

The information to be recorded and discussed during the semi-structured interview, is set out below.

B.1 Interview background information

Date and venue of interview: _____

Researcher name and contact details: _____

Role player Pseudonym: _____

Informed Consent Form and details pertaining to the study (topic, university, ethical clearance reference etc.):

_____

Any requests/instructions from the informant regarding anonymity, privacy, confidential information etc.:

Any other relevant information: _____

B.2 Background

1. What is the specific role and responsibilities of the informant in terms of the organisation/s they represent?

B.3 Institutional framework, support systems and main role players (enabling environment)

1. How do the current institutional framework (the systems of formal laws, regulations, procedures, and informal conventions, customs and norms that shape socio-economic activity and behaviour) impact on the development and growth of the aquaculture sector and on aquaculture enterprises? Potential probing questions:
    a. Elaborate on the specific laws, regulations etc. administered by your organisation
    b. How do the conventions, customs and norms specific to South African society, influence aquaculture development?
    c. Do you think the institutional framework create an enabling environment for aquaculture enterprises and the development of the sector?
    d. In your experience, does the institutional framework and support favour collective-group or community based projects over entrepreneurial or commercially oriented ventures?
2. How do current support systems (policies and plans, research, enterprise development, industry associations etc.) impact on agribusiness or aquaculture enterprise development? Potential probing questions:
    a. Elaborate on the specific policies, plans, programmes etc. that your organisation has developed or implemented
    b. In your experience or opinion, do emerging and small-scale agribusiness/aquaculture enterprises have sufficient access to the appropriate technologies, funding, appropriate market/s, expertise, and production inputs to serve its needs?
    c. If yes, do they know how to access all the resources that are available for enterprise set-up, development and growth?
    d. What is your opinion in terms of current enterprise development; does it pursue socio-economic policy and strategy in isolation from market forces? Or is it sufficient but not properly implemented?

e. Do you think that ventures with social motives provide more opportunities for transformation and poverty alleviation than commercial ventures? If so, does this justify their promotion?
f. In your experience, do policy makers take into account the needs and inputs of ordinary citizens regarding policy and strategy formulation and implementation, or is there a disconnect?
g. Are there any other ways in which the institutional framework and support system impact on the sector and on enterprises?

3. What are the motivations, contexts and key drivers of main role players and how do these impact on aquaculture development? Potential probing questions:
    a. What is the mandate and impact of your organisation on the sector and aquaculture enterprise development?
    b. In your experience, do role players have a top-down approach to the establishment of enterprises, or do they let commercial and market forces stimulate demand?
    c. Various role players have different and potentially conflicting mandates; what has been your experience in terms of how this impacts on interpretation of policy, strategy and regulations?
    d. Do you think that the education system produces enough people with the required skills to run aquaculture businesses?
    e. In your opinion, is there too much focus on environmental sustainability issues? How does this impact on economic/financial and social sustainability?
    f. Are there any other ways in which role players impact on the sector and on aquaculture enterprises?

B.4 Critical success factors

1. The researcher's definition of a self-sustainable enterprise is: "An enterprise that can sustain its own operations from income derived from the sale of its goods and services, without external financial support":
    a. What is your organisation's definition of self-sustainable enterprises? Is that different from being economically or financially sustainable? If so, how do you define economic and financial sustainability?

b. How does your organisation measure return on investments made into the sector or individual enterprises? Describe the return for investments into the aquaculture sector.

B.4.1 Economic and financial sustainability

1. What are the critical success factors for economic and financial sustainability in aquaculture enterprises? Potential probing questions:
    a. Please elaborate on the importance of partnerships between emerging/start-up and established commercial aquaculture enterprises and the impact that these partnerships have had on your success.
    b. What are the sector's main challenges in terms of markets for aquaculture products and services?
    c. Talk me through the development/growth stages of aquaculture enterprise and how their responses to the changing needs and requirements of each stage impact on self-sustainability.
    d. What is your opinion on the importance of investing sweat equity into an enterprise, as a critical success factor?
    e. What are the typical technical backgrounds of owners and managers of aquaculture enterprises, and how do this impact on self-sustainability?
    f. Are there any other economic and financial factors critical to the success of aquaculture enterprise?

B.4.2 Social sustainability and socio-economic

1. What are the critical success factors relating to social sustainability and socio-economic aspects in aquaculture enterprises: Potential probing questions:
    a. Do you think that collective-group or community based aquaculture enterprises are economically or financially sustainable?
    b. Can collective-group or community-based enterprises succeed with continuous public funding support and intervention? If so what would be the conditions for success?
    c. In your experience, is it important for an enterprise to have individual and/or entrepreneurial ownership? Are these qualities promoted in the social environment?

d. How do the socio-economic characteristics in historically disadvantaged communities (e.g. inequality, low education levels, poverty etc.) impact on transformation and economic inclusion in aquaculture enterprises?
e. Do you think that the development and economic growth potential of the aquaculture sector is limited by social sustainability constraints?
f. Are there any other success factors related to the social aspects specific to aquaculture enterprises, that are not addressed above?

B.4.3 Ecological and environmental sustainability

1. What are the critical success factors related to ecological and environmental sustainability in aquaculture enterprises? Potential probing questions:
    a. What is your opinion on compliance with environmental legislation and the impact on aquaculture enterprises, especially small-scale and emerging enterprises?
    b. Do you think that the development and economic growth potential of the aquaculture sector is limited by ecological and environmental sustainability constraints?
    c. How do the different needs of stakeholders in aquaculture areas impact on further development of your sector?
    d. How does climate change impact on aquaculture activities (e.g. water temperature changes, seasonal weather changes, species health, harmful algal blooms (HABs), other diseases, wave changes, extreme events changes)? Do you think there is sufficient institutional understanding or support to ensure long term sustainability for the sector?
    e. Are there any other ecological/environmental factors critical to the success of aquaculture enterprises?

B.5 Reasons for failing to become self-sustainable

1. Why do some public-funded enterprises fail to become self-sustainable after financial support ends? Potential probing questions:
    a. In your opinion, should role players in failed initiatives (including beneficiaries, implementing agents, funding agencies etc.) be held accountable? Will it contribute to more successful ventures in future?

b. Do you think public funding and support is too easy to access or extend if you are already a recipient; If so, does it contribute to dependence instead of self-sustainability in enterprise development initiatives?
c. In your opinion, does public support (financial and non-financial) have enough depth to fully develop businesses?
d. What do you think of the theory that beneficiaries of public-funded enterprises generally do not have the appropriate commercial/business experience or background?
e. Are there any other possible explanations why public funded enterprises fail to become self-sustainable after the end of financial support?

B.6 Effects of the Coronavirus Disease 2019 (COVID-19)

The World Health Organization (WHO) declared COVID-19 a Public Health Emergency of International Concern on 30 January 2020. This was followed by emergency measures instituted in most countries around the world to limit or stop the spread of the disease. South Africa declared a national state of disaster followed by a national lockdown in March 2020.

1. What are the current effects of COVID-19, and the resulting national lockdown from 27 March 2020, on your organisation? Potential probing questions:
    a. How have your services been affected?
    b. What COVID-19 support is your organisation receiving?
    c. What are the effects on morale and health of staff?
    d. What are your organisation's needs in terms of assistance to survive the pandemic?
    e. What is your organisation doing to prepare for and survive the pandemic?
2. How has the aquaculture sector been affected and how are they dealing with it? Potential probing questions:
    a. What are the effects in terms of enterprise operations and production, markets, sales and income, employment of staff, and other aspects relating to sustainability of enterprises in the sector?
    b. What are enterprises doing to prepare, survive and rebuild their businesses?
3. What COVID-19 support is your organisation providing to the sector?
4. What are the potential longer term effects of the disease and the national lockdown on your organisation and the aquaculture sector, and what assistance would be required to overcome these effects?

5. Are aquaculture enterprises resilient enough to survive and overcome the national lockdown and global effects of the pandemic, and why? What makes some enterprises more resilient than others?

APPENDIX C

Focus Group Guide

PHD RESEARCH: CREATING A MODEL TO DEVELOP SELF-SUSTAINABLE AQUACULTURE AGRIBUSINESS ENTERPRISES IN SOUTH AFRICA

Focus Group Discussion of Draft Aquaculture Enterprise Development Model

For representatives of stakeholders in the aquaculture, agribusiness and enterprise development sectors

Venue: _____ Date: _____

Moderator: _____ Assistant Moderator: _____

Audio-visual technician: _____ Number of participants: _____

Start time: _____ End time: _____

Agenda:

1. Welcome, introductions and ground rules
2. Purpose of the focus groups
3. Context and presentation of draft model
4. First questions
5. Short break
6. Continuation of questions
7. Conclusion
8. Way forward and closure

Questions:

1. Have the most prominent needs of the sector been correctly identified?
2. Does the proposed model address the needs of the sector?
3. Are the proposed elements of the model optimum to address the needs identified? If not, what are the alternatives?
4. Could the model be expanded to other aquaculture species and geographical areas?
5. Which stakeholders should drive the implementation of the model, and what resources would they need?
6. Which other stakeholders could assist with implementation of the model?

7. How best can the much-needed post Covid support be delivered?
8. Should the model be implemented as a pilot in Saldanha Bay, focusing on the bivalve shellfish sub-sector?

APPENDIX D

Participant Consent Form Template

RESEARCH STUDY INFORMATION LEAFLET AND CONSENT FORM

DATE:

TITLE OF THE RESEARCH PROJECT

'Agribusiness development initiatives in South Africa - creating a model to develop self-sustainable enterprises'

PRINCIPLE INVESTIGATOR / RESEARCHER(S) NAME(S) AND CONTACT NUMBER(S):

Bernadette Brown Webb Student no. 2016444339 Contact number 0835378290

FACULTY AND DEPARTMENT:

Faculty of Natural and Agricultural Sciences
Centre for Sustainable Agriculture, Rural Development and Extension

STUDYLEADER(S) NAME AND CONTACT NUMBER:

Prof. Johan A. van Niekerk: Study Leader (UFS)
Contact number 051 401 9147/ 083 231 7380; Email vNiekerkJA@ufs.ac.za

Prof Azwihangwisi E. Nesamvuni:
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Contact number 082 806 8762; Email tshikolomo@gmail.com

WHAT IS THE AIM / PURPOSE OF THE STUDY?

South Africa is one of the most unequal societies globally. It is struggling with low economic growth, high poverty levels and a high unemployment rate. Because agribusiness and aquaculture development have potential to contribute to economic growth and transformation, job creation, and providing food security and nutrition, the current institutional framework supports the development of small and medium enterprises (SMEs) in the agribusiness and aquaculture sectors.

Substantial public and private investments (financial and non-financial) have been made into the development of enterprises in the agribusiness and aquaculture sector over the last few decades, especially those owned by or benefiting Historically Disadvantaged Individuals (HDIs). Unfortunately, many agribusiness development initiatives supported with public funding still fail to become self-

sustainable after the financial support ends. In this context self-sustainable means the ability of an enterprise to sustain its own operations from income derived from the sale of its goods and services, without external financial support.

The aim of this study is therefore to develop a model covering all role players to create self-sustainable public funded agribusiness enterprises, and to propose new institutions, interventions, strategies etc. to achieve this aim. The study will focus on agribusinesses in the aquaculture sector.

WHO IS DOING THE RESEARCH?

Bernadette Brown Webb is a senior enterprise development specialist working for the Council for Scientific and Industrial Research (CSIR), and has twenty years' experience in the enterprise development domain. She has been involved in several programmes and projects aimed at enterprise development in support of economic development and transformation, in South Africa and neighboring countries.

Over the course of her career she observed that, in spite of institutional support and high levels of public funding invested in the development of agribusinesses, many such enterprises fail to become self-sustainable after the financial support ends. Discussions with other stakeholders and implementation agents in the enterprise development domain confirmed this observation. She seeks to understand the underlying reasons for this phenomenon, and to identify ways in which the institutional environment and investment of public funding could be improved to increase the chances of public funded agribusiness enterprises to become self-sustainable.

HAS THE STUDY RECEIVED ETHICAL APPROVAL?

This study has received approval from the Research Ethics Committee of UFS. A copy of the approval letter can be obtained from the researcher.

Approval number: UFS-HSD2018/0534

WHY ARE YOU INVITED TO TAKE PART IN THIS RESEARCH PROJECT?

The research design is based on a multiple- case study approach, focusing on agribusinesses in the aquaculture sector. A case study is the investigation of a practical, real-life example to build a multi-dimensional picture of a situation and illustrate relationships, corporate political issues and patterns of influence in particular contexts.

Proposed research tactics include:

- Multiple case studies of real-life enterprises; the research design requires at least three aquaculture enterprises as case studies
- In-depth (semi-structured) interviews with owners/managers of the case study enterprises selected

- In-depth (semi-structured) interviews with relevant external role players
- One to two focus groups with a highly specialized group of enterprise/agribusiness/aquaculture development experts and role players, to debate and validate the proposed model.

You have been identified as a role player/enterprise informant in the _____ sector/for the enterprise _____ in South Africa, in your capacity as _____. You indicated that you are willing to be interviewed as a role player.

As a role player/enterprise informant, you could provide critical insights into _____. You could also provide insights into _____/the researcher selected _____ as a potential case study because _____.

The research design requires a minimum of three case studies, representing a mix of self-sustainable, not yet sustainable/closed, small-scale commercial and large-scale commercial aquaculture enterprises. The researcher plans to focus on the mussel farming industry in particular, and plans to approach all operators in the industry for participation in this study. Therefore, the study may include all the mussel farms currently in operation in South Africa.

The role players to be interviewed, will be selected from all main role player groups impacting on the enterprise/economic/aquaculture development sector including but not limited to government, industry, research agencies, funding agencies, enterprise support agencies and others.

WHAT IS THE NATURE OF PARTICIPATION IN THIS STUDY?

Your role will be as an informant about _____ in South Africa.

The overall study involves document analysis, archival records, audio taping, semi-structured interviews and focus groups.

General and sector background information will include aspects such as:

- Enterprise/Economic/Aquaculture development institutional framework (the systems of formal laws, regulations, procedures, and informal conventions, customs and norms that shape socio-economic activity and behaviour)
- Enterprise/Economic/Aquaculture development support systems (including policies and plans, funding agencies, research, enterprise development, industry associations etc.)
- Role players in enterprise/economic/aquaculture sector development – their contexts, motivations, key drivers and impacts on enterprises
- Role player specific information that could be obtained from documents and records such as:
    - Annual reports and Yearbooks
    - Program reports and reviews
    - Strategies and plans
    - Policy documents

  - Norms, standards and guidelines
  - Any other documentation and records relevant to the role player/organization
- Case study background information will include company specific background information that could be obtained from company documents and interviews. Examples of documents that may be requested by the researcher:
  - Promotional, media and other information about your enterprise
  - Annual reports or financial statements (for the purpose of verification of self-sustainability)
  - Production reports
  - Environmental sustainability policies & reports
  - Corporate Social Responsibility policies & reports
  - Environmental policy and reports
  - ISO14001 processes and documentation
  - Best Management Practices policies and reports
  - Human resource policies and reports
  - Sustainability Reporting policy and reports
  - Any other documentation relevant to the enterprise.

The type of questions to be asked during semi-structured interviews role player and enterprise informant interviews will be structured around the informant's experience and opinions including but not limited to the following themes:

- The informant's roles and responsibilities in terms of the organization/s they represent
- How the current institutional framework and support systems impact on enterprise and economic development, and the development and growth of the aquaculture sector
- The main role players in enterprise/economic/aquaculture sector development, and their motivations, contexts and key drivers
- How main role players impact on the sustainable development and growth of enterprises in general, the aquaculture sector and aquaculture enterprises
- The critical success factors of enterprises in general, the case study enterprise, or in the agribusiness/aquaculture domain in relation to:
  - Economic/financial/self- sustainability, including definitions and measurement thereof
  - Social sustainability and socio-economic aspects
  - Environmental/ecological sustainability, including issues around legislation, climate change etc.
- Potential reasons why some (especially public-funded) enterprise/economic/aquaculture development initiatives fail to become self-sustainable.
- The effects of the COVID-19 pandemic on the organization or enterprise, and enterprise/economic/aquaculture development:
  - Current and potential longer term effects
  - Assistance provided/required
  - Resilience of the enterprise.

The type of questions to be asked during semi-structured interviews with enterprise informants will also include questions related to the company background, as well as questions related to the

informant's experience and opinions that address the objectives of this study. Questions related to the company background information could include:

- The interviewee's role and responsibilities in terms of the enterprise
- Enterprise description and class of aquaculture activity
- Category and type of enterprise
- Description of aquaculture activities
- Size and capacity of farming and processing operations, number of employees
- Farming and processing - production technology, infrastructure, yields, capacity, cycles etc.
- History of company, ownership structures, value chain integration
- Products/services sold, markets for products, pricing ranges
- Details related to testing, safety, quality, accreditation, certification and memberships
- Sources and purposes of funding/support obtained (private, public, financial, non-financial).

Additional questions addressed to enterprise informants will be structured around the following themes:

- The critical success factors of the enterprise:
    - Economic and financial sustainability:
        - The company's definitions and measurement of economic, financial, and self-sustainability; break-even point, profitability, investor returns
- If annual reports/financial statements cannot be provided, the researcher may ask additional questions (to verify self-sustainability of the enterprise) relating to turnover, costs, profit, etc.

You have the right not to provide any documentation deemed sensitive or confidential. You do not have to answer any question or provide any information that makes you feel uncomfortable or could compromise company confidentiality or policy.

Additional questions may be asked, depending on your specific insights and experiences.

The estimated time for an interview is from one to two hours. You may choose to grant more than one interview to cover the proposed questions.

The estimated time frame for all data collection (case studies, role players and focus groups) is _____, with each successive case study and role player interaction expected to provide more insights. This may necessitate follow-up discussions with you, to test additional ideas.

During the semi-structured interview, you may identify additional informants in your organization, or external role players important in agribusiness/aquaculture development, that should be interviewed as well. Relevant role players in the aquaculture/agribusiness sector will be interviewed to obtain their perspectives and insights relevant to this study.

After data collection, analysis and interpretation of data from all case studies have been completed, one or two focus groups with a small selection of relevant role players (including government, industry and others) will be arranged to assess and validate the proposed new model for creation of self-

sustainable public funded agribusiness enterprises. You may be requested to take part in such a focus group.

CAN THE PARTICIPANT WITHDRAW FROM THE STUDY?

Participation in this study is voluntary and there is no penalty or loss of benefit for non-participation. You are under no obligation to consent to participation. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a written consent form. You are free to withdraw at any time and without giving a reason.

Data collection for the study could include the perusing of existing information, a site visit and interview/s with you/your representative/s. Site visits and interviews will include collection of information that will be transcribed for analysis at a later date. The time spent on engaging with you/your organization will depend on your availability and the nature of your organization. It could range from a few hours to a few days. In-depth interviews are expected to take about one to two hours each. For ethical reasons, you may decline to answer any question that may cause discomfort and you may withdraw from this study at any time without consequences.

The only time that you will not be able to withdraw from the research project is when you have submitted non-identifiable material such as survey questionnaires. However, the researcher does not plan to use anonymous survey questionnaires at this stage.

WHAT ARE THE POTENTIAL BENEFITS OF TAKING PART IN THIS STUDY?

Participation in this study does not carry any direct benefits to you or your institution/enterprise. The study aims to contribute to an enabling environment for the aquaculture sector, and an improvement in the long-term sustainability of aquaculture enterprises and agribusinesses in general. Therefore, the potential benefits to you or your organization are indirect.

Your participation in the study, specifically your interview responses and sensitive information will be kept confidential, but information about you will be given to the study sponsors including the University of the Free State. Your responses will by anonymized during analysis and reporting.

WHAT IS THE ANTICIPATED INCONVENIENCE OF TAKING PART IN THIS STUDY?

The expected inconvenience or discomfort may come from the use of devices to record the interview, questions that make you uncomfortable or time taken to conduct the interview. The potential and reasonably foreseeable risks of harm may include:

- Loss of privacy and anonymity through unauthorized access to your information (e.g. data breaches as a result of hacking, theft or loss of the equipment used to record and store information related to the study) – the likelihood of occurrence is perceived as low, but with potentially high impact on your enterprise

- Others identifying your enterprise from the study and using the information to their advantage – the likelihood of occurrence is perceived as medium, but with potentially high impact on your enterprise.

The investigator will mitigate against these risks as follows:

- Taking reasonable care to protect all electronic devices, notes and other materials related to the study against hacking, theft or loss
- Adhering to your instructions regarding the use of recording devices, taking photos and videos, handling of confidential/sensitive information and documents, etc.
- Protecting your anonymity in any unpublished and published documentation about the study.
- Assigning a case number to you instead of using your or your organization's name for data analysis, interpretation and reporting purposes
- Maintaining tight control of sensitive data and only releasing it in an unidentifiable form.

Should any injury or harm occur to you or your organization that is attributable to the study, the study leader or the UFS Natural and Agricultural Sciences Research Ethics Committee could be contacted through the Office of the Dean: Natural and Agricultural Sciences, for investigation and action. Contact details are as follows:
Tel. 051 401 2322; Email smitham@ufs.ac.za

WILL WHAT I SAY BE KEPT CONFIDENTIAL?

Your or your enterprise/organization's name will not be recorded during data collection. The enterprise, and your answers will be given a fictitious code number or a pseudonym and you will be referred to in this way in the data, any publications, or other research reporting methods such as conference proceedings. No one will be able to connect you to the answers you give. Data analysis consultants employed by the UFS will have access to the data in order to assist the researcher with transcribing, analysis and coding of the data. These individuals will maintain confidentiality through their contract agreements with the UFS. Your answers may be reviewed by people responsible for making sure that research is done properly, including the transcriber, coder, and members of the Research Ethics Committee. Otherwise, records that identify you will be available only to people working on the study, unless you give permission for other people to see the records.

Your anonymous data may be used for other purposes, e.g. research report, journal articles, conference presentation, etc. A report of the study may be submitted for publication, but individual participants or enterprises will not be identifiable in such a report.

While every effort will be made by the researcher to ensure that you will not be connected to the information that you share if you take part in a focus group, I cannot guarantee that other participants in the focus group will treat information confidentially. I shall, however, encourage all participants to do so. For this reason, I advise you not to disclose personally sensitive information in the focus group. You can refuse to take part in the focus group even if you have agreed to take part in the interview. You may stop being in the study at any time without getting in trouble.

HOW WILL THE INFORMATION BE STORED AND ULTIMATELY DESTROYED?

Hard copies of your answers will be stored by the researcher for a period of five years in a locked cupboard or office at her place of work (CSIR) in Rosebank, Cape Town for future research or academic purposes; electronic information will be stored on a password protected computer. Future use of the stored data will be subject to further UFS Research Ethics Review and approval if applicable. Information will be destroyed in accordance with the relevant Records Management policies of the UFS and the CSIR.

The potential risk of loss of privacy and anonymity (through fire, floods, theft, hacking etc.) is low as the CSIR has access control and security on its premises, and has fire and flood protocols in place. Electronic equipment is password-protected and subject to the company's policies around protection against computer viruses, hacking etc. However, the potential impact of such loss on your enterprise or organization could be high if sensitive/confidential information has been provided.

The potential risk of third parties identifying your enterprise from the study is regarded as medium, because of the small size of the industry and most operators knowing each other. However, the potential impact of such identification could be high if you can be linked to sensitive information pertaining to your enterprise.

To mitigate against these risks, care will be taken to protect hard copies through locking of cabinets and offices, and electronic information through password protection of computer equipment and keeping anti-virus and other software updated. Electronic backups will be made to mitigate against loss of electronic data. Your responses will be anonymized, and access to any information that links you to the study will be tightly controlled to reduce the risk of identification.

Should any injury or harm occur to you or your organization that is attributable to the study, the study leader or UFS Natural and Agricultural Sciences Research Ethics Committee could be contacted through the Office of the Dean: Natural and Agricultural Sciences, for investigation and action.

WILL I RECEIVE PAYMENT OR ANY INCENTIVES FOR PARTICPATING IN THIS STUDY?

There is no payment or reward offered, financial or otherwise, for participation in the study. During case study site visits and interviews, some costs may be incurred by the participant. These will be discussed beforehand and reasonable costs reimbursed by the researcher. For in-depth interviews the participant should select a suitable, accessible venue. For focus groups, the researcher will be responsible for arranging venues. The expected potential level of inconvenience and/or discomfort to the participant will be related to traveling to the venue and spending the time needed to complete interviews or participate in focus groups.

HOW WILL THE PARTICIPANT BE INFORMED OF THE FINDINGS / RESULTS OF THE STUDY?

If you would like to be informed of the final research findings, please contact Bernadette Brown Webb on telephone number 0835378290 / 0216582749 or email address bbrownwebb@gmail.com / bbrown@csir.co.za / 2016444339@ufs.ac.za. The findings are accessible for five years.

Should you require any further information or want to contact the researcher about any aspect of this study, please Bernadette Brown Webb on telephone number 0835378290 / 0216582749 or email address bbrownwebb@gmail.com / bbrown@csir.co.za / 2016444339@ufs.ac.za.

Should you have concerns about the way in which the research has been conducted, you may contact Prof. Johan van Niekerk on telephone number 051-4012163 or email vNiekerkJA@ufs.zc.za. These may include concerns such as the type of questions asked, the conduct of the researcher during interaction with the participant, issues around the confidentiality of information or other.

Thank you for taking time to read this information sheet and for participating in this study.

CONSENT TO PARTICIPATE IN THIS STUDY

I, _____ (participant name), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet. I have had sufficient opportunity to ask questions and am prepared to participate in the study. I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable). I am aware that the findings of this study will be anonymously processed into a research report, journal publications and/or conference proceedings.

I agree to the recording of the semi-structured interview.

I have received a signed copy of the informed consent agreement.

Full Name of Participant: _____

Signature of Participant: _____ Date: _____

Full Name(s) of Researcher(s): _____Bernadette Brown Webb

Signature of Researcher: _____ Date: _____