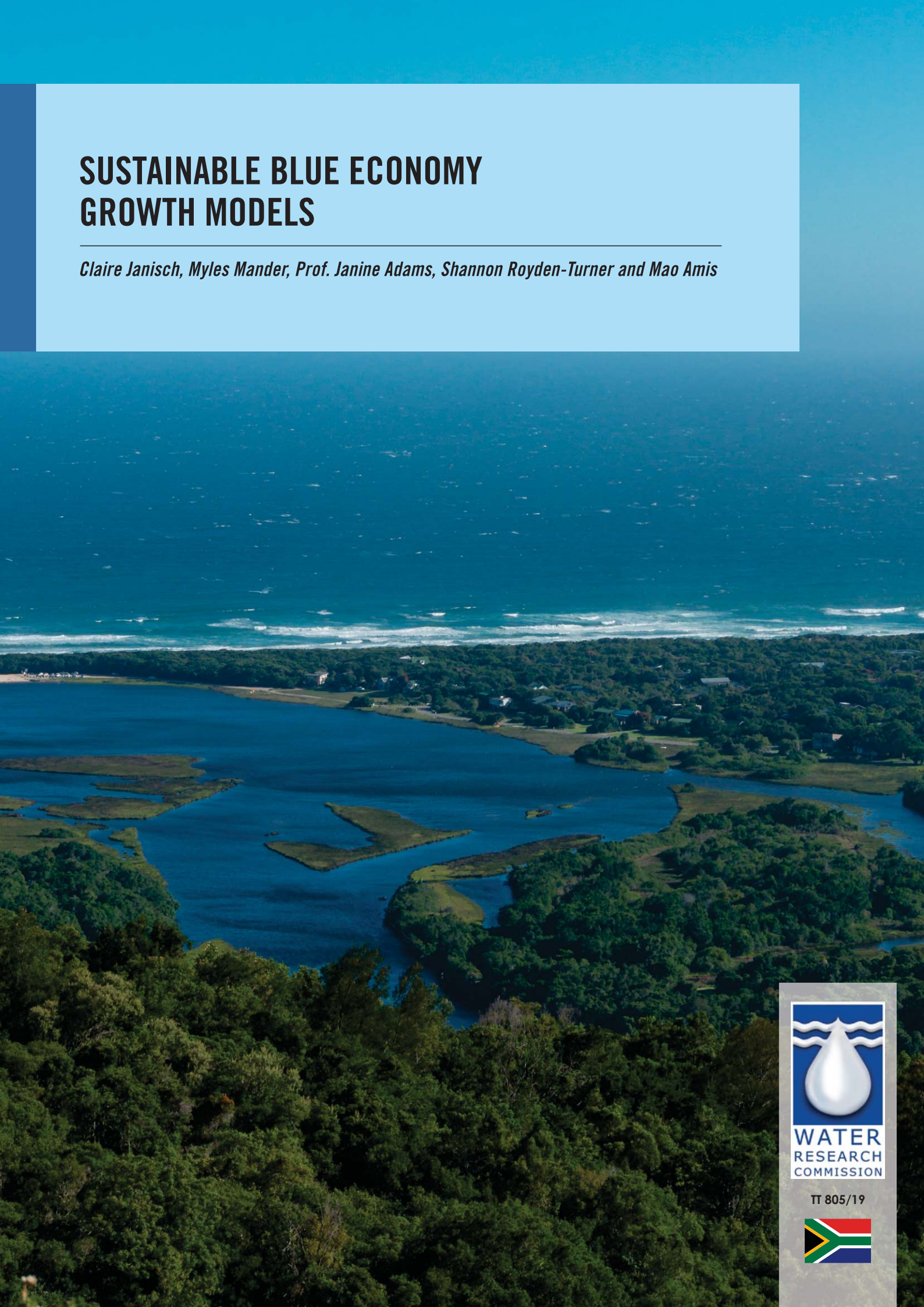
SUSTAINABLE BLUE ECONOMY GROWTH MODELS

Claire Janisch, Myles Mander, Prof. Janine Adams, Shannon Royden-Turner and Mao Amis



WATER RESEARCH COMMISSION

TT 805/19

Sustainable Blue Economy Growth Models

Claire Janisch[1], Myles Mander[2], Prof. Janine Adams[3], Shannon Royden-Turner[4] and Mao Amis[5]

Report to the

WATER RESEARCH COMMISSION

by

[1]Greenhouse Systems Development & BiomimicrySA
[2]FutureWorks
[3]Nelson Mandela Metropolitan University
[4]Actuality Urban
[5]African Centre for a Green Economy

WRC REPORT NO. TT 805/19

January 2020

Obtainable From:
Water Research Commission
Private Bag X03
Gezina, 0031

orders@wrc.org.za or download from www.wrc.org.za

The publication of this report emanates from a Water Research Commission project entitled *Sustainable Blue Economy Growth Models* (WRC Project No. K5/2736).

ISBN 978-0-6392-0101-6
Printed in the Republic of South Africa

EXECUTIVE SUMMARY

"Never before has the health of the oceans been more fragile, and more essential to our wellbeing. Imagine a Blue Economy that actually helps bring the ocean back to health, by fitting within the boundaries of the ocean's ecosystems, accelerating the adoption of clean technologies and renewable energy, and creating circular material flows. Imagine that this process creates new jobs and economic opportunities." – WWF

Internationally, ocean economies, both large and small, are looking to their seas to bolster slowing growth in their terrestrial economies and discover new opportunities for investment and employment. Key considerations in the growth of the ocean economy include:

- there has been a shocking plunge in ocean health that has been directly linked to human activities. The urgency of the ocean health challenge is becoming more prominent in global and local policy discourse
- the Oceans Economy typically prioritises growth over sustainability. Without a clear framework for sustainable growth, even modest progress on ocean health will be a challenge
- current approaches to valuing the ocean economy could mean that we are underestimating its contribution, particularly the value of non-market ecosystem services, such as the protection to coasts offered by coral reefs, or carbon sequestration
- a sustainable ocean economy offers a path for considering economic development and ocean health as compatible propositions. It does not have to be a choice between growth and sustainability
- innovative financing will be needed to direct investments into those economic activities that can enhance ocean health. Society may be in the best position to lead implementation of innovative approaches to restoring ocean health while generating socio-economic benefits

South Africa's coastal resources are highly valuable to the economy, but are under threat. South Africa's coastal areas generate substantial capital through their ecosystem services including tourism, recreation and fishing. Coastal areas generate over R10 billion per year from recreation and tourism alone. Coastal protection and flow regulation has been estimated at R3.5 billion per year. These resources are also valuable to local people: for instance, estuaries generate nearly R65 million a year from subsistence harvesting and fishing. Estuaries contribute R 4.2 billion per annum to the South African economy. However, the development of estuaries and their catchments has come at a cost of about R700 million per annum in terms of lost fishery benefits as well as unknown costs to society from the overexploitation of resources and loss of biodiversity. While estuaries may be viewed as small environmental domains, the larger coastal system in many ways cannot survive without them. Estuaries are nursery areas for many marine invertebrate and fish species of commercial and subsistence importance. The Department of Environment, Forestry and Fisheries recognises 22 commercial fisheries with revenue estimated to be ZAR 3million annually, which has likely increased over time (2016). The squid industry is one of South Africa's most valuable fisheries generating ZAR 500million in foreign revenue per annum. Although commercial fisheries are well managed and reliable catch and research data is collected annually, a number of fish species are being overfished and some stocks have collapsed. 50% of South Africa's fish stocks are considered to be of concern with 22% considered heavily fished and 25% considered heavily depleted.

The National Biodiversity Assessment marine and coastal component (2018) synthesised the present state of biodiversity and ecosystem health. In summary, the report showed that 60% of South African coastal ecosystem types are threatened, comprising more than half the extent of the coastal zone. Pressures on coastal biodiversity include unsustainable harvesting of species, inappropriate infrastructure development, mining, decreased freshwater flow into the sea from rivers, and pollution. Proportionately, the rate of habitat loss in the coastal zone is twice that for the rest of the country. The 2018 assessment indicates that the estuarine realm is the most threatened of all realms in South Africa, both for the number of ecosystem types and for area. By area, 99% is threatened with 3% critically endangered, 74% endangered and 22% vulnerable. This emphasises the need for strategic interventions across multiple sectors to restore estuarine health and protect benefits to people. Estuaries are under protected in South Africa with only 1% of estuarine area well protected. Coastal ecosystems are particularly vulnerable to urbanisation and have been placed under high anthropogenic pressure (especially coastal areas near cities/metros). Another large pressure on the coast is the decline in water quality due to pollution from various sources, including wastewater

treatment works and stormwater runoff, increasing bacterial loads, nutrients and heavy metals. Plastic pollution is a large concern as this entangles marine animals and is ingested leading to untimely deaths through starvation. The degradation of ecosystem health creates gaps for invasive species, parasites, pathogens and diseases, further damaging our natural resources. There has been a significant increase in pollution pressure in estuaries, e.g. 840 million litres of waste water daily flow into estuaries, with deteriorating water quality driving change on regional scales, with 33% of estuaries under severe pollution pressure. However, simple interventions in some estuaries have resulted in improvements in water quality paving the way for scaling up activities around the country.

South Africa's Oceans Economy

South Africa has one of the highest unemployment, poverty stricken and unequal societies in the world. Operation Phakisa is an initiative of the South African government started in 2014 to stimulate the implementation of the National Development Plan and boost the economy. There is a perception that coastal and marine resources are underutilised, and, if utilised to their full potential, could contribute to livelihoods and economy. Operation Phakisa therefore includes investment in: marine transport, oil and gas exploration, aquaculture, marine protection and ocean governance, as well as small harbours development and coastal and marine tourism. Operation Phakisa focuses more on economic opportunities for larger businesses with limited attention to sustainable and inclusive Blue Economy opportunities that support marginalised coastal communities. In addition, there are concerns that many of the initiatives within Operation Phakisa may have negative impacts on ocean health and ecosystem integrity, especially estuaries.

Before Operation Phakisa was implemented there was no overall system in place to guide ocean governance and marine resources were managed sectorally. This could result in conflict between user groups as well as unsustainable use of ocean resources. The Marine Protection Service and Ocean Governance stream of Operation Phakisa aims to develop an overarching, integrated ocean governance framework for the sustainable growth of South Africa's ocean economy. Marine Spatial Planning and Marine Protected Areas (MPAs) are also an important component involving a public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic and social objectives. The Department of Environment, Forestry and Fisheries announced in October 2018 that Cabinet approved a network of 20 new MPAs that will increase protection of the ocean around South Africa from 0.4 to 5%. However, estuaries are outside of the MPA zone, and are not given the protection they need. A big concern for ocean health is the impact of coastal activities and activities upstream of estuaries (from both land and rivers systems), which leaves an important area for action as key contribution to the Blue Economy: slightly upstream and within estuaries.

A (Sustainable) Blue Economy

Whilst the value of ocean resources for the economy are significant, they are not fixed. The condition of the marine assets can either decrease or increase, depending on their use and management. Actions which degrade the marine system have the potential to reduce the economic contribution, while actions which restore marine assets can increase their economic contribution. Consequently, there are significant risks and opportunities associated with developments in the Oceans Economy. We face a time where natural capital will be the major limiting factor for economic productivity and human well-being. Stimulating short-term economic growth in ocean economies may be easily accomplished; however development of an economy based on sustainability will be much more difficult to achieve. To prevent an ecological crisis and realise the full benefit of the oceans it is imperative that proper guidelines and policies are put in place to ensure that the economic use of the oceans also results in long term conservation and restoration. Blue economy projects that build the capacity of people and support the role of the natural environment in sustaining vibrant economies and human well-being will be essential. What is needed is investment in development that restores ocean health while benefiting marginalised coastal communities in South Africa, and also contributing to the oceans economy.

The **Blue Economy is defined as a sustainable and equitable oceans economy** that:

- provides social and economic benefits for current and future generations, by contributing to food security, poverty eradication, livelihoods, income, employment, health, safety, wellbeing, equity, and political stability
- restores, protects and maintains the diversity, productivity, resilience, core functions, and intrinsic value of marine ecosystems – the natural capital upon which its prosperity depends

- is based on circular material flows, clean technologies and renewable energy, to secure economic and social stability over time, while keeping within the limits of one planet.

OBJECTIVES

This WRC project aims to inform more sustainable and inclusive Blue Economy initiatives for South Africa, informed by new economic models as well as proven and operational SMMEs, with a particular focus on activities that improve estuary health and the lives of marginalised coastal communities. The specific aims of this project are:

1. to develop sustainable economic models necessary to support the Blue Economy
2. to pilot test these models using selected case studies (including proven and operational SMMEs) in both warm and cold temperate coastal zones
3. to integrate the best practice into draft SA blue economy strategy and related legislation
4. to develop a model and guiding framework on how coastal ecosystems can support the blue economy that benefits local and broader communities
5. to share knowledge generated with local and global networks and stakeholders.

This project fulfilled the intended aims and objectives, although some through different yet more feasible and practically implementable processes than originally anticipated. The following section summarises the expected results and achievements of this project to address the challenges outlined above:

Scoping Phase: The aim of the scoping phase, which was realised in the scoping report, was to describe the status quo of the Blue Economy in South Africa, define a sustainable Blue Economy, and outline proposed approaches for developing sustainable Blue Economy models. It included an overview of potential projects across the South African coast, from which to select the pilot projects. Pilot projects were selected to form the basis of economic modelling as well as the demonstration of proven and operational SMME business models for the Blue Economy.

Sustainable Economic Models: The key contribution of this project is the development of a bespoke cost/benefit analysis (CBA) economic modelling tool as a way of assessing the wider human benefit of oceans economy development scenarios – one that factors in ecological, social and long-term impacts, rather than only short-term benefits that focus on GDP alone. The economic modelling tool was developed as a generic tool, tested for a potential project in the Knysna Estuary, and further tested using the proposed uThukela Banks MPA as case study.

Proven and Operational SMMEs (sustainable Blue Economy **Business Models).** It was outside of the scope of the project to incubate new businesses, and therefore existing local and international proven and operational SMMEs were documented as best practice examples that can contribute to a regenerative and inclusive blue economy. Although only required to document two proven and operational SMMEs, many more proven and operational ones were documented as well as a number of other new potential ones, illustrating broad opportunities worth investment as part of any national blue economy strategy. Locations included: Hout Bay, Saldanha Bay, Knysna Bay, East London, the Wild Coast, and the KZN coast including Durban Bay.

Integrate best practice into South African Blue Economy Strategy and related legislation. The project team originally intended to work with government to integrate project findings within a National Blue Economy strategy, but it turns out there is no National Blue Economy Strategy beyond Operations Phakisa. In addition, despite many attempts to engage with government there was insufficient interest to engage with this project. It was realised that civil society has a greater capacity and interest in integrating these projects findings within their national strategies and so the focus shifted to enabling WildTrust and WildOceans to expand and integrate these Blue Economy initiatives within their national strategies. Their strategies serve as a model that could be replicated and scaled and they have existing partnership with government that can enable integration of the initiatives into local Estuary Management Plans.

Develop a model or guiding framework on how coastal ecosystems can support the blue economy that benefits local and broader communities: The project team has developed this model and guiding framework which is based on the integration of circular, regenerative, distributed, and doughnut economies with natural capital and the best practice principles of a Blue Economy. It is also informed by the results of the economic modeling, as well as the proven and operational SMMEs identified in

this project. This model and guiding framework can support public, private and civil-society sector decision-makers who need support in undertaking operational and development planning which is cognisant of human wellbeing, inclusive economic development, as well as natural capital as the supplier of services on which society and the worlds' economies have come to depend. This has potential for national application with priority focus on degraded estuaries affected by water quality.

Share Knowledge through workshops, reports, and postgraduate student research publications: A number of workshops were held as part of this research project that enabled interdisciplinary knowledge sharing to and from the action research of this project. These were held in KZN, Port Elizabeth, Cape Town and Pretoria. This project also supported postgraduate research at University of Pretoria, Nelson Mandela Metropolitan Univesity (NMMU), and the Cape Peninsula University of Technology (CPUT).

METHODOLOGY

Select pilot project areas for testing economic models
The pilot projects selected are those that could generate useful test cases for sustainable Blue Economy models. Although this project originally called for one in warm and one in cold coastal conditions only, the following additional criteria for selection were considered: adequate data for economic models, potential to influence Blue Economy policy, coastal focus, addressing a regenerative Blue Economy, replicability, and focus on water quality.

The potential pilot projects were rated against these criteria using a 3-point scoring system and the average of scores from team and reference group members was calculated. From the initial list of 11 local projects, informed by 5 international best practice projects, the following *two focus areas* were selected for the next phases:

1. A **Circular/Regenerative economy approach** to restoring estuary health (using Knysna as a case study for piloting the economic model)
2. An **ecosystem restoration approach** for restoring ocean health in MPAs (using the proposed uThukela Banks MPA as a case study for piloting the economic model),

Develop Sustainable Blue Economy Economic Models
Natural resource economics deals with the supply, demand, and allocation of the Earth's natural resources. One main objective of natural resource economics is to understand better the role of natural resources in the economy in order to develop more sustainable methods of managing those resources to ensure their availability to future generations. Development of Economic Models enables better decision making around the economics of resource allocation. An **Economic Model** is a theoretical construct representing economic processes by a set of variables and a set of logical and/or quantitative relationships between them. The economic model is a simplified, often mathematical, framework designed to illustrate complex processes.

Through research and a number of internal team workshops, a bespoke economic Cost Benefit Analysis model in the form of a Microsoft Excel tool (named: Blue Economy Economic Model) was developed to analyse the costs and benefits of developments in the Blue Economy and was tested in two pilot areas: Knysna Wastewater Treatment Works upgrade (with input from Knysna Municipality, environmental engineers, SANParks, and wastewater treatment works engineers), and the proposed uThukela Banks MPA case studies (with input from WildOceans, Dr Ken Findlay who is Research Chair of Oceans Economy at CPUT, and some local stakeholders). The tool is used at the start of development planning processes to identify options, direct development planning and guide decision making regarding alternative development scenarios. Intervention proponents provided basic data on costs, revenue and timing for a suite of discrete options and combinations. Workshops were held with stakeholders representing alternative perspectives. Biophysical, social and financial impacts were discussed and a series of criteria were scored (both the direction and magnitude of impacts). The costs/benefits were computed and compared in tables and graphs. The workshop results served as recommendations based on analysis outcomes. The economic model focuses on GGP (Gross Geographic Product) and human benefit as comparative outputs. The economic model was documented in an Economic Modelling Report and results are summarised below with details in the body of this report.

Proven and Operational SMMEs – Blue Economy Business Models

A **Business Model** is the key document that enables the transition from an idea or a concept to a company that is scalable and sustainable. Business models for sustainable development aim to deliver economic, social and environmental benefits – the three pillars of sustainable development – through core business activities, thereby incorporating the interests of a wide range of stakeholders in its design. Some well known models for sustainable business include: Natural capitalism, Social Enterprises, Product Service Systems, and New Economy concepts (such as a Circular Economy).

This phase identified and documented sustainable and inclusive Blue Economy Business Models for SMMEs that can benefit marginalised coastal communities while also improving ocean health and especially estuary health. The majority of these are based on proven and operational SMMEs, and also include new potential business models (integrating international best practice), to illustrate the broader potential for a sustainable and inclusive Blue Economy for South Africa. Consultative workshops were held with existing individuals/organisations to distil details for these models, and to identify opportunities for replicating and scaling these business models. Business model diagnostics were completed for some of these with a detailed diagnostic completed for one of the most viable new potential models, i.e. Edible Seaweed model. The majority of these are existing local business models, and new potential business models. Additional potentials based on international best practice have also been included. Where available, the potential for replicating and scaling them was documented. A Sustainable Blue Economy Business Model report documented the detailed findings from this phase, and these are summarised below with some of the details included in the body of this report.

Integrate Best Practice into the Draft Blue Economy Strategy

Despite many attempts to engage actively with government, there was little success in working directly with them to integrate the findings of this project into national strategy. Our project had to proceed with an alternative and it was selected to work with a civil society organisation that already has partnerships with government and is in the best position to integrate and implement these models. Workshops were run with WildTrust/WildOceans to distil their effective models for scaling and implementation and to extrapolate these into a national strategy. The aim is to enable the effective implementation at a national level of these regenerative and inclusive economic models for South Africa's Blue Economy. Results are summarised below with further details in the body of this report.

Develop a Model and Guiding Framework

The methodology for this component of the project included a combination of workshops and interviews with experts, as well as internal team strategic planning processes. The core component of this phase was desktop research relating to Guiding Frameworks on Economic/Business Models, as well as integration of findings from this projects' previous reports. The framework identified ways **to bring broader global frameworks down from conceptual level into practical options** for how coastal ecosystems can support the blue economy that benefits local and broader communities. This framework **focuses on estuaries** as ocean systems that are most vulnerable and, at the same time, are found within coastal areas (to target coastal communities). These ecosystems also have great capacity for and widespread benefit from regeneration while increasing economic opportunities for marginalised communities. The framework further focuses in on those estuaries most affected by water quality degeneration (including organic, inorganic and solid waste impacts from upstream activities). The model and guiding framework are summarised below with details included in the body of this report.

RESULTS, DISCUSSION & KEY FINDINGS

1. Develop Sustainable Economic Models & Pilot Test In Two Areas

The critical question to answer through this phase was: *"What Blue Economy models inform a more sustainable and inclusive ocean economy?".* The team developed a bespoke CBA tool to facilitate comparisons of monetary, social and ecological costs and benefits, ensuring that more informed decisions can be made regarding the choices associated with Blue Economy development. The tool serves as a framework for structured systematic conversation around different potential development scenarios. It is strategic (not a financial feasibility model), to use at the start/planning of process and not too far down the road of development. The model is based on understanding the trade-offs between scenarios. The essential focus of the economic modeling processes is to compare restorative model scenarios with business-as-usual linear economy scenarios, and to calculate

relative socio-economic and environmental benefits from an economic perspective. The purpose is to inform decision makers of the implications of different development decisions. Initial results indicate that regerenative models have significantly greater benefits (3-6 times greater for human benefit in some cases) compared to business-as-usual options. The model shows that by investing in a more circular economy, there are substantial positive gains to be made. The detailed results are summarized in Section 2.3 of this report.

2. Proven And Operational Blue Economy Business Models For SMMEs

The business models documented demonstrate the many Blue Economy opportunities that can benefit marginalised communities and the health of ocean ecosystems. Similar to the *economic models*, the *business models* documented, fit within two main focus areas for this research:

1. ***Circular Economy business models with benefits to both ecological and social resilience***
    - *Plastic waste recycling and upcycling opportunities (to prevent and clean up ocean plastic)*
        - *proven and operational: WildTrust Wastepreneur, Blue Crew model applied to Ocean Bricks, Green Bricks & Pyrolisis processes for plastic upcycling*
        - *proven and operational: Clariter model for upcycling plastic waste into waxes, oils and solvents*
    - *New potential (based on proven and operational): Wastewater and solid waste upcycling opportunities through restoration of ecological infrastructure and upcycling of solid waste*
        - *Knysna as a circular economy (ecological infrastructure generating employment with the aim of increasing river and ocean health through circular material flows)*
        - *Hout Bay as a circular economy (economic development with the aim of increasing river and ocean health through circular material flows)*

2. ***Ecosystem restoration/Regenerative business models with socio-economic benefits***
    - *Ecosystem restoration and ecological infrastructure with benefits to ocean ecosystems and particularly estuaries*
        - *proven and operational WildTrust models (development models integrating ecological infrastructure that benefit marginalised communities) for ecosystem restoration - an effective business model that can be applied for many restoration projects and also as a model for replicating some of the international best practice ideas locally*
        - *proven and operational international Greenwave/Sea Greens model applied to producing a wide range of food and medicinal seaweed products locally in an ecologically regenerative manner*
        - *preventing abalone poaching through alternative livelihoods*
        - *Abalobi Hook to Cook model & WWF Kogelberg small-scale fishery models for sustainable and inclusive fishing*
        - *isiMangaliso, Pondoland and WhaleTime models as examples of SMME-scale eco-tourism potentials for marginalised coastal communities (including within MPAs)*
        - *international best practice models of regenerative and inclusive blue economy SMMEs.*

Replicating and scaling these models could be a significant contribution to the Blue Economy nationally, by generating economic benefits and employment while regenerating ecosystem integrity, in particular for estuaries affected by water quality.

3. Integrated Models Into The Blue Economy Strategy And Policy

The original intention for this project was to work with relevant government departments to integrate the best practice findings of our research (including the economic and business models) into the National Blue Economy Strategy for South Africa. However, this was not feasible owing to:

- lack of engagement with our project from relevant National government departments especially those in charge of Operations (Oceans) Phakisa (even after many attempts from our project team to engage them in this project)
- the fact that there is no Blue Economy Strategy for South Africa, only Operation Phakisa with some components relating to Sustainable Development i.e. Marine Spatial Planning and MPAs
- the allocation of South Africa's Oceans Economy to many separate departmental players, none of whom talk to each other making integration of any new ideas into National Strategy and Policy, really difficult

- advice from experts on choosing to work with civil society organisations rather than national government departments
- the need to rethink economic models driving the current Oceans Economy at a *first principles* level, and therefore the need for a deeper level of engagement with government than simply adding a layer to their existing processes. It is beyond the scope of this project to engage with government at this depth. But it is within the scope of this project to engage with organisations that are already invested in a shift away from business-as-usual towards new economic models
- the selection of an alternative option w.r.t. the aim of *integration within National Blue Economy Strategy & Policy*, namely to work with civil society organisations that already have partnerships with government and are in the best position to integrate these models.

Based on the experience of the non-profit organisation, WildTrust, with over 15 years in successfully implementing similar programs in the Green Economy, and the aim of WildOceans to now do the same within the Blue Economy, the organisation is best placed and most willing to work towards integrating this projects' findings into their national Blue Economy Strategy. **They already have partnerships with government and integrate their estuary programmes into Estuary Management Plans, thereby integrating into relevant policies and related legislation**. They also are effective at working with marginalised communities as well as with ecosystem restoration, both of which are key to the success of this project. They have experience in innovation processes and the in-depth social processes required for this approach to economic development that goes against "business-as-usual", as well as experience and success in the kind of funding models that will most likely lead to successful implementation. The key elements of the integration into WildTrust's national strategy for a Blue Economy include:

- expanding the existing WildLands Green Economy programmes for ecosystem restoration and enterprise development, to WildOceans Blue Economy initiatives and integrating some of the innovative Blue Economy SMME business models identified in this WRC project
- building on the success of the existing WildOceans Blew Crew and Blue port projects in KZN and Durban Bay as a model for:
    - circular economy initiatives (collecting and upcycling solid waste through active and passive interventions that also monitor and map waste data)
    - water quality treatment interventions through engineered ecological infrastructure where feasible
    - ecosystem restoration within the estuary and upstream through the 'adopt-a-river' programme (including both alien clearing and projects such as mangrove restoration)
    - inclusive economic models benefiting marginalised coastal communities, funded through partnerships between government and private sector, as well as larger donor funding organisations (such as IUCN)
    - integration of these projects within government strategy and policy through Estuary Management Plans
- scaling and replicating this project's Economic Model and Framework in other estuaries especially focusing on those most affected by water quality, and where existing initiatives can be built upon, incl: Richards Bay, Knysna estuary, Hout Bay, Saldanha Bay, Swartkops, Sundays, Umhlatuzi, Umhlanga, Umkomazi, and others in a phased approach.

4. Develop Model and Guiding Framework

This component aimed to develop a model and guiding framework on how coastal ecosystems can support the blue economy that benefits local and broader communities. The guiding framework is **an integration of key relevant global guiding frameworks** including: Doughnut economics, The Circular Economy, Distributed Economies, Regenerative Design, Resilience and The Blue Economy, which put forward the need for regenerative, circular and distributed economies that enable both thriving communities and ecosystems. Rather than wait for growth to clean up the environment and reduce inequalities– because history proves it won't – it is far smarter to create economic models that are, by design: economically inclusive and regenerative for ecosystems.

Africa needs to define its own understanding of prosperity and progress, while promoting innovative thinking and practices that will enhance human and ecological well-being. Regenerative economic development embraces biosphere stewardship and recognises that we have a responsibility to leave the living world in a better state than we found it. It calls for creating enterprises whose core business helps to regenerate and distribute wealth, leveraging networks. Industrial manufacturing has begun the metamorphosis from degenerative to regenerative design through what has come to be known as

the Circular Economy. It represents a systemic shift that builds long-term resilience, generates business and economic opportunities, and provides environmental and societal benefits. In a circular economy, economic activity builds and rebuilds overall system health.

The concept of distributed economies calls for a transformation in the industrial and infrastructure systems towards distributed economies departing from the socio-economically and environmentally unsustainable dynamics associated with large-scale, centralised production units that are favoured by 20th century economic drivers. With distributed economies, a selective share of production is distributed to regions where a diverse range of activities are organised in the form of small-scale, flexible units that are synergistically connected or networked with each other to achieve scale and mutually beneficial relationships. Some of the core elements of distributed economies that contribute to regenerative (beyond sustainable) development are listed below:

- increased local use of renewable resources
- wealth creation for a higher number of people
- decreased pollution emissions and waste generation at the local/regional level
- added value benefits maintained in the regions
- increased share of non-material (eg information, know-how)
- higher added value material resources
- diversity and flexibility of economic activities
- increased diversity and intensity of communication; and
- collaboration between regional activities.

Applying **regenerative and distributed economic principles** to enhance natural capital of ocean systems, while providing economic opportunities for marginalised communities, is the overarching framework for a Blue Economy, proposed from this project. Critical to this framework are the **enabling economic and business models** generated from this project. The economic and business models developed for this project take into account both social and environmental consideration and combine the two challenges into one – with **opportunities for both at the interface between ecological restoration and inclusive growth**.

The **Economic Model** developed for this project can be used as a strategic decision making tool that enables stakeholders and decision makers to have a greater understanding of the impacts of different development scenarios. It is recommended to share this model through capacity building processes – in particular those that have the capacity to work with government to enforce these kinds of modelling scenarios in important decisions around development. The **SMME Business Models** developed for this project are practical ways to implement regenerative, circular and distributed economies on the ground within the Blue Economy for South Africa. The WildTrust overarching business model serves as an effective model for implementation, including critical success elements such as: partnership with government, integration of essential social processes, and restoring ecosystems while enabling inclusive growth that benefits marginalised communities. Replicating and scaling these models strategically could be a significant contribution to the national Blue Economy with socio-economic benefits for marginalised coastal communities.

CONCLUSION

"*Economics is the mother tongue of public policy. It dominates our decision-making for the future, guides multi-billion-dollar investments, and shapes our responses to climate change, inequality, and other environmental and social challenges that define our times. Pity then, or more like disaster, that its fundamental ideas are centuries out of date yet are still taught in college courses worldwide and still used to address critical issues in government and business alike.*" – Kate Raworth, 21st Century Economics

The Blue Economy business and economic models from this project are an example of a new way of thinking about business and economy in South Africa that requires a rethinking of the first principles and fundamentals of economic theory. South Africa needs new development economic models in general that are regenerative and inclusive/distributed/networked. The Blue Economy is one space where it could be applied, but without a broader level realisation of a shift in thinking, policy and action to new economic models, these ideas remain 'islands' amongst opposing entrenched systems. If only a few SMMEs and NGOs are attempting to develop and apply these models, while government and traditional business continues business as usual, it is unlikely that large-scale change can be realised.

However, the implementation of these ideas by an organisation such as WildTrust/WildOceans, that has proven models, including successful funding and government partnerships, will play a big role in ensuring that the results of this project are taken forward. These will serve as both inspiration and further proof that there are feasible Blue Economy solutions to the key challenges of South Africa's oceans economy. This project's economic modeling has indicated that by investing in more regenerative and inclusive Blue Economy options, there are substantial positive gains to be made in terms of GGP and Human Benefit Indices over calculation periods compared to conventional scenarios.

RECOMMENDATIONS

The following recommendations have emerged from this project:

- The roll out of this national strategy will need funding from local and international donor funders. The project team has supported WildTrust in a successful application for funding for some aspects of this proposed National Strategy for a Blue Economy. The overarching model and strategy is replicable and is not dependent on only one organisation to implement. If the WRC or other stakeholders, including government, are able to support the roll out of the national strategy, this could speed up the implementation and beneficial results – ensuring estuary health and benefits to marginalised coastal communities, while also supporting the basis of a healthy ocean economy and realising the Sustainable Development Goals (especially SDG14 and SDG1).
- A few SMMEs and NGOs are attempting to develop and apply these models, while government and traditional business continues business as usual, but it is unlikely that large-scale change can be realised. The Johannesburg Business School is developing innovation with regard to business education with an SMME focus. There may be an opportunity for a research project that integrates business school and other research disciplines to develop a vision and practical models on a broader scale in South Africa – of what's possible for a more inclusive economy that regenerates ecosystem health rather than depleting it. The project team members will follow up with this opportunity (Prof Lyal White: lyal.white@jbs.ac.za).
- A partnership with The Water Hub (www.thewaterhub.org.za) should be established for research and development components of this project . The Water Hub has existing partnerships with government and is focused on innovative business models for ecological infrastructure to address water quality challenges in South Africa. It is recommended to undertake further research and development of ecological infrastructure options for improving water quality within estuaries – most likely in partnership with The Water Hub (Contact Dr Kevin Winter: kevin.winter@uct.ac.za).
- Proactive training of other civil society organisations, and where feasible, government organisations, in the principles of the Economic and Business models. The WRC could fund training to empower consultants, provincial officials and other stakeholders, to use the Economic Modelling Tool and approaches developed in this project. Indirectly, national departments would be compelled to deal with the outputs and results of the novel tools developed. The WRC could therefore support the capacity building of stakeholders who can hold government accountable for Blue Economy interventions, including potentially citizen science training and materials.
- Further research for WildTrust and similar NGOs working in the space of regenerative and inclusive growth for South Africa, including sources of water quality impacts, solid waste trends and places for intervention should be supported as well as research by business and economics students into regenerative and inclusive overarching economic models for development in South Africa
- Capital to produce high quality products is required. From a business perspective, scaling up these models, will in turn ensure that such products are well received in the market. At the moment the market for circular economy products, such as upscaled bricks and edible seaweed is still quite nascent. However, the trends show that interest in such products is increasing and the export opportunities to overseas markets for some green economy and blue economy products is also increasing, presenting excellent opportunities for scaling up such interventions.
- A number of additional research gaps that need to be addressed. These include:
    - ecological restoration and adaptive management to benefit society
    - the economic benefits of ecosystem services to various sectors
    - the classification and setting of resource quality objectives (RQOs) for estuaries; and
    - sources of marine pollution (i.e. Source to Sea/Catchment to Coa

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

CPUT	Cape Peninsula University of Technology
DEA	Department of Environmental Affairs
DAFF	Department of Agriculture, Fisheries and Forestry
DWA	Department of Water Affairs
DWS	Department of Water and Sanitation
EEZ	Exclusive Economic Zone
EFZ	Estuary Functional Zone
EMP	Estuary Management Plan
GDP	Gross Domestic Product
GGP	Gross Geographic Product
IMT	Institute of Maritime Technology
KZN	KwaZulu-Natal
LMMA	Locally Managed Marine Area
MCES	Marine and Coastal Ecosystem Services
MPA	Marine Protected Area
MSP	Marine Spatial Planning
NBA	National Biodiversity Assessment
NPC	Non for Profit Company
NRF	National Research Foundation
SDG	Sustainable Development Goal
SMME	Small, Micro and Medium Enterprises
SNA	System of National Accounts
SSFP	Small-Scale Fisheries Policy
TIA	Technology Innovation Agency
TNPA	Transnet National Ports Authority
WEROP	Wave Energy Reverse Osmosis Pump
WWTW	Wastewater Treatment Works

1 INTRODUCTION

1.1 Project Background

The term *Blue Economy* is used for both:

- a sustainable economy based on ocean related activities (sustainable oceans economy) and
- an approach to a circular and regenerative economy that mimics natural processes to eliminate waste and pollution while generating greater economic opportunity and jobs (Pauli 2009)

It is actually essential to apply the latter to ocean related economic activities, based on the current depleted state of our ocean and estuary ecosystems and the critical need for more inclusive economic development – especially for marginalised coastal communities. This project aims to inform more sustainable and inclusive National Blue Economy initiatives informed by economic modeling and action research involving SMMEs. The negative impacts of current ocean economy activities on ecosystem integrity and human wellbeing have been explored, with a focus on estuary health, and this project provides recommendations towards economic activities that can benefit both humans and the environment.

The aims of this project are:

1. to develop sustainable economic models necessary to support the blue economy
2. to pilot test the models using selected case studies in both warm and cold temperate coastal zones (proven and operational SMMEs)
3. to integrate the best practice into the Draft National Blue Economy Strategy and related legislation
4. to develop a model and guiding framework on how coastal ecosystems can support the blue economy that benefits local and broader communities
5. to share knowledge generated with local and global networks and stakeholders.

This project included the following key activities:

- scoping research
- selecting pilot project focus areas
- developing & testing of Economic Model
- identifying proven and operational business models
- developing a model and guiding framework
- integrating best practice into a national Blue Economy strategy

1.2 Project Rationale

Ocean economies, both large and small, are looking to their seas to bolster slowing growth in their terrestrial economies, discover new opportunities for investment and employment, and build competitive advantage in emerging industries. Key considerations (The Economist Intelligence Unit, 2015) in the growth of the ocean economy include the fact that:

- there has been a shocking plunge in ocean health that has been directly linked to human activities, therefore the urgency of the ocean health challenge is becoming more prominent in the global policy discourse
- the Blue Economy typically prioritises growth over sustainability but without a clear framework for sustainable growth, even modest progress on ocean health will be a challenge
- current approaches to valuing the ocean economy could mean that we are underestimating its contribution, particularly the value of non-market services: ecosystem benefits such as the protection to coasts offered by coral reefs, or carbon sequestration
- a sustainable ocean economy offers a path for considering economic development and ocean health as compatible propositions and does not have to be a choice between growth and sustainability.
- innovative financing will be needed to direct investments into those economic activities that can enhance ocean health including the potential for bolstering the development of those “emerging” and “new” industries focused on restoring ocean health.

1.2.1 Value & State of South Africa's Ocean Resources

South Africa's coastal resources are highly valuable to the economy but are under threat. South Africa's coastal areas generate substantial capital through their ecosystem services including tourism, recreation and fishing. Turpie et al., (2017) provided preliminary estimates of the value of South Africa's aquatic and estuarine ecosystems using local data. Coastal protection (eg by mangroves) and flow regulation was estimated at R3.5 billion per year. Water purification in catchments was estimated at between R1 and R100 per ha and R9 million per year. Coastal areas generate over R10 billion per year from recreation and tourism alone. These resources are also valuable to local people, for instance estuaries generate nearly R65 million a year from subsistence harvesting and fishing. Estuaries are "super" ecosystems. Although they constitute less than 2% of South Africa's territory, these highly productive ecosystems contribute R 4.2 billion per annum to the South African economy. They are focal points for development, tourism and recreation, as well as important for supporting biodiversity, livelihoods and marine fisheries. However, the development of estuaries and their catchments has come at a cost of about R700 million per annum in terms of lost fishery benefits as well as unknown costs to society from the overexploitation of resources and loss of biodiversity.

In the State of the Environment Report the Department of Environmental Affairs (2016) recognised 22 commercial fisheries with revenue estimated to be R 3million annually, which has likely increased over time. The squid industry is one of South Africa's most valuable fisheries generating R 500million in foreign revenue per annum (WWF 2016). Mead et al. (2013) said that, although commercial fisheries are well managed and reliable catch and research data is collected annually, a number of fish species are being overfished and some stocks have collapsed (Sink et al. 2012). Fifty (50%) of South Africa's fish stocks are considered to be of concern, with 22% considered heavily fished and 25% considered heavily depleted. Aside from over-exploitation of resources, fisheries also have bycatch (including dolphins, turtles and sharks), accidental bird mortalities and habitat damage. Also, despite significant objections, the Department of Mineral Resources granted three rights to prospect for marine phosphates in 2012 and 2014.

The National Biodiversity Assessment marine and coastal component (2018) synthesised the present state of biodiversity and ecosystem health. In summary the report showed that 60% of South African coastal ecosystem types are threatened, comprising more than half the extent of the coastal zone. Pressures on coastal biodiversity include unsustainable harvesting of species, inappropriate infrastructure development, mining, decreased freshwater flow into the sea from rivers, and pollution. Proportionately, the rate of habitat loss in the coastal zone is twice that for the rest of the country. The coast is the basis for a vibrant tourism industry – in fact, a biodiversity tourism study linked to the NBA reveals that visiting beaches ranks as one of the most popular activities for both international and domestic tourists. Yet some beaches are being eroded as natural movements of sand are disrupted, putting one of South Africa's most popular recreational activities at risk in some places (SANBI, 2018).

There are nearly 300 estuaries along the South African coastline from the Orange River mouth on the West Coast to the Kosi Bay estuarine system on the East Coast. Estuaries constitute some of the most heavily utilised and productive zones on the planet, yet are highly fragile and need protection. Estuaries are nursery areas for many marine invertebrate and fish species of commercial and subsistence importance. While estuaries may be viewed as small environmental domains, the larger coastal system in many ways cannot survive without them. The estuarine realm is the most threatened of all realms in South Africa, both for the number of ecosystem types and for area affected. By area, 99% is threatened with 3% Critically Endangered, 74% Endangered and 22% Vulnerable. These facts emphasise the need for strategic interventions across multiple sectors to restore estuarine health and protect benefits to people. Estuaries are under-protected in South Africa with only 18% of ecosystem types and 1% of estuarine area well protected. There has been a significant increase in pollution pressure in estuaries, eg 840 million litres of waste water daily flow into estuaries, with deteriorating water quality driving change on regional scales. Thus, about 33% of estuaries are under severe (very high and high) pollution pressure (Van Niekerk et al (2019).

This reduces ecosystem resilience and nursery function, kills invertebrates and fish,and makes estuaries vulnerable to invasive species, parasites, pathogens and diseases (eg *Tirebia* and EUS) threating human health, well-being and food security. Poor water quality is also impacting on estuarine resilience to natural stresses such as droughts and climate change over longer time scales. Furthermore, declining water quality threatens habitat diversity such as loss of seagrass

habitat in Knysna (macroalgal blooms), the increase in alien invasive aquatic plants in small KZN estuaries, and the persistent algal blooms in the upper reaches of systems with agricultural return flow. Maintaining and restoring water quality in estuaries requires reducing /recycling waste water, compliance with DWS & DEFF waste water discharge policies, innovative engineering solutions to stormwater management, improved agricultural practices (eg prudent application of agricultural fertilisers and pesticides). Overall, 29% of South African estuaries are subject to severe (high and very high) pressure from habitat modification and development, mostly in the Cool Temperate (63%) and Subtropical (34%) regions.

There is a national deterioration in water quality with resultant losses of biodiversity and ecosystem functioning. Estuaries can no longer assimilate the nutrient loads and under eutrophic conditions, harmful algal blooms develop (Lemley et al. 2017). These threaten ecosystem services as they have an impact on subsistence fisherman, bait collectors and recreational users. However simple interventions in some estuaries have resulted in improvements in water quality paving the way for scaling up of activities around the country. There is a need for urgency to intervene to prevent declining estuary health and loss of ecosystem services. It is for this reason that some of the focus of a framework and strategy for this project is based on the restoration of estuaries in South Africa.

The following data images are taken from the National Biodiversity Assessment 2016 Estuaries Component Lara van Niekerk (updated images from 2018 not provided):-

Figure 1: State of South African Estuaries (Source: SANBI 2017/18)

Figure 2: Pollution Discharge to Estuaries (Source: SANBI 2017/18)

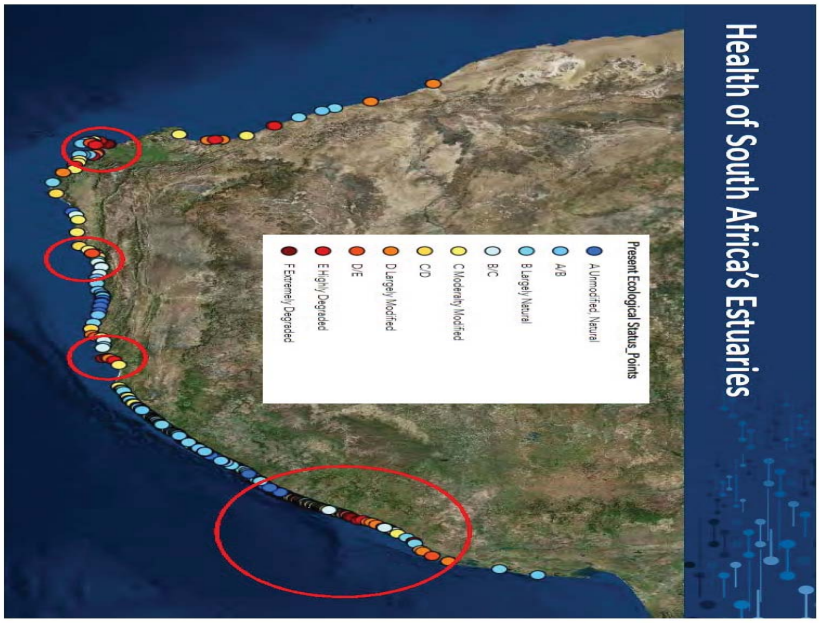


Figure 3: Health of South Africa's Estuaries (Source: SANBI 2017/18)

The Blue Carbon Initiative (http://thebluecarboninitiative.org/) focuses on carbon in coastal ecosystems. Blue carbon is the carbon captured by the world's coastal ocean ecosystems, mostly mangroves, salt marshes, seagrasses and potentially macroalgae. These ecosystems sequester and store large quantities of blue carbon in both the plants and the sediment below. A 2012 World Bank report indicated that the indirect services provided by mangrove forest such as providing fish habitat, carbon sequestration and coastal protection exceeds the value of converting these forests into shrimp farms.

Coastal ecosystems are particularly vulnerable to urbanisation and have been placed under high anthropogenic pressure (especially coastal areas near cities/metros). Another large pressure on the coast is the decline in water quality due to pollution from various sources, including wastewater treatment works and stormwater runoff. Untreated wastewater is discharged into the sea and agricultural runoff and storm water enters the coastal environment and increases bacterial loads, nutrients and heavy metals. Plastic pollution is a large concern as this entangles marine animals and is ingested leading to untimely deaths through starvation. Other pressures include development, the over-exploitation of natural resources and the destruction of natural habitat. The degradation of ecosystem health creates gaps for invasive species, parasites, pathogens and diseases, further damaging our natural resources.

1.2.2 Ecosystem Restoration

Traditional management methods are not enough to prevent further loss and destruction of coastal habitats, there is a need to actively rehabilitate habitats. Restoration of coastal ecosystems has never been more compelling. Ecosystem restoration can be defined as human intervention designed to facilitate the recovery of damaged habitats in order to bring them as closely as possible to their natural state (Yap 2000). Restoration or rehabilitation is a relatively new strategy that has been used in varying degrees of success in developed countries. International best practice indicates that there are many potential economic and social benefits when restoration projects are well designed.

Some restoration efforts have been undertaken in South Africa. The City of Cape Town in the Western Cape has been the most proactive province with extensive attempts to improve and better manage coastal ecosystems. For example, in 2008 the city established an Invasive Species Management Unit to control and reduce invasive plant species in particular Australian wattles (*Acacia* species) planted mainly along the coast for dune stabilization; and aquatic invasive species such as water hyacinth (*Eichhornia crassipes*) that blocks waterways and affects water quality (Gaertner et al.

2016). Funding and manpower for this unit has been successfully increasing over time. Aside from invasive plant clearing the City of Cape Town has also rehabilitated estuaries such as Hout Bay and Silvermine, reintroducing indigenous plants and creating walking paths and benches for public enjoyment.

The estuaries in Cape Town have a long history of manipulation and many can now only be managed in their present alternative state. These so called 'novel' estuaries include the Zandvlei Estuary situated near Muizenberg. The estuary has been transformed by the development of the Marina da Gama houses, mouth stabilisation caused by bridges and a weir, and pollution from storm water canals. This has had severe impacts on the health of the ecosystem resulting in eutrophic conditions that are undesirable to residents, blooms of toxic microalgae that have resulted in fish kills, proliferation of pondweed *Potamogeton pectinatus* that impedes popular kite fishing activities in the lagoon and chokes the canals of the marina, and loss of fish and bird biodiversity (Gibbs et al. 2011).

In recent years reactive management has greatly improved the condition and functioning of the system. The area was declared a provincial reserve in 2006 and Friends of Sandvlei, a community based organisation, have been successful in assisting with maintenance. Active mouth management to restore salinity to the estuary and help prevent eutrophic conditions, mechanical harvesting of pondweed, litter traps at storm water canals, and environmental education have improved the health of this estuary and enhanced the attractiveness of the area to residents and tourists. There are also future plans to extend the reserve to connect to the False Bay coastline, this will be an important conservation link (Gibbs et al. 2011).

A number of community based nature conservancies have been extremely beneficial for the conservation of coastal ecosystems in South Africa. These entities often act as watch dogs notifying the relevant authorities of any irregularities ensuring timeous repairs of sewage leaks and any other erroneous behaviour. One such example is the Zwartkops Conservancy (http://www.zwartkopsconservancy.org/) in Port Elizabeth that has been active in the conservation of the Swartkops Estuary and surrounds for the past 40 years. The conservancy is involved in environmental awareness, community upliftment, pollution control and management of two nature reserves. Organisations such as this help ensure that coastal ecosystems remain preserved to enhance the numerous ecosystem services they provide, especially aesthetically and spiritually, such as providing a safe environment for patrons to enjoy and achieve a sense of place. At many of the country's nature reserves, parks and beaches, there is potential for initiatives and business opportunities that would further entice and enhance use by patrons such as guided nature walks, environmental education, recreational activities such as hikes or boat experiences, picnic and food facilities.

Other examples of restoration of coastal ecosystems, focusing particularly on estuaries include the eradication of an invasive pioneer grass *Spartina alternatiflora* from the Great Brak Estuary in the Western Cape (Adams et al. 2016). First observed as a few small patches in 2004 the species quickly spread covering a total area of 10,221 m^2 in 2011. After a lag in response from government, chemical control was implemented in 2013. By 2015 less then 10 m^2 was left and native salt marsh vegetation had began to regrow between the dead stalks (Riddin et al. 2016). This is the first example of successful eradication of an invasive plant species from a South African estuary.

Bornman and Adams (2010) conducted studies on the recovery of salt marsh habitat at the Orange River Estuary, the border between South Africa and Namibia. The World Ramsar Site is of particular importance as it is one of only a limited number of perennial wetlands along the arid west coast of southern Africa. It was placed on the Montreux record (a register of wetland sites on the List of Wetlands of International Importance where changes in ecological character have occurred, are occurring, or are likely to occur as a result of human interference) in 1995 due to the loss of bird species and extensive salt marsh habitat. This loss was attributed to a multitude of impacts that are further explained in Shaw et al. (2008), and Bornman and Adams (2010). Flooding and hypersaline conditions resulted in dieback of salt marsh habitat creating barren salt lands and excessive wind blow sediment. Research showed that there were enough seeds in the seed bank to enable the recovery of salt marsh in the estuary. However, this is a slow process and to date the area has not fully recovered.

Fernandes and Adams (2016) assessed the condition of vegetation surrounding the estuaries of Mdloti and uMkhomazi estuaries in KwaZulu-Natal. The systems, like most along the coastline, have been impacted by input from wastewater treatment works, invasive plant species and sugarcane agriculture. Encroachment of reeds due to higher nutrient concentrations and reductions in flood frequency and intensity is also problematic. Impacts such as these can be easily mitigated to improve the health of these estuaries. Initiatives such as Working for Water are responsible for clearing of invasive plant species. Set back lines and buffers around coastal ecosystems will prevent loss of habitat through agricultural activities. Owing to healthy seed banks and connectivity to other estuaries, native estuarine plants should be able quickly to return and colonise previously disturbed habitats. Restoration of South Africa's estuaries could provide multiple opportunities to restore ecosystem services and improve coastal livelihoods through work opportunities. Installation of artificial wetlands and restoration of riparian habitat would go a long way to improve water quality. There is a need for urgency to intervene to prevent declining estuary health and loss of ecosystem services. It is for this reason that some of the focus of a framework and strategy for this project is based on the restoration of estuaries in South Africa.

There are two approaches to ecosystem restoration that this project team has researched. The one is how pure ecosystem restoration (such as Marine Protected Areas) can contribute to the Blue Economy in comparison to other development trajectories (Economic Model uThukela Banks MPA case study). The other is an approach to economic development in the form of business models for SMMEs that is also restorative w.r.t. ecosystems. This project has also investigated how these initiatives can contribute to marginalised communities so that Blue Economy initiatives in South Africa can be more inclusive, thereby contributing to both social and ecological resilience.

1.2.3 South Africa's Oceans Economy

South Africa has one of the highest unemployment, poverty stricken and unequal societies in the world, with highly interrupted growth. To close these huge gaps, the economy must grow by 5% per annum by 2019 (SONA-2009). Operation Phakisa is an initiative of the South African government started in 2014 to stimulate the implementation of the National Development Plan and boost the economy.

There is a strong perception by government that coastal and marine resources are underutilised despite the advances in technology. This has led the government to initiate the oceans component of Operation Phakisa in order to help realise the full potential of its marine resources and appreciate the value of this vital national asset and how it can contribute to livelihoods and economy. The following areas of focus are outlined in Oceans Phakisa, namely: marine transport, oil and gas exploration, aquaculture, marine protection and ocean governance. Two additional growth areas were subsequently added, namely, small harbours development, and coastal and marine tourism.

Before Operation Phakisa was implemented there was no overall system in place to guide ocean governance and marine resources were managed sectorally. This method could result in conflict between user groups as well as unsustainable use of ocean resources and failure to capitalise on development opportunities. The Marine Protection Service and Ocean Governance stream of Operation Phakisa aims to develop an overarching, integrated ocean governance framework for the sustainable growth of South Africa's ocean economy. Marine Spatial Planning and Marine Protected Areas are also an important component involving a public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic and social objectives.

1.2.4 Marine Protected Areas

Marine Protected Areas (MPAs) involve the protective management of natural marine areas so as to keep them in their natural state. MPAs can be conserved for a number of reasons including economic resources, biodiversity conservation, and species protection. They are created by delineating zones with permitted and non-permitted uses within that zone (IUCN website). The efficiency of MPAs at building up spawning stocks of commercially important species within their boundaries and increasing catches for local fisheries outside their boundaries has been well documented. MPAs are not only useful tools for effective fisheries management and species protection, they also provide significant benefits in the form of ecosystem services such as coastal protection, waste assimilation and flood

management. If properly designed and managed, MPAs can play vitally important roles in protecting marine habitats and biodiversity (WWFSA website). MPAs benefit tourism, fisheries and recreation; offer coastal protection (particularly important with regards to the effects of climate change and rising sea levels), and assist in reducing greenhouse gases. Networks of marine protected areas maintain healthy biodiversity, provide a carbon sink, generate life-giving oxygen, preserve critical habitat and allow low-impact activities like ecotourism to thrive (Two Oceans Aquarium website).

Most South African MPAs are attached to a National Park or Nature Reserve and that Management Authority then also manages the attached MPA. MPAs in South Africa include a range of 'no-take' zones (where no fishing is allowed) and 'controlled' areas (where limited fishing activities are allowed). MPAs , by spatial exclusion of certain activities, unequivocally present the only viable way to ensure that some of the activities identified as key Blue Economy drivers, do not overstep environmentally sustainable thresholds and theraten other key economy drivers. They are the only solution to protect sensitive habitats from activities such as bottom-trawling and seabed mining. Furthermore, exclusion of certain economically valuable activites (such as aquaculture, oil and gas exploration and extraction) from some places is important to deal with the high risks inherent in these activities. These risks include alien species introductions, ecosystem damage from oil pollution, and mortalities or altered behaviours of threatened species owing to seismic blasting. Not only do these threats impact on and present risk to ocean health, but they also jeopardise the productivity and sustainability of some of the other 'jewels' in the Ocean Economy basket of industries, such as tourism.

When designed appropriately, MPAs can deliver conservation benefits such as the protection of habitats, biodiversity and threatened species as well as socio-economic benefits such as increased tourism revenues, local fish catches and job opportunities. While many fisheries scientists have argued that MPAs will promote sustainable fisheries and enhance fish yields, there are differing views on the efficacy of MPAs as a fisheries management tool. Nonetheless, there is general consensus that MPAs and MPA networks have a role to play in enhancing conservation and fisheries management efforts, and thus, incorporating the human dimensions into the design, planning and management of these areas is critical to their success (Sowman et al, 2015). The Department of Environmental Affairs announced in October 2018 that Cabinet approved a network of 20 new Marine Protected Areas (MPAs) that are representative of South Africa's rich coastal and ocean biodiversity. This will increase protection of the ocean around South Africa from 0.4 to 5%. The new areas will advance ocean protection by approximately 50 000 km^2, an area two and half times the size of the Kruger National Park.

The new network will advance ecosystem protection for offshore ecosystems and provide the first protection to several threatened and fragile ecosystem types. The network includes Childs Bank, a unique underwater feature with deep water corals on its sleep slopes, first protection of undersea mountains in the Indian and Atlantic, submarine canyons including South Africa's Grand Canyon off Saldahna Bay, rare mud habitats and key areas for recovery of linefish. Support for the Marine Protected Area components of the Namaqua and Addo Elephant National Parks are also welcomed with decades of work behind the establishment of these areas. The network is based on collaborative science with input from many institutions. SANBI scientist Dr Kerry Sink led the 5 year Offshore Marine Protected Area Project which was a key input into this work and was the lead of the Operation Phakisa Oceans Economy Marine Protected Area technical team who used advanced planning and hundreds of map layers to align protection and ocean economy goals.

While Marine Protected Areas assist with activities within the ocean, a big concern as to the state of the oceans economy is also the impacts of coastal activities and activities upstream of estuaries (from both land and rivers systems) on ocean health – and estuary health in particular. The poor state of South African estuaries indicates a need for activities to improve the state of these coastal ecosystems, which leaves an important area for action as key contribution to the Blue Economy: slightly upstream and within estuaries.

1.2.5 A (Sustainable) Blue Economy

Whilst the value of ocean resources for the economy are significant, they are not fixed. The condition of the marine assets can change, and either decrease or increase, depending on their use and management. The implication is that actions which degrade the marine system have the potential to

reduce the economic contribution of marine assets, and conversely actions which restore marine assets can increase their economic contribution. Consequently, there are significant risks and opportunities associated with developments in the Oceans Economy.

We face a future world where natural capital will be the major limiting factor for economic productivity and human well-being. Achieving greater efficiencies and resilience in businesses, the economy and society will be fundamental in unlocking future economic growth and social equity. Public, private, and civil-society sector decision-makers need support in undertaking operational and development planning which is cognisant of natural capital as the supplier of services on which society and the worlds' economies have come to depend. Blue Economy projects that build the capacity of people and supports the role of the natural environment in sustaining vibrant economies and human well-being will be essential.

To prevent an ecological crisis and realise the full benefit of the oceans, it is imperative that proper guidelines and policies are put in place to ensure that the economic use of the oceans also results in long term conservation and restoration. Stimulating short-term economic growth in ocean economies may be easily accomplished; however, development of an economy based on sustainability will be much more difficult to achieve. The Blue Economy is therefore defined as a sustainable and equitable oceans economy. It espouses the same desired outcome as the Green Economy, namely: "improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities" (UNEP 2013). It endorses the same principles of resource efficiency and social inclusion, except that its focus is in developing marine and coastal resources in order to unlock the wealth contained.

A Blue Economy draws on scientific findings so as to balance economic benefits and growth with long term ocean health and human equity. The ocean fits within Sustainable Development Goal 14, and aquatic and marine resources play a crucial role in supporting an array of economic sectors that provide livelihoods and employment opportunities to end poverty (SDG 1).

A Blue Economy can be defined more clearly as a marine-based economy that (WWF, 2015):

- provides social and economic benefits for current and future generations, by contributing to food security, poverty eradication, livelihoods, income, employment, health, safety, equity, and political stability.
- restores, protects and maintains the diversity, productivity, resilience, core functions, and intrinsic value of marine ecosystems – the natural capital upon which its prosperity depends.
- Is based on clean technologies, renewable energy, and circular material flows to secure economic and social stability over time, while keeping within the limits of one planet.

2 PROJECT ACTIVITIES

2.1 Scoping Phase

The aim of this initial scoping phase was to develop a baseline understanding of the current status of Blue Economy initiatives in South Africa and also reference relevant global initiatives that could serve as models for local initiatives.

This Scoping Report summarises the key activities of this Scoping Phase including:

- **Desktop Research**: this research both informed and complemented the findings from the consultation with experts and the scoping workshop;
- **Engaging with experts**: Through our team's local and global networks, we have interviewed relevant individuals and organisations to identify key initiatives in the country. The South African Marine Sciences (SAMSS) conference held in July 2017 was a valuable contribution to this process, serving as an opportunity to gather relevant contributions from local and global experts;
- **A scoping workshop**: this was held with DEA Oceans & Coasts and our team to establish an integrative understanding of the various initiatives locally. This included discussions on how best to integrate the findings from this project into a national Blue Economy Strategy;

- **2nd Project Reference Group meeting**: this was held after the first draft of this Scoping Report was complete.
- **Scoping Report**: a summary report on the current status of Blue Economy initiatives in South Africa was generated as a conclusion to this phase. The report formed a useful basis to inform the next phases of this project.

2.2 Selection of Pilot Project Focus Areas

The pilot project focus areas selected for the economic modeling phase of the project are those that can generate useful test cases for sustainable Blue Economy *Economic and Business Models* for South Africa. They take into account the findings from the Scoping Phase desktop research as well as engagement with experts. The pilot areas are the focus for two components of this project:

- to develop sustainable Economic Models necessary to support the blue economy
- to pilot test the model using selected case studies.

The main reason for the selection of these areas is related to the Sustainable Development Goals, and specifically SDG14, considering the likely impacts of the Oceans Economy on sensitive biodiversity areas and other areas of ecological importance within the context of realistic sustainable Blue Economy models:

- pollution flowing from upstream river systems and failing WWTW is a critical impact affecting the health/integrity of estuaries/bays across the South African coastline. By focusing on regenerative and circular innovations that can address this pollution source, restore the health of the estuaries, while also providing opportunities for SMMEs within marginalised coastal communities these serve as highly relevant models in terms of a sustainable and inclusive Blue Economy.
- concerns have been expressed that many of the proposed economic activities within Operation Phakisa can significantly impact ecosystem integrity. The proposed uThukela Banks MPA is a highly relevant case study in that it uses the project's Economic Modeling tool to compare the broader socio-ecological-economic cost/benefits of certain scenarios (such as mining, fishing), with the alternative of a Marine Protected Area. If one considers the ocean as a "factory" – investing in harvesting resources (minerals, fish, etc.) from the factory (Operation Phakisa) is a bad investment if it doesn't consider the long-term potential for the factory to keep producing the resources (ecological impacts).

2.3 Development & Testing of an Economic Model

Natural resource economics deals with the supply, demand, and allocation of the Earth's natural resources. One main objective of natural resource economics is to better understand the role of natural resources in the economy in order to develop more sustainable methods of managing those resources to ensure their availability to future generations. Development of Economic Models enable better decision making around the economics of resource allocation. An **Economic Model** is a theoretical construct representing economic processes by a set of variables and a set of logical and/or quantitative relationships between them. The economic model is a simplified, often mathematical, framework designed to illustrate complex processes.

The key contribution of this project is the development of Economic Models that support not only the sustainability of our environment, but potentially regenerative models that improve environmental status of coastal ecosystems. The essential focus of the economic modeling processes is to compare restorative model scenarios with business-as-usual linear economy scenarios, and to calculate relative socio-economic and environmental benefits from an economic perspective. The purpose is to inform decision makers of the implications of different development decisions.

The development and testing of this economic model was over two phases:

- Deliverable 1 –- a generic circular economic model, developed and tested using the upgrade of the wastewater treatment works in Knysna as a case study. This was an elaborate undertaking and required extensive model development, some literature research, as well as a workshop in Knysna both to undertake a review and to develop some critical assumptions as inputs.

- Deliverable 2 – the economic model applied for the proposed uThukela MPA case study – also involving a workshop with experts to develop critical assumptions as inputs in the model.

The team has developed a bespoke cost/benefit analysis (CBA) tool to facilitate comparisons of monetary, social and ecological costs and benefits, ensuring that more informed decisions can be made regarding the choices associated with Blue Economy development. The Economic Modeling tool was developed as a generic tool, tested in two case study areas.

The tool is an Excel spreadsheet (Appendix B) which:

- directs users to collate basic data on two or more intervention options in the Blue Economy
- directs a systematic conversation on the impacts of proposed options on the biophysical environment, society, economy and human wellbeing. The conversation outcomes are recorded as a series of scores
- amalgamates all the data and scores into a suite of comparable cost and benefits indicators, which summarise the implications of the options for planners and decision makers (some of which attend the workshop).

The tool is used at the start of development planning processes to identify options, direct development planning and enhance processes such as EIAs and licensing. Interventions proponents provide basic data on costs, revenue and timing for a suite of discrete options or combinations. Proponents may be from one or several competing institutions.

A workshop is held with stakeholders representing alternative perspectives. Biophysical, social and financial impacts are discussed and a series of criteria are scored (both the direction (+ or -) and magnitude of impacts). The affected populations are assessed using a human benefit index. The costs and benefits, using indices, are computed and compared in tables and graphs. The workshop can make recommendations based on the outcomes of the analysis. The economic model focuses on GGP (Gross Geographic Product) and human benefit as comparative outputs.

2.3.1 Why the need for an economic tool to evaluate choices?

Operation Phakisa - an initiative of the South African government - is focusing on development of marine transport, marine oil and gas exploration, aquaculture, marine protection and ocean governance. Interventions in complex systems may improve and degrade the marine system, with both positive and negative economic contributions. It is important to compare costs and benefits to understand the net impact, and to identify the winners and losers. To inform decision making, we need a tool to identify and weigh up the costs and benefits of options. The key aim of the tool is to serve as a framework for structured systematic conversation around different potential development scenarios. The tool is strategic (not a financial feasibility model), in that it is best used at the start/planning of process, not too far down the road of development. The model is based on understanding the trade-offs between comparative scenarios. The purpose is to inform decision makers of the implications of different development decisions.

2.3.2 Why is a bespoke economic tool required?

A Cost Benefit Analysis (CBA) of alternative development and management options is required to identify the trade-offs between choices or alternatives. Conventional Cost Benefit Analyses use GDP or income as a measure of benefit. However, this results in a partial analysis, as ecological and social changes also impact on wellbeing and can't be measured using financial metrics. The team has therefore developed a bespoke CBA tool to facilitate comparisons of monetary, social and ecological costs and benefits, ensuring that more informed decisions can be made regarding the choices associated with Blue Economy development.

2.3.3 The philosophy behind the economic model

The tool was developed with the capability to evaluate interventions in a circular economy. The framework therefore had to accommodate waste as a productive flow. Past experiences have shown

GDP is a poor indicator of wellbeing, and the model needed to employ a Human Benefit Index (*Cartwright et al, 2013)* as part of its measure of benefit.

The conventional linear economy model can be considered a leaking system:

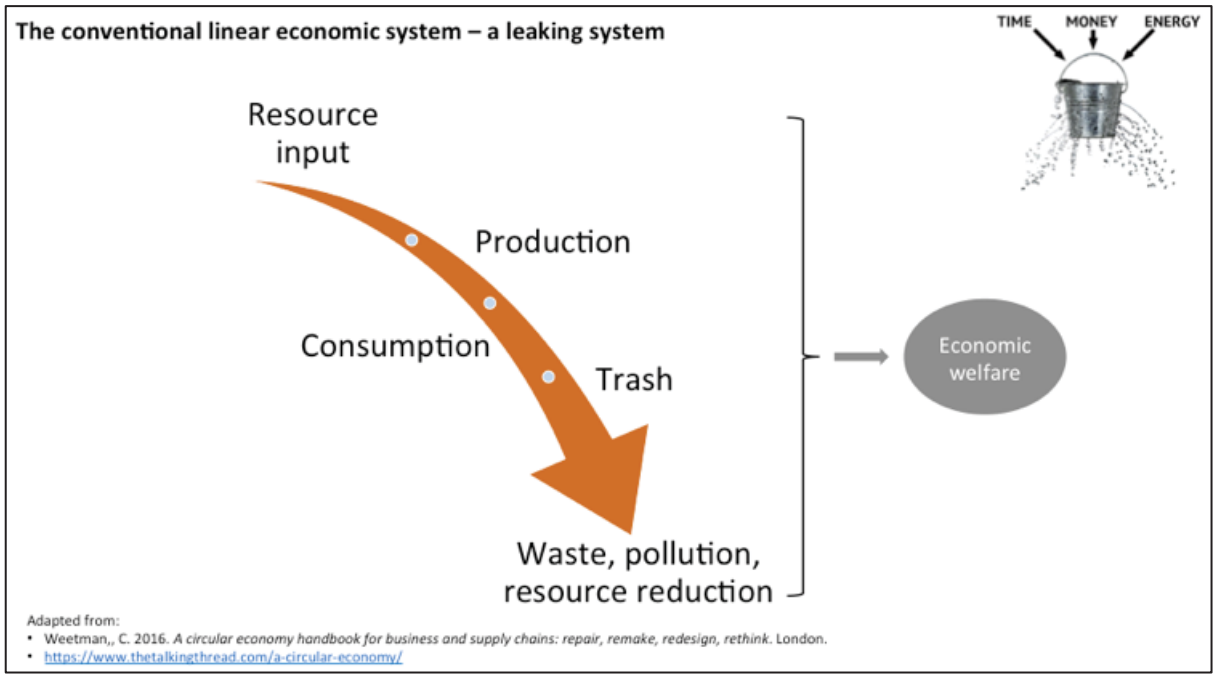


Figure 4: The conventional linear economic system

A regenerative economic model has a more circular approach:

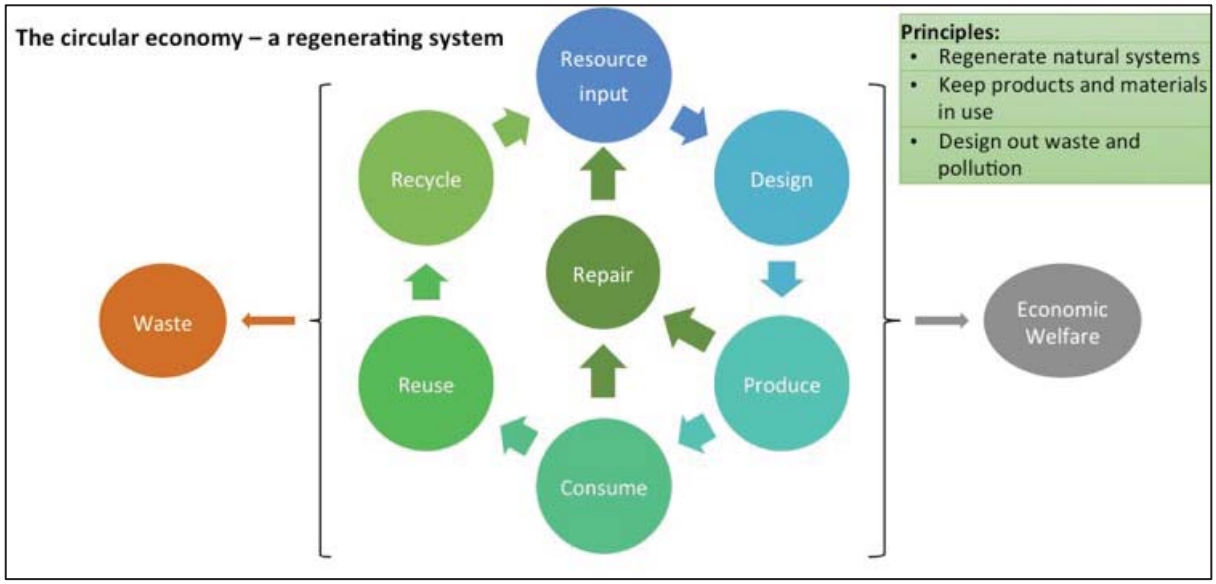


Figure 5: A regenerative circular economic model

In comparing these two systems, there is a human benefit consideration:

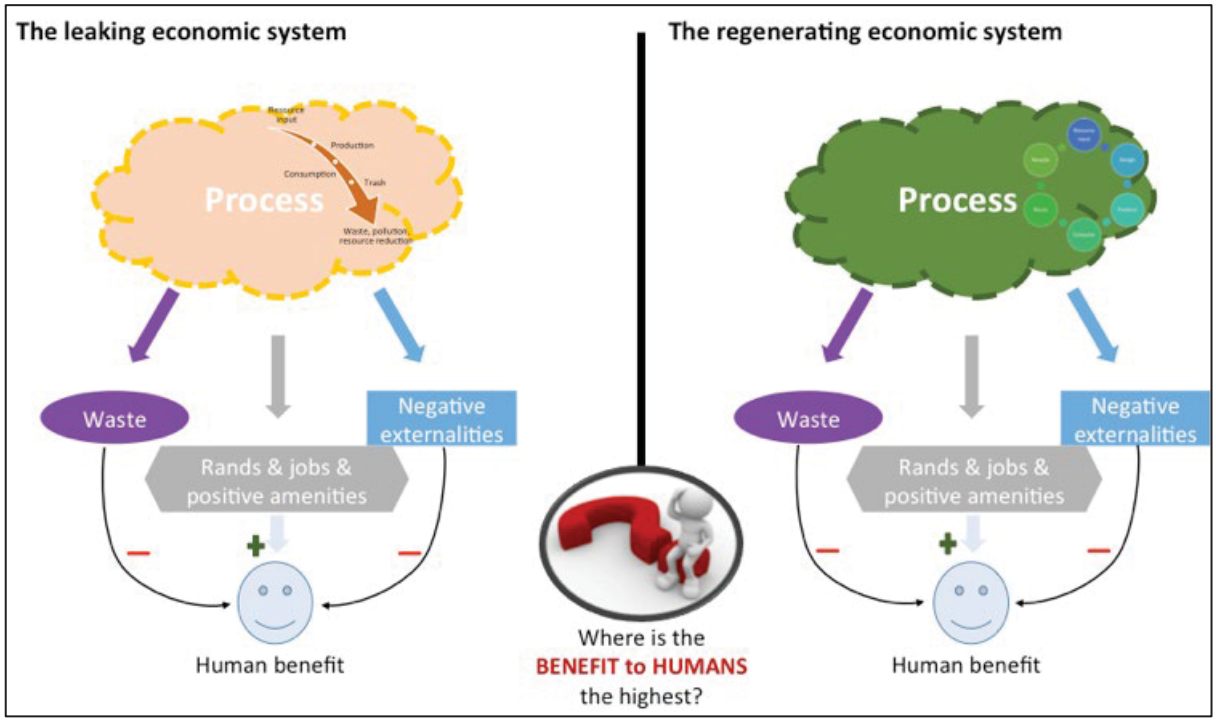


Figure 6: Comparing human benefits from linear vs circular/regenerative economic approaches

A number of factors can be taken into account when considering the change in benefit to humans in order to determine where the benefit to humans is highest in each approach. These are outlined in Figure 7 below.

Factors determining a change in benefit to humans:

- Δhuman capital; Δfinancial capital; Δnatural capital; Δmanufactured capital; Δsocial capital
  - specifically: pressure or intensity of change
- number of people impacted
  - equalising the impact relative to effect of the impact
- relative impact of time on the various impacts
- GGP of the area/region and the impact of the intervention thereof

Figure 7: Factors determining a change in benefit to humans (FutureWorks)

2.3.4 Working with the Model

The model exists in the format of an Excel Spreadsheet (included in Appendix B). The tool and initial testing in Knysna was presented at the 3rd Project Reference Group meeting. The feedback from this meeting was taken into consideration in testing the model within the second case study. The *Back office Tab* is the computing spreadsheet where the selected indicators or levels of impact are converted to numerical scores and where all the algorithms are lodged to compute the composite costs and benefits. This sheet is not to be altered in any way.

The *Results Tab* is a sheet with a series of tables which show the composite results for the biophysical, social and financial costs and benefits, and their combined values. Of key importance is the Benefit to Cost Ratio (BCR) which indicates what unit of benefit has been generated for each Rand spent.

Five resulting indicators are calculated for each option:

1. **Change in the efficacy of the GGP (discounted over the anticipated project period, such as 20years of mining) -** This IS NOT a change in GGP, but an indicator as to whether the option

improves the quality of life of people, or not, and hence the efficacy of the existing/actual GGP. This indicator includes a relative job creation factor.
2. **Impact barometer -** an indicator of the pressure or intensity, and the direction thereof, of the anticipated change in the quality of life of people as a result of the option.
3. **Number of people impacted -** an indicator of the number of people impacted weighted relative to the degree or intensity of impact.
4. **Cost of the option/intervention** - an indicator of the present value of the cost of the proposed option.
5. **Benefit:cost Ratio -** the ratio between the change in the efficacy of the GGP (as proxy for the benefit) and the cost of the option/intervention.

There is a *Weights Tab* with the weights of the various criteria. The default weights for different criteria are all equal and should not be changed unless well considered and agreed upon by the workshop committee. The weights for impacts on human wellbeing are not equal, as a life saving vs minor impact have very different implications for wellbeing. These weights are different and should be kept as they are.

2.3.5 Testing the Model

2.3.5.1 Results From Initial Testing Of The Economic Modelling Tool Using The Knysna Case Study

The Knysna Municipality waste water works, which has a history of poor discharge quality, was selected as a case study. A workshop was held to test the economic model, focusing on waste water treatment options for the Knysna estuary and the affected sectors (biodiversity, tourism and property). A number of alternative interventions have been compared to identify likely impacts on the Knysna Blue Economy. The involvement of SANParks, the municipality, and WWTW engineers during the testing phase of the economic tool, provided an opportunity to engage with alternative sustainable Blue Economy options in a structured and rigorous manner. The overall results of testing this tool at this workshop are included in Table 1 below.

Table 1: Overall results of testing the economic modeling tool with the Knysna WWTW Case Study

	Change in the efficacy of GGP (discounted over timeframe)	Impact index	People impacted: weighted	PV of cost of intervention (Rmil)	BCR	Job creation factor
Existing WWTW+upgrade (10Ml)	2 057	3.3%	6 600	231	9	65%
Polishing+eco-ugrades-combo (10Ml)	10 355	4.8%	18 640	243	43	100%

- the change in GGP efficacy is some 5 times greater for the regenerative ecological engineering option – implying that society's use of its assets (societal, built and natural) is some 5 times more effective and beneficial than the conventional option
- the Impact Index of the regenerative option is more positive
- the number of people positively impacted is 3 times greater for the regenerative option – using a weighted index, and with 45% greater job creation
- the present value of the regenerative option will cost 5% more over 25 years
- the Benefit Cost Ratio overall is 4.8 times greater for the regenerative option. While the current plan will offer significant gains, the benefits to society of the regenerative option are much greater.

Comparative Results: Green/ecological vs conventional options for Knysna WWTW

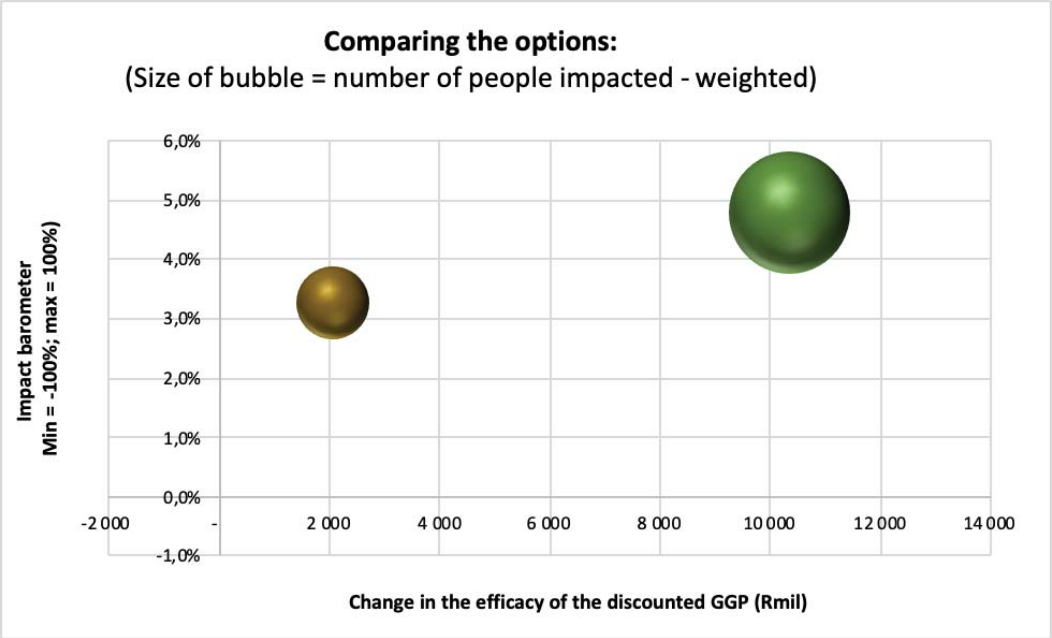


Figure 8: Comparing the results – relative benefits of regenerative vs conventional scenarios

- This graphic shows that the relative benefits of the two options. The green ball is the regenerative option and the brown the conventional option. Note the regenerative option is:
  - higher in terms of positive impacts on society
  - nearly 5 times more efficient in use of societal assets
  - impacts far more people (as a weighted index).

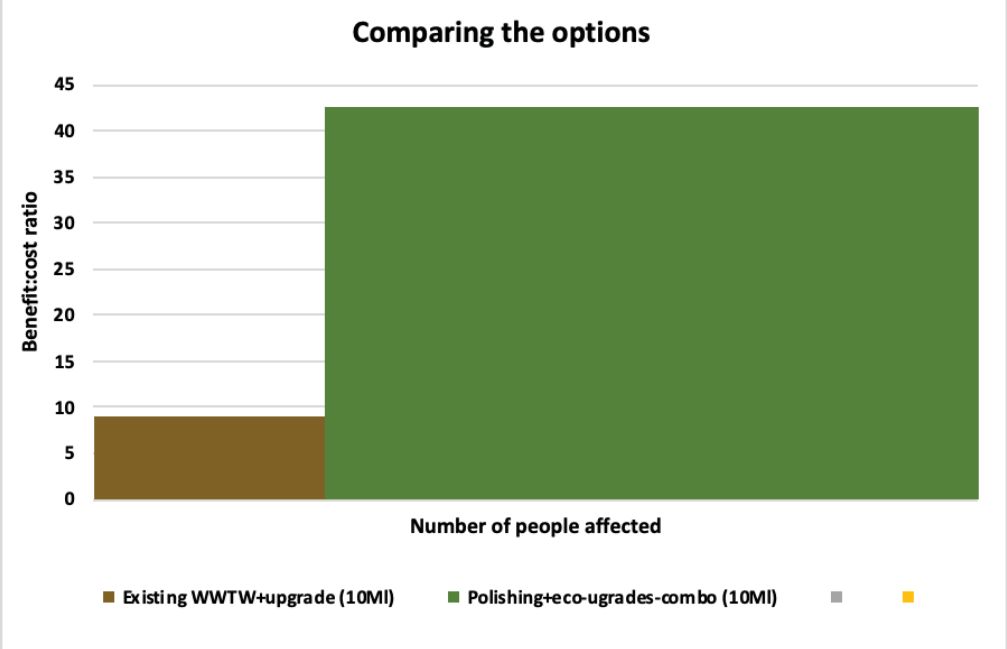


Figure 9: Relative results: Histogram comparing the regenerative vs conventional options for the Knysna WWTW case study.

- The height of the histograms shows the relative benefit cost ratios. The regenerative intervention options (green bar) offers more than 4 times more benefits per Rand spent, than the conventional option (brown bar).
- Note the histogram has variable widths, indicating relative differences.

- This histogram shows that the green column (the regenerative intervention option) benefits significantly more people than the conventional (brown column) option
- The recommendation from this analysis would be to pursue the regenerative ecologically-engineered intervention which promotes a circular economy.
- Note that while the regenerative option's costs are 5% higher over 25 years, this is unlikely to constitute an affordability issue for the municipality.
- Despite these findings, the Knysna Municipality did not select for the ecologically engineered options, based on the experience of the conventional civil engineers within the municipality who have little experience in implementing these solutions. The project team recommended an ecological engineer with experience in implementing the regenerative options, but this was against their business-as-usual approach and it was not driven by a top-down policy or within the municipality itself. It was a proposed solution from an outside organisation and it was also outside of the scope of this project to drive it further. It is for this reason that this project's recommendations include educational processes regarding the use of this tool, as well as in the kinds of ecological infrastructure identified and documented in this project.

2.3.5.2 *Results From Further Testing Of The Economic Modelling Tool Using The uThukela Banks MPA Case Study*

The **uThukela Banks MPA** (http://www.mpatlas.org/mpa/sites/68808160/) was selected by the expert advisors for this project as the best candidate for testing the economic modelling tool on an MPA within the scope of this project. The uThukela Banks MPA functioning is closely linked to the uThukela estuary and the inputs on land. It also has many stakeholders and complex issues, which together with the fact that a better understanding of the socio-economic costs is needed to justify protection versus fishing/mining, make it the area which would also most benefit from this process. A workshop was held on 5th September in Durban to test the economic modeling tool for comparative scenarios around the uThukela Banks MPA.

Three scenarios were considered for a 500 km^2 area offshore of the Thukela mouth

- The current Fisheries scenario
  - Values for this scenario were developed from information provided by various commercial fishing and trawling companies – indicating current values.
- A future Marine Protected Area (MPA), that included limited fishing activities
  - Values for this scenario were developed by KZN Wildlife by using the Aliwal Shoal MPA as a baseline, with additional large vessel costs included.
- A mining scenario that included oil extraction
  - No values were provided by the mining industry for this scenario and the project team were not able to obtain representative examples from Namibia. Consequently, the implications of mining were discussed by the workshop but could not be modelled owing to the lack of monetary estimates.

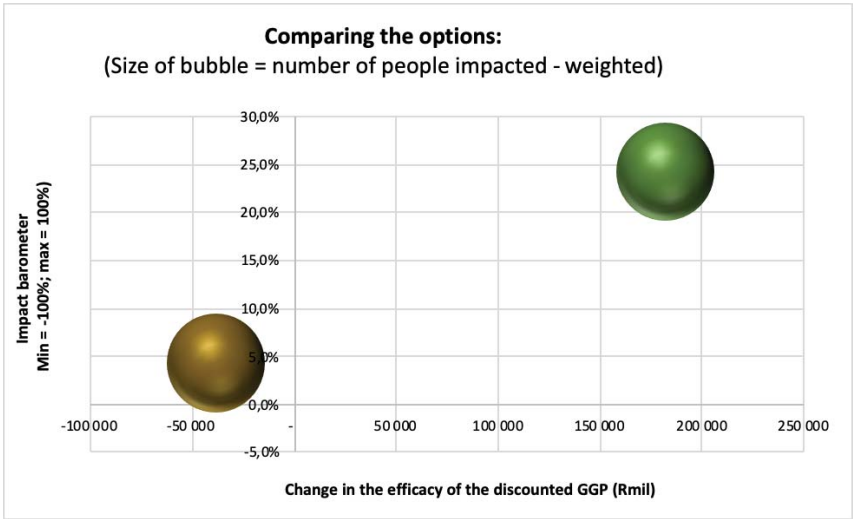


Figure 10: Impact Barometer – comparing the options for the uThukela Banks case study

- The brown bubble depicts the Fishery scenario and the green bubble depicts the MPA scenario.
- The size of the bubble shows the relative impact on people. These are similar.
- The vertical axis shows the impact barometer, with the MPA showing a 5 times greater positive impact than the Fishery scenario.
- The horizontal axis shows the efficacy of GGP. The risks associated with the Fishery scenario imply a negative efficacy or an increasingly in-efficient employment of GGP.

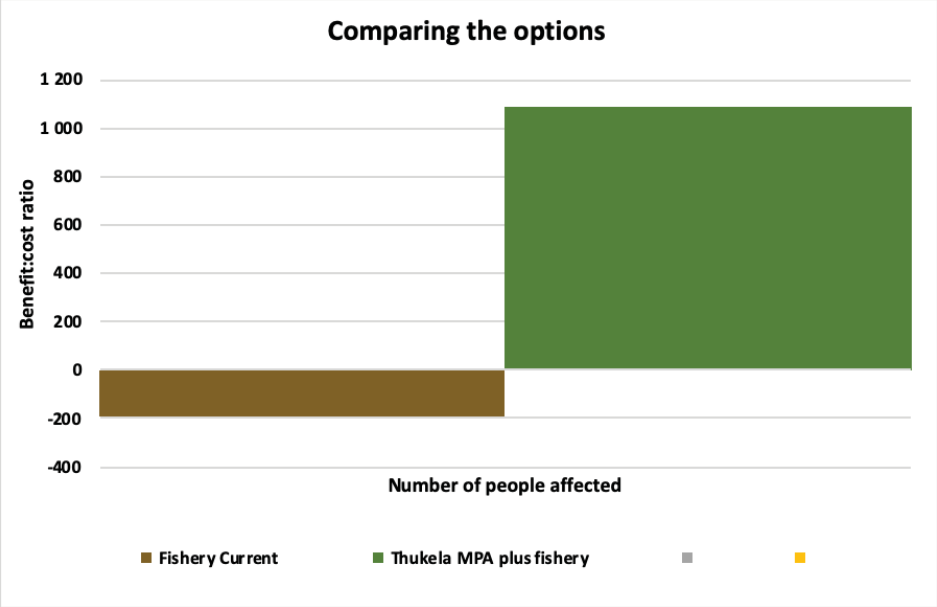


Figure 11: Benefits/Cost ratio – comparing the options for the uThukela Banks case study

- The variable width diagram shows two effects, with the vertical axis showing the benefit cost ratio, and the width of the bar showing the number of people impacted.
- In both scenarios, similar numbers of people benefit to similar degrees.
- However, the Fishery scenario (brown) shows a potential loss making situation.

- Impact index
  - Natural and manufactured capital
    - The current fisheries' impact on natural capital and manufactured capital is negative (-10%), showing that as a result of harvest pressure, largely due to limited control of the recreation fishery, the natural capital will continue to decline over time. On the other hand, a well managed MPA providing protection to marine ecosystems, could lead to a significant positive increase (+42%) in natural capital.
    - The uncontrolled growth of recreation fisheries has serious implications for natural capital, and consequently the commercial sectors. A MPA would be an effective management tool to provide refuge to the fish stocks, thereby strengthening a circular economy, where investment goes into both the building of fish stocks and the harvesting of fish stocks.
  - Social and human capital
    - The two scenarios show a similar small positive impact on social capital, as losses in one sector are cancelled out by gains in another sector.
  - Financial capital
    - The MPA scenario shows the potential to double the impact on financial capital compared to the fishery only scenario. This is largely as a result of a reduced risk in a decline of fishery stocks.

- Change in the efficacy of GGP
    - The MPA scenario shows a 181 000 index in comparison to a negative -39 000 index in the efficacy of the GGP. This shows that without a MPA, the efficacy of GGP will decline with associated human well-being also likely to decline as the natural capital declines without adequate conservation.
- Impact index
    - On average, the MPA scenario has a 5.7 times greater positive impact than the fishery scenario. This is largely driven by an unlimited and little controlled recreation fishery.
- People impacted
    - Both scenarios show a similar effect on people, with a human benefit index of 350 000. This implies that about 350 000 human equivalents (made up of both fulltime impacted and temporary or part-time impact people) are associated with the resources in question.
- Present value of the intervention costs
    - The Present Value of the fishery costs is likely to be R200million while the MPA costs may be R167million (or some 16% less).
- Benefit:Cost ratio
    - This shows that in the long term, in the current fishery scenario, a R1 investment will result in a -R193 loss, while in the MPA scenario a R1 investment will result in a R1 090 gain.
- Job creation factor
    - Both scenarios have similar job creation capabilities.
- Circular economy
    - The model shows that by investing in a more circular economy, there are substantial positive gains to be made.
- At the time of running this workshop, this MPA was only a proposed MPA. As of the end of 2018, it is now an one of the proclaimed ones – effective already. It will be valuable to follow up on the results of the MPA over the next few years.

2.4 Sustainable Blue Economy Business Models

A **business model** is the key document that enables the transition from an idea or a concept to a company that is scalable and sustainable. Business models for sustainable development aim to deliver economic, social and environmental benefits – the three pillars of sustainable development – through core business activities, thereby incorporating the interests of a wide range of stakeholders in its design. Some well known models for sustainable business include: Natural capitalism, Social Enterprises, Product Service Systems, and New Economy concepts (such as a circular economy).

This component of our research aimed to identify sustainable Blue Economy **business models** including “proven and operational” SMMEs. Our research sought to answer the following key questions:

1. What are the kind of business models for SMMEs that can promote a Blue Economy in a more sustainable and inclusive manner?
2. What are the potential opportunities for fostering these kind of business models?
3. What would be the implications for a national Blue Economy strategy if these SMME business models could be replicated and scaled?
4. What is required to build an effective enabling environment to replicate and scale up these business models?

Our team identified, researched and documented sustainable and inclusive Blue Economy Business Models for SMMEs that can benefit marginalised coastal communities while also improving ocean ecosystem health and especially estuary health. This has included both desktop research as well as consultative workshops/interviews with key organisations, businesses and projects. The majority of these are based on existing SMMEs, and we have also included new potential business models in order to illustrate the broader potential for a sustainable and inclusive Blue Economy. We have also documented some international best practice models that could be implemented for the benefits of marginalised coastal communities and estuary health in South Africa.

The following key steps were undertaken in order to answer the questions above:

- identifying and documenting local SMMEs to establish a comprehensive list of existing and new potential SMMEs that contribute to a circular, regenerative and inclusive blue economy
- running consultative workshops with existing individuals/organisations to further distill details for these models, as well as to identify opportunities for replicating and scaling these business models
- completing business model diagnostics for some of these business models with a detailed diagnostic completed for one of the most viable new potential models – the Edible Seaweed model. In order to further flesh out the potential for this business, a business model canvas was used to undertake a detailed analysis of the enterprise
- compiling this report documenting the lessons learned in order to feed into the next phase of this project to integrate these into a national Blue Economy strategy and develop a model and guiding framework on how coastal ecosystems can support the Blue Economy that benefits local and broader communities.

The following key activities were held in this phase (in addition to internal team meetings) to generate the results and contribute to the action research for this project to date.

2.4.1 Workshop with WildTrust

A Workshop was held with WildTrust Trust in KZN on 21 August 2018. This workshop was set up to explore opportunities for learning from WildTrust's proven and operational SMME and business models for circular economy and ecosystem restoration initiatives. In addition the workshop explored new opportunities for replicating and expanding these models to contribute to a sustainable and inclusive Blue Economy.

2.4.2 Workshop with Hout Bay River Catchment Forum

A workshop was held with the Hout Bay River Catchment Forum on 24 August 2018 to explore the potential for SMMEs to participate in a regenerative and inclusive Blue Economy. Existing and new potential initiatives were explored from restoring the health of the river catchment, to aquaculture and other initiatives within the ocean. Hout Bay Disa River is an opportunity to explore how restoring the health of a river catchment upstream of estuaries/bays can contribute to the Blue Economy. The reason why this river is a valuable model is that the entire river length is only 5km and the pollution and other impacts on the river and ocean, are similar to many catchments in South Africa. The negative effects of pollution include significant ecological and social impacts as well as the loss of economic value from tourism, property value, recreational value, fishing impacts and so much more. It is a representative, yet contained, case study for consideration within this Blue Economy research. In addition, the potential solutions explored within our research provide opportunities for SMMEs within marginalised coastal communities to contribute to the Blue Economy.

2.4.3 Business Model Workshops with individuals/organisations

A number of in-depth workshops were held with individuals and organisations to abstract both "proven and operational" SMME business models as well as explore the potential for new SMME models that can contribute to a sustainable and inclusive Blue Economy. The individuals and organisations included:

- Hanno Langenhoven of WildTrust and Wild Oceans regarding Pyrolysis, Green Bricks and Ocean Bricks innovations,
- Gregg Louw on alternative livelihoods for abalone poachers in Western Cape,
- JustiNature organisation on the Edible Seaweed new potential business model,
- A local entrepreneur exploring Biorock SMME business opportunities within the Blue Economy,
- Natasha Rightford and Sue Swain (Biowise) regarding opportunities for Knysna as a circular economy.

2.4.4 Desktop Research and Telephonic/Email interviews

In addition to the above activiies, our team has conducted further desktop research as well as interviews with individuals. These included:

Local Business Models:

- interview with Vuyo Skikwebu of Clariter at Mail & Guardian Circular Economy seminar and through their website
- emails with Serge Raemakers, CEO of Abalobi and additional research through their website. Abalobi aim to develop sustainable fisheries using transformative processes, innovative technology, value chain upgrading, supported by a traditional fishers' knowledge base. This is a great model to add to sustainable and inclusive blue economy business models within the National Blue Economy Strategy.
- Restoring small-scale fisheries in Kogelberg, WWF Project. WWF-SA has embarked on a program to catalyse the development of credible Fisheries Improvement Projects (FIPs) in South Africa in an effort to contribute towards addressing overfishing and unsustainable fishing practices. The Abalobi business model above could be applied here effectively. The program was designed to target small-scale fishing communities to implement structures and frameworks that promote socio-economic prosperity from the fishery, sustainable use of marine resources and inclusion in resource monitoring and management (reference: Moving Sushi website- http://movingsushi.com/).
- Developing South African Edible Seaweed (described in Section 3.4.8 below)
- There are a number of SMMEs involved in ocean/marine related ecotourism. These include the Bhanga Nek Turtle Tours within the iSiMangaliso MPA, and the Pondoland MPA community hikes. A similar opportunity for sustainable and inclusive blue economy business models has emerged through the WildOceans WhaleTime project (described in WildTrust WildOceans models in this report).

International Best Practice Business Models:

- Greenwave, Seagreens, Pharmasea & Kelp farming models – in depth exploration of these models through online webinars with Bren Smith and Daniel Marquez, as well as through websites (Video overview, related press)
- Dr John Todd on Ocean Arks international and his book Healing Earth.
- Eritrea Blue Economy case study: the application of circular economy thinking applied to the Blue Economy in sub-Saharan Africa. During 1998 – 2003, a project took place in the tiny desert country of Eritrea that showcased a Systems Thinking approach to the development of seawater-based agriculture in an arid coastal zone leading to big profits, a revitalised environment and the creation of many jobs (Jeffries, 2017)
- The TRY Oyster Women's Association in The Gambia illustrates multiple linkages of the Blue Economy approach ranging from social inclusiveness to capacity building, job creation, and environmentally sustainable management of small-scale operators. Since its founding in 2007, the association has moved from small gatherings of 40 oyster harvesters in one community in the Tanbi to an established group with organised leadership and more than 500 members from 15 communities in the Greater Banjul area. (UNEP ECA, 2016)
- The Billion Oyster Project which is essentially a citizen science project co-ordinated by the New York Harbor School with the goal of restoring one billion live oysters to New York Harbor by 2030.
- Community-based, locally managed Marine Protected Areas in Fiji: In the early 1990s the residents of Ucunivanua village, Fiji, realised that their livelihoods were under threat. The community decided to take the situation into their own hands. In 1997, with the support and leadership of researchers at the University of the South Pacific in Suva, Fiji, they established a locally managed marine area (LMMA). This took the form of a 24-hectare no-take zone on the mudflats and seagrass bed directly in front of Ucunivanua village. The aim was to restrict the harvesting of kaikoso clams to allow their numbers to regenerate and to encourage their settlement in neighbouring areas. It yielded dramatic results. Seven years after the implementation of community-based marine resource management in the village, the kaikoso clam was once again abundant and village incomes had risen significantly *(This case study was adapted from: United Nations Development Programme. 2012 and published in Sowman et al, 2015)*.

- A similar example in terms of community economic benefits of an MPA in Mexico, is illustrated in the following video created for The Economist: https://www.facebook.com/TheEconomist/videos/10156407738414060/
- Large-scale ocean repair models: keys for ocean restoration are described by Matt Powers in his book: *The Permaculture Student – A Collection of Regenerative Solutions* 2nd Edition, 2016. These are described for the USA, but are applicable globally and many are applicable locally. The keys to ocean repair include:
    - clean and filter water as it approaches and enters the oceans using shellfish
    - clean and filter the coastal waters with kelp and other biology
    - farm seaweed to sequester carbon, nitrogen, and other excess nutrients in the water
    - farm shellfish in the coastal waters to sequester carbon, nitrogen, and other nutrients as they clean the water
    - restore the kelp forests where relevant (recent warming killed over 90% of US west coast kelp)
    - build artificial reefs (reefs provide shelter and act like underwater windbreak as do kelp)
    - return the harvested kelp and shellfish to the soil to return the lost nutrients and sequester carbon

2.5 Summary of Proven and Operational SMMEs in Pilot Focus Areas

Similar to the *economic models*, the *business models* essentially fit within two main focus areas for this research. For these two focus areas, the following SMME business models have been documented (in detail in the original Business Model report, and summarised here):

3. Circular Economy business models with benefits to both ecological and social resilience:

- Plastic waste recycling and upcycling opportunities (to prevent and clean up ocean plastic)
    - proven and operational: WildTrust Wastepreneur, Blue Crew model applied to Ocean Bricks, Green Bricks & Pyrolisis processes for plastic upcycling (described in Section 4 of this report)
    - proven and operational: Clariter model for upcycling plastic waste into waxes, oils and solvents.
- New potential (based on proven and operational): Wastewater and solid waste upcycling opportunities through restoration of ecological infrastructure and upcycling of solid waste:
    - Knysna as a circular economy (described in Section 4 of this report)
    - Hout Bay as a circular economy (described in Section 4 of this report)

4. Ecosystem restoration/Regenerative business models with socio-economic benefits:

- Ecosystem restoration and ecological infrastructure with benefits to ocean ecosystems and particularly estuaries:
    - proven and operational WildTrust models for ecosystem restoration as an effective business model that can be applied to other restoration projects described in this report. Also as a model for replicating some of the international best practice ideas locally (described in Section 3 and 4 of this report).
    - proven and operational international Greenwave, Seagreens, Pharmasea models applied to producing seaweed products locally
    - preventing abalone poaching through alternative livelihoods
    - Abalobi Hook to Cook model & WWF Kogelberg small-scale fishery models (referenced above)
    - isiMangaliso, Pondoland and WhaleTime models as examples of SMME-scale eco-tourism potentials for marginalised coastal communities (including within MPAs).
    - international best practice models listed in Section 2.44 above.

Replicating and scaling these models could be a siginificant contribution to the National Blue Economy with socio-economic benefits for marginalised coastal communities. This is discussed further in the body of this report. A detailed description of each of these business models can be found in the progress report for this project on Sustainable Blue Economy Business Models (If you would like a copy of the detailed report, please contact the project team by email: info@biomimicrysa.co.za).

2.6 Blue Economy Guiding Framework + Integration into National Strategy

2.6.1 Key Activities

This component of our research aimed to:

- develop a model and guiding framework on how coastal ecosystems can support the blue economy that benefits local and broader communities
- integrate the best practice into draft SA blue economy strategy and related legislation.

The following key activities were held in this phase (in addition to internal team meetings) to generate the results and contribute to the action research for this project to date:

- Oceans Economy Workshop, 24 April 2019
    - this workshop was organised by the WRC and hosted at Nelson Mandela University. The workshop objective was: '*To explore innovative socio-economic research ideas in the Blue Economy space*.'
    - the workshop Identified that the largest challenges in the country are poor governance and the lack of implementation of these laws, especially in government. Although concepts such as the Blue Economy have gained a lot of attention recently, they have not yet been applied appropriately in South Africa. For example, Operation Phakisa has focused primarily on economic growth and secondly on the natural environment. This can be seen throughout the country's government and private sector. There remain strong incentives to continue 'business as usual' – the involved parties do not want to adapt to alternative socio-economic models.
    - the workshop produced a policy brief to multi-sectors as mandated: the NDT, DAFF, DEA, DWS (it is through this high-level policy brief that this WRC project team hope to raise a flag within national government as to the opportunities for more inclusive and sustainable Blue Economy initiatives that can benefit both estuaries and marginalised coastal communities).
- engagement with Government since year 1 (2017), was met with limited success:
    - the Synthesis Scoping Workshop was an opportunity for synthesising the content of the Scoping phase and project team collaboration as well as for sharing presentations and discussions with DEA for integration with their work on the Operations Phakisa. Key discussions were held around potential pilot projects and best approaches to sustainable economic models. The focus of the discussion was around Marine Protected Areas and Marine Spatial planning.
    - a summary of the scoping report and workshop and sent a copy of Scoping Report to Andre Share and his team, with no response.
    - there is no National Blue Economy Strategy (sustainable oceans economy strategy), there is only a national Oceans Economy strategy (Operation Phakisa) within which the Marine Spatial Planning and Marine Protected Areas can be considered the 'sustainable' components.
    - there are many different and dispersed government departments involved in the implementation of Operations Phakisa
- integration of findings from this project's previous reports (year 1 - 2017 and year 2 - 2018)
- interview held with several experts,
- internal team strategic planning processes in which it was decided that the best way to take the findings from this project and have them effectively implemented at a local or national level, would be to engage with civil society organisations like WildTrust that already work effectively with government, as well as on the ground in implementation, especially in areas that directly relate to this project. If they can implement within their national strategy for WildOceans – it would be one of the most effective ways to integrate best practice for South Africa's Blue Economy.

2.6.2 Selection of Way Forward

The project therefore selected the following route w.r.t. 'integration within National Blue Economy Strategy & Policy':

- to recognise that this shift away from business-as-usual to a Blue Economy that is more inclusive and regenerative, is actually much deeper than simply an add-on to existing Oceans

Economy initiatives. The economic models driving the current Oceans Economy, need rethinking at a first principles level, and therefore a deeper level of engagement with government is needed than simply adding a layer to their existing processes. It is beyond the scope of this project to engage with government at this depth. But it is within the scope of this project to engage with organisations who are already invested in such a shift away from business-as-usual and towards new economic models;

- to work with civil society that already have partnerships with government and are in the best position to integrate these models, guided by the frameworks outlined in this report;
- that WildTrust – identified in the Blue Economy Business Model component of this report, and who participated in the Economic Modelling pilot study for this project, are in the best position to integrate the best practice from this project in their national Blue Economy strategies;
- based on the experience of WildTrust over the past 15 years in successfully implementing similar programmes in the Green Economy, and the aim of WildOceans to now do the same within the Blue Economy, that WildTrust is the organisation is best placed and most willing to work towards integrating this projects' findings into their national Blue Economy strategy;
- WildTrust already have partnerships with government and integrate their estuary programmes into Estuary Management Plans, thereby integrating into relevant strategies and policies of government;
- they also are effective at working with marginalised communities as well as ecosystem restoration, which is what this project calls for;
- they have experience in innovation processes and the in-depth social processes required for this approach to economic development that goes against 'business-as-usual';
- they have experience and success in the kind of funding models that will most likely lead to the successful implementation of the economic and business models generated from this project;
- working with WildTrust to integrate the best practice from this project into their National Blue Economy Strategy and programmes will also ensure that the ideas will actually be taken forward beyond strategy and policy and will actually be implemented on the ground;
- therefore workshops were run with WildTrust to distil their effective models for implementation (identified in previous phases of this project), and to extrapolate the ideas into a national strategy. The aim of these is to enable the implementation at a national level of these regenerative and inclusive economic models for South Africa's Blue Economy.

2.6.3 Workshops with WildTrust/WildOceans

A number of workshops were held with WildTrust (WildLands and WildOceans) to identify opportunities, distil their models and explore how to integrate the Blue Economy best practice within their WildOceans strategy. This can be considered as an initial effective focus area to take the findings of this project forward into strategy and implementation. At the same time, it can serve as a model perhaps for integration into Estuary Management Plans at a local government level, and hopefully into broader sustainable Oceans Economy strategy at a national level, at some stage when government is in a position to engage with these new socio-economic models that go beyond business-as-usual.

These workshops with WildTrust were facilitated by Actuality - experts in stakeholder engagement and implementation of innovative strategies. Actuality facilitated these workshops through a collective thinking process to make sense of the opportunities for WildTrust and WildOceans role in a more sustainable and inclusive Blue Economy. The aim was to enable expanded thinking to build a new story of possibility for high impact Blue Economy models. A summary of these workshops is included below.

2.6.3.1 Workshop Summary

An explorative workshop was held with key staff within WildTrust and WildOceans to determine their interest in taking the ideas from this project forward into their National Strategy for WildOceans and possibly parts of WildTrust in general. Collection and upcycling of plastic waste entering the ocean was identified as a scalable pilot, and potential locations were discussed. Opportunities for ecological restoration upstream of estuaries and possibly within estuaries were also explored and a further workshop was planned to distill effective models and strategies for taking these forward. An IUCN

funding proposal was submitted with input by the project team for WildOceans to obtain funding for Durban Bay initiatives. This funding proposal was successful and an example of a kind of alternative funding model for implementation of these Blue Economy initiatives on a larger scale in South Africa. A final workshop with WildTrust/WildOceans staff was held:

- to work with WildTrust staff to distill their effective models (developed over 15 years) for restoring the environment while providing economic opportunities for marginalised communities
- to share lessons and opportunities for replicating and scaling existing WildTrust initiatives to contribute to this project
- to share knowledge on this project to more staff within WildTrust – especially the Blue Economy business models identified, and explore opportunities for WildTrust to replicate and scale these models
- to assist WildTrust in understanding the opportunities for WildOceans and WildLands within the Blue Economy and Circular Economy space
- to assist WIldTrust in understanding their potential to build on and scale their WildOceans activities to fulfil necessary gaps at a national level to assist South Africa in achieving a Sustainable Oceans Economy (ie Blue Economy).
- to explore ways to integrate best practice (identified in this project) into WildOceans' Blue Economy strategy
- to develop a strategy for WildOceans/WildTrust to integrate the Blue Economy Business and Economic models from this project within their programs benefiting marginalised coastal communities in South Africa, while focusing on priority estuaries affected by water quality. The results of this workshop are included in Sections 3 and 4 of this report.

3 DEVELOP A MODEL AND GUIDING FRAMEWORK FOR THE BLUE ECONOMY

This component of this project is to develop a model and guiding framework on how coastal ecosystems can support the blue economy that benefits local and broader communities. That framework brings together the findings from this project's previous reports, additional desktop research into relevant global frameworks to inform these models, as well as further activities from year 3 (2019) of this project.

3.1 Guiding Framework: Integrated Perspectives

This project proposes a guiding framework and model for the Blue Economy in South Africa based on the integration of the following existing global guiding frameworks:

- Global Blue Economy Perspectives
- Doughnut Economics
- Circular Economy (& the Blue Economy as put forward by Gunter Pauli)
- Regenerative Design
- Distributed Economies
- Natural Capitalism
- Resilence.

3.1.1 Global Blue Economy Perspectives

The relatively new term is also understood as the effective management of economic activities to ensure sustainable use of oceanic resources (World Bank Group 2017). The approach recognises and values oceans from a small subsistence community viewpoint to commercial and industrial commodities (Keen et al. in press). Figure 12 below represents the key components of the Blue Economy.

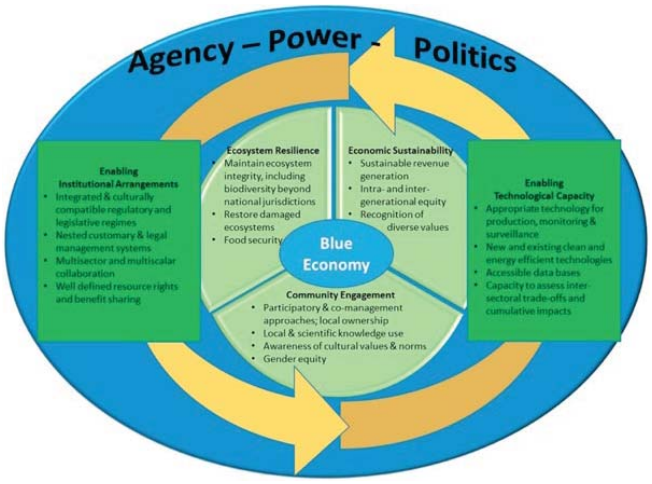


Figure 12: Core components of the blue economy
(Source Keen et al. in press)

The Blue Economy draws on scientific findings so as to balance economic benefits and growth with long term ocean health and human equity. The blue economy aims to understand and better manage ocean sustainability such as sustainable fisheries or reducing marine pollution. It also strives to ensure collaboration between sectors as well as globally across states. It is relevant to all countries and can be applied at different scales. It is a long-term strategy that must be supported by a verified and diverse knowledge base and use innovation in its implementation. The Blue Economy must fully anticipate and incorporate the expected impacts of global change on marine and coastal ecosystems.

Concepts such as the Blue Economy and sustainable ocean economy remain ill-defined and open to interpretation. 'Blue washing' when an entity portrays themselves as environmentally friendly is also a concern (The Economist Intelligence Unit Limited 2015; Zunin 2016; Golden et al. 2017). There is contention regarding the Blue Economy as it is seen as the ideal without proper conceptualisation and to **date it has been more conceptual or political than practical** (Keen et al. in press). Marine resources and ecosystem services have always been undervalued and managed in isolated sectors. It is therefore difficult to address cumulative impacts. The Blue Economy is limited by a number of challenges: most alarmingly, the current unsustainable economic trends that resulted in the degradation of ocean resources; physical alterations of natural landscapes; climate change; and marine pollution.

There is a need to invest in both human capital and innovative Blue Economy activities. **The Blue Economy also requires increased awareness and education to strengthen the concept as without a clear understanding, it will be very difficult to make any progress.** Better economic data and science are required to improve confidence in Blue Economy initiatives. Although there have been vast improvements in ecosystem accounting there are still gaps and inaccuracies that should not be allowed to inform policies (Patil et al. 2016)

The African continent presently sits at a crossroads of opportunity to re-evaluate its development pathway within the context of the Blue Economy, taking into account socioeconomic, political, and environmental considerations. Societies that are dependent on aquatic and marine resources and ecosystems should get ready to embark on a developmental trajectory focused on human and ecosystem well-being. Yet, within the context of the Blue Economy, there are limited innovations, experiences, and practices that can be used to lead this transition. In order to carve its path, **Africa needs to define its own understanding of prosperity and progress, while promoting innovative thinking and practices that will enhance human and ecological well-being** (UNECA, 2016).

Figure 13 below, depicts what the Blue Economy framework could look like: an integrated, holistic, intersectoral-linked development space, anchored on a quadruple-bottom line approach, where development success is measured in economic terms as well as on the basis of environmental and material stewardship, social responsibility, and governance/transparency standing.

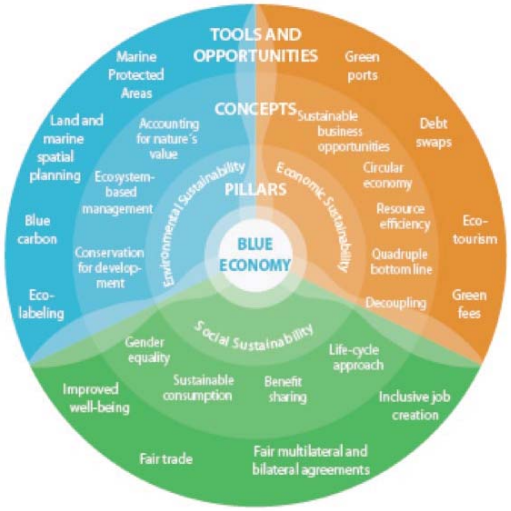


Figure 13: Tools, concepts and pillars of the Blue Economy
Source: UNECA, 2016

At the United Nations Conference on Sustainable Development held in Rio de Janeiro in 2012, Blue Economy was viewed as ocean economy that aims at the "*improvement of human well-being and social equity, while significantly reducing environmental risks and ecological scarcities*". At its core the ocean economy refers to the decoupling of socio-economic development from environmental degradation (Mohanty et al, 2015).

The World Wildlife Fund (WWF), in its publication: *Principles for a Sustainable Blue Economy (WWF, 2015),* states that the term "Blue Economy" or "Blue Growth" has surged into common policy usage, all over the world. For some, Blue Economy means the use of the sea and its resources for sustainable economic development. For others, it simply refers to any economic activity in the maritime sector, whether sustainable or not. The world's oceans, seas, and coastal areas are the largest ecosystems on the planet and a precious part of our natural heritage. Yet, there is still no widely accepted definition of the term. To fill this gap in shared understanding about what characterises a sustainable Blue Economy, and to help ensure that the economic development of the ocean contributes to true prosperity, today and long into the future, WWF has developed a set of "Principles for a Sustainable Blue Economy" (WWF, 2015). The Principles are also harmonised with relevant United Nations agreements; other widely adopted principles for sustainable corporate and organisational governance; and with established understanding concerning related concepts such as Green Economy and Circular Economy.

These Principles provide a definition of a Sustainable Blue Economy and a framework to help us achieve it. They are universal and can be applied to any part of the oceans, seas or coasts, as well as used by any actor involved in the economic development of the sea, including governments, private and financial sector actors, international agencies, and civil society groups. WWF invites all Blue Economy actors to use these Principles for a Sustainable Blue Economy and to embed these definitions, descriptions, and actions into marine policy and activities, all around the world (WWF, 2015).

Their proposed definition is: *a sustainable blue economy is a marine-based economy that*:

- *provides social and economic benefits for current and future generations, by contributing to food security, poverty eradication, livelihoods, income, employment, health, safety, equity, and political stability*
- *restores, protects and maintains the diversity, productivity, resilience, core functions, and intrinsic value of marine ecosystems – the natural capital upon which its prosperity depends*
- *is based on clean technologies, renewable energy, and circular material flows to secure economic and social stability over time, while keeping within the limits of one planet* (WWF, 2015)

The following sections explore additional relevant global guiding frameworks that can inform South Africa's Blue Economy.

3.1.2 Doughnut Economics

In her book on Doughnut Economics (Raworth, 2017) and in her TED Talk in April 2018 (TED Raworth, 2018), British economist Kate Raworth explains the need for 21st Century Economics.

'*Economics is the mother tongue of public policy. It dominates our decision-making for the future, guides multi-billion-dollar investments, and shapes our responses to climate change, inequality, and other environmental and social challenges that define our times. Pity then, or more like disaster, that its fundamental ideas are centuries out of date yet are still taught in college courses worldwide and still used to address critical issues in government and business alike.*' – Kate Raworth

That's why, Raworth argues, it is time to revise our economic thinking for the 21st century. In *Doughnut Economics* (Raworth, 2017), she sets out seven key ways to fundamentally reframe our understanding of what economics is and does. Along the way, she points out how we can break our addiction to degenerative growth; redesign money, finance, and business to be in service to people; and create economies that are **regenerative and distributive/networked** by design.

Named after the "doughnut" image that Raworth first drew to depict a sweet spot of human prosperity, *Doughnut Economics* offers a radically new compass for guiding global development, government policy, and corporate strategy, and sets new standards for what economic success looks like. Raworth (2017) identified the best emergent ideas to address this question: '*How can we turn economies that need to grow, whether or not they make us thrive, into economies that make us thrive, whether or not they grow?'*

The following key ideas are summaries of what she puts forward:

- *'Global GDP is 10 times bigger than it was in 1950 and that increase has brought prosperity to billions of people, but the global economy has also become incredibly divisive, with the vast share of returns to wealth now accruing to a fraction of the global one percent (overwhelming the social foundations on which our world depends for stability - causing social unrest in many different forms across most of the world)'*
- *'The economy has also become incredibly degenerative, rapidly destabilising this delicately balanced planet on which all of our lives depend (overshooting planetary boundaries or the ecological ceiling - the essential conditions we need to survive and be resilient on this planet)'*
- *'Our politicians know it, and so they offer new destinations for growth. You can have green growth, inclusive growth, smart, resilient, balanced growth. Choose any future you want so long as you choose growth. It's time to think again, to reimagine the shape of progress, because today, we have economies that need to grow, whether or not they make us thrive, and what we need, especially in the richest countries, are economies that make us thrive whether or not they grow'*
- *'Humanity's 21st century challenge is clear: to meet the needs of all people within the means of this extraordinary, unique, living planet so that we and the rest of nature can thrive. So this double-sided challenge invites a new shape of progress, no longer this ever-rising line of degenerative growth, but a sweet spot for humanity, thriving in dynamic balance between the (social) foundation and the (ecological) ceiling'*
- *'Millions or billions of people worldwide still fall short on their most basic of needs. And yet, we've already overshot at least four planetary boundaries. This is the state of humanity and our planetary home. No economist from last century saw this picture, so why would we imagine that their theories would be up for taking on its challenges? We need ideas of our own, because we are the first generation to see this and probably the last with a real chance of turning this story around.* ***We need to create economies that tackle this shortfall and overshoot together, by design. We need economies that are regenerative and distributive by design'****. - Kate Raworth*

The Doughnut of social and planetary boundaries (illustrated in Figure 14 below) is an approach to framing this challenge, and it acts as a compass for human progress this century.

Figure 14: The Doughnut of social and planetary boundaries (2017)

The environmental ceiling consists of nine planetary boundaries, as set out by Rockstrom et al, 2009, beyond which lie unacceptable environmental degradation and potential tipping points in Earth systems. The twelve dimensions of the social foundation are derived from internationally agreed minimum social standards, as identified by the world's governments in the Sustainable Development Goals in 2015. Between social and planetary boundaries lies an environmentally safe and socially just space in which humanity can thrive (Monbiot, 2017).

The diagram consists of two rings. The inner ring of the doughnut represents a sufficiency of the resources we need to lead a good life: food, clean water, housing, sanitation, energy, education, healthcare, democracy. Anyone living within that ring, in the hole in the middle of the doughnut, is in a state of deprivation. The outer ring of the doughnut consists of the Earth's environmental limits, beyond which we inflict dangerous levels of climate change, ozone depletion, water pollution, loss of species and other assaults on the living world.

The area between the two rings – the doughnut itself – is the 'ecologically safe and socially just space' in which humanity should strive to live. The purpose of economics should be to help us enter that space and stay there. As well as describing a better world, this model allows us to see, in immediate and comprehensible terms, the state in which we now find ourselves. At the moment we transgress both lines. Billions of people still live in the hole in the middle. We have breached the outer boundary in several places (Raworth, 2017).

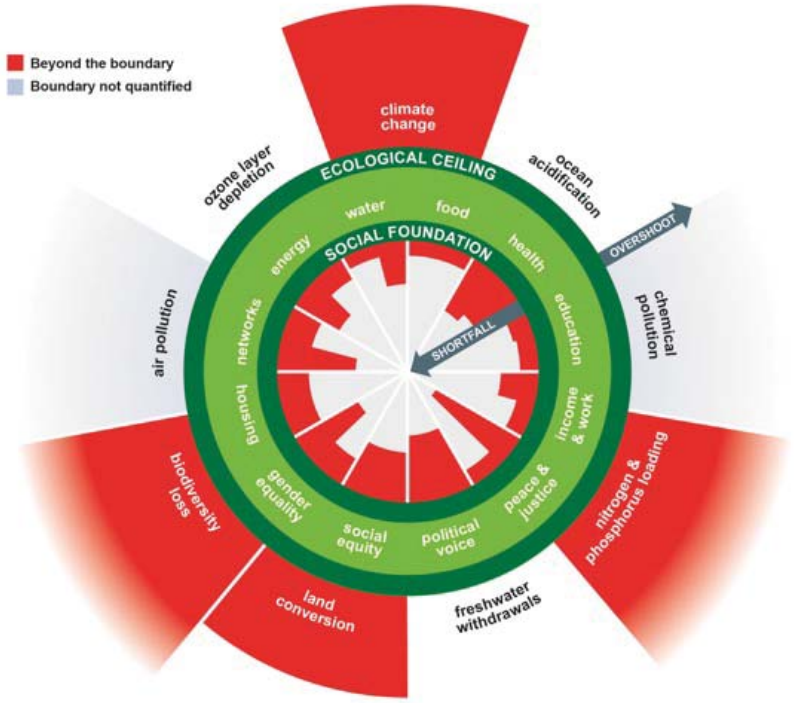


Figure 15: Current overshoot of social and planetary boundaries
(Source: Kate Raworth & Christian Guthier, 2017)

The hole at the Doughnut's centre reveals the proportion of people worldwide falling short on life's essentials, such as food, water, healthcare and political freedom of expression – and a big part of humanity's challenge is to get everyone out of that hole. At the same time, however, we cannot afford to be overshooting the Doughnut's outer crust if we are to safeguard Earth's life-giving systems, such as a stable climate, healthy oceans and a protective ozone layer, on which all our wellbeing fundamentally depends (Monbiot, 2017).

'*The promise to tackle inequality now appears high on every policymaker's list. We are daily offered 'inclusive growth' and 'an economy that works for everyone'. So what kind of economic mindset can help bring it about? The most they tend to offer is more economic growth. Never mind that it drives ecological destruction; that it has failed to relieve structural unemployment or soaring inequality; that, in some recent years, almost all the increment in incomes has been harvested by the top 1%. As values, principles and moral purpose are lost, the promise of growth is all that's left. All that counts is the rate at which we turn natural wealth into cash. If this destroys our prosperity and the wonders that surround us, who cares? We cannot hope to address our predicament without a new worldview. We cannot use the models that caused our crises to solve them. We need to reframe the problem*.' – George Monbiot (Monbiot, 2017).

An economics that helps us to live within the doughnut would seek to reduce inequalities in wealth and income. New metrics would measure genuine prosperity, rather than the speed with which we degrade our long-term prospects. Such proposals are familiar; but without a new framework of thought, piecemeal solutions are unlikely to succeed. By **rethinking economics from first principles,** Raworth allows us to integrate our specific propositions into a coherent programme, and then to measure the extent to which it is realised (Monbiot, 2017).

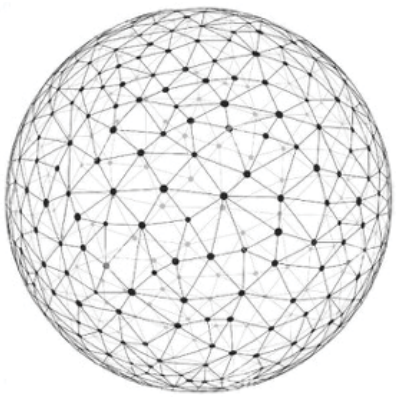


Figure 16: A network of flows: structuring an economy as a distributed network
(Source: Kate Raworth, 2017)

To transform today's divisive economies, we need to create economies that are, **distributive and networked by design –** ones that share value far more equitably and inclusively amongst all those who help to generate it. And thanks to the emergence of network technologies – particularly in digital communications and renewable energy generation – we have a far greater chance of making this happen than any generation before us. (Raworth, 2017)

An **economic story that has been circulating for decades is: 'Poor countries are too poor to be green'.** What's more, they don't need to be, because economic growth will eventually clean up the very pollution that it creates, and replace the resources that it runs down. **It's a story that once appeared to be backed up by data.** But, despite its continuing grip on the imagination of politicians and publics alike, **it has turned out to be a myth**. (Raworth, TED Ideas, 2018)

'*India has performed remarkably economically, but that's not reflected in its environmental outcomes. 'Grow now, clean up later' really doesn't work*.' - Muthukumara Mani, World Bank senior environmental economist

Rather than wait for growth to clean up the environment - because it won't - **it is far smarter to create economies that can restore and renew the cycles of life.** This is critical part of this guiding framework, to develop economic models that are regenerative and distributed by design will far more likely address inequality, while also growing the economy in ways that contribute to healthy ecosystems, rather than impacting them destructively (Raworth, TED Ideas, 2018).

Ecological degradation is not a luxury concern for countries to leave on one side until they are rich enough to give it their attention. Rather than wait for growth to clean it up — because it won't — it is far smarter to create economies that are regenerative by design, restoring and renewing the local-to-global cycles of life on which human well-being depends.

The last 200 years of industrial activity have been based upon a linear industrial system whose design is inherently degenerative. The essence of that industrial system is the cradle-to-grave manufacturing supply chain of take, make, use, lose: extract earth's minerals, metals, biomass and fossil fuels; manufacture them into products; sell those on to consumers who — probably sooner rather than later — will throw them 'away' (Ibid).

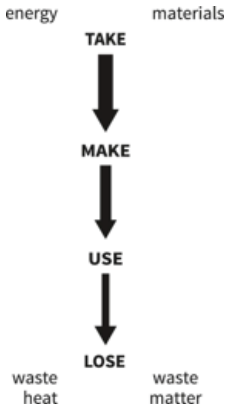


Figure 17: Linear Economy Model

This ubiquitous industrial model has delivered strong profits to many businesses and has financially enriched many nations in the process. But its design is fundamentally flawed because it runs counter to the living world, which thrives by continually recycling life's building blocks such as carbon, oxygen, water, nitrogen and phosphorus.

Industrial activity has broken these natural cycles apart, depleting nature's resources and dumping too much waste in her sinks by:

- extracting oil, coal and gas from under land and sea, burning them, and dumping carbon dioxide in the atmosphere;
- turning nitrogen and phosphorus into fertiliser, then offloading the effluent—from agricultural runoff and sewage—into lakes and oceans;
- uprooting forests to mine metals and minerals that, once packed into consumer gadgets, are then cast onto e-waste dumpsites, with toxic chemicals leaching out into the soil, water and air (Raworth, 2017).

Regenerative design embraces biosphere stewardship and recognises that we have a responsibility to leave the living world in a better state than we found it. It calls for creating enterprises whose core business helps to regenerate and distribute wealth, leveraging networks.

With nature as model, we can study and mimic life's cyclical processes in which one creature's waste becomes another's food (Benyus, 1997).

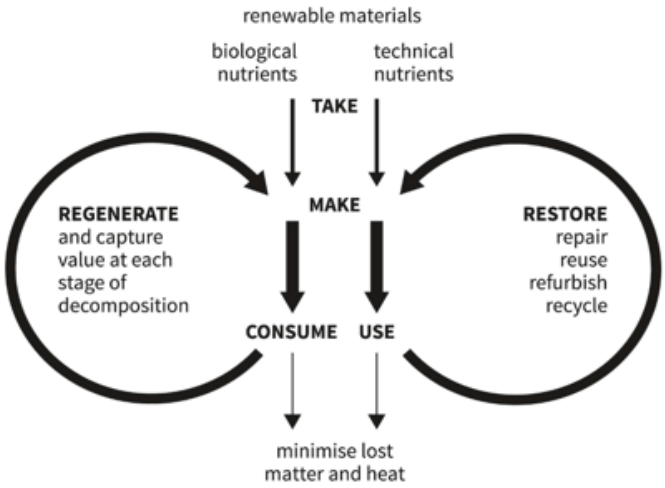


Figure 18: Regenerative Circular Economy Model

Industrial manufacturing has begun the metamorphosis from degenerative to regenerative design through what has come to be known as the Circular Economy. It harnesses the endless

inflow of the sun's energy to continually transform materials into useful products and services. In a degenerative industrial economy, value is monetary, and it is created by searching for ever-lower costs and ever-greater product sales. The typical result has been intense material throughflow. In a regenerative economy, that material throughflow is transformed into round-flow (Raworth, 2017).

3.1.3 The Circular Economy

The circular economy model synthesises several paradigms. These include: Biomimicry (Benyus, 1997); Cradle to Cradle design philosophy of William McDonough and Michael Braungart (McDonough & Brangaurt 2009); and the Blue Economy systems approach described by Gunter Pauli (2009).

As described in the section above, our current economy is based on a linear system of production where we take raw materials and natural resources out of nature, process them into usable goods to meet human needs, and then discard them back into landfills. Basically we have designed a broken or leaking system that creates waste and constantly loses value through the economy. Our linear economy does not fit in a circular world. The opposite to a linear system is a circular one. When you use the natural world as a design reference, you quickly see that the system puts back in what it took out. The natural systems that sustain life on Earth are circular and regenerative (Benyus, 1997).

"*Nothing lives in isolation. Everything is interconnected, so when one views the world as things in isolation, the outcome is linear thinking—which in turn has bred a linear, reductive and wasteful economic system that maximises losses as part of a concept of continued value extraction and creation. We have designed our minds to want simple solutions to complex problems, to avoid chaos, and to believe that we are isolated from the natural world—that we are literally 'apart' from, not 'a part of' nature. We can emulate natural systems to create economic value whilst regenerating the services that sustain us. This requires a shift to circular thinking, and a circular economy.*" -Leyla Acaroglu, Design for Disruption.

A circular economy is an economic system aimed at minimising waste and making the most of resources. In a circular system, resource input and waste, emissions, and energy leakage are minimised by slowing, closing, and narrowing energy and material loops; this can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling. (Wikipedia)

The argument is that circular business models can be as profitable as linear models, allowing us to keep enjoying similar products and services. Looking beyond the current take-make-waste extractive industrial model, a circular economy aims to redefine growth, focusing on society-wide benefits. It entails gradually decoupling economic activity from the consumption of finite resources, and designing waste out of the system. Underpinned by a transition to renewable energy sources, the circular model builds economic, natural, and social capital. It is based on three principles:

- design out waste and pollution
- keep products and materials in use
- regenerate natural systems

(Ellen MacArthur Foundation website).

There's a world of opportunity to rethink and redesign the way we make stuff. We can redesign the way our economy works - designing products that can be 'made to be made again' and powering the system with renewable energy.

'*Transitioning to a circular economy does not only amount to adjustments aimed at reducing the negative impacts of the linear economy. Rather, it represents a* ***systemic shift that builds long-term resilience, generates business and economic opportunities, and provides environmental and societal benefits. In a circular economy, economic activity builds and rebuilds overall system health.*** *The concept recognises the importance of the economy needing to work effectively at all scales – for large and small businesses, for organisations and individuals, globally and locally.*' - Ellen MacArthur Foundation.

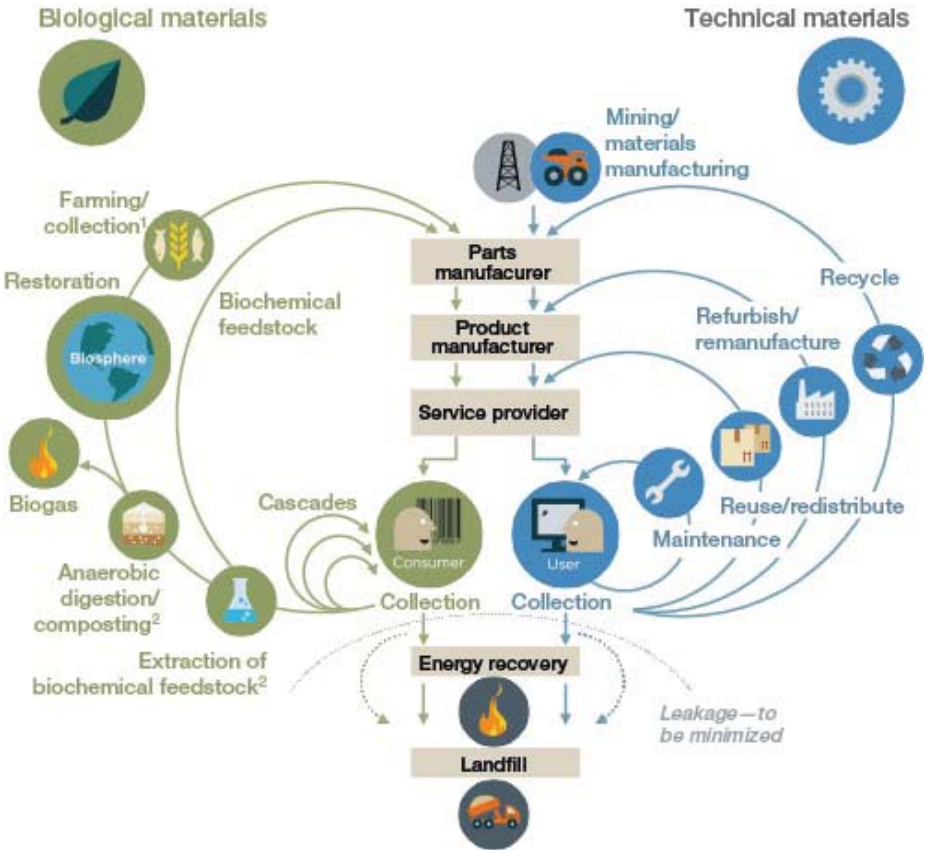


Figure 19: Circular Economy Technical and Biological Loops
(Source: Ellen MacArthur Foundation)

The Circular Economy model distinguishes between technical and biological cycles. Consumption happens only in biological cycles, where food and biologically-based materials (such as cotton or wood) are designed to feed back into the system through processes like composting and anaerobic digestion. These cycles regenerate living systems, such as soil, which provide renewable resources for the economy. Technical cycles recover and restore products, components, and materials through strategies like reuse, repair, re-manufacture or (in the last resort) recycle.

Cradle to cradle thinking (McDonough & Brangaurt, 2009) is what characterises the circular economy. It runs on renewable energy — from solar, wind, wave, biomass and geothermal sources — eliminating all toxic chemicals and, crucially, eradicating waste by design. It does so by recognising that 'waste equals food': instead of heading for landfill, the leftovers from one production process — be they food scraps or scrap metal—become the source materials for the next. **The key to making this work is to think of all materials as belonging to one of two nutrient cycles: either biological nutrients such as soil, plants and animals, or technical nutrients such as plastics, synthetics and metals.** Materials are never 'used up' and thrown 'away' but are used again and again and again through cycles of reuse and renewal. The secret to using biological nutrients endlessly is to: ensure that they are harvested no faster than nature regenerates them; harness their many sources of value as they cascade through the cycles of life; and design production in ways that give back to nature.

'*Many of the human-created systems that we have, such as cities, factories, governments and industrial food production, are failed emulations of the way nature designs things because they have not been designed as a system that nests within other systems. They are isolated and siloed, linear and reductive. We have made things based on our reductive one-dimensional perspective of the world, rather than taken on the more detailed, systemic perspective of what makes everything work on Earth*.' - Leyla Acaroglu, Disruptive Design

3.1.4 The Blue Economy (Gunter Pauli)

The Blue Economy is a business model that can shift society from scarcity to abundance. Initiated by former Ecover CEO and Belgian businessman Gunter Pauli, the Blue Economy is an open-source movement bringing together concrete case studies, initially compiled in a report to the Club of Rome (Pauli, 2009). As the official manifesto states, '*using the resources available in cascading systems, (…) the waste of one product becomes the input to create a new cash flow'*. The concept highlights potential benefits in connecting and combining seemingly disparate environmental problems with open-source scientific solutions based upon physical processes common in the natural world, **to create solutions that are both environmentally beneficial and which have financial and wider social benefits**. The concept suggests that we can alter the way in which we run our industrial processes and tackle resultant environmental problems, refocusing from the use of rare and high-energy cost resources to instead seek solutions based upon simpler and cleaner technologies. The proposal is to focus on the generation of more value, instead of blindly cutting costs. The book aims to inspire entrepreneurs to adopt its insights, by demonstrating ways in which this can create economic benefits via job creation, reduced energy use, and more revenue streams from each step of the process, at the same time benefiting the communities involved. **The approach is relevant to entrepreneurs and offers a broad platform of innovative ideas** that have been implemented somewhere in the world to demonstrate the potential for this approach.

The principles of the Blue Economy (https://www.theblueeconomy.org/principles.html) are all biomimetic and are similar to Biomimicry's Life's Principles. Exploring the >100 case studies on the Blue Economy website, will provide greater insight into the opportunities within this approach: https://www.theblueeconomy.org/innovations.html. Reviewing a wide range of these case studies helps to cement the potential for application of these principles and concepts through practical examples. This project has included Pauli's Blue Economy principles in the selection of proven and operational SMMEs for the Blue Economy Business Models.

3.1.5 Natural Capital

'*With financial capital, when we spend too much we run up debt, which if left unchecked can eventually result in bankruptcy. With natural capital, when we draw down too much stock from our natural environment we also run up a debt which needs to be paid back, for example by replanting clear-cut forests, or allowing aquifers to replenish themselves after we have abstracted water. If we keep drawing down stocks of natural capital without allowing or encouraging nature to recover, we run the risk of local, regional or even global ecosystem collapse.*' - Natural Capital Forum

Natural capital can be defined as the world's stocks of natural assets which include geology, soil, air, water and all living things. It is from this natural capital that humans derive a wide range of services, often called ecosystem services, which make human life possible. At the heart of a natural capital approach is the understanding that nature underpins human health, wealth, culture, identity and happiness, and that the ways in which it does so can be complex and little understood. A natural capital approach works to illuminate this value, and helps decision makers to understand the complex ways in which natural, social and economic systems interact, impact, and depend upon one another. The idea that nature is valuable, is not new. The natural environment has always underpinned humanity's wealth and health. The study of natural capital aims to work out how much the services provided by nature contribute to the economy and wellbeing, so that we can make better decisions about how to manage our natural assets.

'Poorly managed natural capital becomes not only an ecological liability, but a social and economic liability too. Working against nature by overexploiting natural capital can be catastrophic not just in terms of biodiversity loss, but also catastrophic for humans as ecosystem productivity and resilience decline over time and some regions become more prone to extreme events such as floods and droughts. Ultimately, this makes it more difficult for human communities to sustain themselves, particularly in already stressed ecosystems, potentially leading to starvation, conflict over resource scarcity and displacement of populations.' - Natural Capital Forum

How much is our natural capital worth? This is not a question that can be meaningfully answered. In total, natural assets are of infinite value because without them, life on earth simply could not exist.

Although several studies have tried to answer this question in recent years, the values they estimate are not meaningful and do not help inform policy decisions. Meaningful economic valuation instead needs to ask the question: what would we be willing to give up in order to have more of something else? In doing so, it can help answer questions about how much small changes in our natural assets are worth and knowing this can help in making better management decisions. Despite its importance, the value of natural capital is routinely taken for granted. The benefits that come from nature are not taken into account in decision-making. There is growing evidence that uninformed decisions not only damage the environment, but also have significant negative consequences for the economy (Natural Capital Committee, 2019).

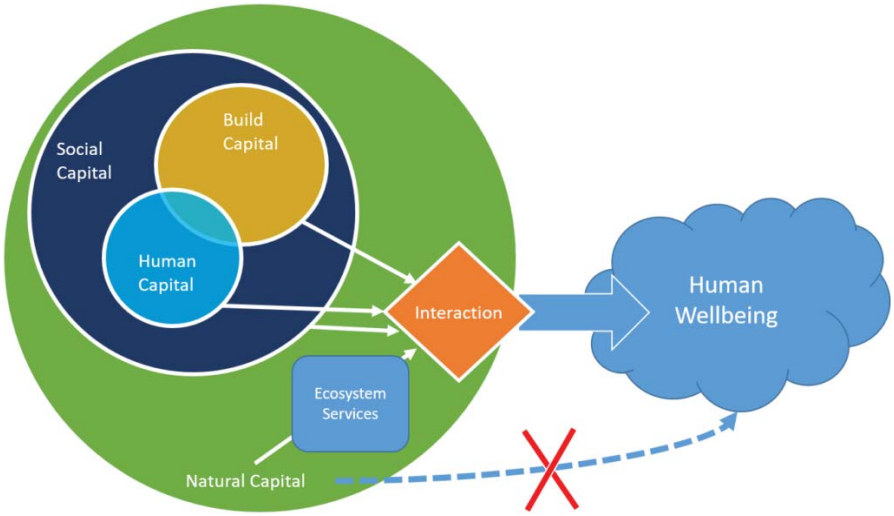


Figure 20: Natural Capital underpins all other capital and human wellbeing
(Source:www.naturalcapital.vn)

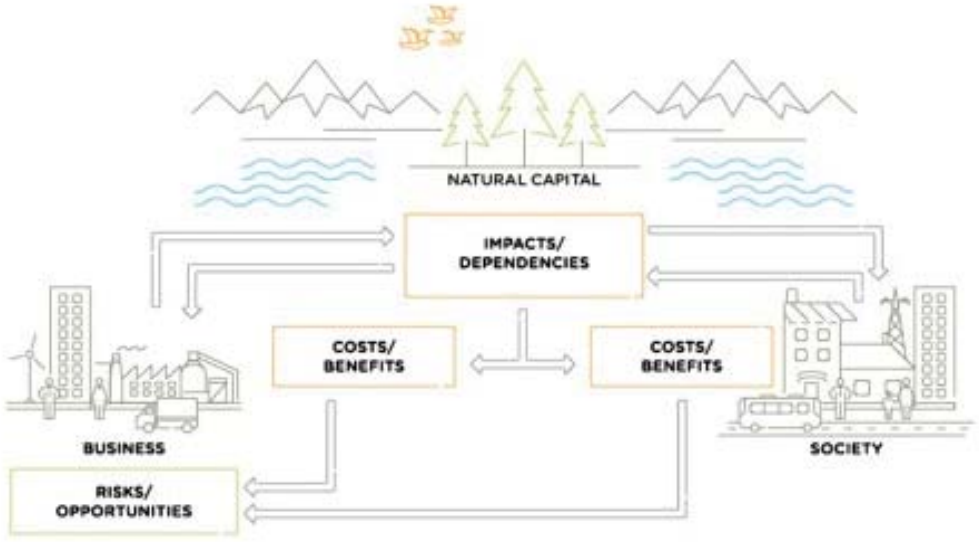


Figure 21: Natural Capital and its relationship to business and society
(Source: Natural Capital Coalition)

Without an understanding of their relationships to natural capital, many decision makers will be at least partly 'flying blind', and can consequently make decisions that are ineffective, inefficient or counterproductive. Decisions in these contexts must be based on information. A natural capital approach broadens the quantity and quality of information available to decision makers, leading to better informed decisions with co-benefits for economies, societies and the natural world. This expands the understanding of the relationships that organisations have with the natural world in terms

of their impacts and dependencies on nature. The fundamental question for decision-makers to ask themselves is; how dependent is my business model on the health of the natural world, and how are my actions impacting on nature's ability to provide what I am dependent on? This simple exercise can be a watershed moment for decision makers, who often realise that their success, and ultimately their profitability, is dependent on the health of a number of natural organisms, ecosystems and phenomena that had never been considered before. The Natural Capital Protocol is a decision making framework that enables organisations to identify, measure and value their direct and indirect impacts and dependencies on natural capital (Natural Capital Coalition website).

Figure 22 below illustrates the need to invest in regenerative development to restore natural capital rather than continuing the downward trend in depleting natural capital through business-as-usual development. The findings from the economic modeling tool developed for this WRC project reinforces the human benefits from investing in natural capital through regenerative development.

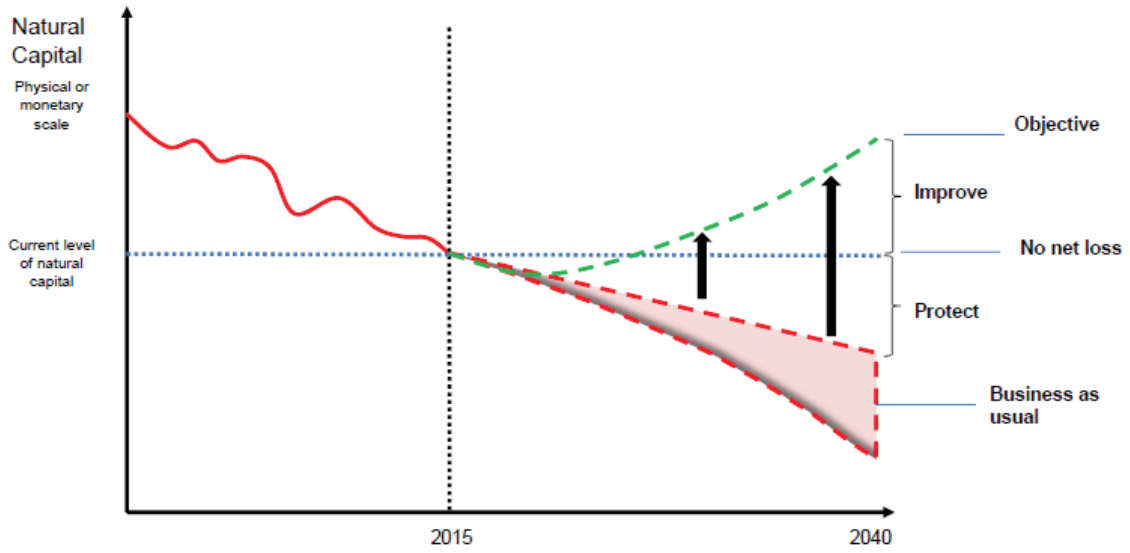


Figure 22: Natural Capital
(Source: Natural Capital Committee, UK)

Natural Capitalism is a business model that involves synergistic elements (these ideas are fully developed in *Lovins, Lovins and Hawken, 2000) including:*

1) *Circular Flows:* Natural Capitalism seeks not merely to reduce waste but to eliminate the concept altogether. **Closed-loop production systems return every output harmlessly to the ecosystem or create valuable inputs for other manufacturing processes.** Industrial processes that emulate nature's benign chemistry reduce dependence on nonrenewable inputs, eliminate waste and toxicity, and often allow more efficient production.

2) *Reinvestment in natural capital*. Any good capitalist reinvests in productive capital. Businesses are finding an exciting range of new cost-effective ways to restore and expand the natural capital directly required for operations and indirectly required to sustain the supply system and customer base. Some of these innovative approaches are integrated into the Blue Economy Business Models identified in this project (Section 3.4 of this report).

3.1.6 Regenerative Design

Regenerative design is a process-oriented whole systems approach to design. The term 'regenerative' describes processes that restore, renew or revitalise their own sources of energy and materials. Regenerative design uses whole systems thinking to create resilient and equitable systems that integrate the needs of society with the integrity of nature. (Wikipedia)

The word ‘regenerate’ means ‘to create again.’ A regenerative system makes no waste; its output is equal to or greater than its input; and part or all of this output goes toward creating further output — in other words, it uses as input what in other systems would become waste. The goal of regenerative design is to develop restorative systems that are dynamic and emergent, and are beneficial for humans and other species.

Although regenerative design is a part of sustainable living, it is not the same as sustainable design. Sustainability implies something that endures over time without degrading, but it does not regenerate itself or create anything new. Sustainable design aims to provide for fundamental human needs; regenerative design goes further in that it plans for the future co-existence and co-evolution of humans and other species.

The development of regenerative design has been influenced by approaches found in biomimicry, natural capitalism, and a circular economy. All these ideas combine to create patterns that mimic nature so that humans can take a symbiotic role in their environment rather than a destructive one. The goal is challenging, but the process of attempting it is viable. A new generation of designers are applying regenerative design to agriculture, architecture, community planning, cities, enterprises, economics and ecosystem regeneration. Examples include the many applications of permaculture around the world, the living building challenge, and biomimicry cities integrating ecological performance standards.

Regenerative design is interconnected with the approaches of Systems Thinking and with the New Economy movement. The 'new economy' considers that the current economic system needs to be restructured. The theory is based on the assumption that people and the planet should come first, and that it is human well-being, not economic growth, which should be prioritised. The Doughnut Economics model of Kate Raworth integrates regenerative/circular and distributed economy models for a thriving economy.

3.1.7 Distributed Economies

Pollution levels and natural resource use have risen tremendously with the large-scale industrialisation of the past centuries. The current system has largely been driven by a concept called ‘Economies of Scale’, the idea that production costs per unit declines as output increases, thus making larger industrial production more attractive and profitable. The belief in this approach has created an industrial production system that is largely dominated by mass production and concentrated industrial cores. The accompanying centralisation has led to social and economic structures that are highly unsustainable. This is exemplified by extensive urban areas with large concentrated populations leading to huge environmental impacts. Industries have grown into massive large-scale operations, increasing the distance between supply and demand while concentrating environmental impacts in a small area. With increased appearance of severe environmental problems, the search for system changes has become very urgent. It has been argued that workers, communities, and the environment, both in developing and developed countries, suffer at the expense of companies that are not rooted in communities and search the globe for cheap labour and resources, as well as low environmental standards (Wikipedia).

This search has led to the concept of distributed economies, an alternative structure for society and economy with rather small-scale businesses in a local economy context, leading potentially to a more sustainable social and economic structure (Johansson et al, 2005).

The concept of distributed economies is a strategy to guide development towards becoming more sustainable and resilient. The concept calls for a transformation in the industrial and infrastructure systems towards distributed economies departing from the socio-economically and environmentally unsustainable dynamics associated with large-scale, centralised production units that are favoured by 20th century economic drivers. With distributed economies, a selective share of production is distributed to regions where a *diverse* range of activities are organised in the form of *small-scale, flexible units* that are *synergistically connected* or *networked* with each other to achieve scale and *mutually beneficial relationships*. Distributed Economies enable *dynamically ‘self-organizing*’ business environments that are more flexible and *resilient* to respond to change (Johannson et al, 2005).

The relations in a distributed economy are much more complex than those in a centralised economy. This feature makes the whole economy more stable – as they no longer rely on just one central node. It also resembles ecological networks**. A big advantage of a Distributed Economy is that it enables entities within the network to work much more with regional/local natural resources, finances, human capital, knowledge, technology, and so on.** It also makes the entities more flexible to respond to the local market needs and thus generating a bigger innovation drive. By doing this, they become a better reflection of their social environment and in that way they can improve quality of life (Wikipedia).

The whole concept of a distributed economy is not at all a new invention – this is how most pre-industrial economies were organised. However, information technology has opened new doors for the concept: information can be shared much more easily and small-scale production facilities (rapid prototyping) are becoming cheaper. We can think of these as distributed digital economies which is **a busy network of relationships that allows small and medium sized enterprises to connect and interact through information technology**. In a distributed economy, there is no need of a central system to boost activity and sustainable productivity. This system opens the doors (theoretically) for all entities within the network regardless of size or location, to innovate and evolve.

Not all industries are fit for Distributed Economies; for example, many chemical processes only become economically feasible and efficient on a large scale. On the other hand, bio-energy and consumer products are interesting candidates.Therefore chemical processes that mimic nature's recipes and structures, using low energy and locally available abundant materials, could potentially be good candidates if combined with technologies such as distributed additive manufacturing through 3D printing.

Some of the core elements of distributed economies that contribute to regenerative (beyond sustainable) development as identified by Johansson et al, 2005 are listed below:

- increased local use of renewable resources;
- wealth creation for a higher number of people;
- decreased pollution emissions and waste generation at the local/regional level;
- added value benefits maintained in the regions;
- increased share of non-material (eg information, know-how);
- higher added value material resources;
- diversity and flexibility of economic activities;
- increased diversity and intensity of communication; and
- collaboration between regional activities.

Case studies to demonstrate these principles in action, can be found in the publication by Johansson et al, Lund University, 2005. The Blue Economy Business Models for SMMEs documented by this project, are almost all examples of Distributed Economy models.

3.1.8 Resilience

'*Resilience is the capacity of a system, be it an individual, a forest, a city or an economy, to deal with change and continue to develop. It is about how humans and nature can use shocks and disturbances like a financial crisis or climate change to spur renewal and innovative thinking.*' - Stockholm Resilience Centre

Over the past decades, few concepts have gained such prominence as resilience. There has been an explosion of research and policies into ways to promote resilient systems. Resilience starts from the belief that humans and nature are strongly coupled to the point that they should be conceived as one social-ecological system. This means that in our globalised society, there are virtually no ecosystems that are not shaped by people and no people without the need for ecosystems and the services they provide.

The problem is that too many of us seem to have disconnected ourselves from nature and forgotten that our economies and societies are fundamentally integrated with the planet. Resilience is therefore an attempt to create a new understanding of how humans and nature interact, adapt and impact each other amid change.

'*Humanity is truly intertwined in biosphere processes from local to global scales. It is becoming clear that a resilient biosphere serves as the basis for just and sustainable development, for human health and well-being, and transformations towards global sustainability are necessary, definitely possible, and highly desirable*.' - Stockholm Resilience Institute

Resilience is being used more often to describe an approach to managing and designing systems - especially cities, in ways that integrate sustainability, well-being and the capacity to adapt to change. The term is increasingly being used as a goal for cities beyond sustainability. Resilient cities are cities that have the ability to absorb, recover and prepare for future shocks (economic, environmental, social & institutional) that are a growing part of the 21st century. Resilient cities promote sustainable development, well-being and inclusive growth. It can also be applied to businesses that are able to adapt to change and maintain their functional integrity. Similarly, it can be applied to a Blue Economy that is able to survive and thrive over the long-term, ensuring the health of ocean ecosystems, as well as the wellbeing of people, especially in times of rapid change.

Resilience science is typically applied to understanding ecological resilience. By connecting the resilience principles of ecosystems to resilience principles of human designed systems, we can begin to understand how to design our systems for the resilience of both. Resilience principles from natural systems that can be applied to design would include: diversity, distribution, redundancy, capacity for self-renewal as well as the continuous capacity of being locally attuned and responsive, as well as being able to evolve to survive. The principles of resilient ecosystems, societies and economies have been applied to the Blue Economy Economic and Business Models generated from this project.

3.2 Guiding Framework for How Coastal Ecosystems Can Support The Blue Economy

3.2.1 Overview

The guiding framework on how coastal ecosystems can support the Blue Economy that benefits local and broader communities, is based on the framework of regenerative and distributed systems that integrate the principles of:

- WWF Principles of a Blue Economy (Sustainable Oceans Economy),
- Doughnut economics,
- Circular Economy,
- The Blue Economy of Gunter Pauli,
- Regenerative Design
- Natural Capitalism
- Distributed Economies, and
- Resilience.

3.2.2 Key Principles of the Guiding Framework

- The framework identifies ways **to bring these broader global guiding frameworks down from conceptual level into practical options** for how coastal ecosystems can support the Blue Economy that benefits local and broader communities.
- This framework contributes significantly towards achieving the WWF Principles (WWF, 2015) for a Blue Economy, i.e.:
    - provides social and economic benefits for current and future generations, by contributing to food security, poverty eradication, livelihoods, income, employment, health, safety, equity, and political stability;
        - distributed, regenerative and circular economies are more likely to realise this than business as usual (linear and centralised) economic models;
    - restores, protects and maintains the diversity, productivity, resilience, core functions, and intrinsic value of marine ecosystems – the natural capital upon which its prosperity depends;
        - owing to the current degraded state of ocean ecosystems, and in particularly estuaries, actions to protect ecosystems (such as MPAs) need to be

complemented by actions to regenerate ecosystems. In this way the Natural Capital of ocean ecosystems can be restored and enable a healthier oceans economy, as well as greater benefit to society;
    - economic activity that restores ocean ecosystem health, in particular estuary health and resilience, needs to be invested in. The models identified in this project enable both ecosystem restoration and economic activities for marginalised coastal communities;
- Is based on clean technologies, renewable energy, and circular material flows to secure economic and social stability over time, while keeping within the limits of one planet;
    - The regenerative, circular economy models identified in this project fit well within this principle;

- this framework **focuses on estuaries** as ocean systems that are most vulnerable, and at the same time, are found within coastal areas (to target coastal communities), these ecosystems also have great capacity for and widespread benefit from regeneration while increasing economic opportunities for marginalised communities. Our framework further focuses in on those estuaries most affected by water quality degeneration (including organic, inorganic and solid waste impacts from upstream activities). Lara van Niekerk, has created a spreadsheet for this project (from her related estuary research) that lists Piority Estuaries in need of restoration from a water quality perspective (included in Appendix A). A number of estuaries were selected (refer to Table 2 below) based on:
    - ecological importance (Highly Important or Important) (Turpie et al 2002 and 2007 update);
    - estuaries marked as Conservation priorities , either in praotected areas or desired protected areas (Turpie et al 2012); and
    - estuaries under Very high/ High/ Medium water quality pressure (we can shorten this list if need be to not include medium level pressures).

- Van Niekerk has also indicated with red highlight (in Table 2 below), a sub set of the selected estuaries that are confirmed as classification priorities by the Department of Water and Sanitation (DWS) processes. These are estuaries that have had DWS Ecological Water Requirement (Reserve) studies or 'Classification of Water Resources studies' done that indicated that the Present State does not meet the Recommended Ecological Condition needs improvement. Another layer is added in terms of confirming that these systems need restoration. It does not necessarily make them higher priorities as they depend on which areas DWS have done, but one or two of these should make it onto the priority list. The selection criteria list is attached in Appendix A. The list of priority estuaries based on water quality is taken from the Estuaries Monitoring and Management Register and is included in Table 2 below.

- **for the purpose of this project – to develop a guiding framework and integrate into a Blue Economy strategy – this list of priority estuaries based on water quality will be used as focus areas for regenerative Blue Economy strategies.**

Table 2: Priority Estuaries w.r.t. Water Quality (Source: Dr Lara Van Niekerk, CSIR)
(Note that Appendix A includes a comprehensive list from which these priority estuaries were selected)

Selection	Name of Estuary
X	Orange
X	Olifants
X	Verlorenvlei
X	Groot Berg
X	Diep/Rietvlei
X	Zand
X	Palmiet

Selection	Name of Estuary
X	Bot/Kleinmond
X	Klein
X	Uilkraals
X	Heuningnes
X	Goukou
X	Gouritz
X	Knysna
X	Piesang
X	Kromme
X	Seekoei
X	Gamtoos
X	Swartkops
X	Sundays
X	Great Fish
X	Keiskamma
X	Mtata
X	Mzimvubu
X	uMkhomazi
X	Durban Bay
X	uMngeni
X	uMhlanga
X	uMhlali
X	uMdlotane
X	iZinkwazi
X	uThukela
X	uMhlathuze
X	Richards Bay
X	iNhlabane
X	iMfolozi/uMsunduze
X	St Lucia

- critical to this framework is the **enabling Economic Model** that measures broader human benefit rather than GDP alone, and integrates circular material flows for technical nutrients (eg waste plastic entering the ocean), while regenerating the ocean systems. This economic model is enhanced by the **types of local Business Models** that can be implemented on the ground as economic development activities that can support a Blue Economy that benefits local coastal and broader communities.
- the realisation that the economic models that drive Oceans Economy strategies are based on economic principles that do not fit the current context of our planet – locally and globally demands a **re-thinking of economics from first principles.** This rethinking allows us to integrate our specific propositions into a coherent programme, and then to measure the extent to which it is realised:
    - it is important to recognise that this shift away from business-as-usual to a Blue Economy that is more inclusive and regenerative, is actually much deeper than simply an add-on to existing Oceans Economy initiatives. **If the economic models driving the current Oceans Economy, need re-thinking at a first principles level, then a deeper level of engagement with government is needed than simply adding a layer to their existing**

processes. It is beyond the scope of this project to engage with government at this depth. It is within the scope of this project to engage with organisations that already recognise the need for this shift and are actively working towards enabling it and proving the concept on the ground. WildTrust is in a good position to implement the kind of different economic and business models developed in this project – based on their history of innovating succesfully in this space to date. WildTrust also engage in partnerships with government to enable their programmes which means they may be in a position to demonstrate within existing government partnerships, the benefits of this move away from business-as-usual;

- a new Economic Model is required that enables us to thrive creatively within the boundaries of a healthy social foundation and ecological ceiling and seek to reduce inequalities in wealth and income, while restoring ecosystem health:
    - the Economic and Business models developed for this project take into account both social and environmental consideration and combine the two challenges into one – with **opportunities for both, at the interface between ecological restoration and inclusive growth**. This is also an approach that WildTrust has pioneered and therefore they are in a good position to implement these ideas effectively – taking them from high level conceptual ideas to actualised projects;
- Economic Models need new metrics that will measure genuine prosperity, rather than only GDP or profit;
    - the Economic Model developed for this project is an example of such a model for decision making around development alternatives – with an emphasis on broader Human Benefit Index, than simply GDP. Similarly, Natural Capital Accounting models (such as those developed by Prof Ken Findlay's research team at CPUT for Marine Spatial Planning, will enable decision making around economic development as well as spatial considerations in Marine Spatial Planning, and will contribute effectively to a more sustainable Blue Economy;
- **rather than wait for growth to clean up the environment - because it won't - it is far smarter to create economies that can restore and renew the cycles of life**. This is critical part of this guiding framework: to develop economic models that are regenerative and distributed by design will far more likely address inequality, while also growing the economy in ways that contribute to healthy ecosystems, rather than impacting them destructively;
    - this is quite a significant change away from business-as-usual economic development. Typically, conservation and restoration processes are conflictual and sit within the realm of environmental organisations, while economic development sits within the realm of economic/business organisations. A new collaboration between these two different (and typically conflicting) roles will be needed as a combined effort to figure out how to work together towards economic models that are restorative rather than degenerative. This kind of development model requires organisations that are able to integrate these two components – ecosystem restoration and inclusive growth. It is for this reason that WildTrust is a great starting point for proof of concept for a Blue Economy that contributes to ecosystem restoration and benefits marginalised coastal communities.
- to transform today's divisive economies, we need to create economies that are distributive and networked by design – ones that share value far more equitably amongst all those who help to generate it. We can think of these as distributed digital economies which is **a busy network of relationships that allows small and medium sized enterprises to connect and interact through information technology**. In a distributed economy, there is no need of a central system to boost activity and sustainable productivity. This system opens the doors (theoretically) for all entities within the network regardless of size or location, to innovation and evolution;
    - digital innovations such as citizen science/tracking Apps can enable both ecosystem restoration processes, circular economy activities (tracking and collecting waste) and distributed economic development models such as the Abalobi App (described in Blue Economy Business Models);
    - it is not surprising that the Business Models identified in this project are a number of SMMEs/individuals that are networked together to achieve scale, rather than one large centralised company achieving profit for its own endss;
- looking beyond the current take-make-waste extractive industrial model, a circular economy aims to redefine growth, focusing on society-wide benefits. It entails gradually decoupling economic activity from the consumption of finite resources, and designing waste out of the system.

Underpinned by a transition to renewable energy sources, the circular model builds economic, natural, and social capital. It is based on three principles:

- design out waste and pollution:
  - this process requires collaboration within the supply chain to design new ways of creating products and processes that eliminate waste or are designed so that waste can be cycled into value. This is both at the product design level and the infrastructure design level – for more effective cycling infrastructure. WildTrust currently track the most prominent brands featuring in waste collected, to then engage with these companies to fund waste clean up/recycling initiatives. This could also be a means to enage with companies to redesign and rethink their products to minimise/eliminate waste while also contributing to cycling infrastructure.
- keep products and materials in use:
  - the Business Models described in this project include innovative ways to do this while generating opportunities for more inclusive development. Additional ideas from international best practice (that could also be adopted locally) are outlined in the models of Pauli's (2009) Blue Economy case studies;
- regenerate natural systems:
  - WildTrust models for regenerating natural systems while contributing to inclusive growth are examples of how this can be done. There are also many more examples of regenerative models for businesses some of which have been documented in the Blue Economy business models of this project;

- transitioning to a circular economy represents a **systemic shift that builds long-term resilience, generates business and economic opportunities, and provides environmental and societal benefits. In a circular economy, economic activity builds and rebuilds overall system health.** The concept recognises the importance of the economy needing to work effectively at all scales – for large and small businesses, for organisations and individuals, globally and locally;
  - this need for transition highlights the recognition that this is an effort at all scales of society – encompassing private sector, government, civil society and citizens. It also highlights the need for social processes as an important component, i.e. it's not just technical/economic solutions – and therefore organisations that have the skills and experience to manage these social processes will be an important component of the transition from business as usual to circular/regenerative/distributed economies. This is another reason that WildTrust is in a good position to implement the Blue Economy models identified in this project at a national strategy level;
- **the key to making this work is to think of all materials as belonging to one of two nutrient cycles: either biological nutrients such as soil, plants and animals, or technical nutrients such as plastics, synthetics and metals.** The principles for using biological nutrients cyclically is to: ensure that they are harvested no faster than nature regenerates them, harness their many sources of value as they cascade through the cycles of life, and design production in ways that give back to nature. '*using the resources available in cascading systems, the waste of one product becomes the input to create a new cash flow'*;
  - this approach is relevant to the upcycling of biological wastes affecting water quality as well as to ecosystem restoration efforts within the Blue Economy. The plastic waste initiatives for recycling and further upcycling provide similar cascading opportunities with greater potential for more inclusive growth;
- this kind of innovation for inclusive and regenerative businesses that cascade value in cyclical loops **inspires entrepreneurial minds and offers a broad platform of innovative ideas** that have been implemented somewhere in the world to demonstrate the potential for this approach. **The ideas within this approach to a circular economy are highly relevant for developing countries and places where job creation and distributed wealth creation (rather than centralised within large corporations) will be essential;**
  - these ideas are therefore highly relevant to marginalised communities and to South Africa's Blue Economy initiatives. The 'entrepreneurial' aspect of these activities also is outside of the business-as-usual role of government to grow the economy, and more likely to be within the realm of organisations prepared to nurture this kind of innovation and entrepreneurship. The programmes that WildTrust has implemented (eg Khutaza Business) together with partners (eg YES programme with training for Youth) are in a

position to offer this kind of entrepreneurial training for enabling SMMEs in marginalised communities.

- the term 'regenerative' describes processes that restore, renew or revitalise their own sources of energy and materials. Regenerative design uses whole systems thinking to create resilient and equitable systems that integrate the needs of society with the integrity of nature;
    - **Systems Thinking** is able to address complexity and is often counter-intuitive – eg economic growth does not address inequality if the economic principles behind the growth are centralised and degenerative – inclusive growth needs to be designed to be distributed and regenerative in the first place. This is an opportunity for economic growth in South Africa that truly benefits all, but it does need innovative thinking and a redesign/rethink of many systems – the most important of which is economic theory itself, and therefore all the business models and infrastructure investments, etc. that are based on this;
- a regenerative system makes no waste; its output is equal to or greater than its input; and part or all of this output goes toward creating further output — in other words, it uses as input what in other systems would become waste. The goal of regenerative design is to develop restorative systems that are dynamic and emergent, and are beneficial for humans and other species;
    - The Blue Economy Business Models that have been documented as part of this project are an example of what this kind of regenerative approach looks like in practice within the oceans economy, and in particular which have benefits to coastal communities.

3.3 Blue Economy: Economic Model

Blue Economy Models that enable regenerative and inclusive (distributed/networked) development need to be developed and tested. The key contribution of this project is therefore the development of a bespoke economic modeling tool that can asses and compare economic interventions, i.e. no action, versus conventional development, versus regenerative models that improve environmental status of coastal ecosystems, as well as contributing to more extensive human benefits.

The essential focus of the economic modeling processes is to compare regenerative, circular model scenarios with business-as-usual linear economy scenarios, and to calculate relative socio-economic and environmental benefits from an economic perspective. The focus of the modeling has been on two main focus areas:

- a Circular/Regenerative economy approach to restoring estuary health in Knysna;
- an ecosystem restoration approach for restoring ocean health in the proposed uThukela MPA

The tool has been tested in the two pilot areas and showed that it was able to:

- promote the sharing of understanding of different perspectives of development scenarios, provided a range of stakeholders are present in the workshop;
- develop new insights into development impacts in the blue economy;
- produce a clear picture of costs and benefits in a one-day workshop of blue economy development options, provided good preparation occurs prior to the meeting; and
- provides insights into wasteful approaches or more optimal approaches to production.

The successful use of the tool in a workshop depends on the buy-in developed amongst the stakeholders by the analysts prior to the workshop. The tool requires relatively accurate cost estimates of development options and also requires that stakeholders offer their perspectives on a range of social, economic and ecological impacts at the workshop. Both these datasets require that stakeholders invest in workshop preparation and participation. The purpose is the tool and workshop process is to inform decision makers of the implications of different development decisions. Initial results from its application for the case studies indicate that regerenative models have significantly greater benefits (3-6 times greater for human benefit in some cases) compared to business-as-usual options. The model shows that by investing in a more circular economy, there are substantial positive gains to be made. The detailed results are summarized in Section 3.4 of this report.

3.4 Blue Economy: Business Model

Our research has identified and documented sustainable Blue Economy **Business Models**, including 'proven and operational' SMMEs that not only fit within this guiding framework, but provide a practical realisation of the conceptual framework, in ways that can and have been implemented on the ground. All of the models are highly relevant and applicable to the South African context, and in particular to improving the health of coastal ecosystems, while providing economic opportunities for coastal communities. Our research has also documented new potentials for SMMEs - demonstrating a wealth of opportunities for sustainable and inclusive Blue Economy business models. The purpose of documenting these is to illustrate the key role that these can play in a national Blue Economy strategy and to motivate for their support and investment. Operation Phakisa focuses more on economic opportunities for larger businesses with limited attention to sustainable and inclusive Blue Economy opportunities that support marginalised coastal communities. In addition, there are concerns that many of the initiatives within Operation Phakisa may have negative impacts on ocean health and ecosystem integrity, especially estuaries. The business models demonstrate many Blue Economy opportunities that can benefit marginalised communities while also contributing to the health of ocean ecosystems and especially estuaries.

This component of this project aimed to answer the following questions:

1. What are the kind of business models for SMMEs that can promote a Blue Economy in a more sustainable and inclusive manner?
2. What are the potential opportunities for fostering these kind of business models?
3. What would be the implications for a national Blue Economy strategy if these SMME business models could be replicated and scaled?
4. What is required to build an effective enabling environment to replicate and scale up these business models?

Similar to the *economic models*, the *business models* essentially fit within two main focus areas for this research. These sustainable and inclusive Blue Economy Business Models for SMMEs are described in more detail in Section 2.44 and Section 4 of this report, and are summarised in Table 3 below. Replicating and scaling these models could be a siginificant contribution to the National Blue Economy with socio-economic benefits for marginalised coastal communities.

Table 3: Overview of sustainable & inclusive Blue Economy business models for SMMEs

Name of project	Proven & Operational	Location	Potential to Scale & Replicate
CIRCULAR ECONOMY MODELS			
WildTrust Wastepreneurs, Blue Crew & Ocean Bricks model	Wastepreneurs and Blue Crew yes. Ocean Bricks new potential.	KZN (Durban & Richards Bay)	Any coastal community with plastic waste impacting ocean health
Clariter model integrating SMMEs	Pilot scale proven & operational	East London	Yes for other industrial sites in coastal areas
Knysna and Hout Bay as circular economy (through ecological infrastructure and other opportunities for for upcycling waste)	Local examples of proven and operational ecological infrastructure (Langrug & Plankenbrug) has potential for application within Knysna and Hout Bay	Knysna, Hout Bay (as a start where there is interest and existing initiatives)	Yes - model can be implemented in many similar coastal communities where failed WWTW or polluted river systems are affecting eastuary health.
ECOSYSTEM RESTORATION MODELS			
WildTrust Ecosystem restoration model (including Treepreneur & Green for Life programs + Khutaza Business Model)	Yes locally	Coastal (KZN) and inland	YES excellent business model for replicating (integrate with ideas below)

ECOSYSTEM RESTORATION MODELS			
Greenwave & Seagreen	Internationally proven with open-source model & education	US east & west coast, Europe	YES (as above and can be integrated into Edible Seaweed model below)
Edible Seaweed	Local model to implement international proven model above	Saldanha Bay	Specific calmer bays eg Knysna
Eritrea Blue Economy model	Yes in Eritrea	New potential to replicate in some areas locally (eg Mtunzini)	Yes (integrating with WildTrust business model above)
Small-scale fisheries socio-economic improvement	Abalobi Hook to Cook & WWF kogelberg fisheries research project	Western Cape & Kogelberg	Yes (also possibly integrate with initiatives below)
Prevention of abalone poaching – alternative livelihoods	Some yes (but not currently active)	Abalone aquaculture, seaweed/kelp aquaculture, fishing tourism & diving (Hout Bay and Rooi Els)	Western cape mainly
Marine Protected Areas eco-tourism business models	Yes internationally and some locally	Mexico, isiMangaliso, Pondoland, WhaleTime	Yes – especially in local MPAs
Ecosystem restoration involving oysters	Yes (internationally)	New York & Gambia	Yes (potentially in Knysna and Hout Bay as a start)
Coastal resilience to climate change	New potential (internationally)	Island of Vieques (near Puerto Rico)	Salt water farming worth exploring.
Large scale ocean restoration (coastal)	Parts have been internationally	Local areas where feasible to be identified	Yes – opportunity to integrate the above models for combined large-scale ocean restoration strategy (coastal)

3.4.1 Overarching Model: WildTrust

The focus of this section is to distill an overarching Business Model that can be applied to all of the documented business models for SMMEs, and that fits within the guiding framework on how coastal ecosystems can support the blue economy that benefits local and broader communities. This project has identified that the WildTrust model is most effective and most applicable. Since the model involves a number of different components, these are documented here, while the key principles are summarised at the end of this section.

WildTrust's model is a proven and operational model for involving marginalised communities in the green economy – especially incorporating ecosystem restoration and circular economy initiatives. Their business model leverages funding from both government funded projects and Corporate Social Responsibility (CSR) funds to provide support and scaling opportunities to individuals that participate in their entrepreneur programmes. Their effective partnerships, social processes, and implementation models can be applied as an overarching model for the many Blue Economy Business Models identified in this project. WildTrust are also interested in expanding the ideas available to their entrepreneurs in terms of business opportunities that can restore ecosystems. The Blue Economy opportunities identified in this project, can leverage their extensive experience in implementing similar projects, and these can most likely be managed through their WildOceans programmes.

WildTrust is known for its innovation and ability to implement impactful projects in complex environments and their commitment to finding solutions that protect vulnerable people while also protecting the fragile natural environment. It is their enabling social processes, coupled with their 15 years of experience in building partnerships and effective programs, that is what makes their model successful. Their organisation is also best placed to implement this model for how coastal ecosystems can support the Blue Economy.

In March 2018, Wildlands Conservation Trust was renamed as WildTrust. Central to this repositioning was the launch of their WildOceans programme. This new programme consolidates their existing marine and coastal conservation work and enables the expansion of support for the ocean environment and the sustainable development of coastal communities and the Blue Economy. The WildOceans programme complements the WildLands programme activities, which has grown into a portfolio of terrestrial conservation and sustainable community development projects. Through both programmes WildTrust is working toward improving both the green and blue economies. Formed through a merger between the Wildlands Trust and the KwaZulu- Natal Conservation Trust in 2004, the Trust has grown into one of South Africa's largest and most influential environmental Non-Government Organisations.

The WildTrust programmes have three interlinked project themes:

- promoting and enabling South Africa's Biodiversity Economy;
- supporting and shaping Ecological Restoration interventions that repair and restore ecosystems; and
- catalysing and encouraging Sustainable Communities across the programme footprint.

With a core focus on inclusive growth, the WildTrust programme is improving the lives of thousands of South Africans whilst restoring and conserving the natural environment that supports them. Underwritten by partnerships with Government, Businesses and Civil Society, Wildlands continues to make a real impact, shaping the future of environmental custodianship and inclusive growth in South Africa (WildTrust website).

Through its WildOceans programme, the WildTrust works closely with local, national and provincial government to improve the knowledge of South African marine systems and to develop the capacity of a new generation of marine scientists, managers and policy makers. The WildOceans programme builds on the foundation built over the past four years, through the Whale Time, Ocean Stewards, Blue Crew, and other initiatives supported through the Blue Fund. In August 2018, Dr Jean Harris joined WildOceans to lead the development of this programme, with emphasis on supporting the conservation of the marine biodiversity of the western Indian Ocean; nurturing the development of the next generation of marine scientists, managers and policy makers; and **supporting the sustainable development of a regional Blue Economy**.

Figure 23: National Distribution of WildTrust Programs

WildTrust has national reach (which is relevant for their capacity to implement a national Blue Economy strategy) with networks in 60 communities across KwaZulu-Natal, Western, Northern & Eastern Cape, as well as Mpumalanga and Gauteng, transforming the lives of thousands of South Africans and improving their livelihoods through innovative sustainable programmes. These

programmes enable small business development, food security, conservation, recycling and restoration efforts; and offer a variety of experiential learning opportunities that provide tangible ways to activate sustainability with a focus on education, training and ambassadorship.

WildTrust Programs include:

- **Recycling** – Recycling for Life Programme;
- **Restoration** – Trees for Life and Greening your Future Programmes;
- **Small business development** – Khuthaza Business, Ubuntu Earth, Clothes for Life and Food for Life Programmes;
- **Education, Training and Ambassadorship** – Ubuntu Earth Programme;
- **Conservation** – Conservation SPACE Program (Species, People and the Conservation of the Environment) Includes eco-tourism, stewardship and species conservation;
- **Food security** – Food for Life Programme; and
- **Livelihood Support** – Trees for Life, Recycling for Life, Food for Life and Clothes for Life Programmes

Figure 24: Programmes of WildTrust Trust

Their Trees for Life and Recycling for Life projects focus on marginalised people, allowing them to access the Green & Blue Economy and earn a decent wage to support their families. WildTrust therefore have the experience to enable marginalised communities to access the Blue Economy. Not only are they committed to labour-intensive ways of managing protected areas, but also on building the capacity of partners to be improved stewards of their own land. They are playing an increasingly active role in the development of the biodiversity economy. They are ideally placed for this project to:

- distill effective models for a sustainable and inclusive Blue Economy that would benefit marginalised coastal communities;
- implement restorative projects for ocean ecosystems and, in particular, estuaries;
- develop a national strategy for their organisation to implement best practice in the Blue Economy (while leveraging existing partnerships with government to do so); and
- enable this WRC project to meet its objectives of integrating best practice into a national Blue Economy strategy – in the most effective way – in the light of the non-engagement by government in this project phase.

3.4.2 Model for Ecological Restoration

The WildLands Ecological Restoration project, with support from the **Department of Environmental Affairs: Natural Resource Management** (NRM) aims to restore degraded forest (using the trees grown by WildLands Tree-preneurs), grasslands, savanna and fynbos landscapes combating land degradation and adapting South Africa's landscape to be better prepared for climate change. Through revegetation and improved management of landscapes they work to re-establish ecosystem function and resilience. South Africa is a water-stressed country and so an important focus has been working along rivers to maintain and restore riparian forest systems that will prove most effective in adapting communities to climate change **by improving water quality and quantity**.

The initiative has predominantly been active in KwaZulu-Natal (Tembe, Somkhanda, the Mkuze Floodplain, Dukuduku in the iSimangaliso area, Richards Bay, Cornubia, Ndwedwe and Buffelsdraai in Greater Durban as well as the Upper uThukela catchment area). Other restoration initiatives have taken place in Port St Johns (Eastern Cape), Stellenbosch (Western Cape) and Hoedspruit (Limpopo). In addition, WildTrust coordinates the Parthenium programme, employing various small- and medium-sized black-owned busineses to control and eradicate this invasive alien plant species across the eastern seaboard of South Africa. This programme would benefit degraded coastal ecosystems, and any activities to restore river catchment health upstream of or within estuaries/bays are beneficial to a sustainable Blue Economy. Thus this programme would be expanding these effective models of **providing employment to local communities and ensuring that resilience is restored in landscapes that provide critical ecosystems services to thousands of people**.

Restoring South Africa's degraded landscapes is a much greater task than can be achieved by WildLands alone. They believe their greatest impact will be the developing and improving the restoration sector through **implementing benchmark restoration projects that will deliver meaningful benefits for both the environment and communities.** Expanding this kind of initiative (while integrating some of the innovative Blue Economy business models distilled from this project) could become a benchmark for regenerative and inclusive Blue Economy models that can be implemented effectively on the ground.

While this proven and operational model is easily replicable and scalable to support the Blue Economy, some of WildTrust restoration projects already directly benefit the Blue Economy. The Treepreneur programme has been piloted around Port St Johns. It is proven and operational in and highly applicable to marginalised coastal communities. There are opportunities to implement further coastal ecosystem restoration projects in that community.

TREES FOR LIFE

Trees for Life is one of WildTrust's oldest and most iconic programs. To address poverty and encourage mass-scale environmental action, Trees for Life rewards a national network of Tree-preneurs with various barter goods in exchange for indigenous trees grown at the homestead level. The programme requires minimal input and most Tree-preneurs make use of recycled materials, such as plastic two-litre bottles to propagate indigenous trees in their backyards. For more than a decade WildTrust has been bartering these trees for various goods received from their network of donors, including Qhubeka bicycles, JoJo watertanks, solar panels and Unilever health and well-being hampers**.** The trees are then planted into restoration sites that form the corner stone of WildLands restoration work.

The key geographic area of focus is across KwaZulu-Natal, with particular emphasis on eThekwini, Msunduzi and the Richards Bay Coastal Forest. The initiative is enabled by partnerships with national and local government: the DEA, Ethekwini Municipality, as well as private sector funding.

Trees for Life is a proven example that can enable people with very low input to grow a lot of trees and could do the same for Mangroves restoration or any restoration programmes where there is a demand for trees. For restoration work, it doesn't make sense to have a whole lot of people scattered across the landscape growing trees, it is better to employ a number of people at a central location to grow trees which is an SMME opportunity.

KHUTHAZA BUSINESS

Inspired by the grit and vision of WildLands Tree-preneurs, Khuthaza Business was launched in 2013 with Enterprise Development support from the South African Sugar Association providing business start-up grants and stock to Tree-preneurs in exchange for trees. The vision for the initiative is to 'Khuthaza' (encourage) individuals who display commitment, determination and business acumen to grow their entrepreneurial ideas and activities and to provide them with an opportunity to enter the cash and Green Economy. This project could be similarly applied within the Blue Economy.

As the project has evolved, WildTrust have been able to integrate a greater training and development component, providing the entrepreneurs with a better foundation from which to grow their businesses. Over the past year, with the support of Unilever South Africa, the Walmart Foundation, Makro, Global Nature Fund, South 32 and Container World, 46 Clothes-preneurs and 50 Unilever Mini- vendors

have been established with 62 learners supported by the Walmart Foundation being provided with accredited training and the support needed to develop a range of small businesses.

Key focus areas have included the Zululand Corridor, the Mkuze Floodplain, Ongoye, Richards Bay Coastal Dune and uMhlatuze areas as well as Msunduzi where there has been a significant and positive impact. These already include marginalised coastal communities.

Through the consultative workshop between WildTrust and this project's research team, one of the challenges identified with their Khutaza program was the lack of innovative business ideas from a green/blue economy objective. Some ideas presented during the Khutaza programme, like an innovative solar cooker product that uses woodchips of alien plants, were not successful. Business ideas that were identified by individuals in the programme were mostly not green economy ideas but general business ideas such as grass cutting, garden services, poultry, catering, tuck shops, beauty salon, hair extensions, wedding and functions. Unfortunately there is a saturation of these kinds of small businesses in these communities. Therefore innovative Blue Economy business models that can benefit marginalised coastal communities (as identified in this project) could be valuable for future Khutaza Business support programmes to match the entrepreneurial interest and support in these communities with relevant Blue Economy business model opportunities.

In addition, through a consultative workshop with WildTrust, opportunities were explored as to how their Khutaza Business, Trees for Life and Greening Your Future programmes could be leveraged to contribute to restoring coastal ecosystems. Innovative ideas such as ecologically engineered restoration infrastructure for pollution management in river systems (eg Hout Bay and Knysna examples identified in this project), as well as international best practice ideas were discussed as the kind of ideas that could be integrated. For example the Eritrea example could be replicated in locally relevant ways and the Mtunzini area was mentioned as an ideal place for such a project. Other opportunities for restoring mangroves or similar coastal ecosystems could also be identified.

FOOD FOR LIFE

The Food for Life project, with support from Nedbank, started in early 2016 with three **community hubs** established in the Msunduzi (Pietermaritzburg), eSikhawini and Cato Manor areas. The initiative aims to create a community culture that values and practices self-worth, self-reliance, enterprise, optimism, proactivity and a 'start with what you have, build on what you know' philosophy. Community members are empowered with climate-smart, permaculture technologies which they can use to improve food security, address malnutrition and reduce costs for themselves and their families. The vision is to create micro- entrepreneurs who use permaculture vegetable gardening to improve their own health and earn an income, while building the local economy through networked, ecologically-sustainable food production.

There are now a total of eight community hubs, including Msunduzi, eSikhawini, Ndwedwe, KwaJobe, KwaGumbi, Mandlakazi, Khula and Acornhoek in Limpopo. A total of 18 Future Farmers (agricultural graduates) have been given the opportunity to develop their skills through implementing this project. As for the initial hubs, the KwaGumbi, Mandlakazi and KwaJobe hubs now have developed seedling tunnels and demonstration gardens. In Khula, WildTrust are funding a local co-operative that is now producing seedlings for the local market. WildTrust's experience and learnings over the past years has seen the initiative restructured to include a training phase with a focus on shifting mindsets; a food security phase with the development of homestead gardens; and a small business creation phase, encouraging the running of the hubs as a small business entity.

There is an opportunity to explore how this kind of model could be applied to sustainable livelihoods within the coastal ecosystem environment. While this is not as simple as permaculture initiatives, their may be some local know-how in sustainable harvesting of seaweeds, or similar that could be explored. The Abalobi model for enabling more sustainable small-scale fishing could be applied within a larger overarching 'sustainable livelihoods' models such as this.

Owing to the poor water quality in many estuary/bay ecosystems, pollution farming initiatives (such as oyster farming in Knysna/Hout Bay or Kelp farming in relevant coastal systems) could be funded through donor funding. Upstream initiatives to curb water quality impacts at source will be necessary for the ideal result of enabling food farming (beyond pollution farming), and ideally into initiative such as Greenwave 3D Ocean farming (international best practice Blue Econony business model).

3.4.3 Model for an Inclusive Circular Economy

RECYCLING FOR LIFE

Recycling for Life started in 2010 in partnership with Unilever South Africa. The project focus is on enabling communities and individuals (Waste-preneurs) to improve their living environment by collecting recycling and selling it to WildLands. This aids communities and individuals in two ways, by creating much-needed income and creating a cleaner environment, particularly for those communities that don't benefit from municipal waste collection services.

The initiative is built around the consistent daily collection of recycling from Waste-preneurs, schools, recycling villages and local businesses across WildLands' operating nodes. The project has been active in Howick and Pietermaritzburg as well as the Greater Durban and Greater Richards Bay areas. With the recycling markets being down, the last years have been tough in the recycling space, but with the support from donors, WildLands are committed to growing their network of people in communities who collect and trade recycling as well as continuing their journey to develop, explore and innovate new and creative solutions to address the waste problem.

WildTrust is transforming the lives of thousands of South African Waste-preneurs who collect millions of kilograms of recycled waste annually. A total of approx 700 Waste-preneurs collected this waste which would have either gone to landfill or accrued in drainage lines and washed out to sea. This initiative has an environmental and social development impact. In the past, the waste has been bartered for bicycles, building materials and Health & Well-being hampers. The Recycling for Life programme continues to provide critical recycling service in unserviced areas in KZN, at the same time providing job opportunities for unemployed Wastepreneurs.

WildTrust supports many SMMEs in the Recycling space through their Wastepreneur Programme as each one is an SMME. There is also an organic move in certain communities where 10 people start working together to create a co-operative of Waste-preneurs. The Wastepreneurs are however dependent on WildTrust getting affordable transport to them. Transport to central point for recycling is a challenge. The market value of waste does not really cover the cost of operation. At this stage it is a fairly heavily subsidised model from WildTrust.

The Recycling for Life team have continued to grow their activities. Highlights have been the commissioning of a polystyrene extruder at the Cato Manor depot, support for the nurdle pollution clean- up response and the Durban Harbour "Blue Port" pilot project. Post 2019, they will be commissioning a Pyrolysis demonstration plant, which will convert polypropylene into diesel, and the formal development of 'Green' and 'Blue' brick projects which will allow for the use of non-recyclable plastic in the production of building bricks.

Recycling itself is a business, where waste is collected by WildTrust from Wastepreneurs and schools for benefitiation and repurposing. WildTrust offers scaling opportunities for each of these smaller scale operators. WildTrust, as an NGO acts as a 'big brother' to cover some of the over expenditure and the trials of business, as well as serving as a link for networking to scale for transport and other costs of recycling to be viable for the individuals involved. All of these things are somewhat subsidised by WildTrust.

WildTrust serve as the market link for the individuals. For example, a Wasterpreneur as an individual can only realise R0.10/kg, if he/she sells directly through to Consol Glass. This is because the volumes are so small and economies of scale not worth their while. But WildTrust can pool them together so that they realise a better price for their product and WildTrust provide the transport and support for those businesses to run. The downside of this business model is that the wastepreneurs are permanently dependent on WildTrust, unless someone were to take over this element in the community once it's big enough.

There are some examples where communites have done this and outgrown the need for WildTrust. These are examples where the community has learned enough to collect glass quickly enough so can directly bring in Consol. In the Midmar area – central waste will pay R2,50/kg cash. WildTrust pay R3,50/kg but it might take 2-4 weeks for the Wastepreneur to receive that in a bank account. The

Wastepreneur therefore has a choice of either receiving immediate cash (which the majority opt for because of desperation) or wait for higher amount from WildTrust. The choice depends on cash flow and resilience of the community. If the Wastepreneurs collect more than R5000 of plastic per annum, they get paid out a dividend from WildEnterprise.

There has been a challenge in the limited space of businesses and companies buying recyclable waste. Recycling businesses are very limited for example, only Consol Glass is a market for glass recycling and transport, logistics and distribution is a huge limiting cost.

As a result of this constraint, WildTrust have been developing waste upcycling innovations to further add value generated from waste collected – and also provide further opportunities for job creation. The following details were provided by Hanno Langenhoven of WildTrust in a meeting with our research team:

1. **Green Bricks Innovation**: WildTrust have now developed technology for turning currently unrecyclable plastic wastes into bricks for building. The plastics that can be upcycled include BOPP (plastic wrapper on coke bottle) currently unrecycable or difficult to recycle. The Green Brick process can convert this waste into a building brick without using cement. WildTrust have partnered up with an engineer to develop a low-tech solution that can be housed in a used shipping container – and therefore generate value for communities where it will be needed. The technology runs on single-phase power and is a hardy machine. Any SMME would be able to use it. The name for this technology is the GreenBrick.
2. **Ocean Brick Innovation**: A further innovation they have developed very recently (which has not yet completed all tests for applications) which can focus on addressing plastic waste that ends up in the ocean (but can be applied to any plastic waste) is the Ocean Brick/Blue Brick innovation. This converts any type of plastic into a building brick (refer to Figure 25 below). Any type of plastic waste that is picked up on the beaches can be ground up and mixed with sand to convert into an ocean brick. The process is indiscriminate about material as one can input anything into the grinder as raw material for the brick.
3. **Pyrolysis Innovation**: The third innovation that WildTrust have been pilot testing in collaboration with USE-IT, is the use of pyrolysis technology for converting polyprop waste into diesel. It is a replicable and scalable model. Pyrolysis is the thermal decomposition of materials at elevated temperatures in an inert atmosphere. It involves the change of chemical composition and is irreversible. The word is coined from the Greek-derived elements pyro ‘fire’ and lysis ‘separating’. In general, pyrolysis of organic substances produces volatile products and leaves a solid residue enriched in carbon (char). The process is used heavily in the chemical industry, for example, to produce ethylene, many forms of carbon, and other chemicals from petroleum, coal, and even wood; or to produce coke from coal. Upcycling applications of pyrolysis can convert biomass into syngas and biochar, waste plastics back into usable oil, or waste into safely disposable substances (Wikipedia, Pyrolysis). In setting up the innovations such as Pyrolysis, WildTrust can generate business units for upcycling waste that can stand alone. One Pyrolysis unit could employ 3-4 people. The output is diesel to fuel WildTrust’s fleet but could potentially result in sale of fuel.
4. **Upcycling cardboard**: this is a process of creating compost out of of 50% garden material, 50% K4 cardboard. It involves chipping the plant material garden waste, shredding cardboard anc converting it into compost over a period of 3 months. All that is required for this is a submersible pump and some minor construction. This is also a decentralised upcycling waste model that is applicable to marginalised communities where cardboard collection is centralised.

Figure 25: Plastic Brick innovation from WildTrust (Ocean Brick)

WildTrust, focusing on inland and coastal communities through the WildLands and WildOceans programmes, have extensive experience in collecting and recycling waste, in ways that involve marginalised communities through their Wastepreneurs programmes. WildTrust are now evolving their model away from simply collecting and recycling waste to a space of innovation, research and development, in terms of upcycling waste into further value for greater socio-economic and environmental benefits. By innovating within WildTrust's capacity to develop proven and operational models, they provide the opportunity for other organisations to benefit from their innovations. The core innovation described here is the development of technologies for turning waste into greater value, namely bricks (building materials) and fuel (through pyrolysis). These two innovations are very recent and have not yet fully completed all tests for market and implementation. However, similar processes and products have been implemented in other countries with success (eg plastic brick houses and pyrolysis of plastic to biodiesel).

In terms of a business model that can support SMMEs in marginalised coastal communities, the following is considered as a replicable and scalable model, based on WildTrust proven and operational Waste-preneurs & Blue Crew models combined with their Ocean Bricks innovation:

- ocean bricks are composed of 40% glass, 30% plastic (indiscriminate to types of plastic), 30% sand, no cement and no water. They are 3x stronger than normal brick. Ultimately the brick itself is 100% recyclable. The bricks are a very recent innovation and are still under testing for approval for building standards. The initial tests look very promising;
- Extended Producer Responsibility for plastic waste means that Corporate Social Responsibility Funds can pay for the bricks (equivalent amount of plastic as corporate generates for achieving a plastic neutral certificate);
- the technology for making these is developed and made in South Africa costing R250,000 compared to international technology at R1,5million;
- a single Ocean Brick will cost in vicinity of R4 to R5 to make. If receiving plastic waste material from a corporate, they will pay R3/kg for removing that waste. A single brick can be sold for R2/kg, making a profit while employing people. If WildTrust is picking up the plastic and making the brick, they can put a value to it;
- it is possible to put a processing unit right next to a landfill, then input plastic material is free and one is only paying a bit for the sand. Work is being done on a model to refine this so that one can crush building rubble (rather than use sand) to make a brick. It could also be possible to monetise the input stream, in that one can get paid to get rid of the waste as a service to someone. Then both the plastic and the building rubble could be monetised as well as providing a certificate that it is legally managed. This makes the business model even more viable;

- this model is scalable and applicable to coastal communities – including those that WildTrust works with already in Richards Bay, 20 communities in Durban, and other communities along the East coast. Requirement will be a community that has a landfill. Not all communities have landfills, but any kind of informal or illegal landfill – a collection point (where one does not have to worry about logistics). eg Makhuze town with normal electricity can plug into a normal plug as the processing unit operates off of single phase electricity. Makhuze will have enough waste around to collect. Umlaze also an option for a community, those upstream from Umgeni river. If there is enough waste to collect;
- one thousand bricks per day can be made from approximately 500kg of plastic per day or 10tons plastic per month. This is an amount of plastic that an average community of 240 people would produce;
- the Blue Crew in Durban on the Umgeni river collects 90 cubic metres of plastic in a week after a big storm event. An Ocean Bricks processing facility would add much value to the business model of the Blue Crew. Additional areas where the combined Blue Crew & Ocean Bricks model would be feasible include: Umbilo (river going into port), Umzamyame, and all plastic carrying rivers that end up in estuaries/beaches. The rivers that carry plastic flow through communitues that don't have service delivery as that is what changes a river into a plastic carrying river. There is sufficient plastic waste to pay-back the cost of the machinery within the expected time-frame that plastic waste will still be a problem; and
- the Ocean Brick model is also applicable in other coastal countries. For example, pristine islands and remote beaches far away from human habitation can operate a brick machine based on marine plastic washed up on beaches.

In terms of the Pyrolisis option; a theoretical budget for that system exists but is not yet available. It is however a potential model for greater value from recycling waste, according to theoretical budget. It could similarly be applied as a decentralised upcycling opportunity within a coastal community, with WildTrust support through funding. There would need to be a demand for the fuel generated as for the bricks example above.

There are also many opportunities for glass upcycling. In KZN, 20,000 tons of glass is imported every month in the form of beer bottles. Only 1000tons of glass every month is exported to consol in Johannesburg for recycling. The rest goes to landfills, rivers and environment. Glass doesn't float. In Cato Manor, there is glass everywhere. Glass is now a major component of a pebble beach. With a glass crusher one can upcycle that waste into ocean bricks, or into filtration media rather than sand for aquariums (eg uShaka marine world or household aquariums), for chemical filtration, or for sand blasters.

The replicable and scalable component of the Blue Crew model would be combining the innovative upcycling models described above within the larger WildEnterprise model as a best business practice model to stimulate local economic development whilst generating 'profit for non-profit purposes'. This is an excellent model for sustainable and inclusive Blue Economy business models involving SMMEs.

3.4.4 Model for Inclusive Business Development

WILDENTERPRISE - Underwriting Green and Blue Economy programmes
Established in March 2011, WildEnterprise (Pty) Ltd. is a black-owned social enterprise established to enable the development of the Green and Blue Economy-based enterprise opportunities emerging from the WildTrust activities. The network of Tree-preneurs and Waste-preneurs supported by the Trust hold a 60% shareholding in the company through the Wildlands Green Community Development Trust. The balance of the shareholding is held by WildTrust. Set up as an Enterprise Development beneficiary and recognised as an empowering supplier in terms of the Broad-based Black Economic Empowerment Code, WildEnterprise is an Exempt Micro Enterprise company with a B-BBEE level 2.

In line with their vision of empowerment, training has been a core service that WildTrust have provided to their teams and beneficiaries. The first of these trainings is a 12-week New Venture Creation skills programme which has been accredited through the ServicesSETA. In the first year of roll-out, over 60 northern KwaZulu-Natal community individuals were the beneficiaries of this

accredited training programme, supported by the Walmart Foundation. In order to increase their offering, they are in the process of extending the scope of their accredited training programmes to include a National Certificate in Plant Production through the AgriSETA and a National Certificate in Nature Conservation: Resource Guardianship through the CathSETA. Khutaza business participants receive business training and understand the principles behind business component, but don't necessarily have innovative business models to develop. Ideally they could integrate inspiring innovative ideas (whether through inspiring people or presentations on innovative business models) with community programs to respond to the needs of the community. Even ideas around how to network micro-entrepreneurs together to a SMME could be explored. Very few organisations are funding micro-entrepreneurs because it is difficult. Khutaza Business funding is for rural micro-entrepreneurs. Strategically, WildTrust could integrate the best of green and blue economy business innovation ideas within this programme. Khutaza Business programme has a new round of business development for 2020. It could pilot more innovative Blue Economy models for 2020 through these processes.

3.4.5 Existing Blue Economy Models

WILDOCEANS
The WildOceans programme follows the lead of the WildLands programme that has achieved innovative solutions for nature conservation while enhancing livelihood opportunities for vulnerable communities. In purpose, both programmes speak directly to the Sustainable Development Goals (RIO+20) of the Blue Economy advanced by the United Nations: 'improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities'. WildOceans integrates strategic action and innovative partnerships to support government and communities to take advantage of services that healthy oceans offer and improve the livelihoods of coastal communities, while protecting marine ecosystems and working to restore natural resources to a more productive state.

The WildOceans programme builds on three foundational projects:

- the capacity- building Ocean Stewards project currently has a Fellowship of almost 70 marine science students from five universities;
- aiming for both socio-economic and conservation gains the Blue Crew project has continued to support female Waste-preneurs based in communities adjacent to coastal environments, bringing the WildLands Recycling for Life project to the coast where much of the waste generated on land ends up; and
- the Whale Time project blends tourism product development (including guide training) with the generation of awareness and knowledge about the recovering (after near extinction from whaling) humpback whale population that migrates along the east coast. (One of the postgraduate students on this programme was supported through the capacity building component of this WRC project.)

MARINE PROTECTED AREA EXPANSION
Recognising the very low level of protection secured for South Africa's oceans, with less than 0.4% of continental Exclusive Economic Zone (EEZ) within marine protected areas (MPAs), WIldOceans launched an MPA Expansion advocacy project in June 2018. It aims to support and encourage government to meet its current MPA target of 10% by 2020, and to reach for the 30% that science indicates needs to be protected for resilience and sustainability. Underpinned by the #OnlyThisMuch campaign it has already made significant progress in building awareness for MPAs and the value of healthy oceans. The overall project also includes elements such as understanding the socio-economic value of MPAs compared to other uses of ocean space, and legal considerations linked to MPA proclamations and activities that pose a threat to the marine environment (such as oil & gas and marine mining).

BLUE CREW
Funded and supported by the Department of Environmental Affairs (DEA) as well as private-sector funding, the Blue Crew grew out of the Recycling for Life project. The Blue Crew is a group of women who are deployed every day on the Durban and Richards Bay coast, to collect waste from beaches

preventing it from getting washed back into the ocean. It's more than a beach cleaning exercise though; the objective is to grow a network of people, previously excluded from economic activity, who care about the marine environment and who are actively involved in making a difference by collecting waste on beaches and estuaries.

The Blue Crew assisted in numerous beach clean-ups during the year. These were supplementary to their daily work on beaches and mainly took place over weekends. The Durban Blue Crew were also among the first responders in the nurdle spill crisis in October 2017. For a brief time, from January to April 2018, the Blue Crew expanded from its normal four-person teams to include a massive team of 80 people. 50 people from the expanded team worked in the Durban harbour and 30 in the Cato Manor area where they mainly cleaned the Mkhumbane river, a small tributary of the Umbilo river that flows into the harbour. During the four months, 25 tons of waste was collected in a relatively small section of the Durban Port. Going forward, WildOceans are actively working to enable the expansion of, and permanent deployment of the Blue Crew teams to clean and care for the coastline.

In addition, cleaning rivers upstream of the ocean is aimed at preventing plastic entering the ocean. This includes wastepreneurs in eg Cato Manor stream which flows into Umbilo, cleaning of Mangroves on the Umgeni, and Wastepreneurs in Claremont which affect the Umgeni river.

3.4.6 Core Principles of the WildTrust Model

Core Principles of the WildTrust Model:

- WildTrust is a mature organisation (15 years old, originally as Wildlands Conservation Trust) with experience in innovation and implementation of these kinds of projects;
- WildTrust has the capacity and experience of building mature relationships - not only in developing partnerships with funders, but with government programmes as well as with communities;
- an extraordinary amount of work has been invested in social processes including: building relationships, partnerships and community involvemen andnot just implementing a technical solution, as there is a huge social component that improves the likelihood of success;
- partnerships are critical for connecting various options for funding as well as implementation As they build 'ecosystems' of partner organisations to fund and implement effectively;
- working with communities over the long-term must go beyond simple employment to fostering entrepreneurs and enabling communities to grow their careers while restoring ecosystem health on which the communities depend;
- a long-term vision is in place, as the organisation has been around for 15 years, as opposed to the shorter-term focus of 4-year cycles of government;
- environmental and social initiatives are combined with inclusive growth models;
- government, private sector and civil society are linked to enable the programmes on the ground - for more effective funding as well as organisations invested in the outcome;
- a 'big brother' network is provided to enable scale and access to markets for many distributed individuals and SMMEs, providing a network of scale and capital/operational funding to distributed, marginalised individuals and SMMEs that typically don't have access to these opportunities;
- training and community hub support is provided;
- an organisation that has the capacity and time to invest in such innovation is needed as shifting from business as usual to new innovations takes time;.
- two way communication with communities and organisations working with communities is vital to ensure that one is not just prescribing solutions but enabling communities to come up with solutions that work for them;
- experience in employing youth and marginalised communities on a large-scale is necessary, with systems in place to enable it (including effectively working with both the Expanded Public Works programme and YES programmes of government);
- operating as a company (NPC) and Enterprise Development organisation means it can do more than a typical NGO and, while also a Public Benefit Organisation – can ensure that tax money can be leveraged and applied to worthy projects;
- it is noted here that a business model does not have to be simple stand-alone SMME model, and that this kind of model which leverages different funding sources to generate networked

opportunities for SMMEs is critical to consider in helping to realise a sustainable and inclusive Blue Economy (just as much as it is critical for the green economy); and

- **therefore, WildEnterprise represents a new generation Enterprise Development company, aimed at using best business practice to stimulate local economic development whilst generating 'profit for non-profit purposes'**. This is an excellent model for initiating and supporting similar initiatives in the Blue Economy, particulary to support marginalised coastal communities.

3.4.7 The Water Hub – as a partner in research and innovation

The Western Cape Government in partnership with Stellenbosch Municipality are proposing the re-development of the site of the old Franschhoek Wastewater Treatment Works into The Water Hub (https://www.thewaterhub.org.za/). This initiative will see the establishment of a research, technology demonstration and skills development centre focused on advancing knowledge of how nature can clean polluted water and restore the health of our rivers.

The Franschhoek Water Hub is a new project that aims to inspire a new generation of leaders in water management in the context of rapid urbanisation and limited financial resources. While there are other similar projects around the globe, it will be the first of its kind to demonstrate state-of-the-art techniques and technologies suitable for the African context. Billed to be a centre of knowledge and learning, the Franschhoek Water Hub will connect multiple elements of the urban and regional water cycle and will explore new options for the treatment of contaminated water, including the use of natural systems and bioprocesses.The Water Hub aspires to become South Africa's leading research and training centre for developing appropriate solutions to contaminated stormwater and water reuse, with a major focus on developing solutions that promote more livable and healthier environments, and to have a strongly-established international reputation.

Through collaboration with government, research institutions and industry, The Water Hub will be instrumental in the promotion of:

- more liveable cities and towns;
- healthier rivers and wetlands; and
- increased food security.

The training and skills development provided at the Water Hub will seek to inspire a new generation of water leaders to forge new knowledge about green technologies in water resource management. The Water Hub can contribute research innovation and development regarding the water quality improvement interventions for estuaries (and related upstream rivers) thereby contributing to the Blue Economy. The Ecosystem Restoration Business Models identified for this WRC project would need further testing and development. Although some models have been proven in similar situations, additional research will be needed for applications such as those proposed for:

- Hout Bay;
- Knysna Bay;
- Motherwell canal;
- Durban Bay canals; and
- other potential sites.

This research can build on the success of the following projects:

- https://www.isidima.net/projects
- https://rethink.earth/biomimicry-builds-urban-possibilities-in-south-africa/
- https://www.biohabitats.com/newsletter/ecology-in-urban-planning/aa_biohabiats-projects-places-and-people/
- Ecomachine references: Todd, J. South Burlington Eco-machine Case Study,
- http://www.toddecological.com/data/uploads/casestudies/jtedcasestudy_southburlington.pdf and Omega Centre for Sustainable Living Eco-Machine case study, https://www.treehugger.com/green-architecture/omega-center-sustainable-living-eco-machine-living-building-water-treatment.html
- Ecomachine Plankenbrug reference: https://youtu.be/-Me9VY5UT60

It must be noted that the ecological engineering solutions proposed have been tested in other pilot projects in the Western Cape and are effective. The WRC has previously supported research into the effectiveness of similar ecological engineered solutions. Reports on these (Eco-Machines) can be found under Projects K5/2096/1 (13219) and K5/2479/3. (Dama-Fakir, et al 2016 and Harris et al, 2017). The Langrug and Plankenbrug eco-machines are also documented on the following page on the BiomimicrySA webpage: https://www.biomimicrysa.co.za/our-projects/

3.4.8 Cultivation and Wild Harvesting of Seaweed

Some of the business models identified in the previous phase of this project, were not yet fully developed, proven or operational. One such example was the Seaweed business idea. This model cannot be integrated into national strategy until it has been further developed and tested. This requires research and development outside of the scope of this project. A proposal has been submitted by the organisation to the WRC for further development of the concept. This section summarises the concept note for how this Seaweed project could be supported by the WRC for further development of this model into a viable business opportunity for the Blue Economy that benefits marginalised coastal communitities.

The commercial seaweed market is estimated to be worth $87billion (USD) by 2024. The West Coast of South Africa has an existing and largely untapped wild seaweed resource, providing an opportunity for community harvesting, administered under the Department of Forests and Fisheries (DAFF) - Community Rights holders. Local commercial cultivation has not yet been trialed. Optimal locations are restricted to protected bay areas, i.e. **estuaries** such as Saldanha Bay. The upwelling cells of the Benguela current are dynamic, thus providing all the nutrients necessary for growth. Seaweeds filter and clean seawater. They also sequester carbon (carbon offset/ climate change mitigation opportunities) and are a low maintenance marine crop. Vertical growing with integrated products (shellfish and seaweeds) have been successfully commercially tried and tested (eg Green Wave 3D Ocean Farming Model described in the Blue Economy Business Model report for this project). The nutritional and medicinal value of seaweeds is significant and well established. The variety of products derived from seaweeds ranges to include: medicine, foods, food additives, 'fixers' in paints, textiles (clothes), and more recently edible packaging, as an alternative to plastic and cardboard. The technical team (entrepreneurs and scientists) combined with established industry (ie The Saldanha Group) have the capacity and experience to establish the local cultivation of seaweed and further develop wild harvesting as well as to take these products in their diversity to market by:

1. *Ocean cultivation*- a partnership with, i.e. Saldanha Group, could trial variations of successful vertical integrated farming models from USA (Greenwave)/ Asia in local protected bay environments, as considered in respect of local species variation and combinations (within *2 years).*
2. *Wild harvesting* - the development and enhancement of community wild harvesting capacity would involve training inharvesting methods and opportunities, in products (options and varieties, identification and establishment) and linking markets and products (within *1 to 1.5 years).*

The Aims and objectives of this project will be:

- to demonstrate the commercial viability an assortment of edible seaweed cultivation in a protected bay;
- to investigate the viability of scalable models of vertical seaweed farming on the West Coast;
- to incorporate local entrepreneurs into seaweed farming models and opportunities;
- to empower local communities in the harvesting and processing of wild seaweeds;
- to test and trial the economic viability of source (sea) to consumer (food, or 'product') for a defined assortment of seaweeds and products, cultivated and wild harvested; and
- to tap into the 2024 projected $87bn opportunity.

The expected outputs and outcomes would include:

- resource utilisation, development and business creation;
- primary products envisaged: a variety of marketable seaweed food and food fortifiers/medicinal products (such as those identified in the Blue Economy Business Model report for this project);

- application of tried and tested international seaweed growing models in an adapted local context;
- documentation of theory, applications and successes to explore scalability and location replicability of seaweed cultivation;
- job creation, local community upliftment (wild harvesting), artisanal fisherman/ entrepreneur opportunity development;
- exposing RSA to currently untapped international market opportunities and assisting in providing alternatives to the local fishing community to mitigate against overfishing and job losses; and
- support additional processes to help sequester carbon thereby mitigating climate change.

3.4.9 What blue economy models inform a sustainable and inclusive economy?

A business model in its simplest form can be defined as a plan of how to produce goods and services by creating value and finding a consumer who is willing to pay for those goods and services. In the case of a Blue Economy, the production of goods and services is intricately linked to the ocean environment and surrounds. A Blue Economy business model however defers from conventional business models, with its focus on sustainability and beneficiation. A major characteristic of a Blue Economy business model is that the resources used to produce goods and services need to be derived from or contribute to the ocean, and in this case with direct or potential benefits to local communities. In this regard an effective Blue Economy business model that is sustainable and inclusive, most comprise of the following characteristics:

- It must be low skilled and labour intensive. For an inclusive business model to be regarded as effective, it needs to provide opportunities for a wide range of stakeholders, more specifically those that are poorly skilled. As a result business models that are labour intensive have a higher chance of achieving inclusivity targets. However, its important to note that such job opportunities need also to provide decent pay and good working conditions that are not exploitative. At the same time the models need to integrate skills development and training components for the long-term success of the initiatives, as well as for developing the skills needed to implement such initiatives;
- It must involve sustainable/regenerative harvesting, as a core requirement for an inclusive business model that is reliant on harvesting raw materials from the ocean or coastal areas. For example the business needs to demonstrate profitability, within the agreed sustainable quotas for the different ocean species in South Africa. An alternative approach to overcome this would be the use of artificial measures, such as aquaculture, which enables sustainable utilisation without negatively impacting the natural ecosystems. Such approaches in some cases may help to reduce pressure on fishing stock, and could lead to recovery of natural populations in the ecosystem. Good examples of this are included in this project's Blue Economy Business Models. These include regenerative ocean farming examples such as seaweed/kelp farming, 3D ocean farming, oyster farming and Eritrea mangrove farming as listed in Section 2.44 of this report. Abalone farming is another example that is currently being undertaken in various coastal areas, to meet the market demand for this highly priced product.
- It must not be capital intensive. One of the major challenges of promoting inclusive business development is the cost of capital. Many of the communities in the coastal regions that require support are extremely poor. Therefore, business opportunities that they can partake in should be based on innovations that are not capital intensive in relation to the infrastructure requirements or start-up capital. In the case of the seaweed harvesting project, it was found that effective community benefits would only accrue if they were to undertake partial processing of the kelp once harvested, before selling it to the larger processing companies, which increases the prices they can charge for their harvest. The WildTrust model for sourcing public and private funding within restoration economy, circular economy and ecological infrastructure models with the aim of benefiting both marginalised communities and the environment, is a useful one for considering how to cover the capital costs; and
- It seems that cooperative business models would be useful for enabling SMMEs to reach the scale required to make the business model viable.

3.4.10 What are the potential opportunities for fostering these kind of business models?

Based on the review of the business case studies for this project, there are numerous opportunities that currently exist and could be used to scale-up and foster such business models. First and foremost, is the existence of the fishing rights allocation policy for smallholder fisheries. This policy, even though it has not yet come into effect, presents an excellent opportunity for community participation, since many community members will be able to harvest legally based on their allocated quotas.

If well organised this could present significant empowerment opportunities. The slow implementation of the policy is however a major barrier, and the fact that communities would need to be organised into cooperatives or such legal arrangment may also pose a challenge. The best approach would be to identify entrepreneurial members of the community and prioritise them for capacity building and mentorship, so that they can be at the forefront of exploiting the business opportunities that may arise within their localities.

The Abalobi and WWF Kogelberg projects documented in Section 2.44 of this report address many of these challenges with great results for supporting both policy and the communities. The Abalobi model integrates digital technologies in the form of an App that enables networking of distributed small scale fisheries, as well as tracking of sustainable fishing practices. This kind of information technology innovation could enable similar processes in other Business Models.

Many of the Blue Economy business opportunities described require linking up with bigger value chains to maximise their potential. For example, in the case of WildTrust, with their Wastepreneuers, tremendous opportunities are unlocked by providing the transport infrastructure and scale for waste collection to be linked to recycling depots. This could be further enhanced by linking directly to manufacturers who use recycled materials to produce goods and services. Setting up upcycling processes within these communities would need to be through partnerships with organisations such as WildTrust and others that would be interested in investing in the upcycling processes (outside of the scope of the community themselves to invest in). Linking up with bigger value chains would enable knowledge exchange between participants on the programme, and would ultimately lead to the Wastepreneurs adding value to the materials they retrieve. The same applies to community members in the Western Cape, who have fishing rights. In the case of kelp for example, there are a couple of medium size enterprises that produce kelp products. Linking local entrepreneurs at the community level with kelp value chain, would empower them with skills that would ultimately be very beneficial in building their own enterprises.

Within the coastal communities immense local knowledge exists around sustainable utlisation of local marine resources, ranging from traditional techniques used for preserving fish, to deep knowledge of the benefits of marine resources, such as their medicinal values. Unfortunately, there are very few business models that are structured in a manner that seeks to unlock their wealth of knowledge in building sustainable enterprises. Many of the traditional practices of fishing communities, are often founded on sustainable utilisation of scarce resources, and thus present a strong foundation for building business models that could benefit communities for a long time. The processing of kelp into products has been traditional knowledge across many cultures around the world. It would be worth exploring ways to identify local indigenous knowledge and sharing models for developing effective kelp products.

3.4.11 What would be the implications for a national Blue Economy strategy if these SMME business models could be replicated and scaled?

The implications for these models include being able to:

- achieve targets in job creation and beneficiation;
- reduce unemeployment;
- transfer skills and knowledge between small and larger companies;
- contribute towards Sustainable Development Goals;
- contribute towards regeneration of ocean ecosystems (in particularly estuary health and biodiversity while still deriving economic benefit from the ocean, as opposed to other

economic activities that deplete ocean ecosystems, especially estuary health and biodiversity); and
- contribute to effective ways to implement the global guiding frameworks of: Doughnut economics, Circular Economy, Distributed Economies, Regenerative Economy, Resilience, Natural Capitalism, and a Blue Economy.

3.4.12 What is required to build an effective enabling environment to replicate and scale up these business models?

Based on our review, the different spheres of government have often been perceived as a barrier to the implementation of innovative business models. For example in the Hout Bay region, where former poachers were convinced to abandon poaching and adopt other legal activities, such as abalone farming, the lack of timeous government support for the initiative led to its collapse, even though it showed significant potential with strong community support. Similarly, a number of initiatives for cleaning up the river/ocean pollution in Hout Bay have been proposed by the community forums as well as academic researchers and civil engineering bodies. None of these have yet been implemented owing to lack of timeous government support. The complicated nature of siloed government departments dealing with issues like these that cross across many departments is also a challenge. It is impossible to ignore how everything is connected in water systems, as stormwater, wastewater and solid waste are all brought together in these systems. Yet government departments manage each of these separately, making implementation of solutions that cross all these departments very difficult. It is useful to explore the implications to each of these budgets by implementing one solution. These are the kind of innovative finance models that would be of interest to cash-strapped government departments. Similarly, at a national level, different government departments are responsible for different components of the oceans economy that are in themselves naturally integrated. It could be of great benefit for the different departments to work together on regenerative and inclusive strategies that benefit all departments simultaneously. For example, the DEA might both develop the oceans economy and protect the environment at the same time.

Important social processes such as developing long-term partnerships as well as skills development and trust building of community members, appears to be an important factor in the efficacy of such business models. High level of unemeployment in some communties, implies that some members have stopped trying to secure employment, and may not have therefore undertaken personal development to prepare them for the workplace. So there is need for capacity building of both technical and soft skills that can enable them to thrive in the work place. The YES programme that employs, trains and grows the capacity for further employment of unemployed youth (the programme that WildTrust integrates within their programmes) is an example of the kind of social processes required beyond basic employment. In addition, building trust between community members and between the community and other external stakeholders, is important for the effective scale up of such interventions. The WildTrust models as well as the Langrug Genius of Space project (BiomimicrySA project included in References) which was referred to as a model for replication in some components of Hout Bay and Knysna for example, provides useful lessons learned in integrating social, technical components as well as in engaging with government when implementing innovative solutions.

From a business perspective, scaling up these models, will require capital to produce high quality products, this will in turn ensure that such products are well received in the market. At the momemt the market for circular economy products, such as upscaled bricks and edible seaweed is still quite nascent. However, the trends show that interest in such products is increasing and the export opportunities to overseas markets for some green economy and blue economy products is also increasing, presenting excellent opportunities for scaling up such interventions

The models described in this report are worth exploring for investment that contributes to a sustainable and inclusive Blue Economy in South Africa.

Table 4: Summary of Key Findings from Our Research

Key Questions	Findings
• What are the kind of business models for SMMEs that can promote a Blue Economy in a more sustainable and inclusive manner?	• low-skilled • labour intensive • sustainable/regenerative harvesting • must not be capital intensive • innovative models for investing in capital leveraging both public and private funds. • cooperative models
• What are the potential opportunities for fostering these kind of business models?	• small-scale fisheries policy approved • linking up SMMEs with bigger value chains to maximise their potential • models that unlock wealth of knowledge within communities for sustainable harvesting
• What would be the implications for a national Blue Economy strategy if these SMME business models could be replicated and scaled?	• cchieve targets in job creation and beneficiation • Reduce unemeployment • transfer skills and knowledge between small and larger companies • contribute towards Sustainable Development Goals • contribute towards regeneration of ocean ecosystems, in particularly estuary health and biodiversity while still deriving economic benefit from the ocean
• What is required to build an effective enabling environment to replicate and scale up these business models?	• a clear regulatory framework • cross-silo cooperation and timeous support bygovernment • skills development and building of trust in community members • capital investment for scaling up these models and to produce high quality products .

4 INTEGRATE INTO THE BLUE ECONOMY STRATEGY

4.1 Integrate Best Practice Business Models Into National Strategy

The aim of this project has shifted to the integration of best practice models into WildTrust's National Blue Economy Strategy because:

- innovation that brings in new approaches requires a significant number of social processes therefore civil society is often required to play a key role in effective implementation of programmes and projects on the ground;
- social processes and not just technical solutions are key components of the model;
- an economic model that accounts for more than just profit to shareholders (or GDP) - is inherent to what an NPC like WildTrust does;
- a strategy needs to be developed and implemented by organisations that have the experience, maturity and effective results on the ground in similar types of initiatives.
- WildTrust is in the best positon to take the model and framework forward into a national Blue Economy strategy as it complements the work of Operation Phakisa, MPAs and MSP, while at the same time addressing a critical missing component of these; and
- working effectively with an organisation to develop a national strategy plus integrating their effective model of implementation, can serve as the urgent need for action on the ground, while also serving as proof of a concept that will hopefully lead to interest by government for adoption within a later national Blue Economy strategy (If not, WildTRust works with government partners to implement in any case).

The Blue Ports Project serves as a model for how to integrate different components – the guiding framework, the overarching model, the innovative business models, the experience of WildTrust, partnerships with government and private sector, as well as integration into relevant local and national

policy (ie Estuary Management Plan), while generating Blue Economy opportunities for coastal communities, in ways that restore ocean health with a focus on priority estuaries.

New potential ideas based on this project include some highlighted above but mostly:

- Blue Port project plus model for replication in other Ports/Bays;
- Blue Crew expansion to other relevant sites in coastal communities (as described above);
- monitoring of water quality into bays – components, flows, trends and sources;
- eco-machine type project for Durban Bay canals, as well as PE, Hout bay and Knysna;
- mangroves initiative for Treepreneurs;
- citizen science initiatives involving Apps for waste monitoring and collection (for upcycling/recycling) as well as for pollution monitoring; and
- pollution farming and into ocean farming as alternative livelihoods programmes

In addition, the Knysna and Hout Bay ecological restoration and circular economy opportunities that were identified in this project, could be implemented through a business model such as WildTrust and be integrated into a national strategy.

4.1.1 Blue Crew and Ocean Bricks – From KZN to National

The Blue Crew and Ocean Bricks circular economy model decribed above can be replicated and scaled to a national strategy, starting in KZN. This can be replicated and expanded to apply to collect and upcycle waste on beaches, in estuaries and river mouths. Ideally the upcycling depot locations would have at least 2-3 resources to enable the waste to be processed and upcycled effectively:

- 3-phase power;
- sufficient space for trucks to turn and proper infrastructure (approx. 2 rugby fields of space);
- brick machine, glass crusher and bailer so that the materials collected can be processed into more economically-viable transporting quantities or upcycle them; and
- if sufficient space, then a fourth component to increase the viability of the upcycling hub would be composting of garden waste or alien plant matter and unrecycled cardboard together
- the cost to set up such a depot would be in the region of R3million.

Each one of these resources would anchor a number of collection crews around it. The locations would also need to be close to where a river mouth/estuary and beach are located together, as well as being close to a community (three sources of waste plus must be able to employ local community). Such waste hotspots already identified, just in KZN include:

- Umgeni
- Umlazi
- Blue Lagoon
- Phoenix (Umhlanga River)
- Cato Manor (Umbilo river system)
- Cato Quest
- KwaMashu.

There is already infrastructure located at Cato Manor/Cato Quest (including a brick machine soon). Team sizes are limited by the amount of waste around. Supervisor/team ratio is 1/25. Ideally teams collecting data and contributing to waste research at the same time.

The same Blue Crew located to collect waste can also work to eradicate aliens integrated through the ‘Adopt-a-River’ programme. There is more space to expand on what the Blue Crew does. This would be a strategy similar to the Blue Ports project described below.

4.1.2 Blue Ports Project – from Durban to National

This section describes a strategy to expand the Blue Crew project to Blue Ports project, and then to expand the Blue Ports project beyond a solid waste focus to include water quality impacts from sewage and inorganic effluent. The strategy is to focus on the Durban Port and then replicate it within Richards Bay and other areas. At the same time, other innovations could be tested within these other estuaries (eg ecosystem restoration and ecological infrastructure for managing water quality):

- Richards Bay
- Knysna estuary
- Hout Bay
- Saldanha Bay
- Swartkops
- Sundays
- Umhlatuzi
- Umhlanga
- Umkomazi
- And others in a phased approach.

Description of Challenge

The Port of Durban or Durban Bay is a modern, well-equipped and highly industrialised port, and one of the busiest in Africa. However, the port also acts as a trap for plastic waste, carried along the rivers and storm water canals flowing into the port. Durban Port is one of the national economy's key assets and an important resource for the citizens of Durban to access for recreational, educational and social activities. While the Port of Durban supports all these activities and uses, it has over the past century become increasingly degraded as a result of a variery of stresses placed on this sensitive ecosystem. Despite the level of degradation, the estuary of the Port of Durban remains an important ecosystem that provides vital nursery areas for a number of marine species and has important feeding and roosting areas for a number of bird species, both resident and migratory. However, diminished and exploited habitats are less able to support healthy populations of estuarine and marine organisms and this renders them less able to perform the environmental, social and economic goods and services on which coastal populations depend for their livelihoods and protection. Conversely, the continued health of marine and estuarine systems, and consequently that of the human systems that depend on them, relies on maintenance of high quality habitat (Paruk, 2019).

The port faces a serious challenge concerning the large volume of solid waste that is discharged into the port on a daily basis through the network of stormwater outfalls from the city that drain into the bay. The combined catchment area of the rivers, canals and stormwater drainage systems that drain into the port is over 220km in size and the unfortunate reality of that is the port waters have been on the receiving end of a large volume of litter, effluent and sewage that is discharged into stormwater reticulation system within the numerous residential, industrial and informal areas of catchment. The effluent and waste that is discharged into the port not only impacts the aesthetics of the port, but also has a profound impact on port users, the marine and bird life and alarmingly, it is posing a significant risk to port operations (Paruk, 2019). Durban Bay is one of the priority estuaries identified by Van Niekerk (2019), in her contribution to this WRC project – identifying priority estuaries that are affected most by water quality impacts.

The biological significance of estuarine habitats such as Durban Bay is widely documented. Although there are over 70 estuaries between the Mozambique border and the Mtamvuna River, most are associated with small catchments and are frequently closed. The few larger river systems, like the Tugela and uMkhomazi, close infrequently but are strongly influenced by the steep KZN coastal gradient which results in strong freshwater and sedimentary transport and inputs, and consequently different characteristics, functions and significance. The major and most diverse estuarine systems in KZN are Durban Bay, Richards Bay, St Lucia and Kosi Bay. These can all be considered sub-tropical in contrast to systems further south which tend to be more temperate in character. Durban Bay has historically possessed the only sheltered, marine dominated, permanently tidal sandbank habitat in the central KZN region (Paruk, 2019).

Unfortunately the Mangroves of the Bayhead Natural Heitage Site and intertidal habitat within the port are being considerably impacted upon by the massive ingress of plastic waste into this sensitive region. After the Umgeni river mouth, the Port of Durban is the most impacted upon estuary by the ingress of solid waste from the catchment. The recent rainfall has inundated the port waters, including the Bayhead natural Heritage Site with waste that profoundly impacts on the marine and birdlife. Transnet National Ports Authority (TNPA) has deployed teams to clean the port but the magnitude of the volume of waste is overwhelming, especially after a major rainfall event (flooding in Durban 2019).

WildOceans have repeatedly stepped in to help address the impact of the onslaught of waste on this fragile coastal ecosystem and have assisted tremendously with collecting and removing waste that

has been washed down to the port from the catchment. Should the actitivies of WildOceans Blue Port project be expanded, this initiative will assist in improving the estuarine habitat and enhancing the ecological status of the system.
The WildOceans Blue Port project was established in 2017 with the specific goals of:

1. progressively reducing the amount of plastic waste flowing into the port through the implementation of an Adopt-A-River project focused on the key rivers and canals flowing into the port (ie impact is not just the port – envision this to expand to the rivers and canals that feed into the port);
2. progressively minimising the amount of plastic waste escaping the port into the ocean, by removing the waste building up in the port;
3. returning the Durban Port ecosystem to a healthy, functioning ecosystem;
4. recording, tracking and analysing dynamic waste movement and compostion including trends spatially, temporally, and most prominent branding on waste in order to determine potential uses and different interventions at different points both for strategic intervention as well as for awareness and advocacy initiatives such as sustainable waste removal and reduction in waste leakage into the marine environment;
5. providing employment to marginalised communities within the coastal communities around the port – specifically reducing youth unemployment;
6. establishing partnerships (external and internal) as well as stakeholder buy-in within the port to enable investment in programmes (eg adopt a spot section) as well as transparent communication with all port users; and
7. testing new low cost technology such as passive interventions that are more sustainable (eg boom and sea bins), containment structures and hopefully bioremediation interventions. These technological solutions could ultimately be SMME opportunities, starting with solid waste – long term to address chemical and biological wastes. Stakeholders on the bay could fund the capital costs of such SMME setups.

Until WildTrust intervened there was no coordinated waste collection effort in the port and only reactive clean-ups. There was also no cohesive communication within users of the port. The Nurdle spill in 2017 sparked this whole programme. Reaction to it was slow and there were no contingency plans in place to manage the spill. Nobody knew what to do. It was the same with waste impacts on the port after massive flooding. WildTrust stepped in to coordinate and implement continuous cleanup and monitoring programmes integrated with their recycling processes.

WildTrust identified the areas in the port that needed attention (hotspot areas) and, through better understanding of the system developed a waste collection framework and model. They engaged with stakeholders as port users because they have all the information and could identify and enable passive intervention points. WildTrust, through their partnership with the YES programme, was able to employ the team on the ground. Using their waste monitoring and research (including weather and access monitoring), they can strategise at the beginning of each month where to focus clean-ups. Waste is collected actively currently and will be collected passively too in the future. Waste collected is sorted (into 7 categories) on site into one-ton bags and weighed. Data is collected including brand monitoring. Recycling trucks come to collect the waste once per week to take it to the depot. If they could have a depot at the port, they would be able to upcycle the waste on site and cut the big cost of transport. The waste could be upcycled into Ocean Bricks or through Pyrolisis into fuel. Richards Bay would be more viable for upcycling to bricks because the technology is already there.

WildTrust are able to address this problem because:

- they are a Not for Profit Company (NPC), not caught up in politics. Plus an NPC structure enables them to provide value and run an effective company with focus on social outcomes not on making a profit. In addition the PBO (Public Benefit Organisation) model means that donors know their tax money is being used wisely. At a technical level, the NPC structure allows WildTrust to receive donations and enterprise development funding. NPC structure also enables them to receive income from recycling and enables the WildEnterprise model;
- it's a multi-partner project and they already have the partnerships in place. They are not threatening in this place. They have a lot of buy-in from public and private partners. Their partner donors are invested in the outcomes as it is important to their work and their business;
- they have access because of their private and public partnership to be able to employ people easily and manage them as well;

- they also have a history in the recycling and waste management place. The collection and recycling component both are managed by WildTrust. If the recycling component were managed separately it would be more challenging;
- they have geographical knowledge of the port in-house and water quality knowledge;
- they have almost 15 years of experience as WildLands and have delivered successfully;
- they have existing projects in the port – eg Whale Time -connections and existing relationships in the port;
- they can facilitate what to do with the waste, including innovative upcycling options;
- They are willing to take risks and have partners that are willing to take risks with them;
- they have experience in engaging and mobilising marginalised communities thus transforming the conservation space, working from ground up and grassroots level and getting communities involved in it from the beginning;
- They have experience working on large public works type programmes and have the payroll systems; and
- they are invested in the career paths of the employees – not just providing a job for the short-term.

To date WildOceans have:

1. secured funding from the South African department of Environmental Affairs to contract 'adopt-a-River' focused local community-based teams – 80 pax for 8 months;
2. secured funding to enable the employment of a Blue Port team, working in and around the Port to collect plastic waste. This team currently consists of 51 youth employed on a 1-year contract and funded through the NEDBANK Youth Employment Services (YES) team. YES is one of the streams through which CSR has been prioritised in South Africa – directed from Presidential Administration. This programme employs youth in a one year programme so that, after the year, youth are more employable as a result of hands-on work experience as well as the training involved. WildTrust has partnerships with Nedbank to work effectively to employ YES programme participants. WildOceans has expanded the Blue Crew to the Blue Port project by integrating YES programme employees from 4 to 50 people;
3. established a waste processing and recycling depot in the Cato Manor community, to sort, bulk and despatch the material collected through the Adopt-A-River and Blue Port teams; and
4. piloted a new innovation that allows for the unrecyclable plastic waste to be upcycled into plastic bricks – 'Ocean Bricks'.

To date, WildOceans have achieved the following:

1. the Adopt-A-River team collected 43 000 kgs of mixed waste over a 4-month period, mid-January through mid-May 2019, including over 21 000 kgs of plastic waste;
2. the Blue Port team have removed over 16 000 kgs of waste from the port, including over 7400 kgs of plastic waste;
3. the Cato Manor depot processed and despatched over 28 000 kgs of plastic waste for recycling; and
4. the 1st plastic brick machine has been commissioned at the Trust's Midmar recycling depot. This has been fully operationalised since 1 July 2019, processing 1 000 kgs of un-recyclable plastic waste into bricks. The plastic waste used in these bricks has been sourced from inland and ocean waste collection projects.

The Adopt-A-River and Blue Port Projects are both young projects, and thus the key challenges relate to the learnings associated with getting these projects going, including:

1. developing an understanding of waste dumping and accrual points along the rivers and canals flowing into the port and establishing effective access routes along these rivers and canals. Replication or scaling of these projects requires a good understanding of waste system locations and dynamic flows before starting;
2. developing an understanding of the waste movement and accrual patterns within the port and enabling effective access to the areas of the port where waste tends to accumulate. Operationally it is challenging as it is more difficult to work in such a big system than originally anticipated. Access to part of the port where waste is accumulating is difficult as one cannot get there by road. One needs a boat to access these;

3. the technology challenges associated with developing the plastic brick concept, which is a new innovation being developed in association with local engineers;
4. tackling only solid waste does not significantly impact the water quality. It also means that there are hazards involved in collection of the waste as a result of pollution (eg sewage on the plastic waste). It is an important start and will enable interventions for treating water quality, but something needs to be done around the sewage and industrial/shipping effluent that enters the port; and
5. changing weather patterns with increase in flooding has been a challenge to the collection processes as well as compounding the waste problem in the Port and contingency plans need to be in place for future floods and failures in wastewater treatment works. Waste accumulating in rivers exacebated because of non service delivery – becomes a WildTrust problem in the Port when flooding happens.

WildOceans Blue Ports project contributes to reducing plastic pollution through circular economy initiatives and achieving a healthier environment by:

1. collecting large amounts of waste from the communities, waterways, canals and beaches that would otherwise end up in the port and ultimately flow into the Indian Ocean. They have made a particularly significant contribution in communities that don't benefit from municipal waste collection services, and in the port, as well as in stopping plastic leakage into the ocean.;
2. supporting and enabling the recycling of as much of this waste as possible;
3. pioneering up-cycling innovations that address the challenge of processing plastic waste that cannot be formally recycled;
4. innovative partnerships with government and the private sector to effect change. The Adopt-A-River and Blue Port Projects are supported by the South African government, local and international corporates;
5. enabling large-scale employment in the environmental sector that creates a shift in environmental consciousness and behaviour change in these families;
6. actively organising and supporting public clean up and awareness days; and
7. actively driving print and online media advocacy and awareness, including a social media waste awareness campaign, entitled 'WASTE_UPRISING'. WildOceans Marine Protected Area advocacy campaign @OceaniMPAct on Facebook and Twitter are examples of the impact that can be made with these platforms. Also see @WildOceansSA.

In the context of plastic waste, the ultimate aim of circular economy initiatives is to design waste out of systems through technical and biological nutrient cycles, focusing on the re-design/re-thinking of products. In the meantime, we also need dramatically to reduce the leakage of current plastic waste into the ocean. This project aims to tackle the existing technical cycle of plastic that is directly impacting our oceans.

A circular economy today also focuses on the notion of 'Waste = Food'. This project is founded on this approach and adds another level. According to Alexandre Lemille (2018) of the African Circular Economy Network: Poverty = Waste, and this is something that this project aims to address. Poverty is an externality of our system that also needs to be designed out, the same way as we plan to design waste out, circularly.

Acting at the critical point where current plastic use enters the oceans in South Africa, WildOceans aim to expand on their circular economy initiatives that turn waste into opportunities:

1. by generating economic activity in marginalised communities through employment of previously unemployed youth through the National Youth Employment Services (YES) project;
2. by driving and supporting the recycling of plastic waste collected through the Adopt-A-River and Blue Port interventions; and
3. by supporting the development of innovative technologies for the collection and up-cycling plastic waste into long-term use valuable items (ie 'Ocean Bricks') - closing the loop on single-use and short-term use plastics that are entering our ocean through canals and streams.

WildTrust is a large regional environmental non-profit organisation and has built its success through innovative partnerships. To enable the effective delivery of the Blue Port project, WildOceans are partnering with:

1. YES (Youth Employment Services) - YES is a collaborative economic enabler led by business with government and labour for youth. The Blue Port team are all employed through this programme;
2. Transnet – is a state-owned company that is custodian of ports, rail and pipelines in South Africa. Transnet National Ports Authority (TNPA) is responsible for the safe, effective and efficient economic functioning of the national port system, which it manages in a landlord capacity. It provides port infrastructure and marine services at the eight commercial seaports in South Africa – Richards Bay, Durban, Saldanha, Port Elizabeth, East London, Mossel Bay and Ngqura. It operates within a legislative and regulatory environment governed by the National Ports Act (Act No. 12 of 2005);
3. the WILDTRUST has a long-standing partnership with Transnet Port Authority and both organisations are committed to finding innovative solutions for cleaning up the port and supporting each other wherever possible. They will be working together at five sites for this project, where Transnet are funding perma-booms at four of these sites, and deploying teams to remove the waste from these booms;
4. three other (private sector) partners: Nedbank, Grindrod Bank and DOW, all of which are co-financing the existing Blue Port Project; and
5. BiomimicrySA is an advisory partner on this project.

This project will help build partnerships with others through the dissemination of the information gathered from this project to port stakeholders, encouraging future investment in the reduction of plastic leakage and through the 'WASTE_UPRISING' social media campaign which will encourage greater citizen engagement.

This project already feeds into the existing Durban Bay Estuarine Management Plan (EMP) prepared by the National Department of Environmental Affairs in collaboration with Transnet National Ports Authority, KZN Economic Development, Tourism and Environmental Affairs, eThekwini Municipality, Environmental Resources Management (ERM) and Marine & Estuarine Research (MER), as well as the Draft KZN Coastal Management Programme. **This project therefore already fits within National and Local Government policy and related legislation.**

The objective of the EMP is to provide a new approach to management of the negative factors impacting the Durban port, including waste leakage, and to provide a vehicle for cooperation, change and motivation for new appropriate solutions to these existing problems. The legal requirement of the EMP is to preserve the functioning of the Durban Port and greater Durban Bay ecosystem, which requires measures to be implemented to prevent further deterioration. This vision will be generated through engagement with a wide range of stakeholders including government, private and public organisations to test active and positive interventions. This project will feed into the greater monitoring and reporting achievements of the EMP that will be submitted to the Minister, as outlined in the Integrated Coastal Management Act (Act No. 24 of 2008).

The model is easily scalable and replicable for the following reasons:

1. there is massive unemployment in South Africa, particularly amongst the youth. The South African government and corporate sectors have a strategic focus on creating youth focus employment opportunities, and so there is likely to be ongoing funding available to support the employment of Adopt-A-River and Blue Port teams. The project currently employs 50 people, but the waste problem is large and could employ so many more;
2. as more companies recognise the tax benefits of employing youth into the sector through the YES programme, these opportunities are likely to increase therefore, the human resources needed to implement the work are readily available;
3. because these are entry level jobs, the wages are not high, and so their recruitment is affordable for most businesses;
4. this project will enable the introduction of additional 'waste trapping' devices that will optimise the activities of this labour force. Many more passive waste trapping systems and beach cleaning rakes and sieves can be applied to the massive waste problem;

5. the ‘Ocean Brick’ trial will allow the WildTrust to develop the ability to include ocean plastic into its plastic brick production process. Additional depots and locations of such technology will enable scaling up of the project – not only in Durban but in many similar locations nationally; and
6. finally, through strong collaboration with Transnet National Ports Authority, the low-cost technology and ease of scalability, this project makes for a good case-study that can be replicated in other ports, not only in South Africa but in other developing countries across the South West Indian Ocean region and globally, many of which exhibit the same degradation, with, as a result, similar stresses placed on their sensitive ecosystems.

This project will build on the platform established through WildTrust’s existing Adopt-a-River and Blue Port projects, through three core interventions:

1. innovative waste trapping:
    - additional low-cost technology interventions will be strategically set up in five safe sites where they can collect the most surface plastic waste, and where there is access for ten members of the Blue Port team to collect ten days a month and send to the depot for sorting and end-use application;
    - Transnet are currently in the process of installing four permanent perma-booms across stormwater outfalls at various sites in the Durban Port where waste leakage is known to accumulate in large volumes (Map 2). The perma-boom is a vertical membrane constructed of heavy-duty PVC-coated polyester belting which prevents the passage of floating pollutants and debris. They are heavy duty, solid buoyancy booms used for permanent or long-term debris containment. They have a 5-year life span;
    - an additional containment structure will be set up in the canal system known as ‘Mullet stream’; a canalised system that is connected to stormwater reticulation network that drains part of the Durban CBD. Despite the small catchment, a significant amount of the litter is discharged from this system. The installation of this containment structure will replace the vertical metal columns that currently remain in the stream and add horizontal bars that will be able to trap waste before it is submerged. These will be made from fibreglass tubing;
    - the ten Blue Port crew deployed to these sites would include two team leaders who would be promoted into these roles to enable the effective co-ordination of the group, split into two teams servicing the five new collection points. The teams would access these sites both by land and by boat. These individuals will receive training to safely remove the waste from these structures using industry-quality pool nets. They will also learn how to monitor the waste accumulation; and
    - a more practical boat specifically designed to collect waste is needed. An example boat in Cape Town is a barge that can move people and waste floating in water can be collected . Specifications for the boat are available and WildTrust are ready to get it made. They just need the funding to enable it.

2. end use applications that are economically sustainable:
    - the WildTrust will trial the development of an Ocean Brick innovation that upcycles a mix of sand, glass and previously unrecycled multi-layer post-consumer plastic waste. The waste collected by the Blue Port team, which includes waste that previously could not be recycled, becomes a beneficiation that addresses a local demand for building materials to enable housing and other infrastructure. 5000 Ocean Bricks will be produced per?.

3. monitoring and reporting:
    - a cell phone application will be developed that allows for easy collection and transfer of data including the geo-location of the waste collection, the type and amount of waste collected, and collection effort. This application will also contain a built-in public interface that allows resource-users within the port to report sites of waste accumulation that the Blue Port team can be deployed to, to actively clean the waste.
    - ultimately, this information will be used as a case study for presentation and dissemination to identify waste movement dynamics within the port and serve as a public participation and awareness tool.

To ensure sustainability of the project WildTrust will also do the following during and beyond the project cycle:

- communicate the results with stakeholders, both personally and publicly to encourage and if necessary, pressurise, stakeholders to invest in these technologies and human resources for creating a healthier port. The application, once developed, can continue to be used and therefore WildTrust can continue to disseminate results as long as they have teams on the ground, and public involved;
- investigate during the project cycle the viability of SMME models stemming from this intervention eg the building of the structures themselves, the collection and sale of recycling, and the Ocean Brick development and sale; and
- integrate the costs of this intervention into future funding proposals. They are constantly looking for further investment into a healthier Blue Port and the more successes that can be demonstrated, the greater the likelihood of success.

The project is piloted within the Durban Port at location indicated on the map below.

Map 2 below: Robust perma-booms have been proposed for deployment in strategic locations, taking advantage of the natural watercourse leading into the Port. These booms have been denoted in Map 2 as multi-coloured circles. Permaboom locations correspond respectively to: Dry-Dock (Yellow), Lavender Creek Mouth (Pink), Mullet Stream Tributary (Blue) and at Ports Car Terminal (Green). Additionally, a containment structure has been demarcated for upriver of Mullet Stream Mouth, denoted as a blue square.

Map 3 below: In addition to the leakage prevention barriers proposed, active waste removal is currently undertaken by the Blue Port team, who have been deployed around key pollution landing points within the port such as the Wilsons Wharf (1) Point Yacht Club (2) and, the Maritime Museum (3) highlighted in pink. The Bayhead industrial zone (4) is highlighted in yellow, and the Natural Heritage site (5), which regularly has large volumes of plastic waste accumulate on the sand banks highlighted in turquoise. Blue Port deployment regions can be observed in Map 3.

Figure 27: Map of Durban Port indicating locations of perma-booms

Figure 28: Plastic removal at key landing points

Additional Strategic interventions that are scalable and need to be explored :

- opportunities for treating the sewage and other industrial effluent that affects the quality of the water entering the port. Ideally these should be addressed at source, but there are opportunities to explore some of the Eco-machine type innovations that were documented in the Blue Economy business models for this WRC project. This type of intervention could be funded by a combination of private and public sector funding, implemented by WildTrust while employing marginalised coastal communities. The WaterHub and WRC could partner in the related research required. This partnership can begin to integrate the ecological restoration work that WildLands is well-known for, into estuary restoration, starting with projects like the Durban Bay. This could even evolve to integrating mangrove restoration in parts of the bay (integrating mangrove treepreneur type programmes if feasible). This could be expanded to more innovations (such as beekeeping and other ideas from the Eritrea business model and could be replicated in other estuaries where Mangrove restoration is necessary and feasible);
- generation of WRC proposals around monitoring and assessing water quality content and sources to best be able to design appropriate solutions. There may also be an opportunity for organisations like Isidima (with the experience of designing and implementing ecological infrastructure solutions like Eco-machines) to submit a proposal to WRC for the research and development phase for such interventions at the incoming canals or alternative locations. Isidima has already been contacted to meet with Prof Janine Adams to investigate the opportunities for a similar system to be developed for the high-sewage load in the Motherwell canal entering an estuary near Port Elizabeth. These ideas are similar to the ones proposed for Hout Bay and Knysna Bay. A strategic approach would be to identify many of the potential locations for these, to generate water quality and flow data, to establish what kind of research and design work is required for these, to use the Economic Modeling process from this project to determine the economic benefits, and to establish innovative business models for how marginalised coastal communities could be involved in these restoration processes – most effectively managed through an overarching model (of public/private partnerships and social processes) that WildTrust is experienced in;
- another way of utilising marginal communities by engagning the many fisherman that are around critical areas of Durban port most of the day, and could be engaged with to fulfil a ‘citizen science’ or monitoring role for Durban Port related projects;
- many other innovative opportunities for collecting and upcycling the solid waste (plastic and glass) as well as treating sewage and industrial effluent and shipping/port related effluent that affects the water quality of the Durban Port. There could be an opportunity for a Biomimicry Open Innovation process around these challenges (as currently being sponsored through WRC Project 2981);
- expanding any or each of these ideas is the beginning of a potential broader strategy at ecosystem restoration of the estuary (Durban Port). The strategy would apply the effective models of WildTrust, the innovative ideas for upcycling (circular economy) solid waste, and restoring ecosystem health through ecological infrastructure initiatives, as well as potentially evolving to integrate pollution farming and then sustainable seafood/seaweed farming in these areas or other estuaries;
- replicating the Abolobi and WWF Kogelberg business models for managing small-scale fisheries as another component of the strategy in relevant estuaries around South Africa;
- effective social processes that the WildTrust model depends on when working with communities. Instead of suggesting business models to communities, there are principles behind these models that could be explored with communities, and, working with them, they could co-create innovative business ideas for circular, regenerative and inclusive business models;
- the business models identified in this project to see which ones could be applied in specific locations. There is a willingness from WildTrust to further explore these opportunities which could then be developed into funding proposals for either growing existing programmes in new locations, or establishing new programmes in existing relevant locations. The opportunities are large for WildTrust to play a key role in effectively generating a national strategy for a Blue Economy that benefits marginalised coastal communities while restoring ecosystem health. WildTrust can then work with their partners (as they do for Durban Bay) to integrate these within local and national government policy such as Estuary Management Plans or similar; and
- opportunities for preventing solid waste from entering the port (address the problem closer to source – within communities before it enters waterways). At a much higher level there is a

need for awareness raising programmes with consumers and retailers to encourage better purchase decisions when it comes to plastic waste generation. There is also a need to target the manufacturers to change away from problematic packaging as well as to be responsible for ensuring circular economy processes are in place for the waste that their products generate.

4.1.3 Knysna as a Circular Economy

Although this is listed as a Circular Economy model it also incorporates ecosystem restoration as a key component in terms of restoring ecological infrastructure that can function as waste upcycling mechanisms.

The Economic Modeling report for this project describes the work done to compare broader socio-economic benefits when applying ecologically engineered systems to the upgrade of the Knysna wastewater treatment works (WWTW). The Human Benefit Index indicates a four-fold greater benefits than conventional approach. One of the reasons is that the ecologically engineered options provide opportunities for job creation including new potential SMME business models. The opportunities are described below.

Estuaries have the capacity to generate large values through servicing tourism, residents and industry. For example, in Knysna there is a large estuary user population with some 44,000 daily users, who together discharge some 3 955m^3 of treated sewage effluent per day into the estuary. The Knysna Estuary is also estimated to contribute some R3billion per annum in elevated property values (Turpie 2005, prices escalated), a premium which generates some R18.7 million per annum in elevated rates for the municipality. Furthermore, the Knysna Estuary attracts some 1 million annual visitors (Mander 2013), generating a GGP of some R2.3 billion (2011 prices) and is believed to responsible for an additional R1 billion spend (2005 prices) in broader South Africa (Turpie 2005).

However, access to Knysna's ecosystem services is becoming increasingly contested. The waste water discharged by the residents and tourists to the estuary degrades the estuary ecology, creating eutrophic conditions and making the estuary less attractive for recreation. A degraded estuary could lead to a 24% to 32% reduction in foreign and local visitors, and an associated R260 million decline in visitor spend (Turpie 2005). This magnitude of loss is further substantiated by McKenna (2010) who estimated that Durban lost some R100million per annum in tourist revenue due to the withdrawal of Blue Flag status for 4 beaches in 2008 – a substantial cost for a reduction in only one ecosystem service – the certainty of bathing water quality. In addition, water quality led to the collapse of the Knysna oyster fishery.

The unhealthy competition between estuary users is reflected in the state of estuaries, where 60% of all estuaries in South Africa are in a fair to poor condition. Management and/or efficient use of estuaries is critical to sustain the existing flow of benefits to society, and without effective management the potential costs to society are significant and potentially unaffordable.

An opportunity therefore exists to consider the inefficiency of estuary use, and establish a new circular economy, one wherein the waste outputs of production are used as inputs for new enterprises, thereby reducing the current pressures on estuaries.

This Knysna example is useful as a replicable model at a national scale where many of the large and small estuaries are densely settled, and where ecological functionality is increasingly compromised.

The urban settlement in Knysna generates outputs, such:

- Large volumes of treated effluent being discharged to the estuary leading to high nutrient loads, eutrophication, algal blooms and poor conditions for tourism and residents.
- Non-point source pollution with high bacteria loads and chemical pollution entering the estuary via storm water culverts or through the streams draining through the town.

This polluted water creates a health risk and other costs to society, such as odours and unsightliness. These impact negatively on the tourism economy, property values, the municipal rates base and the conservation value. Aggravating this problem, is the poor management of wetlands buffering the estuary. Many of problematic streams have wetlands at the estuary entry points, with the capability of

filtering bacteria and assimilating excess nutrients. However, the poor management of these wetlands reduces their effectiveness considerably. While the outputs of the current Knysna economy are discharged to the estuary, there are several opportunities for employing underutilised assets of Knysna.

Knysna's Waste Water Treatment Works as a centralized toilet, expresses the nutrient load of Knysna. The 'treated' effluent released from the WWTWs contains high conductivity, ammonia nitrogen, suspended solids, high chemical oxygen demand (COD), excessive sludge, heavy metals, chemical pollutants, grease/fats, EDC's (endocrine disrupting chemicals) e.g. caffeine, glyphosate and ibuprofen, EC's (emerging contaminants), foul odour, flies, pathogens and pharmaceuticals. The challenge is how to 'filter-feed' and remediate this human load. Nutrients like nitrates and nitrites, phosphorus, sulphur, calcium, magnesium, iron, copper, zinc, boron and other micro-nutrients can be cycled out the water and into soil building processes.

Knysna spends R15 million/year taking waste to Cape Town/Port Elizabeth. 40% of landfill waste is generally organic, so taking organic waste out of the chain can save the Knysna Municipality R5 million per year (reference interview with Natasha Rightford, Sep 2018).

Establishing a virtuous cycle and supporting circular economy in the Knysna system would serve to challenge the conventional model of development, where natural capital erodes with the growth of built capital. Estuaries are too valuable keep on investing in a downward spiral.

There are a wealth of potential opportunities for sustainable and inclusive business models within the broader concept of Knysna as a circular economy. Some opportunities exist simply around ecosystem restoration (equivalent of ecological infrastructure). Examples identified include:

- the buffering wetlands could be enhanced to assimilate excess nutrients, filter bacteria and the associated wetland plant fibres produced could be used in a craft industry. These wetlands could also be employed as solid waste traps, preventing solid waste entering the estuary.
- the streams draining the urban environment could be restored to reduce nutrients and bacteria loads, prior to the water arriving at the estuary. Furthermore, management of the streams could reduce downstream flooding, which is the reason for dredging some of the wetlands.
- many of the culverts could be converted from single-purpose storm water removal systems, to include waste assimilation facilities, supporting buffering of the water.
- the estuary environment could be enhanced by algae farming, which would capture and reduce high nutrient loads.
- the old oyster farm infrastructure embedded in the estuary could be reactivated to farm oysters or some other shellfish, to further clean the estuary. Early production may only be safe for animal feeds, but could improve as the process of cleaning takes place. Excessive nutrients could be recycled into food and algae products.
- management of streams, wetlands, fisheries and algae farms would be labour intensive and could employ local households.

In addition to these, there are opportunities to upgrade the existing wastewater treatment works with ecologically engineered alternatives. The current waste water treatment at the Knysna Waste Water Treatment Works is undertaken by a largely engineered system, managed by municipal employees and consultants. There is only one by-product of the works, and that is partially cleaned water, that is supplied to a local golf course. This too is produced and distributed by engineered works. This project has proposed an alternative method (also considered in the economic modeling component of this project), one that includes water polishing using ecological infrastructure, such as wetlands, floating wetlands and a series of ponds. This infrastructure is labour intensive, in terms of establishment and maintenance. Furthermore, this method is able to produce a suite of by-products, such as plant fibres for craft, fishing for protein and guided birding – all of which are labour intensive, and can add value to local entrepreneurs.

It must be noted that the ecological engineering solutions proposed in this project have been tested in other pilot projects in the Western Cape and are effective. The WRC has previously supported research into the effectiveness of similar ecological engineered solutions. Reports on these (Eco-

Machines) can be found under Projects K5/2096/1 (13219) and K5/2479/3. (Dama-Fakir, et al 2016 and Harris et al, 2017). The Langrug and Plankenbrug eco-machines are also documented on the following page on the BiomimicrySA webpage: https://www.biomimicrysa.co.za/our-projects/

The Eco-processing approach is able to involve local marginalised communities, in supporting wastewater management in Knysna. The WWTW is adjacent to a low income community, called Hornlee, which could be the source of local entrepreneurs. It may also be worth considering involving, the Khaylethu community, which will have Xhosa craft weaving skills, that could add value to the plant fibre produced in the works. Additional opportunities include:

- the craft fibre production could be linked to one of several décor companies operating in Knysna.
- the birding could be linked to many of the commercial guiding operations active in the garden route.
- fish could be traded into the Hornlee community, which already trades fish harvested from the Knysna estuary.
- the construction of the wetlands and their maintenance, could be supported by the Knysna Municipality.
- the remediation ponds could become a great birding offering and there is also potential for an edutourism offering related to the vision for Knysna to 'function like a forest' and exposing and educating tourists to how this is playing out in the urban landscape.
- there is also the opportunity to explore the creation of artificial oyster/mussel beds, and in discussion with SANParks, this would definitely need to be a locally-informed plan and design which would require some research as to ensure any potential environmental impacts are addressed. Dedicated oysterbed remediation within the estuary could generate oyster shells that can be applied in compost for soil building. In addition oyster meat can be fermented to remediate toxins that the oyster has filtered and thereafter harvest bioavailable nutrients similar to fishhydrolysate.

Additional potential business opportunities in upcycling waste/wastewater in Knysna that would otherwise impact ecosystem and estuary health include the following that have been distilled for Knysna communities:

Ways to ***process organic waste into soil*** thereby protecting estuary & ocean:

1. Effective Microorganisms (EM's) – cultivating locally beneficial microbiomes
2. Making bioballs & biobags - made from EM bokashi - digest sediment, sludge and underwater chemical contaminants in both fresh and saline waters.
3. Bokashi applied to organic waste – circular economy community practice which rapidly converts organic waste into compost for soil enhancement
4. Vermiculture – secondary processing with vermicompost as sale-able byproduct
5. Compost applied to gardening – secondary processing
6. Generating growing media & mulch – to add to soil enhancement with compost
7. Biochar – to process downed wood, sequester carbon and establish stable microbiomes

Ways to ***protect water health of estuary and ocean***:

1. Create stormwater buffer gardens – micro-wetlands, treatment gutters, mycopads
2. Create aquatic remediation gardens – floating wetlands and sediment digestors
3. Plant tree gardens – as stormwater management and wastewater management opportunities
4. Create nurseries – for growing endemic fynbos, riparian, estuarine, wetland and forest
5. Apply ecologically engineered Ecomachines for wastewater treatment – including estuarine plants as well as algaes and underwater grasses
6. Restore estuary health using 3D ocean farming concept of Greenwave (refer to international best practice in Section 4.1 below)

Ways for ***human potential*** to take responsibility for human load:

1. There are many unemployed people from rural communities in need of work
2. Knysna can activate a large number of soil warriors – get bokashi circular economy operating all over Knysna
3. Knysna can also activate water warriors –well trained and kitted, water protection units – 4/5 per team to work with a body of water e.g. Salt River, Bongani channel over an extended timeframe until the job is done – they clean, clear & put in living technologies e.g. wetland buffers, waterfalls,

gabion restoration – whatever the river / waterbody is asking the team - guided by a bioremediation practitioner and in so doing protect the water.
4. People warriors – communication & behaviour change
5. Municipal–private partnerships for funding these initiatives with benefits for tourism (thanks to healthy ecosystem and excellent waste treatment /management services)
6. Also a potential to explore landowner rights – river rights partnership – nature rights and influencing landowner's responsibility to support ecosystem services.

The lists above illustrate a vast potential for business models that can contribute to Knysna as a Circular Economy while generating opportunities for SMMEs within marginalised communities. The WildTrust Trust business models for ecosystem restoration and waste upcycling would be an effective model to apply to the above ideas. It is recommended that a partnership be explored between BioWise and WildTrust for exploring how these business ideas can be realised.

4.1.4 Hout Bay as a Circular Economy

Although this is listed as a Circular Economy model it also incorporates ecosystem restoration as a key component in terms of restoring ecological infrastructure that can function as waste upcycling mechanisms.

This project applies biomimicry systems thinking and multi-stakeholder processes to develop a way forward for integrated catchment management in Hout Bay, Cape Town. The project takes a systems perspective on complex urban challenges, and is focused on creating Blue Economy opportunities related to water and waste. These opportunities are underpinned by social and ecological well-being objectives such as fairness, participation, creativity, opportunity, freedom, sustainability, stewardship and regeneration. This project employs a process of a shared learning journey in Hout Bay to discover the genius of the natural world (biomimicry) that can inform new and innovative ways to clean the environment that we depend on. This links together the people of Hout Bay as stewards of their shared environment, enhancing the beauty that people treasure while creating business and job opportunities that are underpinned by social well-being objectives.

Hout Bay is divided into several neighbourhoods of different incomes and degrees of formality. There is a curious but fragile sense of camaraderie and community present among its residents. Its population of about 60,000 has several organisations that work to deal with challenges in the area and to promote peaceful relationships amongst the locals. The area has been described as being a microcosm of South Africa i.e. a mini version representing the general demographics and economic inequalities of the social fabric of the country as a whole. (Hout Bay reference).

In 2014, Actuality as the local representative of Cordaid SA embarked on the development of a project in Hout Bay . The following statement of intent was developed for this project:
"A way to clean the environment and improve living conditions was proposed as a way to link together the people of Hout Bay, enhance the beauty that people treasure; while creating quality opportunities and social upliftment."

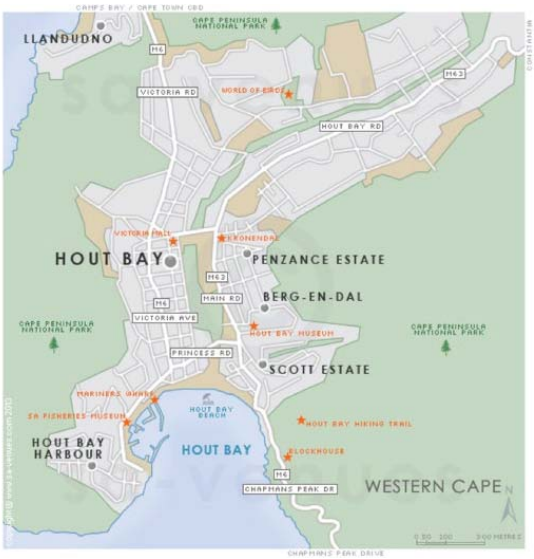


Figure 29: Map of Hout Bay

A number of ideas have been proposed previously based on the recognition of the challenges currently being faced by the Hout Bay community. During a number of community workshops the following core challenges where identified:

1. river health - Reduced flow of upper parts of Hout Bay / Disa River – diversion of water at the source of the river to areas outside Hout Bay, changing natural water flows (storage dams on mountain)
2. rapid urbanisation and local urban management – lack of a clear strategy for how to manage growth of Hout Bay, in both formal and informal areas which is reaching a critical tipping point due to proposals to expand low-cost housing to the edge of the river corridor.
3. Imizamo Yethu and Hangberg – inadequate water and sanitation infrastructure in these two informal settlements in Hout Bay leading to **high levels of pollution entering the river and then into Hout Bay.**
4. **the wetland area** is disconnected from the river – so it cannot perform natural ecological functions like managing floods and cleaning water that **enters the sea**
5. **local fishing industry collapse**, poaching and difficulties with quota system
6. **solid waste**: generating large amounts of waste, waste mixing with stormwater and ending up in the sea and on the beach, generating value from waste is limited
7. **wastewater treatment works** discharges raw untreated sewage into the sea.

Linked to these challenges, several overarching key themes were identified as key objectives and outcomes in this project. These themes include:

- *developing innovative ways to clean the environment using green infrastructure with a focus on managing waste water, storm water and solid waste – it's impact on river health and ocean health;*
- working on inclusive and sustainable ways for improving living conditions for all residents in Hout Bay using green infrastructure projects;
- *addressing the need for social upliftment for the area's residents through creation of opportunities for sustainable jobs and enterprises linked to the design, implementation and management of green infrastructure projects; and*
- enhancing the natural beauty of the area which residents treasure, *ensuring the continued growth of the tourism sector in the area and job opportunities associated with thi**s***.

The Disa River's clear pure waters rise on Table Mountan, but it reaches the sea as the most polluted river in the South Peninsula**.** The Hout Bay River (sometimes called the Disa River) is the only river that rises on Table Mountain that is not extensively canalised in concrete. It remains, in fact, a more or less intact riverine ecosystem from its Table Mountain headwaters to its flood plain, estuary, seasonal lagoon, beach and sea. However, the Hout Bay River, though currently in a degraded state, could be rehabilitated. One major advantage is that it is contained within one Municipal Ward.

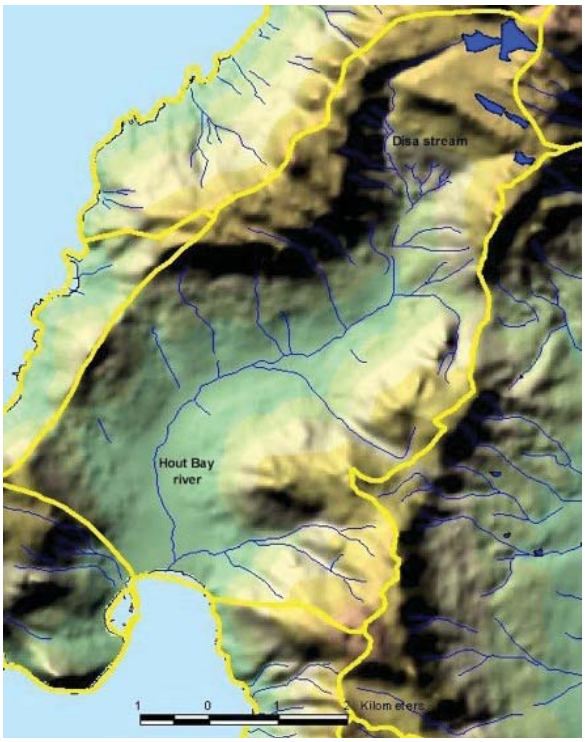


Figure 30: The Disa River, Hout Bay

Figure 31: A sign warning bathers not to swim in the Disa River lagoon mouth in Hout Bay.

The sources of pollution in river systems include:

- a mix of greywater/blackwater and stormwater from informal settlements such as Imizamo Yethu (IY) and Hangberg.
- contamination of stormwater by sewage through a number of informal systems
- waste from the World of Birds (less of an issue)

Pollution affecting the Hout Bay harbour includes:

- the pollution coming from solid waste (litter), wastewater outflows and boat pollution into the harbour
- effluent from fish processing factories located on the harbour

- sewage from the main Hout Bay WWTW which is dessicated and emitted to the ocean – relying on the oceans "natural processes" for clean up.

The impacts of these include:

- health issues for communities living in and around the informal wastewater systems and the rivers and those using the river systems
- affect on aquatic systems – rivers and oceans (severe reduction in fish populations although overfishing also a contribution)
- economic losses such as affect on tourism, as well as on local fisheries especially small-scale fishing

From the Actuality/Cordaid project described above, a number of potentials were identifed to restore river health and the health of the bay. These were revisited in a Workshop with the Hout Bay River Catchment Forum held as part of this WRC project. The list below summarises a comprehensive list of opportunities identified that could contribute to a regenerative and inclusive Blue Economy for Hout Bay. WildTrust's business model for implementation could be applied in this case and it could form part of the implementation of a national Blue Economy strategy.

Opportunities identified include:

- ecologically engineered solution (John Todd) or alternative civil engineering solution for intercepting and treating waste below the informal settlement - Imizamo Yethu (IY) – that can generate low-skill employment opportunities for both its implementation and its operation and even has the potential as an eco-tourism site
- living corridors: ecologically engineered systems/tree wells for treating wastewater as it moves along corridors within Imizamo Yethu, similar to what has been applied in the Langrug Genius of Space project (Dama-Fakir, et al, 2016)
- Blue Disa Project: a critical intervention of a silt trap (will also improve flow of the river) combined with an ecologically engineered solutions (Eco-machine or similar) for treating wastewater in the HoutKappers section of the Disa River (similar to the Plankenbrug eco-machines referenced below). These can generate low-skilled employment opportunities for implementation and operation also including eco-tourism opportunities.
- Hangburg greywater treatment systems (similar to Langrug system referenced above)
- Hout Bay WWTW upgrade (with opportunities to apply ecologically engineered solutions as per a Todd Ecological case study from Burlington Vermont (John Todd), but with local expertise now specialising in these solutions. This could more readily be accepted by local community and serve as low-skilled employment opportunity.
- opportunity to apply WildTrust Wastepreneur model and Ocean Bricks/Pyrolysis upcycling innovations (described in the body of this report) at the new Materials Recycling Facility (MRF) to be implemented in Hout Bay with potential business opportunities for marginalsed coastal communities.
- abalone/oyster farms within Hout Bay (opportunities around cleaning pollution in the bay using oysters – similar opportunity described for Knysna above) and then to possibly farm abalone in the bay.
- ecologically engineered solution (Eco-machine) for treating waste from World of Birds (optional if this waste is still an issue)

It must be noted that the ecological engineering solutions proposed have been tested in other pilot projects in the Western Cape and are effective. The WRC has previously supported research into the effectiveness of similar ecological engineered solutions. Reports on these (Eco-Machines) can be found under Projects K5/2096/1 (13219) and K5/2479/3. (Dama-Fakir, et al 2016 and Harris et al, 2017). The Langrug and Plankenbrug eco-machines are also documented on the following page on the BiomimicrySA webpage: https://www.biomimicrysa.co.za/our-projects/

Figure 32 below summarises the potentials identified. Some of which are illustrated and described in more detail thereafter.

Figure 32: Potential ecological engineering and ecosystem restoration models to restore river and ocean health in Hout Bay

Some of these potentials are illustrated and described further below.

Figure 33: Potential ecological engineering models for treating pollution from World of Birds to restore river and ocean health in Hout Bay

The images of Eco-machines included in Figure 33 above are proven and operational eco-machines from the Omega Centre for Sustainable Living in New York state used to treat sewerage while serving as a beautiful community centre – known as The World's Most Beautiful Water Treatment Plant (John Todd). This model could be applied to treat the pollution from the World of Birds while serving as an additional eco-tourism visiting centre of the World of Birds. The system would not only clean the water pollution but also offer opportunities for low-skilled job creation.

Figure 34: Potential ecological engineering models for treating pollution downstream of IY to restore river and ocean health in Hout Bay

The images of bio-remediation designes included in Figure 34 above are designs for Eco-machines for the Langrug informal settlement in Franschoek for treating highly polluted waste-water and stormwater while serving as a beautiful community centre and job creation opportunity (Langrug Genius of Space project). This model can be applied to treat the pollution downstream of the informal settlement Imizamo Yethu in Hout Bay. The system would not only clean the water pollution but also offer opportunities for low-skilled job creation. This is not the only solution, and alternative civil engineering solutions to intercept this pollution and treat it using conventional WWT technologies have been proposed by a Civil Engineering body (SAICE Marine). They have proposed a similar WWT system as applied in Spier wine estate and this alternative could also be implemented here. The complex political, social and technical aspects of implementing something like this are difficult to address and are outside of the scope of this project. These ideas are simply documented here as potential sustainable and inclusive Blue Economy business models that can not only be implemented in Hout Bay, but could be replicable in other similar polluted river catchments affecting ocean health. WildTrust's overarching model, would be an effective way to organize the implementation thereof as part of a national Blue Economy strategy.

An alternative or complementary option would be an Eco-machine type solution similar to what was applied in the Plankenbrug river in Stellenbosch (referenced below and further documented here) applied near the HoutKappers section on Disa River with potential additional job creation for Houtkappers that is essentially gardening. The Hout Bay River Catchment Forum (HBRCF) have indicated that an additional Eco-machine would be necessary to be integrated within the new proposed plans for the Disa River Nature Park. The potential site has been identified by members of the HBRCF in the image below.

Figure 35: Potential site for ecomachine along Disa River

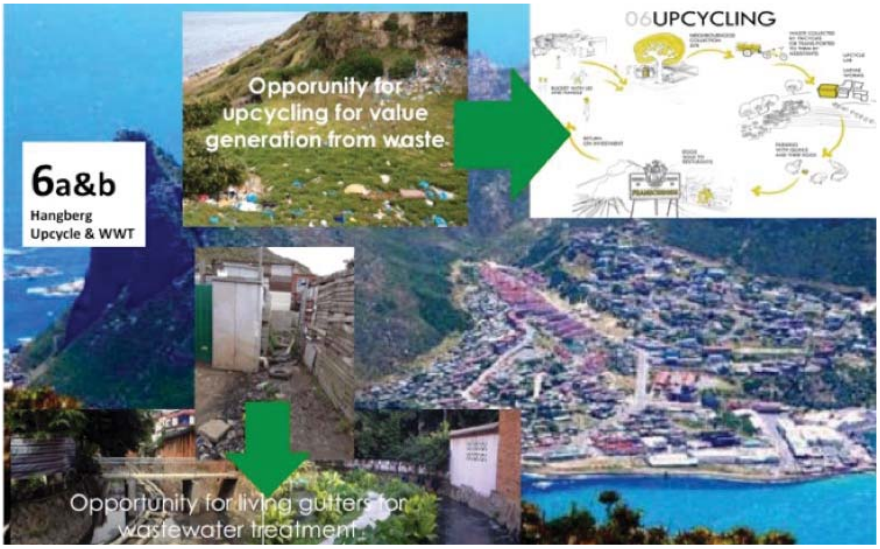


Figure 36: Potential upcycling opportunities managing solid waste and wastewater affecting river and ocean health in Hout Bay

There are a number of models for upcycling organic waste that can be applied here. Some of which are modeled on similar projects in Langrug, as well as Bokashi processing opportunities (eg BokashiBran) which generates employment opportunities while quickly upcycling organic waste into compost/soil. In addition, a new Materials Recycling Facility for Hout Bay is being implemented. The models for upcycling plastic waste described in the Circular Economy case studies of this report are highly applicable here – with strong potential to involve marginalized coastal communities in contributing to a sustainable and inclusive green/blue economy. In addition, the living tree gardens applied in Langrug Genius of Space project in Franschoek (Dama-Fakir et al, 2016) could be similarly applied in Hangberg. Such projects are complex to design and implement, involving significant social processes to build trust, enable coherence and engage empoweringly with the community. However if these processes are followed, they are viable with multiple benefits for communities, ecology and the low-cost provision of critical services to communities. WildTrust would have the experience and models to do so effectively, if the funding was available.

Figure 37: Potential WWTW upgrade opportunities for managing pollution affecting ocean health in Hout Bay

Similar to the Knysna examples described above, there are opportunities to upgrade the Hout bay wastewater treatment system beyond simple emission to ocean. A pre-treatment process through an Ecomachine or more conventional WWT system would improve the quality of wastewater emitted to the ocean. Eco-machines are generally more accepted by local communities (in terms of no smell and aesthetics) than conventional WWTW (as in Burlington Vermont eco-machine for sewerage treatment being an eco-tourism facility) (John Todd). In addition they provide opportunities for low-skilled job creation. In the WRC Thrust 3 Strategy on innovation for waste/water recovery from wastewater (Zvimba, 2018) there are many more opportunities described. Eco-machines are only one of many that provide both ecological and socio-economic opportunities while contributing to a circular economy.

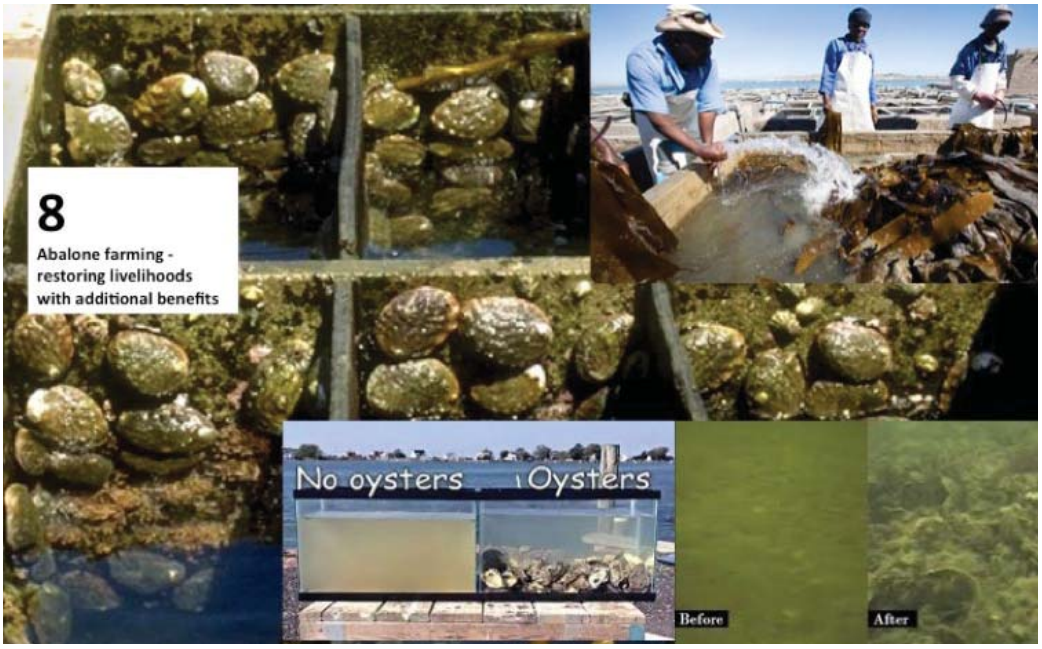


Figure 38: Potential ecological treatment of pollution in Hout Bay through oyster farming

The oyster farming idea proposed for Knysna could also be applied in Hout Bay. The Billion Oyster project and TRY Oyster Women's Associaton in Gambia identified as international best practice models for a Blue Economy, serve as models for this. It would be more viable if the project started by farming oysters to clean up the pollution in the Bay (pollution farming) as a starting point with job creation potential, and then evolving into abalone farming.

Looking deeply at the challenges besetting local communities and the possible nature-inspired solutions for them, the scope of this project is enormous and could serve to transform Hout Bay, providing new Blue Economy opportunities for communities that struggle to access opportunities in the current economy. Given there already exists community initiatives and partnerships looking into these opportunities, there is fertile ground for implementing some or all of these potential projects.

In a workshop with the Hout Bay River Catchment Forum (HBRCF), the researchers on this WRC project re-visited these potentials described above to identify specific opportunities for sustainable and inclusive business models that would contribute to the Blue Economy in Hout Bay. The focus of this workshop was identifying opportunities for improving river health and thereby restoring estuary health. As per the Knysna project, these initiatives require investment in time, capacity building and capital costs, as well as complex social and political procceses. However, similar ecological engineered green infrastructure solutions that are "proven and operational" have been implemented in other areas of the Western Cape and in other countries. These proposed ideas are therefore documented as viable sustainable and inclusive Blue Economy opportunities as part of a national Blue Economy strategy.

This project is an opportunity to explore the potential that could be realized by the Hout Bay community similar to the Knysna as a Circular Economy project. This project is an important model, as the Disa river as a catchment is only 5km long and therefore serves as a model for replication in other water-catchments, with large implications for estuary health.

The kind of funding models to enable these opportunities for a sustainable and inclusive Blue Economy would be similar to those of WildTrust, where public and private funds are leveraged and a larger organization provides support for the SMMEs. A business model similar to WildTrust Treepreneurs could be applied for ecological engineering solutions. Wastepreneurs and Ocean Bricks/Pyrolysis business models could be applied to the new recycling facility with opportunities for local marginalized communities. The Try Women's Oysters project in Gambia identified as international best practice, is a model that could be explored for Hout Bay oysters, combined with existing cooperative initiatives. There could also be opportunity for regenerative kelp farming in some areas of Hout bay (Greenwave website).

4.1.5 Ecosystem restoration models – From WildLands to WildOceans

It is highly recommended for a national Blue Economy strategy to consider how to leverage this WildTrust model to support ecosystem restoration and poverty alleviation to contribute to a sustainable and inclusive regenerative Blue Economy. In short, the WildTrust models applied to other potential projects/business ideas identified in this project would be a win-win combination. It would however need funding to initiate such activities. It is noted that the Restoration Economy model in general has been proven effective in raising both public (eg government ecological infrastructure) and private (eg CSR) funds (for example adopt-a-river program). A national strategy for restoring estuaries as critical coastal ecosystems leveraging the WildTrust model would be a starting point for raising funds for effective initiatives. In terms of the South African landscape, the majority of restoration programmes have been inland/terrestrial. Coastal restoration and benefitation, focusing on estuaries, has a novelty aspect together with urgent priority. With so many socio-economic and environmental benefits possible from these kinds of business models described in this section of this report, there is a win-win opportunity for both funder and the communities involved.

Whether a basic ecosystem restoration project, or a more integrated one emulating the international best practice (eg Eritrea project), where a number of ocean ecosystems are restored, while cleaning water quality, and generating viable ocean economy business models, WildTrust is in a strategic position to apply these models effectively. For example, their Treepreneur program could be a model for restoring mangroves. In addition, their experience in the green carbon market, could open up Blue Carbon opportunities for restoration projects. The postgraduate research into Blue Carbon that forms part of the capacity building component of this project can inform the opportunities in this regard.

Restoration of South Africa's estuaries could provide multiple opportunities to restore ecosystem services and improve coastal livelihoods through work opportunities. Installation of artificial wetlands and restoration of riparian habitat would go a long way in improving water quality. Inputs from stormwater run-off, agricultural return flow and WWTW (wastewater treatment works) pose a threat to the health of South Africa's estuaries. There is a national deterioration in water quality with resultant losses of biodiversity and ecosystem functioning. Estuaries can no longer assimilate the nutrient loads and under eutrophic conditions, harmful algal blooms develop.

These proven and operational WildTrust business models could be applied within Durban Bay, Hout Bay and Knysna - described further below. It is a replicable model for many other estuaries affected by poor water quality in South Africa. The large-scale coastal ecosystem restoration opportunities identified as international best practice Business Models in this project could also be implemented by replicating and scaling WildTrust's proven and operational business models.

Each of the programmes that WildTrust currently runs are models that can be replicated to restore estuaries (and other coastal ecosystems), while employing marginalised coastal communities, and including partnerships with government and private sector to fund and implement them. Some of the existing WildLands programmes are in coastal communities. The many ecosystem restoration business models for Blue Economy that were documented for this WRC project have been presented

to WildTrust and some options for integrating these are being explored. The Blue Port project described above is an example of a focused large-scale project on an estuary that can integrate the circular economy (solid waste collection and upcycling) processes, as well as ecosystem restoration processes – with a focus on water quality. By integrating estuary programmes with 'adopt-a-river' programs the interface between the upstream flow and the estuary itself can be addressed. The following is a summary of some of the opportunities identified for scaling activities to a National Blue Economy strategy (with a focus on estuary restoration):

- ecological infrastructure research and development for interventions such as eco-machines, floating islands or similar that could be implemented just upstream of estuaries or downstream of failing wastewater treatment works to improve water quality. The opportunities identified for Hout Bay and Knysna (in the Blue Economy Business Model report) would need further technical research. This could be done in collaboration with the Water Hub (https://www.thewaterhub.org.za/), with potential support for research by the WRC. These can also learn from previous successful projects as implemented on the Plankenbrug River, in Langrug, and in new locations in South Africa, Africa and worldwide (https://www.isidima.net/projects). The research work of the Water Hub can also contribute to the improvement of wastewater treatment infrastructure in South Africa and hopefully address both formal and informal wastewater infrastructure challenges that are affecting estuary (as well as river and ocean) health nationally;
- implementation of the resulting technological interventions can involve marginalised communities (as was done in Langrug) by replicating models such as the WildTrust model or WildTrust can implement these ideas. WildTrust's processes of developing critical government and private sector/donor funder partnerships as well as their social processes in working with communities will be a critical success factor for such interventions;
- Isidima has been informed of the opportunity for application of an ecomachine type intervention at the Motherwell canal at an important coastal ecosystem (salt pan) near Port Elizabeth. This is one of many potentials that could be rolled out using the model above;
- strategically, this process would focus on priority estuaries (w.r.t. water quality) – as selected by Van Niekerk (2019), and focusing on those which have the best locations for such interventions, as well as communities ideally located for these projects. These interventions could ideally be integrated within Estuary Management Plans (as the Durban Blue Port project has been). This would be an initial way to integrate into related policy and legislation. Ideally the Department of Environmental Affairs could play a key role in rolling out a national programme such as this to restore estuary health while providing economic opportunities for marginalised coastal communities. A combination of solid waste upcycling and ecosystem restoration interventions could provide significant opportunities for communities;
- a phased approach could begin with 'pollution farming' - i.e, installing ecological infrastructure or growing kelp/oysters with the primary aim of improving water quality. Oyster shells could be used for building materials, but the food would not be fit for harvesting in this first phase. Once the water quality is significantly improved, this could transition to seafood/pharmaceutical farming with a combination of seaweeds, seafoods, as per the Greenwave 3D ocean farming model (international best practice) model included in the Blue Economy Business Models (Appendix C);
- Community Hubs (as per WildLands programme model) could be established for enhanced food security or coastal ecosystem restoration. The benefits to the local communities would be enhanced food security, economic opportunities, training and employment, water quality and health related improvements. The benefits to larger community would be estuary water quality health improvements and the associated environmental benefits, as well as the benefits to fishery nurseries (the oceans economy) and the related socio-economic benefits for tourism, property values, etc.; and
- the Economic Modelling tool developed for this project can be used as a strategic planning tool to assess the greater Human Benefit Index as a result of different interventions compared to no interventions.

4.2 Economic Model way Forward

4.2.1 Blue Economy Cost Benefit Analysis: Strategy for integrating it into national programmes

Operation Phakisa developments and decision making needs to be informed by holistic analyses. The conventional cost benefit analysis used by government and business tends to concentrate on financial costs and benefits. Consequently, only a partial analysis is undertaken, with numerous social, economic and ecological factors ignored. For example, the social costs or the ecological costs of marine mining are seldom accounted for in the economy.

The WRC Blue Economy project has attempted to engage with national government departments and local municipalities but there has been little or no appetite in government for engaging with the approaches and tools developed in the project which promote greater transparency and accountability in Blue Economy decision making. This implies that an alternative method of promoting the use of decision making tools in the Blue Economy is required.

4.2.2 The rationale for the alternative approach

Operation Phakisa will need to engage with statutory processes, such as EIAs and licencing, and will therefore need to engage with consultants, provincial authorities and other stakeholders such as academia, NGOs and civil society organisations. Therefore, if the WRC could fund training to empower consultants, provincial officials and other stakeholders, to use the tools and approaches developed in the Blue Economy project, then indirectly, national departments would be compelled to deal with the outputs and results of the novel tools developed. In other words, the WRC can build the capacity of stakeholders who can hold government accountable for Blue Economy interventions.

4.2.3 A proposed approach

Offer a series of one-day capacity building workshop in coastal cities, such as:
Durban, Port Elizabeth, Buffalo City, George, Cape Town and Langebaan.

The following stakeholders could be invited to attend:

- university staff and senior students
- consulting companies
- National, Provincial and Local Government staff who are interested
- civil society organisations
  media organisations.

The content of the capacity building could include:

- Blue circular economies
- the dangers of partial accounting
- circular economy cost benefit analysis
- demonstrating the use of the tool with local current issues (requiring some preparation beforehand)
- sharing the tool with participants.

5 CONTRIBUTION TO SUSTAINABLE DEVELOPMENT GOALS

In September 2015 the United Nations adopted the 2030 Agenda for Sustainable Development with the Sustainable Development Goals (SDGs) at its core. The aim of the Agenda is for all countries to work together to achieve sustained and inclusive economic growth, social development and environmental protection. It is meant to be implemented in a consistent manner under international human rights law with the hope of eradicating poverty, addressing inequality and discrimination. A set of 17 goals were determined after exhaustive deliberation that are accompanied by 169 associated targets.

The 14th goal 'life below water' aims to conserve and sustainably use the oceans, seas and marine resources. The targets, with different end dates, include:

- preventing and significantly reducing marine pollution (this is a core focus of this project in prioritising estuaries most affected by water quality);
- sustainable management, restoration and conservation (at least 10%) of marine and coastal ecosystems (the guiding framework and model described in this document focus on restoration, while also including advocacy towards more Marine Protected Areas);
- effectively regulating harvesting of fish and preventing illegal practices (this project has documented opportunities for this in the Business Models, as well as the included regulation of fishing in the uThukela Banks MPA pilot testing of the economic model); and
- increasing scientific understanding and monitoring; and encourage small-scale artisanal fishers. (Business Models relating to small-scale fisheries have been documented in this project along with ideas for strategies for replicating and scaling these).

This entire project contributes to a national Blue Economy strategy which is an extension of SDG 14. The sustainable and inclusive Business Models as well as the Economic Model described in this project contribute to each of the targets within SDG14.

In addition, the Blue Economy is interlinked with the majority of the other SDGs in a variety of ways summarised below:

- aquatic and marine resources play a crucial role in supporting an array of economic sectors that provide livelihoods and the focus of this project in identifying SMME opportunities for marginalised communities addresses employment opportunities to end poverty (SDG 1);
- the Greenwave, Regenerative Kelp Farming, Eritrea and Edible Seaweed Models identified in the Business Models, contribute to SDG2 (enhanced sustainable food production);
- improved water quality (SDG3) is a key component of the overarching model and strategy (with a focus on estuarine water quality and its sources further upstream);
- developing capacity for implementing the models described here could contribute significantly to skills development (SDG4);
- by focusing on opportunities within the Blue Economy for SMMEs in marginalised communities, the models described here contribute to increased equal rights to economic resources (SDG5);
- the ecological infrastructure models described in the Business Models for this project and the general approach to enhanced ocean water quality through ecosystem restoration contribute to SDG6 (investment in nature-based water provision services);
- renewable energy from the ocean is a key consideration for a sustainable Blue Economy (although not for SMMEs so not considered in depth as part of this project, but are discussed in our Scoping Report) (SDG 7);
- job-creation and economic diversification (SDG8) is the core focus of this project;
- many of the Business Models identified in this project contribute to increased and improved water and waste infrastructure (SDG9);
- enhanced engagement of all stakeholders in a national Blue Economy Strategy is a key focus of this project – expanding the benefit of the Blue Economy to all stakeholders rather than a few (SDG10);
- improved cycling and use of water (SDG11), is a benefit of the Business Models described this project;
- promotion of more equitable trade of (ocean) related goods and services (SDG12) is considered in some of the Blue Economy business models described in this project;
- resilience to an uncertain climate future (SDG13) is a critical consideration in restoring ecosystem health – a core focus of this project;
- as discussed above, enhanced health of aquatic and marine ecosystems (SDG14), as well as increased stock abundance supporting sustainable fisheries are key focus areas for the contribution of this project;
- increased water security (SDG15) would be the result of some of the ecosystem restoration and waste upcycling models described in this project;
- improved governance (SDG16) can be realised through the national Blue Economy Strategy that this project contributes to; and

- the overarching model described in this report is based on improved partnerships between public, private and civil society actors (SDG17).

Figure 39 below is a non-exhaustive list of linkages between Blue Economy development and the 17 SDGs. The models described in this project all contribute to the positive side of this figure. Not implementing these models within a national Blue Economy strategy could have negative impacts as listed in the right hand side of the figure below.

Source: Authors. SDG icons from https://sustainabledevelopment.un.org

Figure 39: Linkages between development of the Blue Economy and Sustainable Development Goals
Source: UNECA, 2016

The African continent presently sits at a crossroads of opportunity to re-evaluate its development pathway within the context of the Blue Economy, taking into account socio-economic, political, and environmental considerations. Societies that are dependent on aquatic and marine resources and ecosystems should get ready to embark on a developmental trajectory focused on human and ecosystem well-being. Yet, within the context of the Blue Economy, there are limited innovations, experiences, and practices that can be used to lead this transition. In order to carve its path, Africa needs to define its own understanding of prosperity and progress, while promoting innovative thinking and practices that will enhance human and ecological well-being (UNECA, 2016). The guiding framework and models described in this report are the kind of innovations that can support South

Africa's prosperity and progress within a Blue Economy that enhances both human and ecological well-being.

6 CONCLUSION

This project fulfilled the intended aims and objectives, some through more feasible and practically implementable processes than originally anticipated. The key contribution of this project is the development of a Guiding Framework, supported by an Economic Model and practical SMME Business Models for a Blue Economy that benefits coastal ecosystems and marginalised coastal communities and contributes to many of the Sustainable Development Goals (especially SDG14 and SDG1). While ideally this could be integrated into a national Blue Economy strategy at a government level, the departure from business-as-usual, combined with the need for in-depth social processes to facilitate this, require an organisation with the skill, will, and experience to develop and implement such a strategy. It is for this reason that the project engaged with WildTrust/WildOceans to integrate the framework and working models from this project into their national Blue Economy strategy, including effective implementation through their programmes. WildTrust has existing relationships with government and some of the projects outlined in the strategy, are already integrated with local and national government policy. This project team would welcome any engagement from government to consider the integration of the ideas documented here within their national strategies relating to a sustainable ocean economy.

The Blue Economy business and economic models from this project are an example of a new way of thinking about business and economy in South Africa that requires a rethinking of the *first principles* of economics. South Africa needs a new development model for business that is regenerative and inclusive/distributed/networked. The Blue Economy is one space where it could be applied, but without a broader level realisation of a shift in thinking, policy and action to new economic models, these ideas remain 'islands' amongst opposing entrenched systems. It is as much the role of researchers to do the innovations , as it is the role of institutions (business/Gov) to implement innovate new business and economic models and related education.

7 RECOMMENDATIONS

The following recommendations have emerged from this project:

- The roll out of this national strategy will need funding from local and international donor funders. The project team has supported WildTrust in a successful application for funding for some aspects of this proposed National Strategy for a Blue Economy. The overarching model and strategy is replicable and is not dependent on only one organisation to implement. If the WRC or other stakeholders, including government, are able to support the roll out of the national strategy, this could speed up the implementation and beneficial results – ensuring estuary health and benefits to marginalised coastal communities, while also supporting the basis of a healthy ocean economy and realising the Sustainable Development Goals (especially SDG14 and SDG1).
- A few SMMEs and NGOs are attempting to develop and apply these models, while government and traditional business continues business as usual, but it is unlikely that large-scale change can be realised. The Johannesburg Business School is developing innovation with regard to business education with an SMME focus. There may be an opportunity for a research project that integrates business school and other research disciplines to develop a vision and practical models on a broader scale in South Africa – of what's possible for a more inclusive economy that regenerates ecosystem health rather than depleting it. The project team members will follow up with this opportunity (Prof Lyal White: lyal.white@jbs.ac.za).
- A partnership with The Water Hub (www.thewaterhub.org.za) should be established for research and development components of this project . The Water Hub has existing partnerships with government and is focused on innovative business models for ecological infrastructure to address water quality challenges in South Africa. It is recommended to undertake further research and development of ecological infrastructure options for improving water quality within estuaries – most likely in partnership with The Water Hub (Contact Dr Kevin Winter: kevin.winter@uct.ac.za).

- Proactive training of other civil society organisations, and where feasible, government organisations, in the principles of the Economic and Business models. The WRC could fund training to empower consultants, provincial officials and other stakeholders, to use the Economic Modelling Tool and approaches developed in this project. Indirectly, national departments would be compelled to deal with the outputs and results of the novel tools developed. The WRC could therefore support the capacity building of stakeholders who can hold government accountable for Blue Economy interventions, including potentially citizen science training and materials.
- Further research for WildTrust and similar NGOs working in the space of regenerative and inclusive growth for South Africa, including sources of water quality impacts, solid waste trends and places for intervention should be supported as well as research by business and economics students into regenerative and inclusive overarching economic models for development in South Africa
- Capital to produce high quality products is required. From a business perspective, scaling up these models, will in turn ensure that such products are well received in the market. At the moment the market for circular economy products, such as upscaled bricks and edible seaweed is still quite nascent. However, the trends show that interest in such products is increasing and the export opportunities to overseas markets for some green economy and blue economy products is also increasing, presenting excellent opportunities for scaling up such interventions.
- A number of additional research gaps that need to be addressed. These include:
    - ecological restoration and adaptive management to benefit society
    - the economic benefits of ecosystem services to various sectors
    - the classification and setting of resource quality objectives (RQOs) for estuaries; and
    - sources of marine pollution (i.e. Source to Sea/Catchment to Coas

8 REFERENCES

Adams JB, Taljaard, S., Van Niekerk, L. and Lemley, D.A., *Nutrient enrichment threatens ecological resilience and health of microtidal estuaries,* African Journal of Aquatic Science, Special Issue, 2019

Adams, JB., Van Wyk, E., Riddin, T. 2016. First record of *Spartina alterniflora* in southern Africa indicates adaptive potential of this saline grass. *Biological Invasions* 18: 2153–2158.

Adams, J.B., Veldkornet, D., Tabot, P. 2016. Distribution of macrophyte species and habitats in South African estuaries. *South African Journal of Botany* 107: 5–11.

Benyus, J., *Biomimicry: Innovation Inspired by Nature*. New York: Morrow, 1997. Print.

Billion Oyster project website: https://www.billionoysterproject.org/about/

Billion Oyster Project Wikipedia: https://99percentinvisible.org/episode/oyster-tecture/

Biopower Systems reference: http://bps.energy/)

Biorock/Seament references: https://en.wikipedia.org/wiki/Biorock and http://www.biorock.org/

Biri Initiative artificial reefs: biri-initiative.org

Bornman, T. and Steyn, P. 2014. Large-scale toxic red tides plague eastern and southern coasts of South Africa. Available online at: http://www.saeon.ac.za/enewsletter/archives/2014/february2014/doc04. Accessed 3 September 2017.

Bornman, T.G., Adams, J.B. 2010. Response of a hypersaline salt marsh to a large flood and rainfall event along the west coast of southern Africa. *Estuarine and Coastal Shelf Science* 87: 378-386.

Cartwright, A., Blignaut, J., de Wit, M., Goldberg, K., Mander, M., O'Donoghue, S., and Roberts, D. 2013. Economics of climate change adaptation on a municipal level under conditions of uncertainty and resource constraints: The case of Durban, South Africa. *Environment & urbanization*, 25(1):1-18

Dama-Fakir, P., Dower, A., Janisch, C., O'Connor, C., Otto, D. and Welz, P. *Biomimicry and Wetlands,* Report to the Water Research Commission by Golder Associates Africa, Biomimicry Institute of South Africa, Digby Wells Environmental, Cape Peninsula University of Technology, WRC Report No K5/2096/1 (13219), June 2016

Department of Environmental Affairs (DEA). 2016. 2nd South Africa Environment Outlook. A report on the state of the environment. Department of Environmental Affairs, Pretoria. 328 pp.

Ecomachine references: Todd, J. South Burlington Eco-machine Case Study, http://www.toddecological.com/data/uploads/casestudies/jtedcasestudy_southburlington.pdf and Omega Centre for Sustainable Living Eco-Machine case study, https://www.treehugger.com/green-architecture/omega-center-sustainable-living-eco-machine-living-building-water-treatment.html

Ecomachine Plankenbrug reference: https://youtu.be/-Me9VY5UT60

Gaertner, M., Larson, B.M.H., Irlich, U.M., Holmes, P.M., Stafford, L., van Wilgen, B.W., Richardson, D.M. 2016. Managing invasive species in cities: A framework from Cape Town, South Africa. *Landscape and Urban Planning* 151: 1-9.

Gibbs, D., Thompson, V., Sheasby, C. 2011. Integrated reserve management plan: Zandvlei Estuary Nature Reserve. Compiled by Biodiversity Management Branch, Environmental Resource Management Department City of Cape Town, South Africa, 215 pp.

Greenwave references: www.greenwave.org and www.grandviewresearch.com/press-release/global-commercial-seaweed-market and https://vimeo.com/album/5368604 Bren Smith Webinar Notes: *Restoring the Oceans with 3D Ocean Farming* Webinar

Harris, J. and Janisch, C. , *Biomimicry Wastewater Treatment Technology-Monitoring and Evaluation,* Report to the Water Research Commission by Isidima Design & Development and BiomimicrySA, KSA 3: Water Use and Waste Management, For the Project K5/2479/3, April 2017

Hout Bay reference: http://www.houtbayinfo.co.za/

Jeffries, N. 2017, A Story of Regeneration and Reforestation from Eritrea**,** *Circulate,* April 2017 - http://circulatenews.org/2017/04/a-story-of-regeneration-and-reforestation-from-eritrea/

Johansson, A, Kisch, P., Murat, M., *Distributed Economies – A New Engine for Innovation, Journal of Cleaner Production* 13(10-11). p.971-979, 2005

Keen, M.G., Schwarz, A.Wini-Simoen, L. In press. Towards defining the Blue Economy: Practical lessons from Pacific Ocean governance. *Marine Policy* in press.

Kim, W. Chan.Mauborgne, Renée.Blue Ocean Strategy: How To Create Uncontested Market Space And Make The Competition Irrelevant. Boston, Mass. : Harvard Business School Press, 2005.

Knysna as circular economy: http://biowise.org.za/business-unusual/

Knysna reference: Interview with Natasha Rightford, Sep 2018

Kogelberg Fisheries project reference*: Moving Sushi website: http://movingsushi.com/.*

Langrug Genius of Space project and Plankenbrug eco-machines are also documented on the following page on the BiomimicrySA webpage: https://www.biomimicrysa.co.za/our-projects/

Lemille, A. [Poverty=Waste] , *The WorldWatch Institute Europe, 2017*

Lemley, D.A., Adams, J.B. and S. Taljaard. 2017. Comparative assessment of two agriculturally-influenced estuaries: Similar pressure, different response. *Marine Pollution Bulletin* 117: 135-146.

Lovins A & H. and Hawken, P., Natural Capitalism: Creating the Next Industrial Revolution, Rocky Mountain Institute, 2000

McDonough, W. and Braungart, M. *Cradle to Cradle: Remaking the Way We Make Things*. London: Vintage, 2009.

Mexico MPA reference, video created by The Economist: https://www.facebook.com/TheEconomist/videos/10156407738414060/

Mohanty, S.K., Priydarshi, D. & Gaurr, A.G.P., 2015. Prospects of Blue Economy in the Indian Ocean, RIS Research and Information System for Developing Countries, India, 2015

Mander, M., Blignaut, J.N., Inglesi-Lotz, R., Claire-Glavan, J. and Parr, S. 2016. The amenity value of Abu Dhabi's coastal and marine resources to its beach visitors. *Ecosystem services,* 19:32-41. http://dx.doi.org/10.1016/j.ecoser.2016.04.005.

Marquez, D., Growing Kelp to Restore Marine Ecosystems, webinar notes, https://vimeo.com/album/5368604

Mead, A., Griffiths, C.L., Branch, G.M., McQuaid, C.D., Blamey, L.K., Bolton, J.J., Anderson, R.J., Dufois, F., Rouault, M., Froneman, P.W., Whitfield, A.K., Harris, L.R., Nel, R., Pillay, D. and Adams, J.B. 2013. Human-mediated drivers of change — impacts on coastal ecosystems and marine biota of South Africa. *African Journal of Marine Science* 35: 403-425.

Mexico MPA reference, video created by The Economist: https://www.facebook.com/TheEconomist/videos/10156407738414060/

Monbiot, G. *Finally, a breakthrough alternative to growth economics – the doughnut,* The Guardian Newspaper, April 2017 (https://www.theguardian.com/commentisfree/2017/apr/12/doughnut-growth-economics-book-economic-model)

MPA Forum website: http://mpaforum.org.za/portfolio/isimangaliso/).

Natural Capital Committee, website, http://www.naturalcapitalcommittee.org/natural-capital/, 2019

Natural Capital Committee UK, http://www.naturalcapitalcommittee.org/state-of-natural-capital-reports/

Paruk, S. *Letter of Support for WildOceans Proposal to IUCN for a Circular Economy Approach to Plastics Leakage in the Port of Durban*, Environmental Specialist, Transnet National Ports Authority – Port of Durban, 2019

Patil, P.G., Virdin, J., Diez, S.M., Roberts, J., Singh, A., Toward A Blue Economy: A Promise for Sustainable Growth in the Caribbean; An Overview. The World Bank, Washington D.C, 91 pp., 2016

Pauli, G., *The Blue Economy——A Report to the Club of Rome.* Nairobi: UNEP, 2009

Powers, M. *The Permaculture Student – A Collection of Regenerative Solutions* 2nd Edition, 2016.

Pyrolysis Wikipedia https://en.wikipedia.org/wiki/Pyrolysis

Raworth, K. *Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist,* Chelsea Green Publishing, 2017

Raworth, TED Ideas, *Why we need to move toward an economy that can regenerate itself,* April 2018, Kate Raworth contribution - https://ideas.ted.com/why-we-need-to-move-toward-an-economy-that-can-regenerate-itself/

Riddin, T., Van Wyk, E., Adams, J. 2016. The rise and fall of an invasive estuarine grass. *South African Journal of Botany* 107: 74-79.

Saez, E. Striking it Richer: The Evolution of Top Incomes in the United States (Updated with 2012 preliminary estimates), UC Berkeley, September 3, 2013

SANBI, 2018, SA Coastal Biodiversity Status In Spotlight On Clean-Up Day, 27 September 2019, https://www.sanbi.org/news/sa-coastal-biodiversity-status-in-spotlight-on-clean-up-day/

Sink, K., Holness, S., Harris, L., Majiedt, P., Atkinson, L., Robinson, T., Kirkman, S., Hutchings, L., Leslie, R., Lamberth, S., Kerwath, S., von der Heyden, S., Lombard, A., Attwood, C., Branch, G., Fairweather, T., Taljaard, S., Weerts, S., Cowley, P., Awad, A., Halpern, B., Grantham, H., Wolf, T. 2012. National Biodiversity Assessment 2011: Technical Report. Volume 4: Marine and Coastal Component. South African National Biodiversity Institute, Pretoria. Pp 325.

Sink. K.J., Wilkinson, S., Atkinson, L.J., Sims, P.F., Leslie, R.W., Attwood, C.G. 2012. The potential impacts of South Africa's demersal hake trawl fishery on benthic habitats: Historical

perspectives, spatial analyses, current review and potential management actions. Unpublished report, South African National Biodiversity Institute.

Smith, B. 2016. The Seas Will Save Us: How an Army of Ocean Farmers are Starting an Economic Revolution, Medium, Mar 2016. https://medium.com/invironment/an-army-of-ocean-farmers-on-the-frontlines-of-the-blue-green-economic-revolution-d5ae171285a3

Sowman, M., Raemaekers, S., and Sunde, J., *Guidelines for Integrating Human Dimensions into MPA Planning and Management,* Environmental Evaluation Unit, University of Cape Town, March 2014 - http://dtnac4dfluyw8.cloudfront.net/downloads/hd_of_mpa_guidelines_full.pdf

TED, Raworth, 2018 https://www.ted.com/talks/kate_raworth_a_healthy_economy_should_be_designed_to_thrive_not_grow?language=en),

Tedesco, K. *2015.* "A Billion Oysters Tell The History Of New York" *Village Voice, (1 June 2015)*

The Economist Intelligence Unit Limited. 2015. The blue economy Growth, opportunity and a sustainable ocean economy. An Economist Intelligence Unit briefing paper for the World Ocean Summit 2015, London, U.K., 18 pp.

Todd, J., *The Island Of Vieques After Hurricane Maria's Devastation In The Caribbean - A Plan to Storm Proof the Island of Vieques Through Advanced Ecological Design and Social Innovation: A Way Forward*, Annals of Earth, Volume XXXV, Number 2, 2017, A publication of Ocean Arks International.

The World Bank. 2015. The Sunken Billions Revisited: Progress and Challenges in Global Marine Fisheries. Available online: http://www.worldbank.org/en/topic/environment/brief/the-sunken-billions-revisited-progress-and-challenges-in-global-marine-fisheries. [Accessed on 15 September 2017].

Turpie, J.K., Clark, B., Napier, V., Savy, C. and Joubert, A. 2005. The economic value of the Knysna Estuary, South Africa. Marine and Coastal Management, Department of Environmental Affairs and Tourism, Cape Town, South Africa.

Turpie, J.K., Wilson, G., Van Niekerk, L., 2012. National Biodiversity Assessment 2011: National Estuary Biodiversity Plan for South Africa. Anchor Environmental Consulting, Cape Town. Report produced for the Council for Scientific and Industrial Research and the South African National Biodiversity Institute. Available online: http://bgis.sanbi.org/nba/NBA2011NationalEstuaryBiodiversityPlanforSouthAfrica.pdf [Accessed 12 September 2017].

UNECA, 2016, Africa's Blue Economy: A policy handbook, United Nations Economic Commission for Africa, ECA Printing and Publishing Unit, Ethiopia.

UNEP, GRID-Arendal. *Green Economy for Oceans: Blue Economy Success Stories* (in progress) as sited in UNEP ECA, 2015

Van Niekerk, L. The condition of South Africa's Estuaries, SANBI Estuaries Component, Presentation, Wilderness, June 2016

Van Niekerk, L, Adams, JB Lamberth, SJ, MacKay, F, Taljaard, S, Turpie, JK, Ramhukad, C-L. 2019. Chapter 3: Estuary Ecosystem Classification. South African National Biodiversity Assessment 2018: Technical Report. Volume 4: Estuarine Environment. South African National Biodiversity Institute, Pretoria. Report Number: SANBI/NAT/NBA2018/2019/Vol3/A

WildTrust Trust Annual Reports, *Reflections*, 2017 and 2018

WildTrust Trust consultative workshop – notes August 2018, March, April and June 2019

WildTrust Trust website: www.wildtrust.co.za

World Bank Group. 2017.The potential of the Blue Economy: Increasing long-term benefits of the sustainable marine resources for small island developing states and coastal least developed countries. International Bank for Reconstruction and Development/The World Bank, Washington.

WRC, Oceans and Estuary Socio-economic research needs - Workshop Summary, 24 April 2019

WWF-SA. 2016. *Oceans facts and futures: Valuing South Africa's ocean economy*. WWF-SA, Cape Town, South Africa, 41 pp.

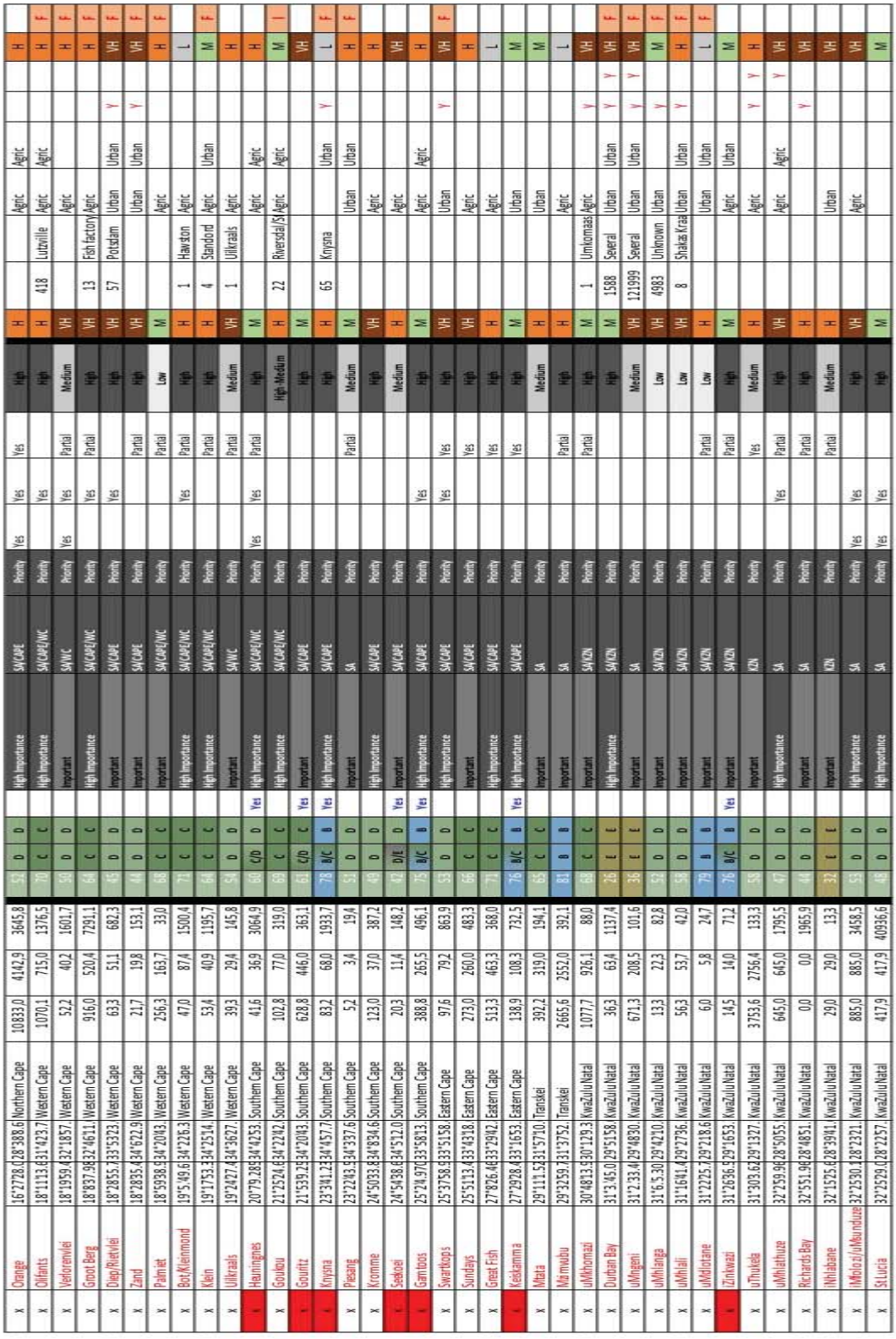
WWFSA website: http://www.wwf.org.za/what_we_do/marine2/oceanstewardship/protected_areas/.

WWF. 2015. *Principles for a Sustainable Blue Economy*. WWF Baltic Ecoregion Program, May 2015 **(**http://wwf.panda.org/?247477/Principles-for-a-Sustainable-Blue-Economy**)**

Yap, H.T. 2000. The case for restoration of tropical coastal ecosystems. *Ocean & Coastal Management* 43: 841-851.

Appendix A: List of Priority Estuaries – South Africa

Source: Lara Van Niekerk, Water Quality Restoration Priorities for Estuaries South Africa, June 2019



x	Orange	16°27'28.1"28°38'8.6"	Northern Cape	10833,0	4142,9	3645,8	53	D	D		High Importantce	SA/CAPE	Priority	Yes	Yes	Yes	High	H			Agric	Agric			H	
x	Olifants	18°11'13.6"31°42'3.7"	Western Cape	1070,1	715,0	1376,5	70	C	C		High Importantce	SA/CAPE/WC	Priority		Yes		High	H	418	Lutzville	Agric	Agric			H	F
x	Verlorenvlei	18°19'59.4"32°18'57.1"	Western Cape	52,2	40,2	1601,7	50	D	D		Important	SA WC	Priority	Yes	Yes	Partial	Medium	VH			Agric				H	F
x	Groot Berg	18°8'37.98"32°46'11.1"	Western Cape	916,0	520,4	7291,1	64	C	C		High Importantce	SA/CAPE/WC	Priority		Yes	Partial	High	VH	13	Fish factory	Agric				H	F
x	Diep/Rietvlei	18°3'855.7"33°5'323.1"	Western Cape	63,3	51,1	682,3	45	D	D		Important	SA/CAPE	Priority		Yes		High	VH	57	Potsdam	Urban	Urban	Y		VH	F
x	Zand	18°3'835.4"34°6'22.9"	Western Cape	21,7	19,8	153,1	44	D	D		Important	SA/CAPE	Priority			Partial	High	VH			Urban	Urban	Y		VH	F
x	Palmiet	18°5'938.3"34°20'43.1"	Western Cape	256,3	163,7	33,0	68	C	C		Important	SA/CAPE/WC	Priority			Partial	Low	M			Agric				H	F
x	Bot/Kleinmond	19°5'49.6"34°22'6.3"	Western Cape	47,0	87,4	1500,4	71	C	C		High Importantce	SA/CAPE/WC	Priority		Yes	Partial	High	H	1	Hawston	Agric			L		
x	Klein	19°1'753.3"34°2'514.1"	Western Cape	53,4	40,9	1195,7	64	C	C		High Importantce	SA/CAPE/WC	Priority			Partial	High	H	4	Standford	Agric	Urban			M	F
x	Uilkraals	19°2'427.4"34°3'627.1"	Western Cape	39,3	29,4	145,8	54	D	D		Important	SA WC	Priority			Partial	Medium	VH	1	Uilkraals	Agric				H	F
x	Haamgnes	20°7'9.28"34°4'23.5"	Southern Cape	41,6	36,9	3064,9	60	C/D	D	Yes	High Importantce	SA/CAPE/WC	Priority	Yes	Yes	Partial	High	M			Agric	Agric			H	F
x	Goukou	21°2'52.4"34°2'24.2"	Southern Cape	102,8	77,0	319,0	69	C	C		High Importantce	SA/CAPE/WC	Priority				High-Medium	H	22	Riversdal/S	Agric	Agric			M	I
x	Gouritz	21°53'0.2"34°20'43.1"	Southern Cape	628,8	446,0	363,1	63	C/D	C	Yes	Important	SA/CAPE	Priority				High	M			Agric				L	VH	
x	Knysna	23°3'41.2"34°4'57.7"	Southern Cape	83,2	68,0	1933,7	78	B/C	B	Yes	High Importantce	SA/CAPE	Priority				High	H	65	Knysna		Urban	Y		L	F
x	Piesang	23°2'24.3"34°3'37.6"	Southern Cape	5,2	3,4	19,4	53	D	D		Important	SA	Priority			Partial	Medium	M			Urban	Urban			H	F
x	Kromme	24°5'0.3"34°8'34.6"	Southern Cape	123,0	37,0	387,2	49	D	D		High Importantce	SA/CAPE	Priority				High	VH			Agric				H	
x	Seekoei	24°5'4.38"34°5'12.0"	Southern Cape	20,3	11,4	148,2	62	D/E	D	Yes	Important	SA/CAPE	Priority				Medium	H			Agric				VH	
x	Gamtoos	25°2'4.97"33°58'3.5"	Southern Cape	388,8	265,5	496,1	75	B/C	B	Yes	High Importantce	SA/CAPE	Priority		Yes		High	M			Agric	Agric			H	
x	Swartkops	25°3'7.58"33°5'51.5"	Eastern Cape	97,6	79,2	863,9	53	D	D		High Importantce	SA/CAPE	Priority		Yes	Yes	High	VH			Urban		Y		VH	F
x	Sundays	25°5'11.3"33°43'4.3"	Eastern Cape	273,0	260,0	483,3	66	C	C		Important	SA/CAPE	Priority			Yes	High	VH			Agric				H	
x	Great Fish	27°8'26.4"33°29'4.2"	Eastern Cape	513,3	463,3	368,0	73	C	C		High Importantce	SA/CAPE	Priority			Yes	High	H			Agric				L	
x	Keiskamma	27°3'9.28"33°16'53.5"	Eastern Cape	138,9	108,3	732,5	76	B/C	B	Yes	High Importantce	SA/CAPE	Priority			Yes	High	M			Urban				M	
x	Mtata	29°11'1.53"31°57'0.1"	Transkei	392,2	319,0	194,1	65	C	C		Important	SA	Priority				Medium	H			Urban				M	
x	Mamvubu	29°3'2.59"31°3'7.52"	Transkei	2665,6	2552,0	392,1	81	B	B		Important	SA	Priority			Partial	High	H			Agric				L	
x	uMkhomazi	30°48'3.3"30°12'9.3"	KwaZuluNatal	1077,7	926,1	88,0	69	C	C		Important	SA/KZN	Priority			Partial	High	M	1	Umkomaas	Agric		Y		VH	
x	Durban Bay	31°3'45.0"29°51'58.4"	KwaZuluNatal	36,3	63,4	1137,4	26	E	E		High Importantce	SA/KZN	Priority				High	M	1588	Several	Urban	Urban	Y	Y	VH	F
x	uMngeni	31°2'33.4"29°48'30.4"	KwaZuluNatal	671,3	208,5	101,6	36	E	E		Important	SA	Priority				Medium	VH	121999	Several	Urban	Urban	Y	Y	VH	F
x	uMhlanga	31°6'5.30"29°42'10.4"	KwaZuluNatal	13,3	22,3	82,8	59	D	D		Important	SA/KZN	Priority				Low	VH	4983	Unknown	Urban		Y		M	F
x	uMhlali	31°11'41.4"29°27'36.4"	KwaZuluNatal	56,3	53,7	42,0	58	D	D		Important	SA/KZN	Priority				Low	VH	8	Shaks Kraa	Urban	Urban	Y		H	F
x	uMdloti ane	31°2'22.5"29°2'18.6"	KwaZuluNatal	6,0	5,8	24,7	79	B	B		Important	SA/KZN	Priority			Partial	Low	H			Urban	Urban			L	F
x	iZinkwazi	31°2'36.2"29°16'53.1"	KwaZuluNatal	14,5	14,0	71,2	76	B/C	B	Yes	Important	SA/KZN	Priority			Partial	High	M			Agric	Urban			M	
x	uThukela	31°30'3.62"29°13'27.4"	KwaZuluNatal	3753,6	2756,4	133,3	55	D	D		Important	KZN	Priority			Yes	Medium	H			Agric		Y	Y	H	
x	uMhlathuze	32°2'59.94"28°50'55.4"	KwaZuluNatal	645,0	645,0	1795,5	47	D	D		High Importantce	SA	Priority		Yes	Partial	High	VH			Agric	Agric		Y	VH	
x	Richards Bay	32°5'51.94"28°48'51.1"	KwaZuluNatal	0,0	0,0	1965,9	44	D	D		Important	SA	Priority			Partial	High	H					Y		VH	
x	iNhlabane	32°1'52.5"28°39'41.1"	KwaZuluNatal	29,0	29,0	13,3	32	E	E		Important	KZN	Priority			Partial	Medium	H			Urban				VH	
x	iMfolozi/uMunduze	32°2'53.0"28°2'32.1"	KwaZuluNatal	885,0	885,0	3458,5	53	D	D		High Importantce	SA	Priority	Yes	Yes		High	VH			Agric				VH	
x	St Lucia	32°2'52.9"28°2'25.7"	KwaZuluNatal	417,9	417,9	40936,6	48	D	D		High Importantce	SA	Priority	Yes	Yes		High	M							M	

Appendix B: Economic Modelling Tool

Attached as a separate Excel file.