Investigation of the viability of selected indigenous wetland plants to support entrepreneurship and job creation in South Africa.

The case of Typha capensis, a Wetland Plant

Report to the
Water Research Commission

by

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WRC Report No. KV 348/15

ISBN 078-1-4312-0735-0

January 2016

Obtainable from
Water Research Commission
Private Bag X03
GEZINA, 0031

The publication of this report emanates from a project entitled *Investigation of the viability of selected indigenous wetland plants to support entrepreneurship and job creation in South Africa* (WRC Project No. K8/1088)

Executive summary

Background and rationale

The Water Research Commission's "light-house" flagship programmes are trans-disciplinary, multi-KSA and inter-institutional mega-projects that examines priority water issues across the innovation value chain. Amongst these programmes, the Green Village Programme (GVP) intends to reduce carbon/ecological footprints by adopting more environmentally-friendly options ('green' options), in realisation of the centrality and importance of healthy ecosystems. In addition the GVP promotes the Sustainable Development Goals in encouraging green and sustainable options namely; promoting sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all; building resilient infrastructure, promoting inclusive and sustainable industrialization and fostering innovation; and protecting, restoring and promoting sustainable use of terrestrial ecosystems. Thus the GVP is an important mechanism for fostering development towards a green economy.

An important part of the GVP is thus to create economic opportunities for marginalised communities by addressing their basic needs such as generating green jobs without compromising the integrity of the environment and the future generations. In short, the GVP must add value and transform living standards, creating economically active communities which are integrated into the mainstream economy.

This document is structured according to the general business case guidelines provided by National Treasury, which are applicable for all government departments and public entities. The business case is a detailed yet succinct document, supported by a series of Appendixes which contains the detailed research conducted in support of the business case.

This is a GVP business case for creating a *Typha capensis* (Cape Bulrush or Cattail) (hereinafter referred to as "Typha") value addition venture, which creates significant economic and employment opportunities.

This is a quasi-Payments for Ecosystem Services (PES) initiative.

Typha is an indigenous wetland plant **(refer to Figures 1a & 1b)** that occurs across the country **(refer to Figure 1c)**. It acts as a pioneer species in degraded wetlands, which means that fairly dense populations of Typha occurs in various degraded wetland systems across the country. Typha is therefore an abundant and fast growing plant species, which plays an important role in the rehabilitation of degraded wetlands, especially where nutrient pollution occurs. The Working for Wetlands Programme has identified certain wetlands where this indigenous species has become an environmental problem, due to it out-competing other species. This business case therefore has the added benefit of generating a revenue stream from a species which is effectively a weed in some wetlands.

In addition, German research and development initiatives (http://www.ibp.fraunhofer.de/en.html) have demonstrated the successful use of Typha as a construction material. The Fraunhofer-Institute for Building Physics IBP has developed a panel product and has used it for external and internal wall construction. The manufacturing technology for this is relatively simple.

Objectives

The study was designed to address the following objectives:

1. Conduct extensive literature review on capability of selected wetland plant(s) to create jobs.
2. Through the Green innovation and interactions, provide value chain production methods required from input (wetland plant) to market.
3. Establish viable market options based on proven customer need as well as how to sustain the business.
4. Identify training needs and develop a viable regulatory structure critical to sustain the innovative business.
5. Produce a tested and fundable business plan, taking particular care of risks.

These objectives were achieved and are addressed in the following sections:

1. The literature review informed all aspects of the document. Specific literature review sections are provided in Appendixes 1, 2, 7 and 9 and all literature cited are listed in the References section.
2. Value chain methodology was used to identify and map relevant wetland plant beneficiation value chains (Appendix 3), and thereafter used to analyse the business case reported on in the main document and Appendixes 4 and 5.
3. Market assessment was conducted through a combination of value chain analyses, market size estimation and price analyses sourced from literature, company data, expert interviews and engagement with potential project funders (Section 5 and Appendixes 6 and 14).
4. Training needs were identified and are addressed in sections 11 and 14.
5. The main body of this report is structured in business case format, using a structure specified by National Treasury and applicable to all government entities. The business case includes a very detailed financial feasibility assessment using best available evidence.

Methodology

This business case investigated the potential of manufacturing high value interior architectural, green building materials using Typha as a raw material, and creating economic opportunities and jobs in poor peri-urban, rural and urban communities of South Africa, and linking these opportunities to established private sector value chains.

This business case is based on extensive literature reviews, expert assessments and desktop investigations, applied to a case study at the Balamhlanga wetland 20 km east of Jozini Dam **(refer to Figure 2).**

Results and discussion

The analysis included a concept level cash flow analysis and indicates that a feasibility business opportunity is possible. A capital investment of approximately R3.7 million would be required to establish a sustainable community-based business venture, with a potential annual revenue exceeding R7 million, creating at least 25 full-time jobs, creating additional small business

opportunities and with a favourable Internal rate of return (IRR), which exceeds 25%. This business case demonstrates that small-scale production of high value Typha panel products would be profitable, largely because of the lower risk associated with low up front capital requirements, the fact that it does not require crop nor planting inputs, and the fact that there is a growing market for high value interior architecture products by corporate businesses in the retail and business-to-business sectors.

Conclusions and recommendations for further research

In order to achieve this business potential, the analysis also identifies 4 key areas of research, development and marketing activities required to confirm the details of the feasibility of the proposed venture, including:

1. Demonstrable product development and market offtake securement of high value interior architecture products;
2. Typha resource and management planning (including a Typha resource assessment, complimentary wetland plant assessment and legislative assessment);
3. Typha beneficiation (i.e. board manufacturing) technology investigation and development.

It is recommended that these additional research, development and marketing activities are ideally suited a WRC GVP investigation, supported by complimentary funding streams from other (non-WRC) government sources, such as the Green Fund and others.

It is also recommended that this additional research be executed using a multi-disciplinary, multi-funded, pilot study approach. The Balamhlanga wetland is eminently suited and reportedly has a 200 ha Typha population. The pilot site is located in the Jozini Municipality in KwaZulu-Natal **(Figure 2).**

Acknowledgements

Prime Africa's research team would like to acknowledge the following organisations and people for their invaluable input to this business case report.

- The Water Research Commission (WRC) for funding the work;
- Mr Bonani Madikizela of the WRC for providing excellent project guidance;
- Dr Piet-Louis Grundling of Wetrest for initiating this project;
- Dr Jan Sliva of the Technische Universität München, Germany for technical input on Typha panel boards uses in Germany;
- Dr Donovan Kotze for providing the preliminary list of indigenous wetland plants in South Africa with a potential for economic use;
- Mr James Mackenzie, Ms Nancy Job and Mr Dieter Kassier, all wetland specialists, for ecological information on the sustainable use of Typha;
- Mr Andre Fivaz of the Thatcher's Association of South Africa for providing technical information on construction material from wetland plants in South Africa;
- Mr Terry Hannan of GFP Machinery for providing advice on the production process and equipment requirements; and
- Ms Carin Wolfaardt or ARC Architects for providing advice on interior architecture applications for Typha panel products.

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List of acronyms

CARA	Conservation of Agriculture Resources Act, 1983 (CARA) Act No. 43 of 1983
CICES	Common International Classification of Ecosystem Services
CPA	Common Property Association
DACST	Department of Arts, Culture, Science & Technology
DAFF	Department of Agriculture, Forestry & Fisheries
DEA	Department of Environmental Affairs
DWS	Department of Water & Sanitation
ECA	Environment Conservation Act, 1989 (ECA), Act No. 73 of 1989.
FEGS-CS	Final Ecosystem Goods and Services-Classification System
GDP	Gross Domestic Product
GVP	Green Village Programme
KSA	Key Strategic Area
KZN-DARD	KwaZulu-Natal Department of Agriculture & Rural Development
MA	Millennium Ecosystem Assessment
NEMBA	National Environmental Management: Biodiversity Act, 2004
NPO	Non-Profit Organisation
NWA	National Water Act, 1998 (NWA), Act No. 36 of 1998.
OSB	Oriented Strand Board
PBO	Public Beneficiation Organization
PES	Payment of Ecosystem Services
TEEB	The Economics of Ecosystems and Biodiversity
WfW	Working for Wetlands

1 Background

Rural communities in South Africa benefit directly from the use of wetland plant resources by as much as 15-28% of their livelihood accruals (Shackleton et al., 2007). Women in particular are dependent on a wide range of wild harvested products, from fruits to craft materials, as a source of cash income. For poor women in the rural areas of South Africa income from sales of traditional brooms contributed more than 75% of cash income for one-third of households surveyed. On the other hand, out of the 51.7 million people in South Africa, some 12 million languish in poverty, the majority of which are resident in an estimated 27 district municipalities (DM) spread across the country, but mainly concentrated in the Eastern Cape, Limpopo and KwaZulu-Natal provinces. Drastic and innovative rescue measures and development interventions are required. A vast number of these people either survive on social grants or migrate to urban areas in search of better livelihoods, the hope of which is in many cases unfulfilled, resulting in increased unemployment figures.

The research conducted here identified various wetland plants that can be commercialised with the purpose of creating employment **(refer to Appendix 3).** ***Alepidea amatymbica*** iKhathazo is a wetland plant with high commercial value and is currently being traded in the informal medicinal markets of KwaZulu-Natal, South Africa. The plant has various uses in combating several ailments. *A. amatymbica* were sold annually by 54 herb-traders in the KwaZulu-Natal region. The species was the third most traded individual species in terms of annual volume, Cunningham (1988). Thus, this plant is of potential high commercial value that could be used to create entrepreneurship and job opportunities in the medicinal and bioprospecting industry.

Thamnochortus insignis Cape Thatching Reed is commonly used in the thatching industry of South Africa preliminary surveys from local farm worker reveals that they harvest the thatch by hand will produce about 50 to 100 bundles a day. Purchases are up to 20 000 bundles per day, each bundle weighing about 20 kg at R2-3/bundle. With the paradigm shift toward green living, the thatch industry will see a growing increase in demand to build houses, usually with low-cost, local vegetation; that will be harvested and processed in the value chain by the local communities.

There is a current market of the ***Aponogeton distachyos***, Waterblommetjie Riverside Farm Waterblommetjies 400 grams are sold at R32.99 at namely Pick ‘n Pay, Woolworths Fruits and Veg City. However, information on the Waterblommetjie brought to the market is yet to be studied for its availability period, quantity brought to the market, number of vendors involved in selling of species, trend of market availability of species, extraction pattern of species, and pressure on the resources using standard methods.

The Ilala Palm ***Hyphaene coriacea***; Ilala Palm indigenous wetland plant has proved to be of great economic value as it is sold on craft stalls catering to the tourist trade in Tongaland (KZN north of St Lucia and east of the Lebombo) sell a wide variety of baskets. The craft industry contributed R2 billion rand to the gross domestic product (GDP) in the craft industry value chain and consisted of over 7 000 craft producer organisations in 2005 as documented by Department of Trade & Industry (2005).

The ***Miscanthus junceus***; Besemgras, is a wetland plant investigated in the literature review report as a plant with a high potential to be used for landscaping for water treatment in heavily polluted

water ways and wetlands. Research into its potential as a plant for water purification and riverbank protection seems warranted (van Oudtshoorn, 1999; van Wyk & Gericke, 2000). Therefore the presence of this plant in wetlands also assists in improving wetland regulatory functioning and increase of water chemical purification downstream.

However, this techno-economic analysis focuses on Typha due to (1) its relative abundance, and (2) its potential for job and entrepreneurship opportunities based on proven German technology.

The Department of Environmental Affairs' Working for Wetlands Programme is responsible for wetland rehabilitation in South Africa, and have identified the need for managing Typha through clearing, from rivers and wetlands, whilst creating jobs in the process. Typha often grows uncontrolled along the most river banks and wetlands (Grundling *et al.,* 2015). This pioneering property of Typha creates a business opportunity, because it has become very abundant, while, on the one hand, if left uncontrolled, it can out-compete other species and thus its population needs to be managed.

A German case study by has demonstrated that *Typha capensis* is a wetland plant that provides an economically viable raw material for construction materials **(Appendix 4).** The plant can grow as high as 3 meters. May be harvested within 6 months even with large plant interspace (0.5 to 2 plants per square metre), provided boundary conditions are favourable. Typha populations are robust, natural monocultures, which yield 15-20 t of dry matter per hectare each year (about 150-250 m^3 of building material). This corresponds to four or five times the crop yielded by native coniferous forests. The practicability of Typha cultivation has already been demonstrated by the project entitled *"Rohrkolbenanbau in Niedermooren"* (Cultivation of Typha in fens) managed by the Department of Landscape Ecology at TU Munich which was funded by the German Federal Environmental Foundation (Deutsche Bundesstiftung Umwelt BDU) (Pfadenhauer & Heinz 2001).

In the South African setting, it is possible to develop high value, green building, and interior architecture materials.

Thus, this business case investigates the option for commercial use of Typha as a high value, green, interior architecture building material. This business case develops a case study producing such green building material from Typha at the Balamhlanga wetland in KwaZulu-Natal **(Figure 3)**.

The business case envisages to empower rural people to sustainably harvest the Typha, produce high value, green, interior architecture building material in the form of panel boards, to be sold to a green building market. Thus, this initiative will create employment and entrepreneurship opportunities for vulnerable rural communities residing in wetland areas with vast populations of Typha.

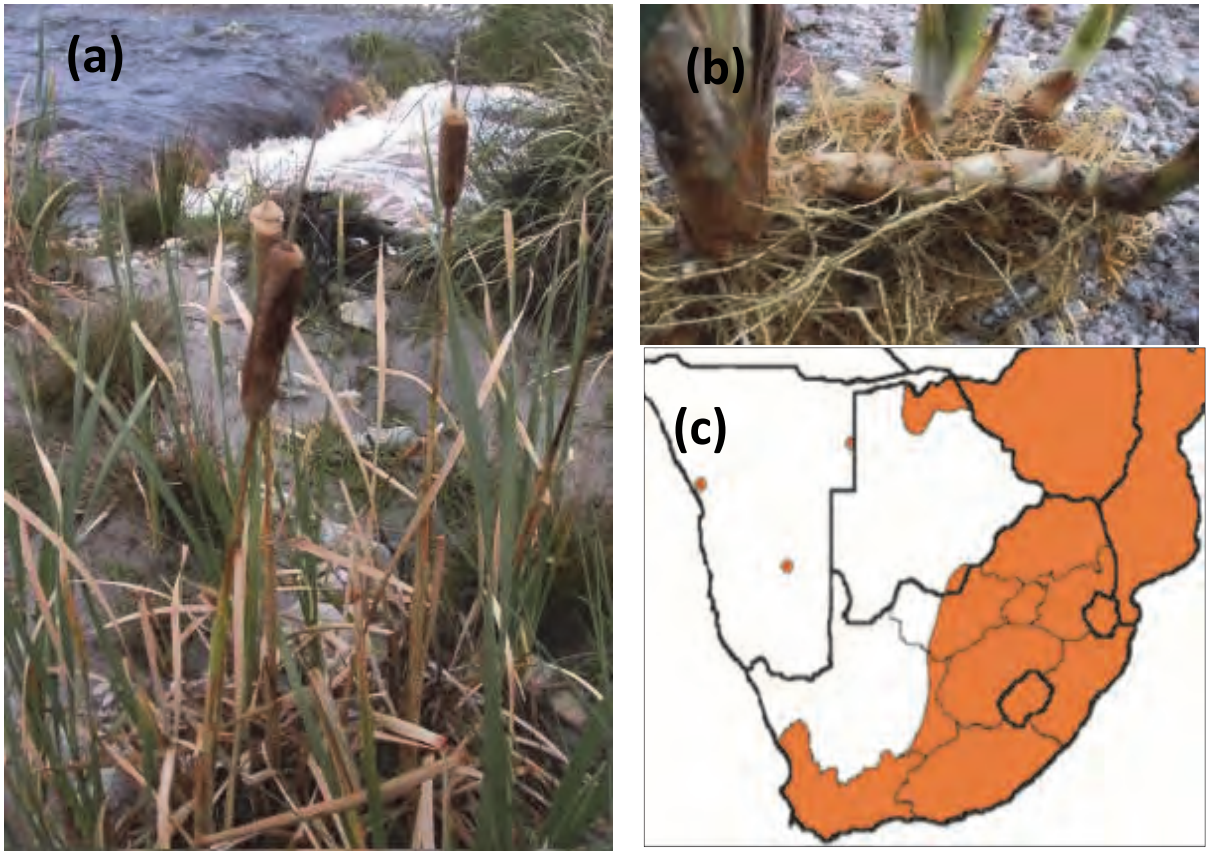

Figure 1: (a) Typha plant in a water-way (b) Typha rhizomes www.plantzafrica.com (c) Distribution map of Typha in South Africa (Van Ginkel *et al.*, 2011)

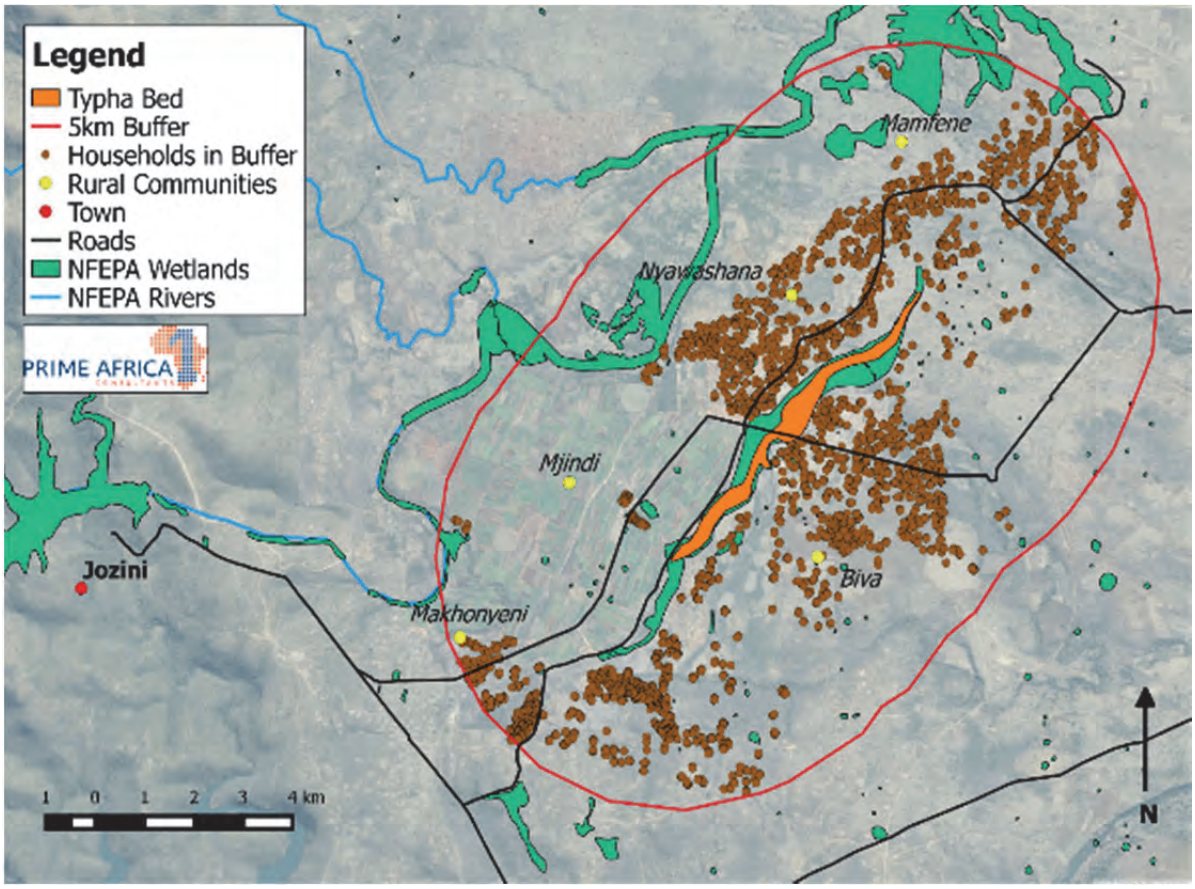

Figure 2: The Balamhlanga Wetland with Typha distribution and surrounding communities in the Jozini Municipality.

2 Mandate analysis

The WRC's GVP has the mandate of putting in action research and development outputs related to water-related ecosystems and promoting food security, energy, rehabilitation, and biodiversity (including wetlands) protection. The move from a singular to a multi-disciplinary and multi-sectoral programmatic approach, as anticipated by the GVP, is aimed at demonstrating that basic services provision can be achieved without compromising ecological infrastructure (wetland ecosystems), through exploring greener alternatives such as construction of houses using Typha capensis plant material.

The GVP programme also has the mandate to demonstrate that an integrated multi-sectoral and multi-disciplinary approach to implementation of scientific and technological knowledge can be achieved as an affordable investment that benefits targeted communities, shareholders (funders and researchers) and the environment. The WRC's GVP has the following outcomes:

- Initially focus on a research portfolio and analysis level in an attempt to establish needs/possible tools for solutions
- Secure developmental models and scenarios
- Identify possible science and technology interventions
- Demonstrate what the integrated approach can achieve, and market the idea to implementers/funders
- Develop models for up-scaling the framework for implementation
- Look for innovative solutions at a small scale with potential for IP/beneficiation
- Support entrepreneurship and green job creation.

In addition to this, supporting and partnering government organisations have key supporting roles and mandates relating to this business case, and their involvement in this business case is envisaged:

- Department of Environmental Affairs through its Green Economy initiative, and the Working for Wetlands Programme
- Department of Water and Sanitation through its mandate of protecting water resources and enabling use of water resources
- Department of Science and Technology through its mandate to support appropriate technology development
- Department of Small Business Development.

The WRC's GVP mandate positions the WRC as a research, development and technology partner to the above organisations.

3 Problem statement and business case objectives

3.1 PROBLEM STATEMENT

Anthropological and ethnographic studies show that for a very long time, rural women and men have planted and harvested crops in and around wetland ecosystems, deriving limited or no market value, due to a number of limitations. The core of the research problem addressed in this report revolves around the need for a clearly articulated business case to guide collection and market potential value chain analysis of *Typha capensis* in ways that robustly tackle issues of poverty pertaining to traditional rural communities residing in wetland areas. The main research problem is to identify … ***"the best way to develop a robust business case and analyse existing value chain for the marketing of the Typha wetland plant and its use by the Balamhlanga Wetland community living in traditional rural scenario?..."***

3.2 BUSINESS CASE OBJECTIVES

The objective of this business case is to commercialise the indigenous Typha wetland plant and to create economic opportunities, jobs and entrepreneurship.

This is to be achieved through the manufacturing of a green building material in the form of a panel product, following the German Federal Environmental Foundation technology approach **(refer to Figure 3).**

It is a fundamental objective to facilitate the conservation and restoration of wetlands, whilst using it as a resource that would create socio-economic security for the impoverished communities. Thus, wetlands become sustainable economic assets and can be invested as Ecological Infrastructure, by the cultivation of economically valuable plants in South African wetlands. This venture in commercialization of indigenous wetland plant Typha will create green jobs through sustainable enterprise.

Using the results from literature and key expert interviews, this business case assesses the environmental, economic and social benefits that Typha provides. The business case considers the likely production, management, operational and marketing challenges for the envisioned production process and final products in the context of South Africa, and identifies additional research and development requirements. Thus, this report seeks to elucidate the need to justify a business case to sustainably use and commercialize the indigenous Typha wetland plant in South Africa to create jobs and entrepreneurship especially for the economically marginalised communities residing in wetland areas.

This report considers the potential economic value of Typha, however, it does not contain a comprehensive economic valuation of all wetland plants. It is therefore recommended that other indigenous wetland plants be included into the GVP initiative, in order to complement management plans and reduce risks through expanding product portfolios.

This business case therefore develops a small scale model useful in identifying the necessary conditions to achieve profitability in the Typha business – such as a minimum market share required to break even. If the WRC deems this approach to be attractive, the next step would be to develop a larger, GVP-based multi-disciplinary research initiative and accommodating business plan.

Figure 3: Examples of Typha board products (Krus *et al.,* 2014)

4 SWOT analysis

A SWOT (Strength-Weaknesses-Opportunities-Threats) analysis is an important risk management tool in any business case. For instance, Typha has been known to grow aggressively as a pioneer species in high nutrients degraded wetlands, and is widely distributed across South Africa's wetlands and river systems. The proliferation of Typha may therefore lead to many problems such as draining open water spaces (reduction of water quality & quantity), blocking irrigation canals, making access to rivers and fishing difficult for the local population (Elberson, 2005). In this regard, the WRC has identified using panel boards from Typha to create green buildings as one of the solutions to limiting the proliferation of Typha and simultaneously reducing deforestation in South Africa.

Table 1: The SWOT analysis below identifies key opportunities and risks related to the business case.

Strengths	Weaknesses
• Abundant, wide distribution • Pioneer species for wetland rehabilitation • Proven building material • Balamhlanga Wetland Community has existing Typha plant in abundance • Wide distribution of indigenous Typha in South Africa • Least concern on Red Data List; not threatened or endangered species • Local Ecological Knowledge of *Typha capensis* • Typical investments of between R500 000 and R1 000 000 per hectare equivalent that is typically made by the Working for Wetlands Programme in rehabilitating wetlands.	• New products and markets need to be developed to position Typha panels as high-value products • Typha resource knowledge gaps exist (e.g. yield of Typha, source of Typha, plant productivity, etc.) • Typha beneficiation technology gap
Opportunities	**Threats**
• Green interior architecture market potential • Controlled Typha growth in wetlands • Reduction in deforestation using this alternative • Job creation & entrepreneurship through the demonstrable product • Cultivation of the plant in degraded wetlands as a mitigation measure • Appealing high value end product • Identify willing community (demographics StatsSA)	• Environmental risks associated with Typha and Typha harvesting from wetlands • Legal clauses; legislation prohibiting cultivation/harvesting activities • Unsustainable harvesting • Social license for the Typha harvest as a part of job creation • Market uncertainty • Quality of the product • Lack of capital investment for project implementation • Potential conflicts on roles, responsibilities and ownership

5 Product description and market potential

This business case is dependent on the development of a new product to be sold as a high value product into the South African interior architecture market. This is a new and fast-growing market, which uses high value building materials in green building applications. These products have attributes such as low carbon footprints in production; good isolation properties minimising energy requirements for heating or cooling of the buildings; low emissions associated with manufacturing and use (especially of glues used in composite materials manufacturing); sustainable manufacturing supporting enterprise development and aesthetic appeal associated with natural features. Thus, this market is willing to pay price premiums for products that have been certified (1) to be environmentally sustainably produced; (2) to not contain harmful chemical substances, and (3) to support job creation and poverty alleviation. The Department of Environmental Affairs in their new

Head Office building made extensive use of such products. Market evidence suggests that South Africa's demand for such products exceed the domestic supply.

This is a niche market that is distinct from the conventional building panel construction market. The total panel products market is worth and estimated R2.18 billion annually (DAFF, 2014), and the Typha panels envisaged here would be positioned as a high value, niche market within this.

The Typha board product envisaged here would take the form of a bespoke (i.e. tailored to unique customer specifications) panel product, of maximum size 2.44 m x 1.22 m x 50 mm and a density of approximately 220 kg/m^3. The product would be manufactured as a batch-process oriented strand board (OSB) product and would thus lend itself to tailor-making product designs and sizes to specific customer requirements.

Typical customers would include commercial property developers, owners and leasers who would engage interior architects and shop-fitters to develop branded and green commercial property interiors. Customers could also include eco-tourism and government clients such as SANPARKS, Ezemvelo Wildlife and others. Please refer to section 14 for more information.

Typha boards would offer many advantages to its consumers. Firstly, it will provide a cost-effective alternative to more expensive imported products. Secondly, it provides a compelling unique branding benefit. Thirdly, its light density would provide good insulation properties in green buildings.

Figure 4: Examples of high value oriented strand board products for interior architecture applications (www.coolhunting.com)

6 Business description

The Typha production business would involve an integrated harvesting, transport and small manufacturing operation located in close proximity to a suitably abundant Typha population (Blignaut, 2008)

Harvesting would be done according to a suitable management plan approved by relevant authorities. Harvesting would be done by hand and would be labour-intensive.

The harvested leaves would be dried and bundled and transported over a short distance, using local transport suppliers, to the production facility.

The production facility would require an industrial building of 500-1000 m^2 of secure under-cover area with 3-phased power. The site would contain 2 panel production lines comprising sequential hammer-milling, glue dispensing, panel forming, panel pressing, and panel setting activities. In addition, this business case envisages an artisanal manufacturing facility which would produce artwork to be integrated into the panel products. The final panel products will be shipped directly to the clients from here.

This business description is a likely scenario but would be finalised only once business planning and off-take agreements are implemented.

7 Environmental issues

The commercialisation of Typha is associated with two key and contradictory environmental risks which need to be managed and mitigated through the business case.

The first of these risks result from creating a market for Typha as a raw material, which could result in (a) uncontrolled harvesting activities within wetlands, and (b) planting of wetland areas with Typha, thus putting wetland health at risk. Though Typha is indigenous to South Africa its property as a pioneering species in degraded wetlands creates the hazard that it can become invasive. For instance, the project for the "Eradication of Typha Weeds Invasion on the Balamhlanga Stream in Jozini Local Municipality", was initiated by the KZN Department of Agriculture and Rural Development (DARD) in conjunction with the Ezemvelo KZN Wildlife as the implementing agent (Grundling *et al.,* 2015). The objective of the Typha eradication project was to reduce the surface it occupies the Balamhlanga Wetland.

The second of these risks relate to securing a long-term sustainable supply of Typha, to enable sustainable supply to the production facility. There are natural limits to the natural yield of Typha and the business case need to be structured within these limits.

These environmental risks call for the development of a Typha management plan. This Management Plan should be structured to including a comprehensive Typha sustainable resource assessment; a biological study that informs the agronomic potential of Typha; complimentary wetland plant assessment and a legislative assessment.

Within this management plan it should not be forgotten that Typha plays an extremely valuable role as a pioneer species in rehabilitating degraded wetlands. Typha thrives in nutrient-rich, degraded wetlands, curbing erosion and preserving habitat whilst avoiding more pristine water-ways. In addition, planting Typha populations downstream of urban, agriculture, mining or industrial areas could regulate water pollution.

The management plan would also be required to facilitate the necessary water use licencing and environmental authorisation and requirements that seek to protect wetlands and therefore regulate wetland activities **(refer to Appendix 8).**

8 Risks and mitigation

In addition to the environmental risks highlighted above, 4 other key risks that arise from the literature review and the SWOT analysis above also need to be considered.

Firstly, literature has revealed a large gap in the understanding of the growth rates, agronomic characteristics and economics of producing Typha as a raw material. This is a risk also highlighted in the section above (Environmental issues) and need to be addressed as part of a Typha management plan. Such a management plan would not only enable and understanding of the national Typha resource, but would also provide a blueprint for developing wetland-specific Typha management plans. It is further envisaged that Typha may be a resource for planting in artificial wetlands used in high nutrient pollution water environments (e.g. associated with wastewater treatment works).

Secondly, a project of this nature crucially depends on engaging and empowering target communities. Resolving wetland access and tenure, identifying business owners, employees and services providers are key issues that require careful planning and consideration. Transferring technology and business responsibility are sensitive and complicated issues. If these socio-economic matters are not adequately addressed, the business case will fail. This requires a wetland social science programme to identify risk areas and develop mitigation measures.

Thirdly, Typha beneficiation (i.e. board manufacturing) has to date only been piloted in Germany. It is expected that a technology transfer initiative from Germany would be beneficial. In addition, localised product development and learning also needs to take place. This would include resolving drying, transport and manufacturing techniques and internalising indigenous knowledge into the manufacturing process, especially in the artisanal component of the manufacturing. In line with the national strategy of decentralization, and in order to be able to adjust the capacity of production in accordance with the growth of the local demand, the project must design a modular, decentralized process that can be accessible for national investors and define the minimum production scale that will allow commercializing Typha products at competitive prices. Appropriation and replication of the project by national investors is a key factor of success of the future project, which therefore must involve activities that will facilitate favourable and enabling environment that will encourage national investors to invest on Typha-based building material production.

Finally, there exists a market risk due to the fact that the Typha board would be a new product on the market. This risk needs to be managed through an integrated product development (see for example **Figure 4**) and marketing initiative. There is a need to know more about the cost

implications of production and about supply and demand, once a prototype product is available, which can be demonstrated to customers, and product quality and delivery can be guaranteed.

Ultimately, the above work would require (1) developing a greater understanding of the market, (2) identifying or predicting indigenous plant performance in different production systems, and (3) establishing the production budgets for cultivation within various agricultural systems. The information gained from this work could then provide an understanding of what range of prices could be expected on the market, and what range of costs and yields could be associated with the different cultivation systems. This would enable development of a model that would be able to assess a large number of combinations of variables such as price, market demand, yield characteristics, agricultural inputs and input costs.

These key risk areas need to be mitigated during the business implementation phase.

9 Alternatives

The alternative to this business proposal is fundamentally to leave Typha management to the Working for Wetlands Programme (refer to section 14). The advantage of this business case it that it would, subject to a scientifically credible wetland management plan, control Typha populations while adding significant value to this resource, while generating a significant revenue stream to support rural small business development and meaningful employment creation.

10 Financial assessment

The pilot business model associated with the Balamhlanga wetland envisages a small-scale production facility for Typha panel board production in the Jozini Town. Dried Typha plant material from rural harvesters from the Balamhlanga Wetland would be transported to the production factory, and would sell and ship the high value Typha boards to final consumers. Although the raw material (mainly dry Typha) cost would be very low, the harvesting, transport and production costs are the key cost items that need to be covered.

Regarding the source material, further studies are needed to understand the cost of using Typha versus leveraging biomass leftovers from agricultural or other sources. It is important to set up facilities that can process not only Typha but other biomass residuals. Regarding the production process, we would recommend further study to understand the economics of the different stages of the Typha panel board production process; separating boards and residuals.

Given the existing 200 ha of Typha in a portion of the wetland, with a productivity of 15 to 20 dry tons/year, a potential Typha harvest of about 3000 tons/year of dry matter is expected to be available in the long-term. However, the production in this case is constrained by the production capacity of the panel presses. This business case was modelled through a desktop cash flow analysis, using information from literature, quotes from suppliers and expert opinions. The detailed analysis is summarised in Appendix 4. The business case envisages a 2-line production system, with 2 panel presses running in parallel. This would result in an effective Typha harvest area of only 35 ha per year and a Typha board production yield of 15,360 boards per year, assuming a single-shift

production process. This in turn will yield a revenue of approximately R7,100,000 per year and create 25 meaningful employment opportunities. The capital investment requirements to realise this opportunity is estimated at approximately R3,762,000 per year and this creates an attractive return on investment **(Table 2)**.

Table 2: Salient features of the Balamhlanga Typha Board business case (Product description: 2.44 m x 1.22 m x 50 mm high value Typha oriented strand board)

Item	Number	Unit
Effective wetland harvesting area required	33.5	ha
Effective Typha (monoculture) yield (dry mass) – Average	15.0	t/ha
Total Jobs created in the entire Value Chain	25	#
Distance from wetland to production site	20	Km
Transport from wetland to production site	320	R/load
Capital requirements	3,762,000	R Year 0
Boards/a	15,360	#/a
Total Revenue	7,100,000	R/year
Capital cost per job	153,089	R/job
Internal rate of return before tax	>25%	

11 Human resource requirements

The envisaged permanent human resources requirements in Balamhlanga Typha commercialization venture would consist of (1) programme support staff and (2) business venture employees.

In the case of the programme support staff it is important to appropriate programme management and scientific and technical support staff, through a GVP-based research programme.

In the case of the business venture employees, staff and suppliers are required for the following functions:

- Harvesting: at least 13 full time employees
- Transport: sub-contractors to be determined
- Production employees: 10 full time employees
- Management, marketing and administration: 3 full time employees.

Training requirements for these positions would include:

- Domain specific technical training based on best operating practices in each of the functions
- Occupational safety and health training
- Business development training
- Employee-specific careers development based on detailed skills surveys for each position and employee need to be conducted.

In addition, business owners would benefit from “business angel” mentorship. This would be especially important to develop entrepreneurship skills of the business owners and employees.

12 **Recommended business option**

Various legal entities, and permutations of legal entities exist, through which ownership structures could be arranged.

The most appropriate legal entity to implement is likely a Communal property association (CPA). CPA's are established in terms of the Communal Property Associations Act, Act number 28 of 1996. The objective of the Act is to create a new form of juristic person to allow disadvantaged communities to acquire, hold and manage property in common. A community that qualifies in terms of the Act can therefore, on the basis of agreement contained in a written constitution, form a legal entity (the CPA) and thereby become owners of property, including land, via the CPA. The Property of the CPA must be dealt with in the constitution in considerable detail. Land or other assets to be owned by the CPA must be identified. The purpose for which the property may be used and how it is to be divided physically, and then allocated, must be stated. Whether rights may be sold and, if so, to whom, must be explained. The constitution must also detail the devolution of property rights upon a member's death. Once registered, the CPA becomes a juristic person – that can sue and be sued. It may acquire rights and incur obligations in its own name, in accordance with its constitution. A registered CPA has perpetual succession, even though its membership may alter. The CPA has the power to acquire and dispose of immovable property and real rights therein as well as the competence to encumber by way of mortgage, servitude, lease, etc. (www.ruraldevelopment.gov.za › Publications)

Another option is that of a Public benefit organisation (PBO). The Act requires that the PBO conducts its activities in a non-profit manner and with an altruistic or philanthropic intent. Furthermore, the activities conducted by the PBO cannot directly or indirectly enhance the economic self-interest of any person acting in a fiduciary capacity for the PBO or for an EMPLOYEE thereof, except in the form of reasonable remuneration payable to that fiduciary or employee for services rendered. In addition, at least 85% of the activities conducted by the PBO, measured either as the cost related to the activities or the time expended relating thereto must be carried out for the benefit of persons in the country, unless the Minister having reference to the circumstances of the PBO directs otherwise.

Another option is that of a Non-profit company. Typically, community-serving organizations are focused on providing services to the community in general, either globally or locally: organizations delivering human services programs or projects, aid and development programs, medical research, education and health services, and so on. It could be argued many non-profits sit across both camps, at least in terms of the impact they make. Although NPOs are permitted to GENERATE surplus revenues, they must be retained by the organization for its self-preservation, expansion, or plans. Designation as a non-profit does not mean that the organization does not intend to MAKE A PROFIT, but rather that the organization has no 'owners' and that the funds realized in the operation of the organization will not be used to benefit any owners. The extent to which an NPO can generate surplus revenues may be constrained or use of surplus revenues may be restricted.

13 Value for money

Economic value for money will always be contingent upon the Typha board production being sustainable while the wetland performing its natural function.

The need to address sustained economic growth while simultaneously preserving the natural environment presents important policy challenges for countries such as South Africa. Growing concerns about climate change, a loss of biodiversity, and the poor management of natural resources such as forests and water all indicate that the benefits of growth – and its ability to deliver social well-being – must be increasingly considered in light of environmental costs. Some of the most innovative instruments focused on balancing growth and environmental impact are originating in developing countries. Payment for Ecosystem Services (PES) is one such instrument, and this business case presents a PES opportunity.

Payments for ecosystem services (PES), also known as payments for environmental services (or benefits), are incentives offered to farmers or landowners in exchange for managing their land to provide some sort of ecological service. They have been defined as "a transparent system for the additional provision of environmental services through conditional payments to voluntary providers." These programmes promote the conservation of natural resources in the marketplace. In this regard, communities living near wetland area may be paid by the government for conserving the ecosystem services in the event that small business enterprises could not be established by the locals. PES recognises that landowners and communities face opportunity costs in foregoing certain economic activities to preserve and restore natural environments and that compensation is necessary to make these costs acceptable, particularly for poor people living in wetland areas (refer to Appendix 9 for more information on PES in South Africa).

14 Implementation approach and timeline

Following from the risk assessment reported in section 8 above, this section proposes a 4-tiered pilot implementation strategy centred on the Balamhlanga wetland. The purpose of this strategic approach is to address the multiplicity of risks associated with this venture within the 4 key risk areas identified above, with the intention of further investigating, and designing mitigation activities, through an integrated, multi-disciplinary research, development and implementation approach.

14.1 PRODUCT DEVELOPMENT AND MARKET OFFTAKE SECUREMENT OF HIGH VALUE INTERIOR ARCHITECTURE PRODUCTS.

There exists a market risk due to the fact that the Typha board would be a new product to the market. Product quality specifications and delivery warrantees need to be set and competitive advantages need to be exploited. This risk needs to be managed through an integrated product development and marketing initiative. There is therefore a need to develop a prototype product, which can be demonstrated to customers.

Launch a marketing, education, and market research campaign to increase demand for Typha panel boards. Find out what segments of the population are open to the Typha panel boards. Examine the speed at which consumers choose to adopt Typha panel boards over other building material and

why. Study customer willingness to pay for Typha panel boards and factors that increase customers' willingness to pay. Study what might be unique about the market regarding demand and willingness to pay for Typha panel boards.

Make a close assessment of the panel board supply chain to identify a good entry point. For this analysis we assumed that we will be able to sell via specifications by interior architect firms to their customers. To this end it is likely that bespoke products (e.g. sold to game lodges or Mr Price Home market) at this industrial scale of Typha production would be most profitable. It is recommended the pilot site produce panel boards at a small prototype scale in conjunction with market testing, raising awareness within the market, and investigating optimal harvesting strategies.

14.2 TYPHA BENEFICIATION (I.E. BOARD MANUFACTURING) TECHNOLOGY INVESTIGATION AND DEVELOPMENT

Typha beneficiation (i.e. board manufacturing) has to date only been piloted in Germany. It is expected that a technology transfer initiative from Germany would be beneficial. In addition, localised product development and learning also needs to take place. This would include resolving drying, transport and manufacturing techniques and internalising indigenous knowledge into the manufacturing process, especially in the artisanal component of the manufacturing. Developing a prototype product is key to this step.

Expert option, literature and other investigations have suggested that drying and transporting Typha can be significant logistical challenges that drive up costs. However the examples that we found sited production facilities near the source of Typha. These examples did not require the extent of transport that the pilot study would require to bring Typha (wet or dry) to the large scale processing facility. Thus, the research team should conduct a pilot that require transporting Typha to a central location from the Jozini Town where the wetland site with Typha is located then transported to markets.

In line with the national strategy of decentralization, and in order to be able to adjust the capacity of production in accordance with the growth of the local demand, the project must design a modular, decentralized process. It must be accessible for investors. Appropriation and replication of the project by national investors is a key factor of success of the future project, which therefore must involve activities that will facilitate favourable and enabling environment that will encourage national investors to invest on Typha-based building material production.

14.3 TYPHA RESOURCE AND MANAGEMENT PLANNING

Literature has revealed a large gap in the understanding of the growth rates, agronomic characteristics and economics of producing Typha as a raw material. This risk needs to be addressed as part of a Typha resource and management plan.

Such a management plan would not only enable and understanding of the national Typha resource, but would also provide a blueprint for developing wetland-specific Typha management plans. It is further envisaged that Typha may be a resource for planting in artificial wetlands used in high nutrient pollution water environments (e.g. associated with wastewater treatment works).

Both the Working for Water and the Working for Wetlands programmes in principle have mandates to address the significant environmental challenges associated with the spread of Typha in the South

Africa's water resources, specifically in waterways and wetlands. These mandates are governed by a range of Acts and supporting regulations (refer to Appendix 8). Commercializing Typha by producing panel boards is promising as a way to potentially address these challenges and produce profits.

Harvesting represents a large portion of the Typha panel boards production cost. So far those studying Typha commercialization have proposed and tried several methods of harvesting. The challenge of Typha growing in water, and the fact that it must be cut several centimetres above the water make the harvesting process challenging. We recommend further studies harvesting techniques to settle on one that will have predictable costs. If jobs and entrepreneurship opportunities are to be created through harvesting, the capacity and costs of South Africa's rural labour force will have to be considered. The harvesting equipment, clothing, safety, and similar issues also need to be addressed, ideally during the small scale prototyping described above.

14.4 SOCIO-ECONOMIC AND SKILLS ASSESSMENT

A project of this nature crucially depends on engaging and empowering target communities. Resolving wetland access and tenure, identifying business owners, employees and services providers are key issues that require careful planning and consideration.

The required human resources need to be identified and trained through an appropriate skills development programme.

Transferring technology and business responsibility are sensitive and complicated issues. If these socio-economic matters are not adequately addressed, the business case will fail. This requires a wetland social science programme to identify risk areas and develop mitigation measures.

14.5 SEEK PARTNERSHIPS

The business owners would face many barriers in starting a business of this nature. Thus it is recommended that key strategic partners be engaged with resources in supporting the required water and environmental licences and technology transfer requirements. This development project would require a multi-disciplinary approach including engineering, ecology and business development skills, as well as basic laboratory and workshop facilities where prototyping could be done. Organisations such as Universities, public entities like the CSIR and various NGOs have such resources; therefore appropriate partnerships would be important. In addition, a South African-German technology transfer partnership is possible. Such a technology transfer partnership would have to take due consideration of possible intellectual property issues, and would still need to ensure new knowledge and know-how development.

In working towards initiating these partnerships, we conducted multiple engagements with various Government and private sector role players. The feedback from these engagements is provided in **Table 3** below.

Table 3: Stakeholder / potential funder feedback

	Organisation	Date	Contact Person	Issues Discussed	Recommendations / next steps
1.	Department of Environmental Affairs	4 September 2015	Natalie Feltman (Director, 0123999616); Tseleng Mabunda (Intern)	DEA was impressed with the community based project initiative, they have their own model of engaging with communities on similar initiatives; DEA to verify the need of Bioprospecting Permit requirements; There will be a need for an EIA Application process and Water Use License Application due to the nature of the activity; There will be a need to undertake any other relevant specialist studies during the development of the Typha Management Plan phase; DEA highlighted that there is need for an "Exit Strategy" after the pilot project phase so as to continue with the long-term sustainability of the Typha project.	There is need to engage with wetland scientists and experts during the scoping phase of the EIA process so as to ascertain all the activities; Project team will have to engage with the EIA Unit of the Relevant Authority (DEA National/Provincial) early within the development phase of the project so as to possibly expedite the EIA process eliminating any potential delays during project implementation; Project team were referred to the Natural Resources Management Division within the Department as this initiative falls within the EPWP Working for Wetlands/Water programme; DEA requested to be involved in the Reference Group meetings as they have keen interest in the use of indigenous plants for sustainable livelihoods;
2.	Department of Environmental Affairs – Natural Resources Management Division	30 September 2015	Mr Ashok Maharaj (Deputy Director: Budget and Contract Management, 021 4412708)	The project team submitted a proposal to support the Typha initiative to the EPWP Working for Wetlands/Water programme through the open tender process – BID Reference Number: NMR001-2015-16; The Appointment For The Outsourcing Of Natural Resource Management Projects, Operational Support, Planning, Capacity Building, Training And Development For The Period 2016/17-2018/19	Awaiting outcome of EPWP project adjudication.

3.	Department of Trade & Industry	8 September 2015	Sinah Mosehla (Director, 0123941377) Makhosazana Mayekiso (Deputy Director), Meshack Mathye (Deputy Director)	DTI was impressed with the initiative since it is in line with one of its objectives of facilitating transformation of the economy by promoting industrial development, investment, competitiveness and employment creation. However, they do not get involved in the R&D phase of a project; they involve themselves when a product is ready to be introduced in the market. In addition, the DTI prefers to fund entrepreneurs rather than community projects. A business structure with clear entrepreneurial ownership is therefore a pre-requisite. DTI indicated that the Business Case answered most of their questions – it remained important to develop prototype products to test market demand and development of the Typha Management Plan to ensure sustainability. Different streams/divisions of potential 'funding' within the DTI were highlighted.	DTI is interested to become involved in this initiative. In a next phase, the DTI to schedule a follow-up meeting with all the possible 'funding' streams/divisions within the DTI in order to determine the most appropriate funding source(s) for the proposed initiative. DTI to liaise with the Green Economy Unit within the Department to introduce the concept. Project Team to ensure that all areas of concern to be covered during the R&D phases of the project as suggested.
4.	KZN Ezemvelo Wildlife	22 September 2015	Vusi Mngomezulu (Manager, 0338451889), Skhumbuzo Khubeka (Freshwater Ecologist)	Ezemvelo impressed with the initiative; they are currently looking at possible solutions to the current 'problems' poised by the presence of Typha in the Balamhlanga area. They have suggestions in place on how to deal with the Typha but had not come across such a proposed solution. The current 'thinking' is that if they can contain the water overflows from the dam than there won't be any Typha growing in the area, to the satisfaction of the community since the plant is seen to be a nuisance by the community.	KZN Ezemvelo Wildlife will take into consideration our proposed initiative and if possible adapt it into the current Typha Management Plan that KZN Ezemvelo is formulating. Similar studies proposed by the project team that has already been conducted in the past on the Balamhlanga Wetland will be made available to the project team during implementation so as to curb unnecessary double work. KZN Ezemvelo Wildlife suggested that there is need for prior engagement with the social

				There are studies that have been done on the Balamahlanga wetland similar to that being proposed by the project team. The Balamhlanga Wetland issue is championed by KZN DAFF Provincial working together with KZN Ezemvelo Wildlife.	scientists as part of the project in understanding and demonstrating the wetland-community nexus. Follow up meeting to be scheduled as appropriate to discuss KZN Ezemvelo Wildlife's involvement.
5.	Department of Science & Technology	16 October 2015	Shanna Nienaber (Deputy Director, 0128436558)	DST support R&D initiatives up to pre-commercialization stage; they are a catalyser of such projects rather than an implementer. They channel such projects through entities like CSIR, HSRC, TIA, etc. There is in place an MOU between DST and WRC to work together on such initiatives. DEA-GREEN FUND/DST/DTI are likely to be key partners.	Initiative to be introduced to the Socioeconomic Partnership Programme (Nonhlanhla Mkhize). They are the unit that interfaces R&D with communities. DST to liaise with the follow up meeting. The Water R&D roadmap which WRC will be hosting the Portfolio Management Unit may also be appropriate to play a role in this initiative. DST and WRC have established WADER and project team must also have a conversation with WADER.
6.	Development Bank of South Africa	17 September	Julie Clarke; Najma Mohamed (Policy Advisor: Green Fund, 0113135239); Michelle Layte (Green Fund Manager)	The DBSA referred us to the Green Fund as an ideal funding mechanism.	Continue with follow ups on status of Green Fund and involve DBSA in Phase 2.
7.	Department of Small Business Development	24 August 2015	Judy Booysen, Lindokuhle Mkhumane, Mzoxolo Maki, Mojalefa Mohoto	We attempted on numerous occasions to contact the DSBD, telephonically and via e-mail, but have received no response.	Wait for e-mail response from DSBD.

8.	Airports Company South Africa	21 October 2015	Ms Thokozani (PR Officer)	We suspect that the composite board product used at the CT Airport is in fact Oriented Strand Board (OSB), manufactured from pine timber, typically supplied by companies like ITM Board or Lansdowne Boards in Cape Town, to construction sites. We contacted ACSA CT telephonically, but they could not provide us with any additional information.	No further action required.
9.	ARC Architects	11 June 2015	Carin Wolfaardt	We conducted and extensive interview and discussion with ARC Architects to (1) specify the product requirements for a Typha board and (2) to verify the market potential thereof. The key elements of the interview have been captured in the business case above.	Engage ARC Architects during the design phase of the project.
10.	Nedbank Foundation	19 October 2015	Electronic	Nedbank spends at least 1% of net profit after tax (NPAT) on socio-economic development (SED). One of Nedbank's SED themes is Enterprise development. Nedbank regards enterprise development as a cornerstone of social sustainability for SA as it is key to ongoing creation of much-needed employment opportunities. Nedbank takes a multifaceted, proactive approach to enterprise development, including a mix of funding, transactional and support products, and services that provide flexibility and adaptability across all industries. Some of the enterprise development initiatives undertaken or supported by Nedbank Group in 2011 included:	Application to be submitted by an already established organisation, with a site already in place. Organisation's proposal submitted via email to NedbankFoundation@nedbank.co.za before 31 March every year. Proposal to be assessed against various internal criteria. Due-diligence investigation will be conducted, as well as interviews with representatives of the organisation. Visits to the project site(s) to confirm information provided. Application of financial control measures, service level agreements and governance structures. Review of any co-funders' to negate conflict of interest, reputational risk or duplication of

				Laundry Cooperative (KwaZulu-Natal) – This cooperative is situated in rural KwaZulu-Natal and comprises 30 members who provide laundry services to various campsites and lodges in and around the Giant's Castle area. Nedbank Business Banking provided grant assistance to the cooperative in 2010 and additional loan assistance in 2011 for procurement of equipment. **Poultry Cooperative (KwaZulu-Natal)** – Nedbank Business Banking provided financial assistance and business advice to this small cooperative located in the Nula district, near Port Shepstone. The funds will enable the cooperative to increase production from 600 birds per six-week cycle to 4 000 birds per six-week cycle. **Non-profit organisations** – Nedbank Group views non-profit organisations (NPOs) that facilitate employment opportunities for rural communities as a key role player in job creation. Nedbank provided assistance to an NPO in KwaZulu-Natal that focuses on facilitating market access for small businesses in the region through partnerships with rural and other marginalised communities. Altogether 520 beneficiaries were positively impacted through this intervention, with 316 jobs supported or created.	funding. If requested investment exceeds R50 000, it must be approved by the trustees. After investment, regular reports are submitted by the organisation to the Nedbank Foundation, which monitors progress. A retrospective analysis is conducted 2-3 years after initial investment, to assess impact

15 Key recommendation: Way forward

In order to achieve this business potential envisaged above, 4 key areas of research, development and marketing activities need to be developed:

1. Prototype product developed and market offtake securement of high value interior architecture products.
2. Typha beneficiation (i.e. board manufacturing) technology investigation and development
3. Typha resource and management planning (including a Typha resource assessment, complimentary wetland plant assessment and legislative assessment)
4. Socio-economic and skills assessment

It is recommended that these additional research, development and marketing activities are ideally suited a WRC GVP investigation, supported by complimentary funding streams from other (non-WRC) government sources.

It is recommended that this additional research be executed using a multi-disciplinary, multi-funded, pilot study approach, by following up on the recommendations made in **Table 3**.

The Balamhlanga wetland is eminently suited and reportedly has a 200 ha Typha population. The pilot site is located in the Jozini Municipality in KwaZulu-Natal **(Figure 2).** In addition, KZN Ezemvelo Wildlife is looking for a sustainable solution for the Typha issue and managing the wetland, hence a Typha business presents an opportunity.

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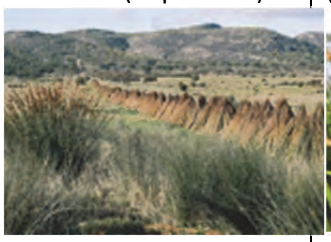
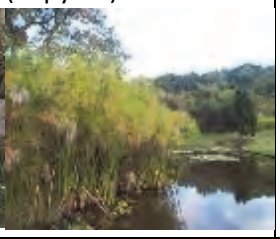
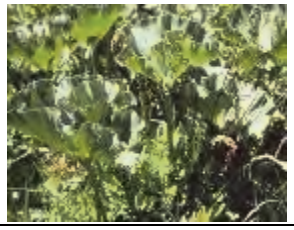
17 Appendix 1: Scientific background and wetland plant potential

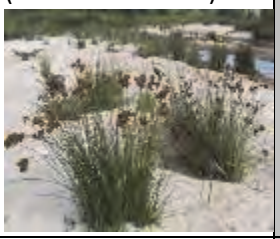
This is the second deliverable of this project and is part of Phase 2; where a resource economic and techno-economic analysis will be conducted. Deliverable 2 addresses aim 2 and 3 of this WRC project, namely, "Through the Green innovation and interaction value chain production methods required from input (wetland plant) to market and establish viable market options based on proven customer need as well as how to sustain the business." Phase 1 of the project consisted of a database of wetland plants that were selected on a Decision-making Matrix for assessing attributes of wetland plants for their economic viability that have a high potential for commercialization. The database consists of a collection of information on 20 prime wetland plants which due to their usefulness have a potential economic value. The plants are listed by species name, by category of most popular use, and by geographical area. The categories (value chains hereafter) of use to which plants have been assigned areas follows: ornamental, utilitarian, essential oils, medicinal, food, water purification. The plants are linked to specific geographical regions of South Africa, where they may grow.

For the incorporation of the value chain analysis of selected wetland plants that could be sustainably used to create jobs and entrepreneurship we highlight viable market options to achieve this. A thorough extensive review on the current viable and proposed value chains of wetland plants commercially used and that can support entrepreneurship and job creation, was conducted. Key wetland plant species that will be discussed in this report include iNcema *(Juncus Kraussi),* Waterblommetjies *(Aponogeton distachyos)* as well as selected wetland species with a commercial potential such as the Cape Bulrush *(Typha capenis)*, will be investigated, using various case studies in South Africa.

Furthermore, the report will investigate case studies for the Green innovations and interaction in the sustainable use of the selected wetland plants, especially in respect of their market options in enhancing the livelihoods of the local community that use and trade these wetland plants.

In this report we more specifically investigate the five value chains (wetland plants for bioprospecting, construction material, crafts production, edible food and landscaping) were identified in Deliverable 1. This report is the second report of a series of four Deliverables to be developed during the course of this project. The project duration is 4 months (January-June 2015). The report provides extensive examples of commercialization of key wetland plants that are capable of creating jobs and entrepreneurship opportunities in South Africa.

	Construction/ Building	Crafts	Bioprospecting Potential	Edible Food	Landscaping
1.	***Chondropetalum tectorum*** (Cape Rush) 	***Cyperus latifolus*** (iKhwane) 	***Alepidea amatymbica*** (iKathazo) 	***Aponogeton distachyos*** (Waterblommetjie) 	***Miscanthus junceus*** (Besemgras) 
2.	***Phragmites australis*** (Common Reed) 	***Cyperus natalensis*** (Giant Dune Sedge) 	***Crinum macowanii*** (River Lily) 	***Colocasia esculenta*** (Madumbe) 	
3.	***Typha capensis*** (Cape Bulrush/Cattail) 	***Cyperus papyrus*** (Papyrus) 	***Ficus sur*** (Broom Cluster Fig) 	***Hyphaene coriacea*** (Lala Palm) 	
4.		***Cyperus sexangularis*** (iMizi) 	***Gunnera perpensa*** (River Pumpkin) 	***Raphia australis*** (Kosi Palm) 	
5.		***Cyperus textilis*** (Tall star sedge) 	***Imperata cylindrical*** (Beady Grass) 		

6.		***Juncus Kraussi,*** (Dune Slack Rush) 			
7.		***Schoenoplectus brachyceras*** (Mat Sedge) 			

18 Appendix 2: Commercialization of indigenous wetlands plants

18.1 DEFINITION OF WETLANDS

Wetlands are defined as wetland'' means land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil (South African National Water Act, 1998). On the other hand, Wetlands are areas where the water table is at or near the surface level, or the land is covered by shallow water. The Ramsar Convention defines wetlands as: “areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres” (article 1.1).

Consequently, The Economics of Ecosystems and Biodiversity TEEB Water and Wetlands is about the “water-wetlands-ecosystem services” interface – it concerns the importance of water and its role in underpinning all ecosystem services and the fundamental role of wetlands in global and local water cycles.

18.2 WETLAND ECOSYSTEMS; WHAT THEY ARE…

The Millennium Ecosystem Assessment (MA, 2005) defined Ecosystem Services as “the benefits people derive from ecosystems”. Besides provisioning services or goods like food, wood and other raw materials, plants, animals, fungi and micro-organisms provide essential regulating services such as pollination of crops, prevention of soil erosion and water purification, and a vast array of cultural services, like recreation and a sense of place. In more recent literature, ecosystem services have been classified by The Economics of Ecosystems and Biodiversity (TEEB, 2010) does not propose that placing a value on ecosystem. Ecosystem services means that they should be traded on the market. Such decisions are socially and ethically complicated. TEEB does not suggest placing blind faith in the ability of markets to optimize social welfare by privatizing the ecological commons and letting markets discover prices for them. What TEEB offers is a toolkit for integrating good stewardship because it’s good economic practice. The Common International Classification of Ecosystem Services (CICES, 2011) developed from the work on environmental accounting undertaken by the European Environment Agency (EEA). CICES is important because it recognises that ecosystem accounting methods require some standardisation in the way we describe ecosystem services.

Table 4: Evolution of the Classification of Ecosystem Goods and Services

MA 2005	TEEB 2010	CICES 2011	FEGS 2013
MA provides a classification that is globally recognised and used in sub global assessments.	TEEB provides an updated classification, based on the MA, which is used in on-going national TEEB studies across Europe.	CICES provides a hierarchical system, building on the MA and TEEB classifications but tailored to accounting.	FEGS-CS provides a classification system of environmental class or sub-class and a beneficiary category or sub-category to minimize double counting

Unlike, MA, 2005 (**Table 4**) that provides a classification that is globally recognised and used in sub global assessments CICES provides a hierarchical system, building on the MA and TEEB classifications but tailored to accounting. Finally, the Final Ecosystem Goods and Services Classification System. (FEGS-CS, 2013) defines and classifies 338 Final Ecosystem Goods and Services (FEGS), each defined and uniquely numbered by a combination of environmental class or sub-class and a beneficiary category or sub-category. This systematic approach minimizes double counting and relates each FEGS to a defined beneficiary, thus linking it specifically to human well-being. Thus this report will attempt to classify ecosystems according to FEGS-CS, 2013.

18.3 ECOSYSTEM GOODS AND SERVICES BENEFITS

Subsequent to the FEGS-CS 2013; ecosystems around the world, provide a variety of goods and services such as land for cultivation, water for productive purposes (crops, livestock and construction) and non-productive purposes (washing, bathing and consumption), grazing pastures, fuel-wood, reeds and building materials and other indirect benefits (recreation, flood attenuation, storm buffering) (Schuyt and Brander 2004). Thus, these services can be classified into two types, i.e. Environmental Class (regulatory & supporting services) and beneficial category (provisioning and cultural services) (FEGS-CS, 2013). Provisioning and cultural services are the basic supplies/benefits or products that people harvest or utilize from wetlands such as reeds, wild fruits, fish and water and gain spiritual benefits and a sense of belonging. Thus, there is growing international acknowledgement of the importance of natural resources to rural households in contributing to their livelihood need; natural resources serve a number of functions, including daily subsistence, income-generation, cash saving (Shackleton & Shackleton, 2004a), safety nets during times of adversity, and meeting spiritual and cultural needs.

18.4 LIVELIHOODS DEPENDENCY ON WETLANDS

Soon after the new dispensation came into being in South Africa in 1994, growing anger against the continued closure of the reserve culminated in a local protest action. Following the protest the government agreed to partially reopen the reserves to harvesting of forest resources (medicinal plants, weaving and thatch grasses), but not marine resources) (DEA&T, 1999). Immediately following the reopening, harvesting rates, particularly of construction timber, were high (Shackleton et al., 2007) Thus, the Sustainable Livelihoods (SL) framework is used to understand how local communities benefit from wetland goods and services. This framework assumes that people may have access to five beneficiary categories of assets (human, financial, physical, social, and natural) and combine them to achieve their objectives through livelihood strategies. Due to the diversity of goods and services provided by wetland ecosystems as well as the existence of diverging livelihood goals between wetland users that result from disparities in terms of physical access to these resources and access to different forms of assets (social, physical, natural, human and financial), the intensity of use strategies employed by users differ tremendously across households (Chiputwa 2006; Masiyandima et al. 2004; McCartney and van Koppen 2004).

18.5 GREEN ECONOMY AND WETLANDS

The first, best prize for this group of the poor is the creation of market-based employment opportunities which offer an income sufficient to lift them out of poverty. In light of the inevitable challenges faced by most growing economies, the United Nations Environmental Programme (UNEP; 2015) has developed a working definition of a green economy as one a system of economic activities related to the production, distribution and consumption of goods and services that results in

improved human well-being over the long-term and **social equity**, **while significantly reducing environmental risks and ecological scarcities for future generations**. In its simplest expression, a green economy can be thought of as one which is **low carbon**, **resource efficient** and **socially inclusive; as well as create jobs and opportunities for entrepreneurship.**

Thus, the green economy may be supported through managing ecosystem assets via investment. These investments need to be catalysed and supported by targeted public expenditure, policy reforms and regulation changes. This development path should maintain, enhance and, where necessary, rebuild natural capital as a critical economic asset and source of public benefits, especially for poor people whose livelihoods and security depend strongly on nature.

18.6 STRATEGIES FOR A GREEN ECONOMY

Investing In Wetland Ecosystems as Ecological Infrastructure

Securing state investment in natural resources management may be achieved through understanding the role of nature. As water infrastructure changes the picture of what investment is needed to ensure water, food and energy security; nature and ecosystem services then become part of the investment focus for economic development and for water, food and energy security, as a complement to build infrastructure rather than a competitor, and thus as a keystone of a future green economy (IUCN, 2012). The results from such investment should be accounted for in terms of economic returns and water, food and energy security, as well as, critically, social equity and resilience.

The key to working with ecosystems in the green economy and the water-food-energy nexus is the application of analytical tools for, first, quantifying the services provided by ecosystems and, second, estimating their economic value (IUCN, 2012). Economic valuations for the infrastructure benefits of ecosystem services are based on, especially, market prices for products (e.g. wetland fisheries), the cost of replacing ecosystems through engineering (e.g. water filtration) or the costs of damage avoided (e.g. flood attenuation).With valuations for natural infrastructure in hand, decision makers can weigh up the costs and benefits of alternate choices for infrastructure development and operation, with a more complete picture of cost effectiveness and broader impacts on sustainable development. In a bid to secure sustainable development, South Africa through the department of Environmental Affairs have established the **National Green Economy Strategy**, a strategic directive to grow economic activity in the green industry sector thereby attracting investments, creating jobs and improving competitiveness. The strategy also includes plans to move existing economic sectors towards cleaner, low-carbon industries in order to protect the environment without compromising economic benefits.

These benefits may be accrued by investing in natural infrastructure is different than investing in conventional built infrastructure. Instead of top-down planning and decision making, working with natural infrastructure benefits from incorporating more bottom-up strategies and actions. Natural infrastructure options can therefore benefit social equity in development. Thus, investment in **Ecological Infrastructure** has been the recent call to most countries to possibly substitute build infrastructure by providing cost effective, long-term solutions to services and underpinning socio-economic development. Thus, the key to investing in ecological infrastructure is to identify priority management actions through green innovations. These innovations have been endorsed by the South African National Biodiversity Institute and currently there is strengthening the consideration

of **wetlands and water resources** in decision-making around mining in Mpumalanga, through improved spatial data, funded through the Water Research Commission.

18.7 GREEN INNOVATIONS

Green Innovations have been seen as the way forward in promoting a green economy. Numerous instances of protecting and conserving ecological infrastructure are one way in of being innovative and thus, reducing costs with natural asset substitution instead of manufactured goods, thus generate national income. Several countries have particularly been innovative using wetland ecosystems to create jobs because it is usually a labour intensive endeavour. Research shows, a few studies have only scratched the surface of this job creation potential. Many of the jobs would be in the poorest parts of the country with the least access to other employment opportunities. The 2011 Green Jobs Report by the Industrial Development Corporation and the Development Bank of South Africa (DBSA) highlights that the bulk of the jobs related to the green economy are likely to come from natural resource management – many more than from, for example, renewable energy generation or technologies for reducing emissions. For instance;

Vietnam: Since 1994, local communities have **planted and protected mangroves** in northern coastal regions of Vietnam, where more than 70% of the population is threatened by natural hazards (Dilley et al. 2005). Restoration of natural mangrove forests is more cost-effective than building artificial barriers. An investment of US$1.1 million has saved an estimated US$7.3 million a year in sea dyke maintenance (IFRC 2002). During typhoon Wukong in 2000, the project areas suffered significantly less damage than neighbouring provinces (Brown et al. 2006).

Benefits of restoration-Manalana wetland, South Africa: In 2006 the 'Working for Water' (WfW) public works programme invested €86,000 to restore the Manalana wetland (near Bushbuckridge, Mpumalanga). It was estimated that the total economic benefits provided by the rehabilitated wetland was €182,000 in Net Present Value terms; that the value of livelihood benefits derived from the degraded wetland was just 34% of what could be achieved after investment in ecosystem rehabilitation; and that the provisioning services now provided by the rehabilitated wetlands have an economic value of €297/household per year. In addition, the Manalana wetland acted as a safety net for poor households during periods of economic difficulties such as high unemployment. Source: Pollard et al. (2008)

Therefore, wetland ecosystems/ecological infrastructure may be used in innovative ways to promote the green economy.

18.8 PROBLEM

It has been established that up to 80% of South African households use herbs for medicinal and cultural purposes (Mander 1998, Shackleton 2005) and there is strong reliance on wild harvested products for household items, income generation (Shackleton and Shackleton 2004), fuelwood (Twine et al., 2003), foods (Clark et al. 2002, Shackleton 2002, UNDP 2006), and veterinary medicines (Dold and Cocks 2001). In Botswana, for example, basketry (from palm fronds) forms a crucial source of income for thousands of poor women (Russi et al., 2013). Literature reveals that natural resources serve a number of functions, including daily subsistence, income-generation, cash saving (Shackleton & Shackleton, 2004a), safety nets during times of adversity (Arnold & Ruiz Pérez, 2001; Shackleton & Shackleton, 2004b; Paumgarten, 2006), and meeting spiritual and cultural needs

(Cocks & Wiersum, 2003). It is now widely appreciated that analysis of rural livelihoods cannot be complete without inclusion of the natural resource component (Campbell et al., 2002), although the number of case studies from southern and South Africa is woefully low.

As a result of these considerations the Water Research Commission (WRC) previously initiated this project on the cultivation of aquatic plants in restored urban wetlands for income generation in local communities. Nonetheless, problems are still existent.

Therefore, the main problem is highlighted in the following:

Infrastructure in transport and communication affects entrepreneurial activities.

South Africa's transport infrastructure is sub-optimal and entrepreneurship is not as activated as it should be in South Africa. South Africa's sub-optimal transport infrastructure impairs the culture of entrepreneurship. An estimated ten (10) million South Africans still do not have access to transportation and are thus confined in their physical movements (Gore & Fal, 2010). The Transportation industry continues to determine the type of industry that will flourish. Fresh agricultural products require a well-developed transport network. The craft industry which is usually viable in rural areas requires commercial airports to enable tourists and the manufacturers themselves to access the market. Other communication infrastructure is also highly underdeveloped.

Bureaucracy

The other factor that hinders rural entrepreneurship is bureaucracy. There are a lot of formal procedures that business licence applications have to go through before they are approved. This usually delays and affects the effective exploitation of opportunities. Entrepreneurs are often exposed to bureaucracy (red tape) and corruption (Haftendorn & Salzano, 2003). There are also barriers in tribes and languages, which may limit socio-economic interactions in trade and certain tribal groups may be marginalised. Yet again, the rural customer has a fairly simple thinking and their decisions are still governed by customs and traditions. It is difficult to make them adopt new practices.

Capital Investment

The lack of adequate start-up finance is one of the most prominent impediments to people seeking to create their own businesses in rural areas (Ulrich, 2006). Rural people lack personal savings, credibility and collateral securities for debt financing, business experience and skills. They also face strict credit scoring methodologies and regulations, complex documentation procedures and long waiting periods when they apply for funding (Robinson, Dassie, & Christy, 2004). More so, rural people lack knowledge, awareness and understanding of start up financing possibilities. They lack successful micro-lending or finance and seed funding. In rural areas, the situation is exacerbated by the fact that the potential entrepreneurs lack collateral to access financial assistance from banks. Poor or lack of networking also affects rural entrepreneurship (Ozgen & Minsky, 2007). This causes rural entrepreneurs to be isolated from viable linkages in urban areas. In as much as rural areas are rich in social capital, there is need to be able to link with other entrepreneurs other than those in rural areas. Rural networking may lead to direct support in terms of raising funds, inter-trading, cooperative efforts, leadership and entrepreneurship development.

Skills and Knowledge

Furthermore, lack of confidence and assertiveness also affect rural entrepreneurship (Hookoomsing & Essco, 2003). In addition to poor perseverance, lack of management skills, lack of technical skills and risk aversion also affect rural entrepreneurship. Rural areas also face the challenge of dominance by a single business or industry (Lyons, 2000). To make matters worse, the small and dispersed populations in rural communities do not generate the number of daily face-to-face interactions that foster innovation and entrepreneurship. (Robinson, Dassie, & Christy, 2004) argue that the geographic location of enterprises in rural areas is an impediment to entrepreneurship. Rural entrepreneurs also face discrimination in the business world. The lack of market information (on commodity prices, suppliers) leads to loss of income and exploitation of rural entrepreneurs by middlemen (Haftendorn & Salzano, 2003). In the private sector, there appears to be little understanding of indigenous plant cultivation in agricultural systems, particularly concerning the performance of plants and the economics of production and marketing processes. As a result, neither the state, private companies, nor individuals are unable to recognize the value of commercializing the production of indigenous plants. As there is no clear indication of the costs and benefits of commercial cultivation, no serious consideration is given to production. Private companies and individuals do not understand the cost implication of production, and they do not understand what financial benefits they could gain from cultivation. There has also been little understanding of the potential for domesticating indigenous plants for small- or large-scale farming systems. While there has been a lot of pioneering work, in the form of mass production, there has been little or no adoption by farmers.

Market Challenges

Poor people and consequently underdeveloped markets characterize rural markets. A vast majority of rural people is tradition bound, and they also face problems such as inconsistent electrical power, scarce infrastructure and unreliable telephone system, and politico-business associations that hinder development efforts. Therefore, there is lack of market initiatives thus demand and supply fluctuations. Rural population is scattered over a large land area. And it is almost impossible to ensure the availability of a brand all over the country. District fairs are periodic and occasional in nature. Manufacturers and retailers prefer such occasions, as they allow greater visibility and capture the attention of the target audience for larger spans of time. Advertising in such a highly heterogeneous market is also very expensive. Large-scale farmers and agricultural companies have not understood the use of indigenous plants. The past racial divisions in South Africa have contributed to considerable ignorance as to the scale of trade in plant products, and there is suspicion with regard to traditional plant use. The large market and the potential market opportunities have largely gone unnoticed.

18.9 PROBLEM SOLUTION

Cultivation of economically valuable plants creates a source of employment and skills development for communities near the wetland. Wetland cultivation projects have the potential to become a focus for other business and entrepreneurial activities in the surrounding communities and thus secure their livelihoods. Thus cultivation of economically valuable plants in wetlands can provide the economic incentives needed to ensure the continued preservation and rehabilitation of wetlands as part of the Payment for Ecosystem Service (PES) scheme; Working for Wetlands Programme.

This business case is an instrument that proposes the use of wetland plant resources to pursue a business initiative of the Green Innovation for entrepreneurship and employment creation in South Africa. It will be used to ascertain economic viability for the proposed project of commercialising wetland plants. As such, it is the most important document in the project review and approval process.

The business case has three primary objectives:

1. **Economic objectives:**
    - **a.** Turning degraded urban/peri-urban and rural wetlands – on publicly-owned land into economic assets, for plant cultivation, to generate income for local communities;
    - **b.** Testing the marketability and exportability of indigenous wetland plants, with the long-term view of developing wetland plant cultivation as local trade and export industry'.
2. **Environmental objectives:**
    - **a.** Enhancing the aesthetic of the urban/rural environment; therfore meeting the Green Village Programme initiatives;
    - **b.** To turn wetlands (Ecological Infrastructure) to an economic asset. It could also determining whether and to what extent the cultivation of a wetland might benefit the ecological, economic and social aspects of the environment.
3. **Social objectives:**
    - **a.** Providing local recreational amenities and contributing to environmental awareness within the local community;
    - **b.** Facilitating the establishment of positive working relationships between local communities and local government;
    - **c.** Providing community development through capacity building of local organisations

Thus, the draft final business plan will allow for all foreseeable eventualities and worst-case scenarios, such as periods of drought or disease which may interfere with productivity. Contingency plans should be made to deal with these events. Consequently, this proposed business plan is a Phase 2 of the feasibility study set out to develop a business plan for a wetland plant commercialization project using a selection of prime wetland plants, and to identify potential sites within SA where pilot projects could be implemented.

19 Appendix 3: Benefits of wetland plant uses

19.1 VALUE CHAIN ANALYSIS

Porter (1985) describes value chain analysis as an evaluation of the activities performed by an organization and further links these activities to the organizations competitive position. As the basis from which value chain analysis evolved, sub-sector analysis provides a framework for the evaluation of performance within a specific subsector by analysing the functioning and performance of each actor in the chain. Four important elements related to subsector analysis, as identified by Lusby and Panlibuton (2004), include the understanding markets and market trends, understanding relationships between market participants, identifying constraints and opportunities and mapping the interrelationships within the sector graphically. Holtzman (2002) further identifies the understanding of commodity characteristics and consumption patterns as key elements of value chain evaluation, due to the effect of product demand in driving the supply response system. Holtzman (2002) further identifies structure, conduct and performance as key factors to be evaluated at different levels of the value chain.

Wetlands contain biodiversity of global significance, and provide the resource base for a wide range of economic activities that provide employment for many thousands of people. This business case highlights the potential financial value of indigenous wetland plants of South Africa in terms of existing economic activities associated with their harvest and use. In other words, what would society lose if the wetland vegetation became degraded or lost due to unsustainable land use practices?' is the key question and motivation of the business case.

From the previous Literature Review Report of this feasibility study; 20 key indigenous wetland plant species were identified have a potential to be commercialised used to create jobs and entrepreneurship in South Africa. Further, the report also highlighted 5 major value chains where these plants could be explored in terms of potential markets and ultimately, economic viability. The five value chains include; bioprospecting, construction, crafts, edible foods and landscaping; these will be discussed more in the following sections.

19.1.1 BIOPROSPECTING

Trending literature defines **Bioprospecting** as the process of discovery and commercialization of new products based on biological resources. Despite being intuitively helpful, bioprospecting has only recently begun to incorporate indigenous knowledge in focusing screening efforts for bioactive compounds (Saslis-Lagoudakisa, 2012). Conversely, South Africa's Department of Environmental Affairs defines the term 'bioprospecting' as inclusive of 'any research on, or development or application of, indigenous biological resources for commercial or industrial exploitation'. (DEA, 2013). Because South Africa has a vast array of biological resources; the use of indigenous biological resources as one of the primary sources for healing of ailments and for symbolic purposes, makes it easy to understand why South Africa is considered to be the third most mega-diverse country after Indonesia and Brazil. Apart from this large variety of biological resources, South African communities and individuals also have a wealth of traditional knowledge about the use of indigenous biological resources for medicinal, nutritional and personal care purposes. This combined wealth – of biodiversity and associated traditional knowledge – is one of South Africa's greatest assets and

needs to be used in a way which not only contributes positively to the lives of the present generation of South Africans, but will continue to provide benefits for future generations.

Therefore, there is a growing global recognition that biological resources are vital to humanity's economic and social development for present and future generations. In the agriculture industry of South Africa, it is estimated that cultivation as a segment of the value chain holds the largest potential for growing the industry and creating formal jobs. In order to realise the minimum market potential – at least 500 hectares per year established for 5 years (DEA, 2013). Thus, bioprospecting activities in South Africa are one of the green innovations that could be used to create green jobs for people living in wetland communities.

Medicinal Plant Trade

The trade in medicinal plants is extensive. Almost every city and town in South Africa has some form of trade in plants for medicinal or cultural purposes, most often through informal street markets or small shops known as Amayeza stores (Xhosa) or Muthi shops (Zulu).

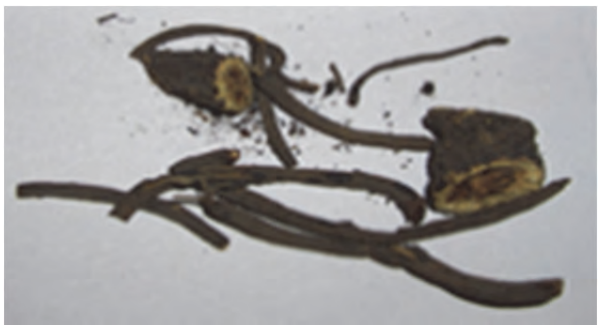
Medicinal plant trade:  A selection of plants, bark and roots used in traditional African medicine. Photo by Janelle Cabuco (Health24.com-2015)	• It is estimated that the medicinal plant trade industry is worth between R750 million and R1 billion per annum nationally in South Africa (Cocks & Dold 2000). • It is estimated that 435 tonnes of wild-harvested plant material (165.3 tonnes of Thicket p.a.) are traded in the six city centers in the Eastern Cape alone every year, generating an income of R19 million per annum, R7 220 000 p.a. of which is generated by Thicket species alone • However, despite this high total income value, the average monthly income per capita is between R150 and R500 (Dold & Cocks 2001
 ***Alepidea amatymbica*** Kalmoes (A); ikhathazo (Z); lesooko (S), iqwili (Xh)	• *A. amatymbica* were sold annually by 54 herb-traders in the KwaZulu-Natal region. The species was the third most traded individual species in terms of annual volume. Cunningham (1988) further • Dold and Cocks (2002) cited *Alepidea amatymbica* var. *amatymbica* as the 19th most prevalent species in the Eastern Cape markets, and estimated that more than 1 200 kg were sold annually in the region. Williams et al. (2007) recorded 64% of Witwatersrand muti shops selling the species and estimated that 556 bags (50 kg-size) were bought annually between the 189 shops in the region in 1994. Assuming that 1 bag holds about 485 individual rhizomes (from Cunningham 1988), this equates to more than 269,000 plants • The maximum recorded density in the protected areas was 5.7 plants/sq m (mean = 1 plant/sq m. • 'Conner further estimated that the Coleford subpopulation had less than 180 000 individual plants, and that if 1.82 million plants were harvested annually for the Durban market (as cited by Mander 1998), then 10 areas equivalent to Coleford were being cleared annually for one market

Figure 5: Medicinal Plant Trade in South Africa.

Medicinal plants are harvested regularly with little or no control or management in communal areas and State-owned land in the Eastern Cape. No plants are cultivated and all material is wild harvested. Unfortunately, as yet, there are no management structures in place and the present harvesting rates are uncontrolled and far from sustainable (Cocks & Dold 2000). If certain medicinal plants are not supplemented from alternative sources, such as cultivated plants, in the near future, it is certain that their survival in the wild will be seriously threatened (Dold & Cocks 2001).

Table 5: Gross annual incomes generated by the medicinal plant trade in the Eastern Cape and number of indigenous plant species traded (across all vegetation types).

Sector	Quantity Harvested p.a. (kg)	Annual Income Ranges	No. of Species Used
Street traders / gatherers	167 – 3 106 Average: 761	R6 000 – R35 988	92
Healers (69% collect their own)	54 – 3 900 Average: 100	R2 400 – R24 000	125
Amayeza (Buy from street traders & gatherers)	Average: 882	-	65

Source: Cock & Dold (2000)

Issues to consider in the value chain: Economic criteria

1. Distance from roads and airport, if relevant.
2. Investment in security measures on site

Thus, a key benefit of this assignment was the collection of primary data on the bioprospecting industry in South Africa through a literature review and business economic analysis was conducted by analysing all primary collected data through internet product search, shop surveys and industry interviews as well as secondary data and information collected with a view to conduct a market sizing and to complete a value chain analysis

19.2 CONSTRUCTION INDUSTRY A SPECIALIZED TRADE OF THATCHING IN SOUTH AFRICA

The ***Chondropetalum tectorum*** Cape Rush, ***Phragmites australis*** Norfolk reed, swamp grass or Umhlanga grass and ***Thamnochortus insignis*** Cape Thatching Reed (E), Dekriet (Afr), **(Figure 6)** are commonly used in the thatching industry of South Africa. An interview held with Andre Fivaz of Hantam Thatchers highlighted that the Cape dekriet from wetlands is the most common thatching material. Local farm worker harvest the thatch by hand will produce only about 50 to 100 bundles a day, whereas a mechanical cutter and binder will process about 6 000 bundles a day. Andre indicated that he purchases up to 20 000 bundles per day, each bundle weighing about 20 kg at R2-3/bundle. Hantam Thatchers then constructs 'lappas'; depending on the size of the roof, 1 m^2 = 90 bundles and each 1 m^2 costs between R1000-1200. (**Pers.comm, Andre Fivaz; Hantam Thatchers,** March, 2015)

Figure 6: *Thamnochortus insignis* cut in the growing season and not sun-dried for at least 7 days before bundling & (b) Finished product, thatched guest lodge.
Source: SANS 10407:2004 South African National Standard. Thatched Roof Construction

With the paradigm shift toward green living, the thatch industry will see a growing increase in demand to build houses, usually with low-cost, local vegetation; that will be harvested and processed in the value chain by the local communities. By contrast in some developed countries it is now the choice of affluent people who desire a rustic look for their home, would like a more ecologically friendly roof, or who have purchased an originally thatched abode.

19.2.1 CRAFTS INDUSTRY

Literature shows that, the craft industry is a key strategy of the South African (SA) government for sustainable development and the creation of employment opportunities (Department of Labour 2011). It also contributes to economic growth and environmental stewardship (United Nations 2008; United Nations 2010). Furthermore there is an increasing demand for craft products globally, especially for home accessories and décor, gifts and products for garden and outdoor living which are simultaneously used for decorative and functional purposes (United States Agency for International Development 2006).

Historically, South Africa has establish from informal crafters, small-to-medium crafting organizations such as Inina Craft Agency Ilala Weavers to larger homeware stores such as PepHome, @Home, @Home living space, and Mr Price Home as well as Woolworths Artistic Collection department, which operate from inside the Woolworths branches. Craft retailers are often more represented in areas with greater urban based population and tourism economies. Craft retail activities have seen an increase of craft retail outlets that now represent approximately 750 outlets consisting of craft markets, galleries, small retailers and national chains (Department of Labour 2008). As a result of this industry, various articles of craft have been produced from specifically indigenous wetland plants such as the Ilala Palm ***Hyphaene coriacea***; Ilala (z), Ilala Palm (e), Lala Palm (e), Lalapalm (a), Mulala (v). Thus, this indigenous wetland plant has proved to be of great economic value as it is sold on craft stalls catering to the tourist trade in Tongaland (KZN north of St Lucia and east of the Lebombo) sell a wide variety of baskets **(Figure 7)**, mats, mbenges and wall hangings and other items made of lala palm fibres. The purchase of these souvenirs is to be encouraged, as the raw material from which they are made is eminently renewable, at rates documented by Moll (1972). Moll reports that his study of lala palm in Tongaland was precipitated by a proposal to harvest the leaves commercially.

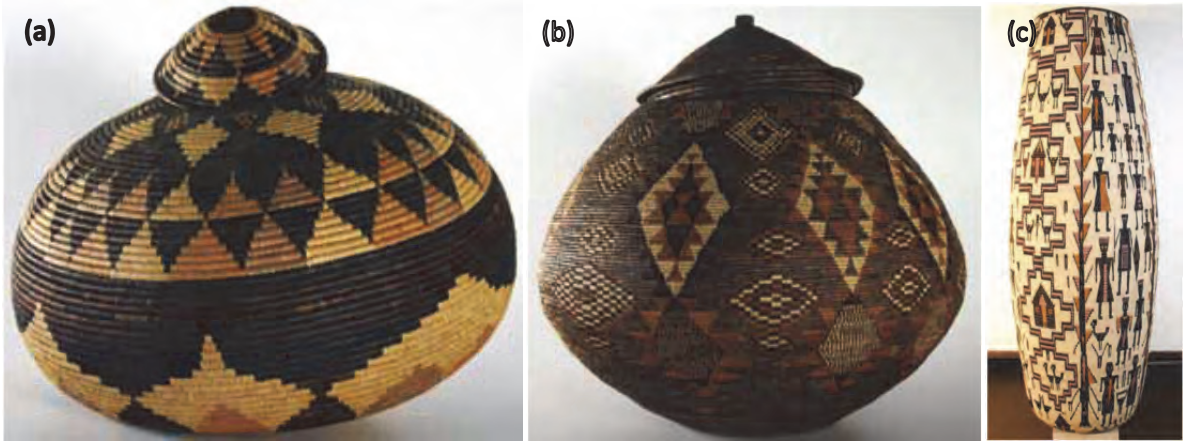


Figure 7: Zulu baskets (a,b,c), artist unknown. Ilala palm and grass www.ilalaweavers.com

The craft industry contributed R2 billion rand to the gross domestic product (GDP) in the craft industry value chain and consisted of over 7 000 craft producer organisations in 2005 as documented by Department of Trade & Industry. The number of craft producer organisations has also increased by 40% with an average growth of 8% per year, double the national average according to the Department of Labour. Furthermore the industry employs over 40 000 and the local market has shown a strong growth of between 3-4% annually. The SA government spent R97 million on the establishment and growth of the craft industry in SA between 2001 and 2003 (Makhitha *et al.,* 2014), making this an important sector.

The craft industry is highly significant due to the employment it creates and incorporates both informal craft producers selling on the roadside and formal craft producers that sell their products locally and internationally (Elk 2004). Craft provides an entry point to the economy for thousands of marginalised people, the majority of whom are women; it allows flexibility to engage in livelihood activities (agriculture, child-care, food-provision, etc.). In addition, it builds broad life-skills, promotes expression of cultural heritage and affords the opportunity to engage across a range of other economic sectors (tourism, culture and heritage, manufacturing, and retail) – Gijima KZN Local Economic Development Support Programme). Thus, there is sufficient basis to establish more jobs and promote a green economy through sustainable harvesting of wetland plants that could be utilised for trade in the crafting industry.

19.2.2 EDIBLE FOOD INDUSTRY

Literature reveals that out of all the indigenous edible wetland plants in this assignment, there is a current market of the ***Aponogeton distachyos***, Cape pondweed (e) Waterblommetjie (a) in the food market. The plant has been a traditional wild-gathered vegetable and has been brought into cultivation as a food crop during the past twenty years (Pemberton, 2000). Danie van Tubbergh, one of the 10 largest growers of waterblommetjies; has 17 ha of waterblommetjie, which produce 5-10 tons of edible flowers per ha/year. He markets these to chain supermarkets and cans them under the Riverside Farm label **(Figure 8).** Van Tubbergh has sold as much as 800-900 kg/week to one of the chains (Pemberton, 2000). Traditionally, waterblommetjie was collected from fresh water marshes and other shallow water bodies for private use or to sell at roadside stands and markets.

Waterblommetjie cultivation is a good complement to other crops such as wheat or wine grapes since its labour intense harvest occurs in late winter and early spring when labour is less needed for other crops. Thus, the local community of the Western Cape can be trained employed to cultivate Waterblommetjies and produce a continued supply to the market.

Figure 8: Waterblommtjies at (a) Riverside farm (b) Two Waterblommetjie harversters (c) Processed and canned Waterblommetjies

From the internet product search and industry interviews, three major markets sell the Waterblommetjie; namely Pick 'n' Pay, Woolworths Fruits and Veg City were surveyed for analyzing marketing pattern of the Waterblommetjie species. However, information on the Waterblommetjie brought to the market is yet to be studied for its availability period, quantity brought to the market, number of vendors involved in selling of species, trend of market availability of species, extraction pattern of species, and pressure on the resources using standard methods. In addition, information will be gathered on the plant parts used and quantities sold, number of retailers in the market, prices and total volume available for each species, and these data were used for assessing the net quantities sold and the value of the products

Value chain analysis of the food industry will then be conducted by overlaying the market sizing analysis outputs over the value chain. This enabled us to estimate salient indicators such as industry structure (e.g. potential for small business participation), profitability, labour requirements, and other salient information

19.2.3 LANDSCAPING INDUSTRY

The ***Miscanthus junceus***; Besemgras, is a wetland plant investigated in the literature review report as a plant with a high potential to be used for landscaping for water treatment in heavily polluted water ways and wetlands. A key environmental problem facing South Africa is water pollution. This arises from many sources, including mining and industrial effluents, and runoff of biocides, nutrients and pathogens from agricultural lands, urban areas and informal settlements with poor sanitation (Kotze, 2000). The plant is mainly distributed in Gauteng, Kwa Zulu Natal and Mpumalanga, and by virtue of the respective provinces of being mining areas; the water ways are susceptible to water pollution in the form of Acid Mine Drainage (AMD). This tall, erect, tufted, perennial grass is used to make brooms and plays an important role in purifying water and stabilising riverbanks; due to its characteristics. ***Miscanthus junceus*** is only used and traded locally. Research into its potential as a

plant for water purification and riverbank protection seems warranted (van Oudtshoorn, 1999; van Wyk & Gericke, 2000

Due to the inherent properties of wetlands, they provide the function of water purification as a regulatory ecosystem service (FEGS, 2013). Wetland plant such as the ***Miscanthus junceus*** have a high capacity for reducing the velocity of water flow (because of such factors as the resistance offered by wetland vegetation and the gradual slope of most wetlands) which results in suspended particles being more readily deposited; thus also stabilizing the river bank. In addition, a variety of anaerobic and aerobic processes that remove pollutants from the water, including: chemical precipitation, adsorption, ion exchange, nitrification and denitrification. Microbial activity in the wetland is particularly important for promoting nitrification and denitrification. Given these characteristic, a wetland with such plants may be able to remove pollutants from suspended solids, nutrients and toxicants.

Figure 9: (a) *Miscanthus junceus* growing along river bed Porta4u.org.za (b) A small wetland has been constructed at KwaMaritane in the North West Province. Landscaping: SALI (c) The final wetlands in the wetland series system at Maropeng are planted with a variety of indigenous species that destroy pathogenic bacteria; Phragmites spp is the mainphytoremediation agent in these wetlands.

Ultimately, this improves the health and functioning of the wetland in terms of Present Ecological Sate (PES). An example of the Nakivubo swamp in Uganda provides valuable wastewater purification and nutrient retention ecosystem services which could save costs of introducing new public services like sewage control (Almak, 2010). By purifying water wetlands save us a lot of money. In this case, the cost of developing the wetland was calculated by looking at the investment and recurrent costs of a sewage and water treatment, and the cost per household for sanitation infrastructure. The additional capital and recurrent expenditures of the expansion of the sewage treatment plant had already been calculated by the Uganda Water and Sewerage Corporation. The cost to livelihoods of adjacent dwellings was calculated based on income per person and returns to labour from using the wetland.

The results of the evaluation showed that the wastewater purification and nutrient retention ecosystem services of Nakivubo Swamp have a high economic value between US$1 million a year (using replacement cost methods) and US$.75 million a year (using mitigation expenditures methods) (Emerton, 2003). Furthermore, the Wetlands Inspectorate Division and the IUCN showed that a sewage treatment plant would cost over US 2 million dollars to maintain each year (Almak, 2010). Not only was the cost of expanding the sewage treatment plant greater than the value of the wetland, there was associated costs to livelihoods.

Likewise, South Africa may adopt similar initiatives by accruing “avoided costs of replacing manmade alternatives with natural wetland functions”, and the “expenditures on mitigating the effects of wetland loss”. Rand Water has joined forces with the South African Landscapers Institute (SALI) to promote the concept of Water Wise landscaping, through retention ponds (artificial wetlands with planted wetland plants) may also be used to conserve water for water wise landscaping. Water Wise demonstration gardens at the Delta Park Environmental Centre in Victory Park in Johannesburg and the Walter Sisulu National Botanical Gardens in Roodepoort. Thus, local people in these areas may be employed to create artificial wetlands that could be used for flood control or water purification cost saved from the ecological infrastructure could generate more income for a green economy.

On the basis of this economic argument, and through highlighting the role of wetlands as an essential part of the county’s water and sanitation as well as ecological infrastructure, plans to drain and reclaim key wetlands should be reversed and be designated as part of the nation’s greenbelt zones; thus promoting the envisaged Green Village Programme.

20 Appendix 4: Cost of *Typha capensis* value chain

Table 6: Key assumptions of the Balamhlanga Typha Board business case (Product description: 2.44 mx1.22 mx50 mm high value Typha oriented strand board)

Harvesting			
Item	Number	Unit	Assumptions: Notes and References
Working days per year (Department of Labour)	240	days	South Africa Depart of Labour 2015
Conversion: green to dry Typha	6.00	t/t	21 t wet Typha yields 3.5 t dry Typha – Caro *et al.,* 2011 Massachusetts Institute of Technology
Wetland size	200.00	ha	Harvestable Typha in Balamhlanga wetland – Grundling, 2015 WET-Rest
Effective wetland harvest area required	33.53	ha	Calculation
Effective Typha (monoculture) yield (dry mass) – Upper estimate	20	t/ha/a	Krus *et al.,* 2014 Fraunhofer Institute for Building Physics
Effective Typha (monoculture) yield (dry mass) – Lower estimate	15	t/ha/a	Krus *et al.,* 2014 Fraunhofer Institute for Building Physics
Effective Typha (monoculture) yield (dry mass) – Average	15	t/ha/a	Assumption
Harvest productivity	1.00	t/day	250 kg/hour per person per 6 hour working-day – Caro *et al.,* 2011 Massachusetts Institute of Technology
Product density	0.1	t/m^3	15-20 tons dry mass produces 150-250 m^3 building material (1 t = 10 m^3) – Theuerkorn (2013) Typha Technik Naturbaustoffe
Total green yield per harvest / ha	90	t/ha	Calculation
Total green yield per harvest for entire wetland	3,018	t	Calculation
Number of harvests per year	1	harvests/a	Assumption
Total annual green yield for entire wetland	3,018	t	Hall (2009) University of California
Job creation potential	3,018	person days	Calculation
Job creation potential	13	jobs/a	Calculation
Annual wage	37,538	R/person/a	Department of Labour 2015 – Farmworker minimum wage + 20%
Annual wages	471,998	R/a	Calculation
Equipment	6,036	R/a	Calculation
Equipment	480	R/person/a	Calculation

Clothing and footwear	280	R/person/a	
Panga	100	R/person/a	
Baling string	100	R/person/a	
Cost at roadside	**158**	**R/green t**	**Calculation**

Transport to production site			
Item	Number	Unit	Notes/References
Air drying duration – Upper estimate	10	days	Hall (2009) University of California
Air drying duration – Lower estimate	5	days	Hall (2009) University of California
Air drying duration – Average	7.5	days	Calculation
Estimated transport cost	8.0	R/km	2 ton truck
Load per vehicle	2.0	t	2 ton truck
Distance to production site (one way)	20.0	Km	Distance from wetland to Jozini
Estimated transport cost	320.0	R/load	Assuming a return trip
Estimated transport cost	160.0	R/ton	Calculation
Estimated transport cost	482,842	R/a	Calculation
Cost at production site	**318.4**	R/t	Calculation

Production costs			
Item	Number	Unit	Notes/References
Production lines	2	#	Assumption based on single shift
1x IWM TA48 200T Hydraulic veneer press – 5 layer	725,000	R	Cost per machine
1x Interwood TA48X120T Hot Press – New	375,000	R	Cost per machine
1x Interwood TA69-150T Hot Press – New	475,000	R	Cost per machine
1x IWM TA48B – 50T / 10 Cold Press – New	149,000	R	Cot per machine
Balance	1,000	R	Assumption
Hammer mill	50,000	R	Assumption
Containers	2	#	Assumption
Containers	250	R	Assumption

Glue mixer	50,000	R	Assumption
Total cost of preparation line	101,500	R	Calculation
Milling lines	2	#	Assumption
Total cost: Production lines	203,000	R	Calculation
Other capital requirements	2,000,000	R	Assumption
Total capital requirements	3,762,000	R	Calculation
Operational costs	571,632.00	R	Labour + fuel
Electricity	1.00	R/kWh	Assumption
Electricity	47.30	kW	GFP Machines
Electricity	8.00	h/day	Assumption
Electricity	181,632.00	kWh/year	Calculation
Electricity	181,632.00	R/a	Calculation
Glue	25.00	R/board	Assumption
Glue	768,000	R/a	Assumption
Maintenance	180,000.00	R/a	Assumption
Employees	12	#	Assumption
Wages	120,000	R/person	Calculation
Wages	1,440,000	R/a	Calculation
Rent	90,000.00	R/a	500 m^2 at R10/m^2/month
Boards/hour/production line	4.00	#	Assumption
Boards/hour	8.00	#	Calculation
Boards/a	15,360.00	#	Calculation
Board volume	0.15	m^3/board	2440 mm x 1220 mm x 50 mm
Board density	220	kg/m^3	Assumption
Board weight	32.7	kg/board	Calculation
Dry weight raw material required	503	t/a	Calculation
Cost ex production site	**462.0**	**R/board**	Assumption
Cost ex production site	**14,109**	**R/t**	Assumption

Market potential			
Item	Number	Unit	Notes/References
Panel Products market share in South Africa	2,188.	R(million)	Department of Agriculture, Forestry & Fisheries
Density of Typha	60	kg/m^3	Krus *et al.,* 2014 Fraunhofer Institute for Building Physics
Standard Price of 2440 mm x 100 mm x 1220 mm	440	R/board	Retail price: www.itm.co.za
Salient information			
Item	Number	Unit	Recommendations
Effective wetland harvesting area required	33.5	ha	Wetland harvest potential to be verified
Effective Typha (monoculture) yield (dry mass) – Average	15.0	t/ha	Wetland harvest potential to be verified
Total Jobs created in the entire Value Chain	25	#	Skills assessment required
Transport from wetland to production site	320	R/load	To be verified through experimentation
Capital requirements	3,762,000	R Year 0	To be verified through firm quotes
Boards/a	15,360	#/a	
Total Revenue	7,100,000	R/year	Firm off-take agreements required
Capital cost per job	153,089	R/job	
Internal rate of return before tax	28%		To be verified at feasibility level

Table 7: Concept level cash flow analysis for a Typha Board production facility at the Balamhlanga wetland.

CASH FLOW PROJECTION												
Throughput	**Notes**	**Units**	**Year 0**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Wetland area		Ha		34	34	34	34	34	34	34	34	34	34
Annual yield		Dry tons/Ha		15	15	15	15	15	15	15	15	15	15
Annual yield		Dry tons		510	510	510	510	510	510	510	510	510	510
Number of boards	Production limit	# per year		15,360	15,360	15,360	15,360	15,360	15,360	15,360	15,360	15,360	15,360
Average price	www.itm.co.za std OSB board	R/board		440									
Price (exl Transport)	Price premium over OSB	5%		462	462	462	462	462	462	462	462	462	462
Receipts													
Turnover		R(Million)		7,096,320	7,096,320	7,096,320	7,096,320	7,096,320	7,096,320	7,096,320	7,096,320	7,096,320	7,096,320
Capital investments			3,762,000										
Working capital													
Total receipts			**3,762,000**	**7,096,320**	**7,096,320**	**7,096,320**	**7,096,320**	**7,096,320**	**7,096,320**	**7,096,320**	**7,096,320**	**7,096,320**	**7,096,320**
Variable Costs													
Harvesting				471,998	471,998	471,998	471,998	471,998	471,998	471,998	471,998	471,998	471,998
Transport	Roadside to Production facility			482,842	482,842	482,842	482,842	482,842	482,842	482,842	482,842	482,842	482,842
Glue				768,000	768,000	768,000	768,000	768,000	768,000	768,000	768,000	768,000	768,000
Electricity				181,632	181,632	181,632	181,632	181,632	181,632	181,632	181,632	181,632	181,632
Maintenance				180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000
Total variable costs				**2,084,472**	**2,084,472**	**2,084,472**	**2,084,472**	**2,084,472**	**2,084,472**	**2,084,472**	**2,084,472**	**2,084,472**	**2,084,472**
Gross Profit			**3,762,000**	**5,011,848**	**5,011,848**	**5,011,848**	**5,011,848**	**5,011,848**	**5,011,848**	**5,011,848**	**5,011,848**	**5,011,848**	**5,011,848**
				71%	**71%**	**71%**	**71%**	**71%**	**71%**	**71%**	**71%**	**71%**	**71%**
Fixed costs													
Capital items			3,762,000					3,762,000					
Labour	Manufacturing			1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000
UIF etc	2%			28,800	28,800	28,800	28,800	28,800	28,800	28,800	28,800	28,800	28,800
Office administration	Admin persion, Office equipemt, telephones, etc			180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000
Insurance	1% of capital			37,620	37,620	37,620	37,620	37,620	37,620	37,620	37,620	37,620	37,620
Rent				90,000	90,000	90,000	90,000	90,000	90,000	90,000	90,000	90,000	90,000
Depreciation	5 year linear			752,400	752,400	752,400	752,400	752,400	752,400	752,400	752,400	752,400	752,400
Interest	10% %/a			992,406	992,406	992,406	992,406	992,406	992,406	992,406	992,406	992,406	992,406
Total fixed costs			**3,762,000**	**3,521,226**	**3,521,226**	**3,521,226**	**3,521,226**	**7,283,226**	**3,521,226**	**3,521,226**	**3,521,226**	**3,521,226**	**3,521,226**
Net profit			**-**	**1,490,622**	**1,490,622**	**1,490,622**	**1,490,622**	**-2,271,378**	**1,490,622**	**1,490,622**	**1,490,622**	**1,490,622**	**1,490,622**
Net profit				21%	21%	21%	21%	-32%	21%	21%	21%	21%	21%
Cash - Beginning of period			-	-	1,490,622	2,981,244	4,471,866	5,962,487	3,691,109	5,181,731	6,672,353	8,162,975	9,653,597
+ Receipts			3,762,000	7,096,320	7,096,320	7,096,320	7,096,320	7,096,320	7,096,320	7,096,320	7,096,320	7,096,320	7,096,320
- Payments			-3,762,000	-5,605,698	-5,605,698	-5,605,698	-5,605,698	-9,367,698	-5,605,698	-5,605,698	-5,605,698	-5,605,698	-5,605,698
+- Fixed Assets Purchased/Sold													
Cash - End of period			-	1,490,622	2,981,244	4,471,866	5,962,487	3,691,109	5,181,731	6,672,353	8,162,975	9,653,597	11,144,218
Net cash flow (excl investments)			-3,762,000	1,490,622	1,490,622	1,490,622	1,490,622	-2,271,378	1,490,622	1,490,622	1,490,622	1,490,622	1,490,622
		28%											

21 Appendix 5: Use of Typha for construction

In the value chain analysis of construction materials derived from wetland products; market sizing was adopted to provide a basis for motivating the use of indigenous wetland plants for job creation and entrepreneurship. In this instance, ***Typha capensis*** (Bulrush, Papkuil, Ibhuma), is such an indigenous wetland plant that could be used and the value chain analysis was established based on studies conducted on the plant in Germany **(Figure 10)**

a) **Cultivation segment:** Cultivation is an agricultural activity and holds the largest potential for growing the industry and creating formal jobs. *Typha capensis*, grows in abundance in the grassland biome of all provinces in South Africa and as such it is a relatively abundant wetland plant species. In this respect, there are quite a number of be suitable cultivation areas in South Africa for commercial purposes. For example, degraded wetland sites that were used for agricultural purposes or mining for decades could be revitalized by cultivating Typha. Scientists have already shown that this is possible through the "Cattail Cultivation in Lowland Moors" project sponsored by the Deutschen Bundesstiftung Umwelt DBU (German Federal Environment Foundation).
b) **Wild harvesting segment:** as population growth increases, increasing demand for building material products will place these wild wetland plant resources at increasing risk – thus a need to develop suitable resource plans for each key species – Sustainable harvesting practices – Consistent permitting requirements – Effective monitoring systems. SANBI and the provincial conservation agencies have large roles to play
c) Trading segment:
Product quality control

- Setting of product standards through certification, labelling guidelines and other means can greatly support the development of the industry.
- This would improve the value experience of both wholesale and retail customers and lead to better prices and increased sales while protecting the brand of the industry.
- A precedent for such an arrangement exists within the wine and spirits industry in South Africa.
- The bio-prospecting industry would have to develop its own governance arrangements, and quality and scientific standards for certification.
- An important step forward for the growth and development of the industry.
- The economic asset value South Africa's unique biodiversity can be significantly enhanced through this and a uniquely South African brand and trade-mark can be built.
- The DST and DTI would both be instrumental in supporting such an initiative

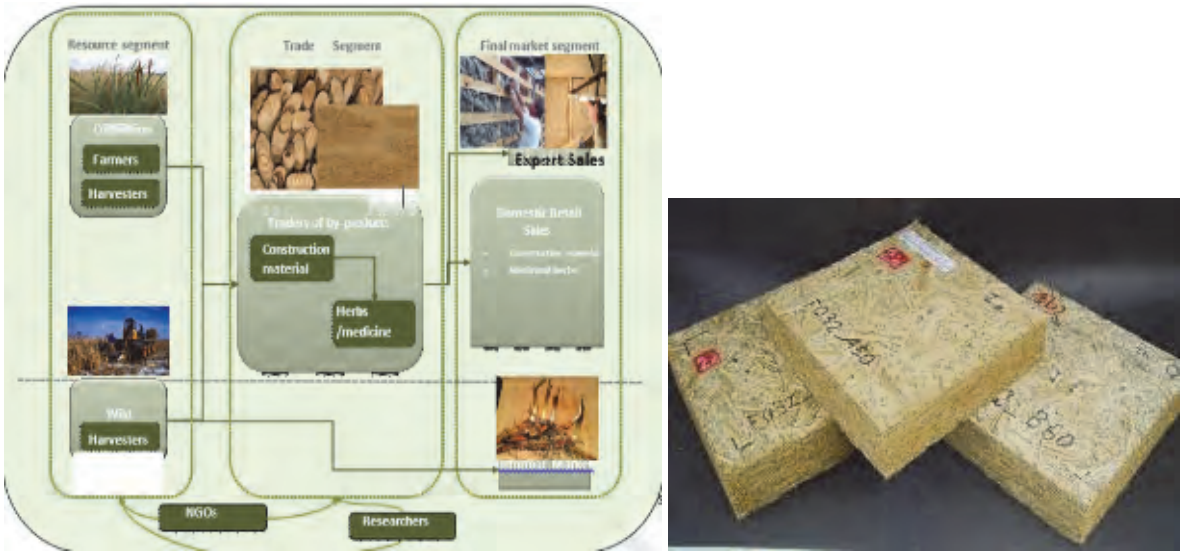


Figure 10: (a) Value Chain Segments of Typha capensis and (b) processed blocks.

Prior to this, at a symposium on Typha held in Cape Town in 1989, it was reported that Typha, despite its potential to be an invader, does have several economic benefits. Leaves were used for caulking barrels and for insulating the roofs of early houses at the Cape.

22 Appendix 6: Market assessment

In Africa the focus point of development is economic growth through opening of markets and privatisation of publicly-owned natural resources. Perrings and Lovette (2000) argued that the opening of markets would have largely beneficial environmental consequences. The removal of market price distortions, such as agricultural or energy subsidies, could improve the efficiency of economic activity and reduce the impact of that activity on the environment. Also improving the security of land tenure by assigning private property or use rights promotes investment in land conservation and environmental stewardship. Moreover, greater macro-economic stability encourages investment, and persuades resource users to take a longer-term view of their decisions. But the environmental effects of liberalization are ambiguous. On the positive side, trade liberalization may stimulate environmental protection by lowering costs. But there are costs as well as benefits to expanding trade. If it stimulates demand for the products of environmentally damaging activities, then it follows that it will increase environmental damage (Perrings & Lovette, 2000). Biodiversity conservation in many developing countries has been complicated by the fact that the local benefits of conservation are less than the local opportunity costs. The local community can do better exploiting the resources than by conserving them. Partly in response to this, many programmes attempt to combine the creation of employment and poverty eradication with conservation programmes (Perrings & Lovette, 2000).Thus, the following mechanisms may be adopted.

Market mechanisms

Appropriately recognizing the multiple values of biodiversity in national policies is likely to require new regulatory and market mechanisms, such as:

- better valuation and the creation of markets for ecosystem services;
- more widespread certification systems;
- payment programmes to increase incentives for conservation and protection of biodiversity and ecosystems;
- new policies providing tax incentives for low biodiversity impact operations;
- reducing and eliminating perverse incentives for biodiversity loss;
- developing conservation easements; and
- mechanisms for upstream-downstream transfers.

23 Appendix 7: Case studies of wetland plants commercialization

This section highlights the different case studies within South Africa where wetland communities are currently generating income from commercializing wetland plant products.

Inyibiba Pilot Project-Cape Town

Cultivation of these beautiful indigenous wetland flowers for wedding and funeral ceremonies; the Arum Lily (e), Inyibiba (x), (***Zantedeschia aethiopica***) were envisaged to provide much-needed job opportunities and income for the Khayelitsha jobless in Cape Town Tygerberg's mayor, Clifford Sitonga, and fellow councillors in conjunction with the Greenpoint community, gathered for the ceremonial planting of arum lilies (inyibiba) in Khayelitsha to pilot the Inyibiba project, developed to assess arum lily cultivation as a means of community upliftment and environmental development. With the arum lily an indigenous flower in the Western Cape, it was envisaged that there could be blooming good times ahead if it becomes part of the multi-billion rand flower industry worldwide. `The project would support local residents of Greenpoint by employing them on site, about 50 jobs were created.

Although the Inyibiba Pilot Project did not become economically sustainable in its 12 months of 'operation, in that time it provided employment and wages to members of a community with high levels of unemployment. The Inyibiba Pilot Project made a loss of R420.675.99 in its first year of operation. In monetary terms there was no economic benefit to the project. However the budget did predict this loss in the first year, with a profit only expected from the second year onwards. It also established an area of 1 hectare containing over 36 000 Arum Lily (e), Inyibiba (x), (*Zantedeschia aethiopica*) plants which can be harvested for flowers in future seasons. Nevertheless, potential economic benefit has been created in that the area is planted and the project can proceed. The plants already established will be used in the coming years to generate income either by selling flowers to the local or the export market, or to both. Most of the first year expenses have been written off and the income in coming years will with good management result in economic benefit and an economically sustainable project.

iSimangaliso Wetland Weavers-Mr. PriceHome

Example of the wise use of pristine wetlands: Kosi Bay Nature Reserve – approximately 10 ha of iNcema *(Juncits kraussii)* sedge is sustainably harvested by local women. In 1992, there was a ban on the use of sickles and this has made collecting less commercially viable and curbed the large number of people that used to over-exploit the sedge resource (Kyle, 1995). Therefore, in its endeavour to bring South African craft into mainstream décor markets the iSimangaliso Wetland Park Authority's craft programme has entered into an exciting new partnership with Mr Price Home.

Twenty-four producer groups from rural crafters are making highly sophisticated products woven from isikhonkho, sisal and ilala palm which will have a strong presence in the South African retail market – at prices that are affordable for the discerning buyer, and also fair and right for the crafters. Craft has great potential as an important source of income for skilled but formally unemployed people and this partnership has the potential to significantly increase the number of crafters involved in the programme through the volume of potential orders.

Through conducting training, mentoring and transferring skills effectively the product developers have supported crafters to overcome these challenges. This programme is implemented by the St Lucia Wetlands Authority as part of its activities that ensure that neighbouring communities derive benefits from the iSimangaliso Wetland Park. This craft programme has received funding from the National Department of Arts and Culture, CREATE SA and the Flemish government.

iNcema Project: KZN

The project entails growing iNcema plants (Juncus kraussii) for production of crafts for the domestic market. The first iNcema was planted in 1997, and there is now an area of 3000 m^2 planted with iNcema.

Mondi have at no charge made a building available for use by the group of crafters and also provide the wetland cultivation site at no charge. The site establishment and management is funded by the Department of Arts. Culture, Science and Technology (DACST) and Mondi. Income from the cut bundles of ncema (should any be sold instead of being used for craft production), and from the craft work produced, goes directly to the five 'share -holder' workers in mutually-agreed proportions. They have formed an Association, and regulate their affairs themselves without outside influence. This may be a benefit of operating outside of the highly-populated urban settlements. In urban areas many people tend to compete for the few economic opportunities that may become available through project such as those under discussion, and the very creation of economic opportunity can become a source of conflict in the 'community*. In rural areas, on the other hand, this is likely to be less of a factor in the success of the project. The INR estimates that the ncema area will be able to generate R36 000 per season if the ncema is used for making mats (INR. 2001).

The Case of the Ga-Mampa wetland in the Limpopo

The Ga-Mampa wetland in the Limpopo Province is a wetland highly used by local stakeholders within its vicinity. Most of the materials harvested from the wetland are used for household subsistence and are rarely sold. In addition to their economic and livelihood value, the wetland services are also essential to sustain the social and cultural responsibilities in gift giving to neighbours and relatives. The study on the wetland conducted by Morardet *et al.,* 2010 concludes that the local people are highly dependent on the wetland ecosystem services in many ways but that current use exceeds sustainability levels, which jeopardizes their future livelihoods. The study therefore recommend that the local stakeholders be supported in identifying alternative sources of livelihoods while simultaneously developing sustainable management strategies for small wetlands such as Ga-Mampa. Thus, this feasibility study suggests that given a highly economically valuable wetland could be used to create jobs and entrepreneurship for the local people living within the vicinity of the Gamampa wetland.

Table 1: Net financial value, time spent per household and value per unit of time of the main provisioning services of Ga-Mampa wetland

Wetland services	NFV per participating household (US$)	NFV per hectare (US$) (*)	Time spent per participating household (hours per year)	Value per hour spent in the activity
Cropping	1072	263	942h	R8.2/h
Edible plant collection	84	263	91h	R6.0/h
Reed collection	93	65	41 h	R14.6/h
Sedge collection and mat making	88	66	80 h	R8.9/h
Fuel wood collection	667	33	108h	R40.0/h
Hunting	49	2	10 h	R31.5/h
Fishing	12	2	-	-

(*) based on total wetland area.

Edible plant collection

Edible plant collection is the most frequent wetland provisioning service, as at least 95% of households collect edible plant from the wetland. Collection takes place all year round with highest collection intensity between November and March. Some households collect excess of these plants in the wet season and sun-dry them for use in the dry season when available quantity in the wetland is reduced. Collection is done by hand into small farm seed buckets. During the survey, the buckets were used as unit of measurement since it was easier for respondents to estimate quantity using this unit. A 2 *kg* bucket was estimated to contain about 300 g of edible plants; analysis was based on this conversion.

At average price of R2 ($0.31) per 150 g, annual gross value of edible plants collection from the Ga Mampa wetland is $31,523. Because cost of collection is due only to the farm seed bucket whose cost is regarded as negligible, NFV for edible plant was estimated equal to GFV. 86% of harvested edible plants is used for direct household consumption, while some 11% is used to meet social responsibilities through gift giving to elderly neighbours and relatives. Participating households spend on average about 91 hours annually collecting edible plants, hence a value of time spent on this activity of about R6 ($0.93) per hour.

Reed collection

As in many other wetlands in Africa, Ga-Mampa people collect reeds *(Phragmites mauritianus)* for roofing their houses. Most respondents believe that use of reeds in buildings has been gradually declining in Ga-Mampa valley, a condition blamed on decreasing quantity of reeds in the wetland coupled with "modernization" leading to taste for zinc roofing. Approximately, about 50% of buildings in Ga-Mampa are roofed with reeds probably collected in Ga Mampa wetland. Period to collect reeds (usually between June and July) is sanctioned by the headmen. It is an offence to collect reeds without the headmen's permission when they have not yet declared time for reed collection. Annual reed harvest is estimated at 2,526 bundles. Reed and sedge are harvested in bundles. A bundle is about 60cm in diameter and could weigh between 5 and 10 kg. Of this about

72% is used directly by households for roofing their own house. Estimated gross value of reed collection in the Ga-Mampa wetland is $7,820. Apart from labour, the main cost involved in the use of reeds is mainly due to cutlass used for harvesting.

Sedge collection

Sedge (*Cyperus latifolis and Cyperus sexangularis*) is an important wetland resource in Ga-Mampa as in many other wetlands in Africa. Sedges are used for making different art and craft items such as baskets and mats (legoga). Sedge collection is regulated by headmen in the same way as reeds with regards to period of collection. Sedges are hardly sold until *legoga* is made from it. An estimated 756 bundles of sedges are harvested from the wetland annually. Of the total quantity harvested 75% (564 bundles) is used in making mats and the remaining 25% (192 bundles) is sold, mainly to households within Ga-Mampa. It can be assumed that they were used for making mats, however because this was not investigated during the field work, this assumption has not been considered in the calculation. On average, 0.75 bundle of sedge, is used to make one mat, meaning in total, about 750 mats were made annually. Of this total, 77% were sold to customers from Ga-Mampa, Kappa and Mafefe. The remaining was used as gift and for personal use. Combining worth of quantity sold directly in bundles at R20 ($3.10) per bundle, and number of mats made at a standard price of R80 ($12.4), average annual GFV derived from sedge harvesting from the Ga-Mampa wetland is estimated as $9,288. Cost involved in use of sedge from the wetland is due to (i) cutlass used for harvesting (ii) thread and needle used in making mats (iii) cost of building a locally made knitting machine, and (iv) cost of transportation to and from market. Taking these monetary costs into consideration, average annual NFV was estimated as $7,918. Cash income derived from sales of bundles of sedges and mats amounts to $7,728.

It takes about twenty hours (3 hours for walking to and from wetland and 17 hours for harvesting) of household labour to collect average quantity of sedge (8.4 bundles), in addition, it requires about 7.2 hours to make 1 mat. The value of time spent in this activity is then estimated at R8.9 ($1.38) per hour.

Medicinal plant collection

Not much is known about the use of the Ga-Mampa wetland for medicinal plants. This is probably due to “secrecy” in the community about its use (Darradi, 2005). Information gathered reveals that, three main medicinal plants are collected from the wetland: *Mupurogu, Mutusa, Masheo Mabe*. Unfortunately it was not possible to determine the scientific name of these plants during the field survey. Mupurogu, is claimed by one of the users to be able to “prevent any type of disease, no matter how bad it could be”. *Mutusa and Masheo Mabe* are used together with other plants collected from elsewhere (mountain) for local male fertility drug. Because of the seeming secret surrounding its use it was not possible to estimate the economic value of medicinal plant in this study.

Total use value of main provisioning services

Based on the calculation of the economic value of each individual provisioning service of Ga-Mampa wetland (reed, edible foods, medicines) the total economic value of all provisioning services provided by Ga-Mampa wetland was estimated at 90.565 US$ (gross financial value). Based on this estimation, cropping contribute the highest value of about 40% of the total gross financial value of the Ga-Mampa wetland. If we look at cash income, however, sedge collection accounted for about

56%. Thus, natural resource trade does allow some rural households to escape poverty (Shackleton 2005, Shackleton et al., 2007), with consumption and trade being particularly important for the poorer households in rural communities (Twine et al, 2003; Shackleton & Shackleton, 2006). In this regard, the potential is quite high for commercialization rather than just subsistence utilization.

The case of Nedbank Green Funding, Department of Economic Development and Gijima; KwaZulu-Natal

New and evolving concepts of ownership over biodiversity and genetic resources, protection of traditional knowledge, the ecosystem approach, ecosystem services and valuation, have created policy challenges for all of the actors. Governments at all levels, communities and businesses are grappling with how to incorporate environmental, social and cultural concerns more effectively into their decision making processes. In order to achieve sustainable development, biodiversity needs to be mainstreamed into energy, health, security, agricultural, land use, urban planning and development policies.

- Nedbank Business Banking's involvement with the KwaZulu-Natal Department of Economic Development and Gijima KZN. We are able to consolidate mutual strengths, thereby intensifying the impact of initiatives designed to assist and guide businesses to becoming sustainable, job-creating enterprises," The MOU has already brought about improvements in the lives of many people in the province. From the formation of business plans through to the granting of implementation funding, every step is crucial to ongoing business success and growth, which is critical to improving the lives of individuals and uplifting the economic conditions of entire communities.
- While many of these initiatives are small, the Nedbank Foundation made a big contribution to the development of crafters by providing R250 000 to the University of KwaZulu-Natal to support crafters in the province. This contribution from Nedbank, together with a cash injection from Gijima KZN and other grant donors, has allowed one such enterprise to grow into a thriving business, now known as the Inina Craft Agency. The Inina Craft Agency is considered a highly successful example of rural enterprise development, and the model could well be replicated for future projects. It is in this spirit that the KwaZulu-Natal Department of Economic Development has historically allocated R3 to continue support of Inina and the success they represent for rural businesses everywhere.

Opportunities for Pro-poor policies

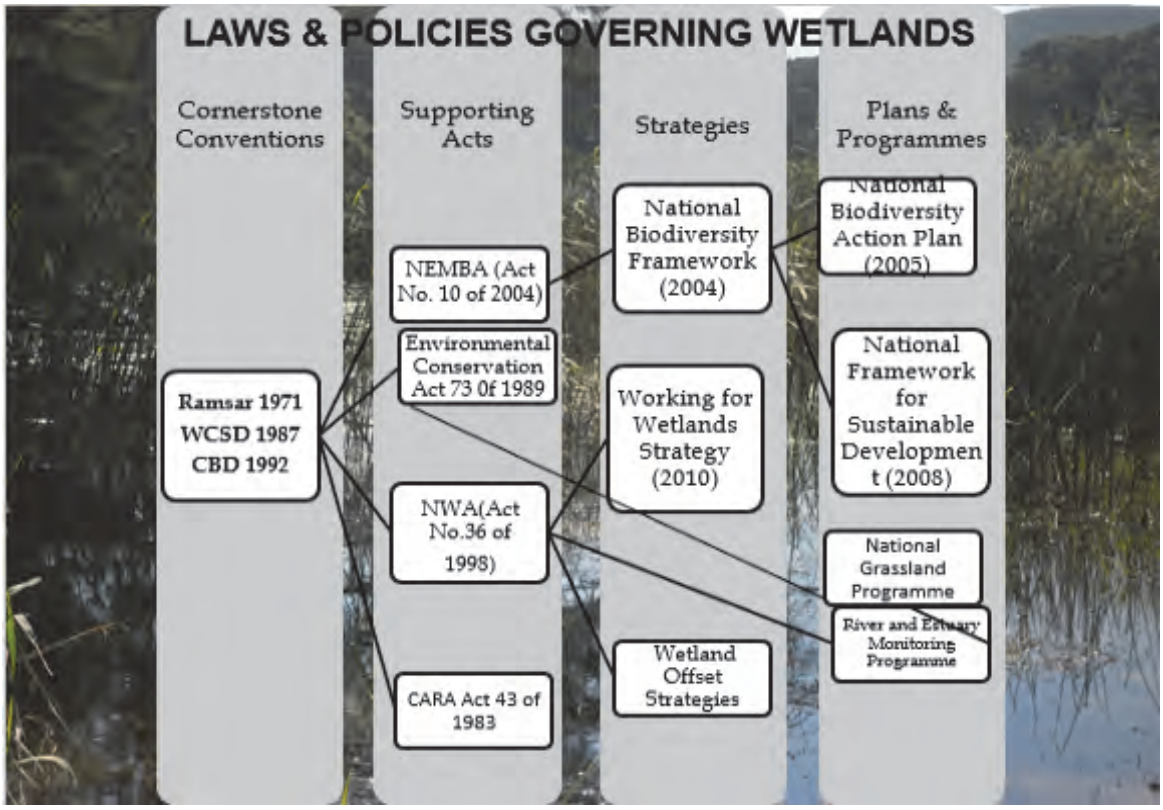
Implementing policies that benefit the poorest in society will be challenging, but necessary. Raising the profile and representation of direct biodiversity users and stewards, especially smallholders, will be key in developing effective implementation mechanisms. Recognizing the role women play in protecting, using and understanding biodiversity in many parts of the world can lead to the mutual benefit of empowering communities and ensuring sustainable use of biodiversity. Including all stakeholders in the shaping and testing of policies will be necessary to ensure long-term viability and acceptance of the policy changes. Generalizing and scaling up inclusive projects is a key challenge and opportunity for the international community.

Threats to Small-to-Medium Business Enterprises

Rural areas have markets that are too small (Lyons, 2000). Societies are economically stagnated, offering limited market incentives and the level of capital accumulation is too small to enable potential entrepreneurs to take advantage of the limited opportunities that exist in rural areas (Lee & Suzanne, 2000). This explains the common trend in rural areas where the market for products is too low to encourage expansion of entrepreneurial activities. For the market that exists, products are sold at very low price to accommodate the majority of the poor who dwell in rural areas. This limits entrepreneurs from exploiting some opportunities in rural areas

However when a market opportunities have been assessed and the cash flow spreadsheet prepared, the planning should identify the critical risks and potential problems that the project will face. Contingency plans, together with a contingency budget, must be made in order to handle these situations and delays which inevitably arise. The business plan must also make allowance for inflation, and for the effects of exchange rate fluctuation in the case of an export project. It is also advisable to develop business plans for sites of different sizes, since a project that is not financially viable on a small site may turn out to become so on a larger one. In general it is best to choose a site that is manageable but which can be extended as finance allows, i.e. start small, but plan for expansion.

24 Appendix 8: Legislation & regulations



Relevant Legislation

• Environment Conservation Act, 1989 (ECA), Act No. 73 of 1989.

• National Water Act, 1998 (NWA), Act No. 36 of 1998.

• National Environmental Management: Biodiversity Act, 2004 (NEMBA), Act No.

• Conservation of Agriculture Resources Act, 1983 (CARA) Act No. 43 of 1983

• National Environmental Management: Biodiversity Act, 2004 (NEMBA), Act No.

NEMA EIA Regulations 2010 and 2006 General Listing Notice

According to the EIA Regulations promulgated in 2010 under the National Environmental Management Act, a Basic Assessment would be required for either of the following two activities that might be triggered by wetland plants control options.

Listing 1, Activity No. 18:

The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of more than 5 cubic metres of soil, sand, shells, shell grit, pebbles or rock from

i. a watercourse **(wetland);**
ii. the sea;
iii. the seashore;
iv. the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater

But excluding where such infilling, depositing, dredging, excavation, removal or moving

i. is for maintenance purposes undertaken in accordance with a management plan agreed to by the relevant environmental authority;

or

ii. occurs behind the development setback line

Listing 3, Activity No. 12:

The clearance of an area of 300 square metres or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation

a. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004;
b. Within critical biodiversity areas identified in bioregional plans;

within the littoral active zone or 100 metres inland from high water mark of the sea or an **estuary**, whichever distance is the greater, excluding where such removal will occur behind the development setback line on erven in urban areas.

Listing 3, Activity No. 13:

Clearance of 1 hectare or more of vegetation where 75% or more of plant cover is indigenous

(a) Critical biodiversity areas and ecological support areas as identified in systematic biodiversity plans adopted by the competent authority;

(b) National Protected Area Expansion Strategy Focus areas;

(c) (i) In an estuary;
(ii) Outside urban areas, the following:
(aa) A protected area identified in terms of NEMPAA, excluding conservancies;
(bb) National Protected Area Expansion Strategy Focus areas;
(cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;
(dd) Sites or areas identified in terms of an International Convention;
(ee) Core areas in biosphere reserves;

(ff) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve;
(gg) Areas seawards of the development setback line or within 1 kilometre from the high-water mark of the sea if no such development setback line is determined;

Listing 3, Activity No. 14:

Clearance of 5 hectares or more of vegetation where 75% or more of plant cover is indigenous except where such removal is required

(i) All areas outside urban areas.

Listing 3, Activity No. 15:

Construction of structures of any size for any form of aquaculture

(i) In an estuary;
(ii) In a Protected Area identified in the NEMPAA;
(iii) Areas on the watercourse side of the development setback line or within 100 metres from the edge of a watercourse where no such setback line has been determined

25 Appendix 9: Background to PES in South Africa

A study by Blignaut and Mander (2010), looking at five past watershed restoration and reforestation projects in South Africa, estimates that conservation in these areas has provided a monetary annual return equivalent to R116 to R220 per hectare per year over periods of about 30 years compared to equivalent estimated costs of watershed restoration totalling between R21 to R88 per hectare per year.

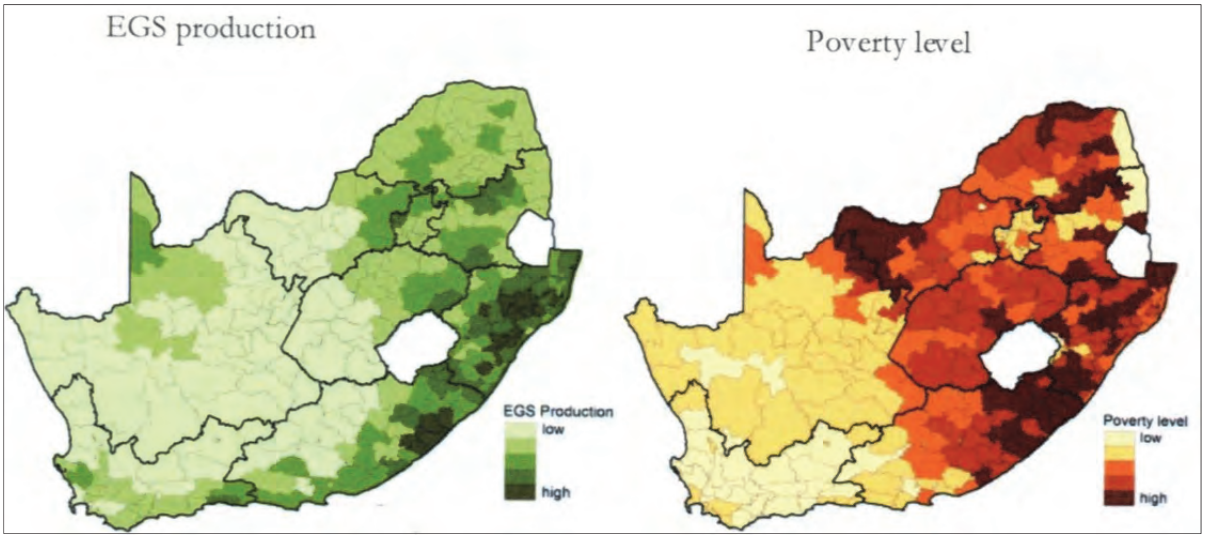


Figure 11: Ecosystem Service production and poverty on a municipal level
Source: Egoh et al., (2008); StatsSA (2004)

South African data that maps the distribution of poverty with the distribution of Environmental Goods and Services (EGS) or ES illustrates a spatial overlap (Blignaut et al., 2008). This means that it if South Africa prioritises these regions, it is possible for PES schemes to simultaneously meet conservation and poverty goals. **Figure 11** illustrates the potential of 'EGS production' when four ES (carbon sequestration, soil retention, water supply and water flow regulation) are combined. The data is based on a poverty line for households whose annual income is below R4800. 'High poverty' refers to instances where over forty per cent of households live below the poverty line in any given municipality (Blignaut et al., 2008). The market value of ES was estimated to be between R16, 514 million and R26, 255 million per annum and has the potential to generate between 442 634 and 472 634 jobs per year. Based on the analysis of where high levels of poverty coincide with ecosystems which have high productive potential **(Figure 11)**, the provinces of Eastern Cape, Limpopo, Mpumalanga and KwaZulu-Natal should be considered priority zones. The demand for ES is spatially separated from the supply side of ES as the former is located in South Africa's wealthier cities and the latter in poor rural areas.

Currently, In South Africa the creation of PES markets is still at the formative stages of design and implementation; however ***the Working for Wetlands Programme*** is a prominent and extensive government led initiative. The Working for Wetlands focuses on the restoration of wetlands in order to protect ecosystems; generate clean water supplies; protect against floods; provide water for agriculture; and conserve medicinal plants (DWAF, 2008; Ferraro, 2009; Talbot, 2012). Thus, PES may be regarded as a way for meeting the Green Economy Strategy.

The values of some ecosystem goods or services can be measured using market prices. Some ecosystem products, such as fish or wood, are traded in markets. Thus, their values can be estimated by estimating consumer and producer surplus, as with any other market good. Other ecosystem services, such as clean water, are used as inputs in production, and their value may be measured by their contribution to the profits made from the final good (Grobicki, 2002). However, some benefits of preserving wetlands (optional access, existence and bequest value) are intangible to many people because wetlands are not assets traded on markets and it is therefore difficult to price them (Breen *et al.,* 1994). Nevertheless, the desire and preference of people to preserve wetlands can be converted into monetary terms. This was done in the Wakkerstroom vlei in Kwazulu-Natal; based on how much would one be willing to pay into an exclusive fund to have exclusive access to a particular wetland., the study of Breen and colleagues (1994) found that a median household (gross annual income R 80 000-R90 000) was willing to pay R17.51-R20.00 per month tor the option of visiting a wetland.

In another instance, the City of Cape Town, South Africa, recently undertook an intensive assessment of the value of ecosystem services generated by natural areas in the city. These areas include nature reserves, coastal areas, wetlands, and rivers. Using valuation methods such as "willingness to pay," the study estimated the net present value of the city's natural assets as US$5.13-9.78 billion. The study has helped leverage funding for the environment from across departments by revealing the considerable contribution of ecosystem services to human welfare and underscoring the need to account and pay for their maintenance.