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INTRODUCTION

IMPROVING LIVES AND LIVELIHOODS

The Durban University of Technology (DUT), forged from the melding together of Technikon Natal and ML Sultan Technikon in 2002, boasts five campuses in Durban and two in Pietermaritzburg with approximately 34 000 active students a year.

Our vision for 2030 includes our staff and students becoming creative, innovative, entrepreneurial and adaptive, participating productively in the development of South Africa and the world through our state-of-the-art infrastructure and systems.

Our new Strategic Plan upholds Stewardship, Systems & Processes, Sustainability and Society, the interdependence among which now provides a multi-disciplinary, cross-institutional and integrated approach.

By living our values and principles within a culture of shared responsibility and accountability, and by embracing creativity, we will build an enabling environment that supports dynamic curricula, which, in turn, inspires innovation and entrepreneurship, resulting in the delivery of a distinctively DUT experience within an environmentally responsible and financially sustainable framework.

This should lead to mutually beneficial collaborations, the practical application of knowledge and the development of future-ready graduates, thus improving lives and livelihoods.

However, we cannot achieve all of this alone.

The question is:

**WILL YOU PARTNER WITH
US TO IGNITE OUR VISION?**



AN ENGAGED UNIVERSITY

Be engaged and productive global citizens that establish mutually beneficial partnerships

INNOVATION AND ENTREPRENEURSHIP

Leverage new knowledge and solutions for societal impact

ADAPTIVE GRADUATES

Develop graduates with the acumen to initiate and/or respond to change

A DISTINCTIVE EDUCATION

Create a compelling and future-oriented living and learning environment

FINANCIAL SUSTAINABILITY

Engender a sustainable and efficient business model

GREEN ECOSYSTEMS

Improve efficiency of resource utilisation and decrease environmental risk

INNOVATIVE CURRICULA AND RESEARCH

Provide curricula that stimulate creativity and innovation to generate new knowledge and solutions

DIGITAL ENVIRONMENT

Adopt integrated digital systems and processes that enable our people to deliver optimally

STATE-OF-THE-ART INFRASTRUCTURE

Provide contemporary work, learning and living spaces

LIVED VALUES

Nurture a people centred culture that embodies our values and principles

INSTITUTIONAL CULTURE

Foster a culture of accountability and shared responsibility

CREATIVITY

Inspire innovation and entrepreneurship



DUT RESEARCH FOCUS AREAS 2021



WATER
Leader: Prof F. Bux
Institute for Water and Wastewater
Technology



**ENZYME
TECHNOLOGY**
Leader: Prof S. Singh
Applied Sciences



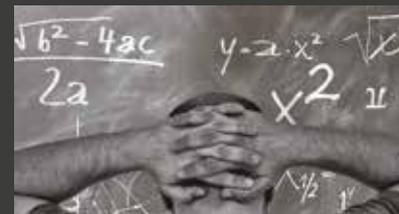
NANOTECHNOLOGY
Leader: Prof K. Kanny
Engineering and the Built Environment
(Mechanical Engineering)



**FOOD AND
NUTRITION
SECURITY**
Leader: Prof E.O. Amonsou
(from 1 April 2020)
Applied Sciences



**COMPUTATIONAL
MODELLING AND
BIOANALYTICAL
CHEMISTRY**
Leader: Prof PK. Bisetty
Department of Chemistry



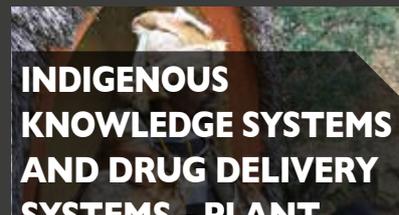
SYSTEMS SCIENCE
Leader: Prof K. Duffy
Institute of Systems Science



URBAN FUTURES
Leader: Prof M. Marks
Urban Futures Centre



PEACEBUILDING
Leader: Prof Geoff Harris
International Centre of Nonviolence
(ICON) and Management Sciences



**INDIGENOUS
KNOWLEDGE SYSTEMS
AND DRUG DELIVERY
SYSTEMS – PLANT
BIOTECHNOLOGY**
Leader: Prof B. Odhav &
Dr V. Mohanlal
Faculty of Applied Sciences



ENERGY

Leader: Dr I. Lazarus
Department of Physics



ICT AND SOCIETY

Leader: Prof O.O. Olugbara
Faculty of Accounting and Informatics



HEALTH STUDIES

Leader: Prof N. Sibiya
Faculty of Health Sciences



GENDER JUSTICE AND HUMAN DEVELOPMENT

Leader: Prof C. Potgieter
Arts and Design Research and
Postgraduate Support [new]
(coordinated by the Office of the DVC RIE)



TRANSFORMATION THROUGH THE ARTS AND DESIGN

Leader: Dr E. Rapeane-Mathonsi
Faculty of Arts and Design



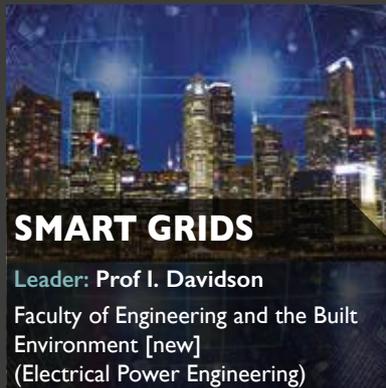
SPACE SCIENCE PROGRAMME

Leader: Prof I. Davidson
(Re: Prof D. Ilcev)
Accounting and Informatics
Management Sciences
Engineering and the Built Environment
(Coordinated by the Office of the
DVC RIE)
*DST-funded Initiative



GREEN ENGINEERING AND PROCESS SUSTAINABILITY

Leader: Prof S. Rathilal
Engineering and the Built Environment
[new] (Chemical Engineering)



SMART GRIDS

Leader: Prof I. Davidson
Faculty of Engineering and the Built
Environment [new]
(Electrical Power Engineering)

ADOPT A SCHOOL



SUMMARY

The main purpose for the Adopt a School project is to introduce entrepreneurship to school children while they are still at a very young age. This is in line with ENVISION 2030 that has refocused the University's character from being a student-focused to people-centred and engaging University. Advocate Rory Voller, a Commissioner at CIPC, in his interview with Brand South Africa, said, "South Africa must teach innovation and entrepreneurship to schoolchildren; in the new world of work, problem solvers, collaborators and flexible creative thinkers will be most in demand. We need more creative thinkers; the world does not need more lawyers, it needs dreamers who will do extraordinary things. The world of work is being re-imagined, and South Africa needs to teach its youth to be more innovative and more entrepreneurial to create a sustainable and growing economy."

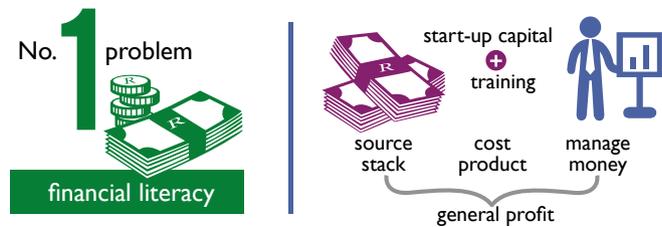


The programme will focus on entrepreneurship for kids and teach children about the basic concepts of entrepreneurship and financial literacy. A practical approach that involves using the environments that are mostly understood by children will be used. Speaking to the *SundayTimes* in December 2019, Paul Slot from the Debt Counselling Association said that 10 million people in South Africa have bad debt – meaning they have missed three or more monthly repayments. He said that these people have an average of eight loans each. Those in bad debt spend 63% of their after-tax income on repayments on average, he said. The major source of the high level of indebtedness in South Africa has been caused by low levels or lack of financial literacy among the working class. As such, the introduction of this literacy skill will ensure that this project will be able to develop future employees and entrepreneurs who are prudent when it comes to how finances are managed.

In order to achieve this, the DUT's Midlands Entrepreneurship Centre has adopted four schools within neighbouring communities to expose primary and high school learners to entrepreneurship.

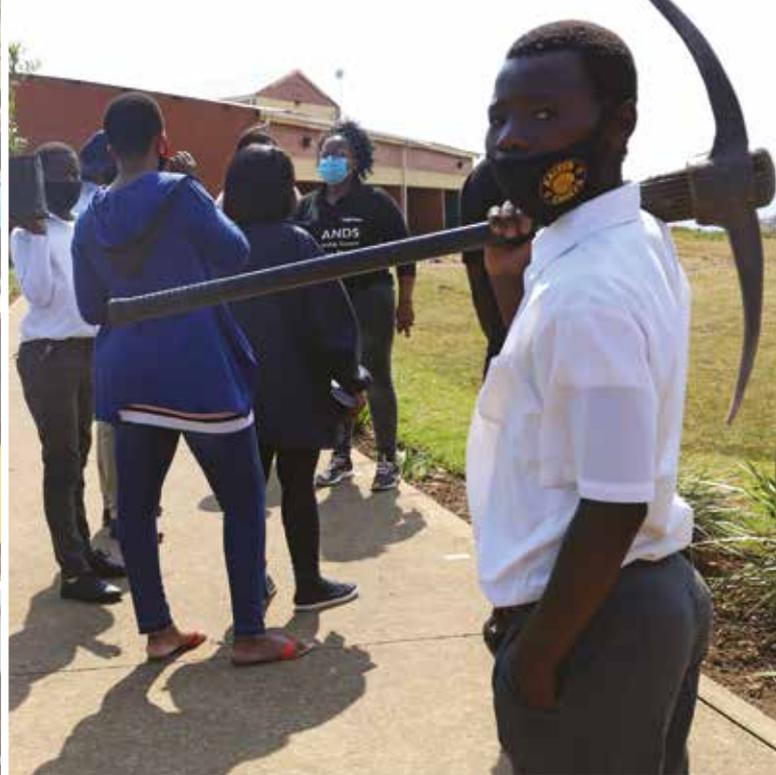
Children will be taught how to start and run their own small businesses, teach them how to manage the money they make, and encourage them to be innovative about the types of businesses they want to start. The project team will provide them with start-up capital, teach them how to source stock, how to

cost the product, how to manage their money so that it can generate a sustainable profit in the long run, and how to save it.



AIMS AND OBJECTIVES

The project aims to train BEd students on entrepreneurship so that they can train learners. An entrepreneurship winter class will provide programmes that will teach learners more about entrepreneurship and financial literacy and a coordinator will monitor the implementation process. Project leaders will encourage learners to attend the students' entrepreneurship week seminar. They will also persuade business owners to come and talk to learners about running a sustainable business within their communities, providing skills training that they can use practically to sell goods at DUT's fleamarket.



IMPACT

The cultivation of an entrepreneurship mindset and the acquisition of financial literacy at a young age is priceless as it will create employment, hope and a positive outlook, and will foster resilience, independence and critical thinking.



WHY SHOULD DONORS ASSIST?

South Africa is very behind in terms of grooming children to become entrepreneurs, but this project will help to change this as well as provide them with a viable and available alternative to the shrinking job market. The project needs to be implemented in every single school in the country in order to change the perception that once a learner finishes school, their only option is to become employed within the public and private sector. This will open up the youth to opportunities that they can create for themselves and also help to play a role in improving the country's economy.



“The world of work is being re-imagined, and South Africa needs to teach its youth to be more innovative and entrepreneurial to create a sustainable and growing economy.”
– Advocate Rory Voller



PROJECT LEADERS AND CONTACT DETAILS

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Tel: 033 845 9056



TIMELINE

January to December 2021



BUDGET

R70 000

ADVANCED OXIDATION USING PHOTOCATALYSIS FOR WASTEWATER TREATMENT



SUMMARY

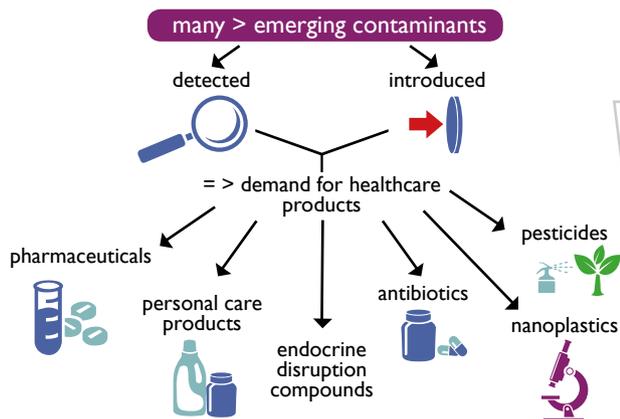
Many wastewater treatment technologies are available for the removal of traditional contaminants from wastewater, however, many more emerging contaminants are either not detected or are being introduced due to an increased demand for healthcare products. Some of these include pharmaceuticals, personal care products, endocrine disruption compounds, antibiotics, pesticides, nanoplastics, etc. This is placing a huge strain on existing wastewater treatment plants and traditional technologies may not be effective in removing these emerging contaminants. As such, many advanced technologies are being investigated, with photocatalytic degradation being one of the leading ones.



AIMS AND OBJECTIVES

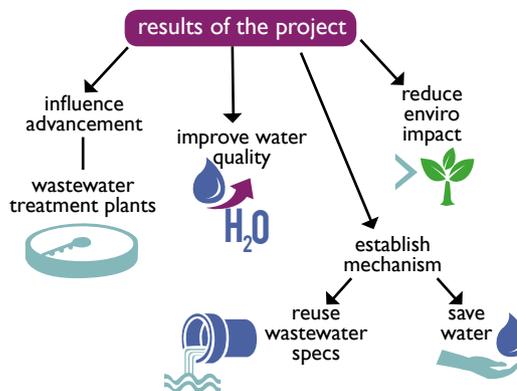
The main aim is to establish a continuous photocatalytic treatment system for the degradation of organic content in water, including the emerging contaminants. The specific objectives are to:

- Investigate pretreatment methods to reduce high organic content, like anaerobic digestion
- Investigate the effect of various photocatalysts for the advanced treatment system
- Optimise the operating variables of the photocatalytic reactor in order to maximise the removal of the emerging contaminants



IMPACT

The results of the project will influence the advancement of small-scale wastewater treatment plants, help to improve water quality to meet stringent discharge regulations and reduce the impact on the environment. It will also help to establish a mechanism to help wastewater reuse specs and save water.



WHAT IS UNIQUE?

Advanced analytical techniques are now able to detect contaminants that were not previously detectable. Photocatalysts have already proven to be useful in removing contaminants, however, the recovery and reuse of the catalysts is still a challenge. This project will address these challenges and also investigate the use of other methods of catalyst activation besides UV radiation.



SUCCESS STORIES

The project team has published some journal papers showing the effectiveness of photocatalysis for the treatment of wastewaters, including oily wastewaters and those from the sugar industry.



LESSONS LEARNT

A proper 'closed' reactor needs to be acquired/built so that the UV radiation is concentrated on the internal system only and other methods of activating the catalysts need to be investigated (such as visible light).



WHY SHOULD DONORS ASSIST?

The project aims to provide a complete solution for the removal of emerging contaminants together with using greener, more sustainable solutions. The catalysts that are being investigated and synthesised will be recoverable and reusable to ensure that no additional disposal contamination is introduced. The solution will also be linked to traditional treatment methods like anaerobic digestion with the introduction of the synthesised catalysts into the biomass to improve the methane content of the biogas produced.



“ The project was initiated with the WRC and Umgeni Water and is proving successful. The partners are very happy with the progress being made, however, it is currently restricted to a lab scale and needs to be tested on a pilot scale. ”
– Prof Sudesh Rathilal



PROJECT LEADER/S AND CONTACT DETAILS

Prof Sudesh Rathilal

Emmanuel Kweiyor Tetteh, Nomthandazo Sibiya, Gloria Amo Duodo and the possibility of two new MEng students

Email: rathilals@dut.ac.za | **Cell:** 083 783 1964



TIMELINE

The project will start in January 2021 and last for two years



BUDGET

Reactor	R150 000
Consumables	R75 000
Analysis	R50 000



BIOBRICKS



SUMMARY

Concrete and clay products used in the building industry are known to have a negative environmental impact in terms of mining (environmental degradation) and production (energy intensiveness and emissions). Bricks and blocks made from cement and clay remain the most used and readily available products. Hence, in order to minimise the environmental impact, BioBricks, made from waste sugar cane bagasse ash, offer significant environmental and local enterprise development benefits.



AIMS AND OBJECTIVES

This project aims to maximise these benefits, given the abundance of raw waste materials available from the sugar manufacturing industry in the KwaZulu-Natal province.



IMPACT

The manufacture of green bricks is a step towards the advancement of green building, which includes using environmentally-friendly, non-toxic materials, reducing waste and using recycled materials. Municipalities have agreed to be the first buyers of the bricks. BioBricks are being used in green estates in different regions of KZN and Corobrick has been identified as a sub-segment to approach at a later stage. The project will eventually produce any combination of the following products at a profitable level:

- Paving – particularly for pedestrian areas, office parks or light manufacturing/warehouse applications
- Retaining blocks – used in road construction, undulating building sites and garden areas
- Kerbing – for roads and large parking areas

These products could be distributed to local end users to ensure sustainability. The



construction sector in general will benefit, including road construction.

The BioBrick project has the potential to afford a third stream of income to DUT as a spin-off company could be created to provide sustainable green jobs for the youth in KZN. The project is likely to attract green funding from foreign countries for further expansion to other parts of the African continent. The migration of individuals from rural areas of KZN to urban areas has created a high demand for bricks. The project is in line with provincial plans to develop the economy of the Province, to train black South African youth and women as well as attract foreign investment to the Province. Additionally, the SMEs to be established at a later stage will be black-owned. This fulfills current KZN provincial objectives.



WHAT IS UNIQUE?

The project's technology involves the use of various recycled industrial waste streams plus an optimised 'secret source' (a patentable ingredient) to manufacture environmentally-friendly BioBricks for local consumption. The production output will be sold to building material outlets (yards) or directly to residential and commercial building projects. The project will greatly improve the sustainable management of ash waste that is available at the many sugar factories in the province of KZN. DUT is currently conducting research, development and testing work on Biobrick materials for the eventual production of commercial building bricks and blocks.

Furthermore, it is estimated that 17 million m² of residential housing units are built annually. In the case of RDP and informal houses, about 140 000 to 180 000 individual housing units are constructed each year. It is estimated that around 10 million m² of non-residential (commercial and public buildings) space is constructed annually. Together with housing, the combined total of 27 million m² horizontal area translates into 50-60 million m² of vertical walling. The key driver of these projects is increased urbanisation in this region similar to many other regional nodes in South Africa. At

17 million m²
residential
housing units
built p/a



140 000
to
180 000
RDP houses
built p/a



10 million m²
Non-residential
BUILDINGS
built p/a



the lowest population projection of 1.5-2%, the number of households is expected to increase to between 128 000-137 000 in 2030, from about 100 000 in 2020. This implies the need for an additional 30 000-40 000 housing units in total over the period to 2030.

In addition, the BioBrick project is a profitable business and global warming is a reality and everybody's concern. DUT is creating a platform for academics, the private sector and investors to work together to solve a common global concern.



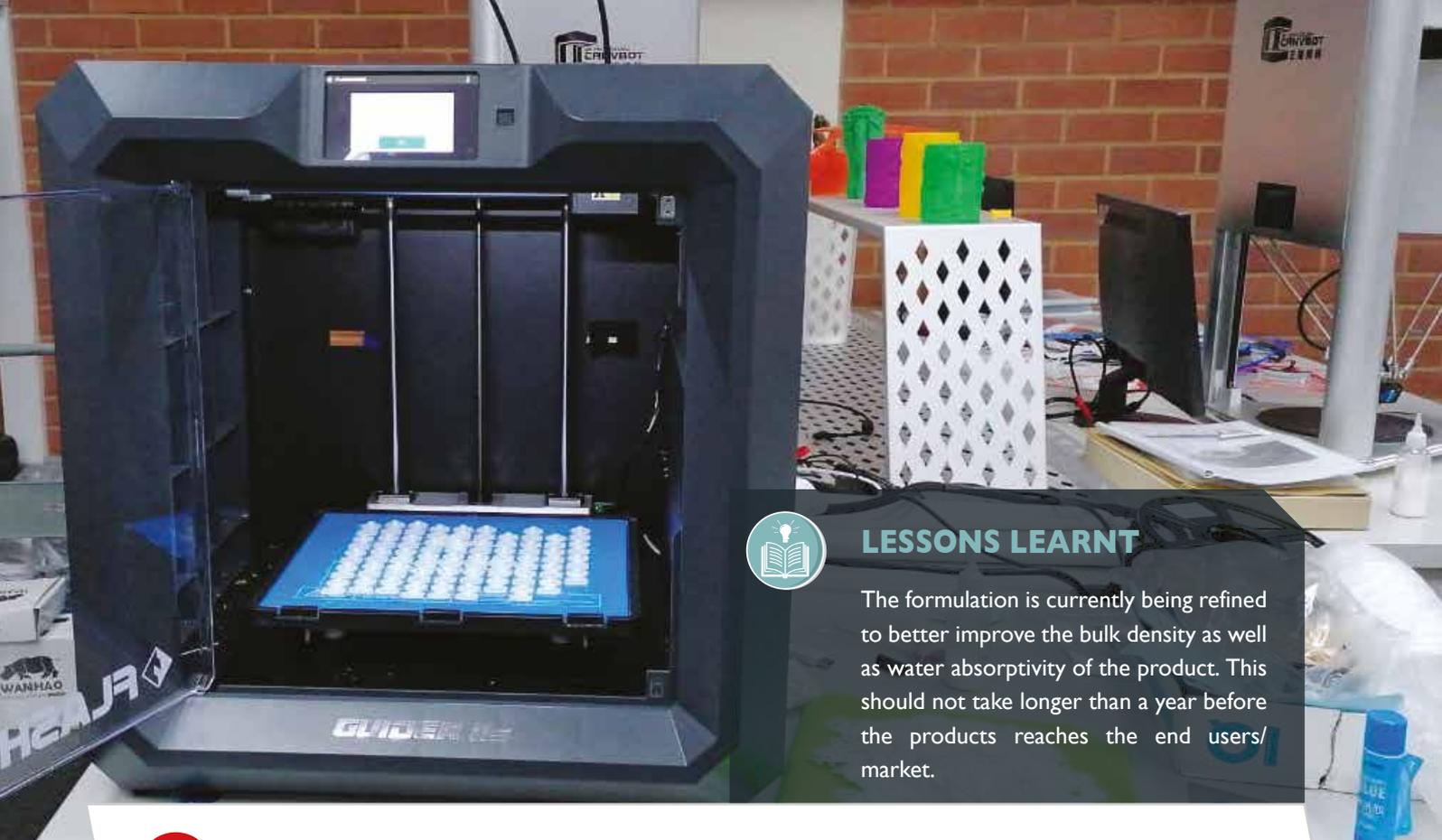
SUCCESS STORIES

Seed funding was obtained from the Technology Innovation Agency (TIA), which afforded a comprehensive market study and business plan. The project recently procured funding from Admond Capital Pty Ltd specifically to buy machinery and to file the patent at DUT.

The project is a business opportunity with an annual sales revenue of R11.5 million – analysis in the Durban region of KwaZulu-Natal Province shows a profit margin of 15% on sales, resulting in a profit before tax and finance charges of R1.5 million per annum.

Furthermore, the lab experiments have demonstrated that the resulting products meet some of the requirements according to South African National Standards (SANS). The 'secret ingredient' (formulation) is currently being refined for further optimisation and to improve their comprehensive strength.





LESSONS LEARNT

The formulation is currently being refined to better improve the bulk density as well as water absorptivity of the product. This should not take longer than a year before the products reaches the end users/ market.



WHY SHOULD DONORS ASSIST?

The BioBricks project is the development of value-added products to generate wealth for a sustainable economy. 'Clever building materials' are produced from different waste streams without the use of energy. DUT embraces sustainability and society as two of the main 'Perspectives' in its ENVISION 2030. The project helps the sugar cane crushing industries to pay less carbon tax for carbon dioxide emissions and air pollution. Furthermore, the project supports a few

global initiatives and national strategies such as the Department of Science and Innovation's Bioeconomy strategy, Millennium Development Goals, Sustainable Development Goals, Africa's Agenda 2063, Low Carbon Growth Plan, to name but a few. It will help South Africa to transition towards a low carbon economy while supporting its waste economy strategy. DUT is transitioning towards being an entrepreneurial university and this platform will also sharpen industry partnerships, which is one of DUT's current mandates to assist student placement after graduation.



“ Most politicians like the project as it will not only solve the carbon emissions and pollution challenges in the Province, but will create platforms to train human capital for 4IR. ”
 – Dr Linda Z. Linganiso



BUDGET

WORK PACKAGE	MILESTONE	COMPLETION DATE	BUDGET
Further Refinement of Brick Formulation	Optimises Formulation (secret source)	June 2021	R200 000
Patent Filing	Patent	September 2021	R20 000
Product Certification	Certified Market Samples	January 2022	R50 000
Knowledge Generation Outputs	Five peer-reviewed Manuscripts accepted or published in International Journals	June 2023	R100 000
Human Capital Development	PhD and MSc Graduates	December 2023	R540 000
Total			R910 000



PROJECT LEADER, TEAM AND CONTACT DETAILS

Dr Linda Z. Linganiso

Dr Farai Dziike, Dr Linda Z. Linganiso and Prof S. Moyo

Email: researchdirector@dut.ac.za



TIMELINE

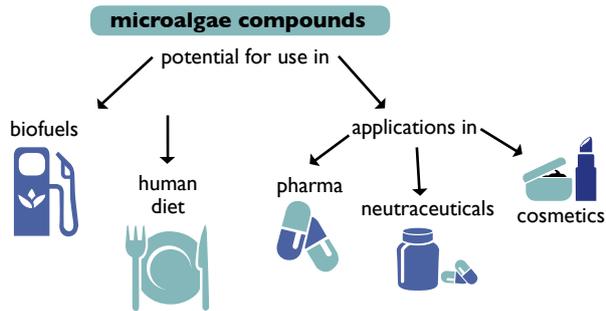
Development of Technology Innovation: January 2021 – December 2023

BIOFUELS AND BIOPRODUCTS FROM ALGAE



SUMMARY

Microalgae have great potential as a bioresource in South Africa and around the world owing to their ability to absorb carbon dioxide, their fast growth rate, adaptability to harsh conditions and cultivation on non-arable land. Microalgae can sustainably produce several important biochemical constituents – lipids, proteins, carbohydrates and various other high-value compounds such as pigments and polysaccharides – at a large scale. These compounds have the potential to be used for biofuels, human diet and applications in the pharmaceuticals, nutraceuticals and cosmetics industries. Among functional ingredients identified from microalgae, natural pigments, i.e. chlorophylls, carotenoids and phycobiliproteins, have received attention for being antioxidants, anti-carcinogenic, anti-inflammatory and neuroprotective.



Although microalgae have gained interest as alternative feedstock for the production of biofuels and high-value products, the high costs of production, the lack of a reliable water supply source and the low production scale of microalgal biomass provide a barrier against commercial fruition.

Application of the biorefinery approach using waste streams for biomass cultivation can ease the major cost challenges of production. Wastewater often comprises organic and inorganic nutrients, synthetic compounds and trace elements, which form suitable substrates for the cultivation of several algal species. Microalgae efficiently remove and utilise the nitrogen and phosphorus present in wastewater and assimilate them as part of their biomass. The utilisation of wastewater as a nutrient and a water source under different modes of cultivation offer a dual purpose of remediation and biomass generation. Given that microalgal biomass contains high levels of micro- and macronutrients essential for plant growth, they have the potential application as biofertilisers, which are

either produced after the extraction of lipids using the residues in the form of a biorefinery approach or can be produced using the whole cells. Biofertilisers can help assist in the growth of crops and reduce agricultural dependence on chemical fertilisers.

Green microalgae, *Scenedesmus obliquus*, using waste water as a substrate at demonstration scale (300 000L raceway pond at Kingsburgh Waste Water Treatment Works in eThekweni Municipality), are being cultivated to produce biofuels. For the successful implementation of this technology, a large-scale cultivation system with high biomass and lipid productivities, efficient and cost-effective harvesting and extraction processes is essential. Proof of concept has been completed at laboratory scale and lipid and biomass optimisation studies have been conducted on the raceway pond. A low-cost algal harvesting technology is being used to rapidly and efficiently collect microalgal biomass from a cultivation system. Sequential solid and liquid separation technology has been developed for extracting oil from wet microalgal biomass.



AIMS AND OBJECTIVES

Aim: Evaluation of indigenous microalgae for the production of pigments and bioactive compounds.

Objectives:

1. Isolation of microalgae from fresh water, wastewater and marine environments
2. Extraction and purification of phycobiliproteins, carotenoids and chlorophyll
3. Optimisation of cultivation conditions to enhance biomass and pigment production
4. Evaluation of antimicrobial and antioxidant activities of crude and purified extracts

Aim: Nutrient recovery from wastewater and biofertiliser production using algae.

Objectives:

1. Treatment of raw and primary wastewater streams by algae
2. Assessing the feasibility of tertiary treatment of wastewater using an algal system
3. Assessment of algal systems for the remediation of domestic, industrial and agricultural wastewaters
4. To evaluate microalgae potential to produce sustainable biofertilisers

Aim: Large-scale cultivation of algae for production of biofuels using wastewater as a resource.

Objectives:

- Pilot-scale cultivation of microalgae using domestic wastewater in a raceway pond
- Elucidation of population dynamics and symbiotic interaction(s) within the raceway pond
- Optimisation of culture conditions for maximum lipid productivity at pilot scale
- Extraction of lipid from wet biomass



IMPACT

Large-scale harvesting and extraction are a bottleneck to the technology, therefore, developing a successful, cost-effective culturing, harvesting and oil extracting method is one step further to pre-commercialisation. The large-scale cultivation of algae has extensive socio-economic benefits and affords environmental protection while treating and upcycling waste streams. Growth in the biofuels industries further affords the potential for job creation.



WHAT IS UNIQUE?

There is an increasing interest in the application of microalgae as a biologically active supplementary ingredient to food/feed or in cosmetic and pharmaceutical industries. These are all-natural alternatives to currently chemically-produced synthetic products. The project's research focuses on screening for pigments and bioactive compounds from indigenous microalgae from different environments, including wastewater, fresh water, marine and hypersaline water in KwaZulu-Natal. Extraction costs of microalgal intracellular metabolites remain high; the downstream separation stages often account for 50-80% of the total production costs, depending on the biochemical characteristics and purity required for the intended use, thus limiting commercial exploitation. Therefore, the research also attempts to alleviate some of the bottlenecks by optimising the yield and extraction of the valuable compounds.

The project seeks to convert a waste problem into an environmentally-friendly sustainable nutrient recovery and redistribution system. The use of microalgal biomass generated

through the biorefinery approach for biofertilisers in South Africa has not been well explored. The recovery of nutrients from wastewaters by microalgae and the use of its biomass as a biofertiliser seem to provide a promising alternative, environmentally-friendly solution to chemical fertilisers. The nutrients (nitrogen and phosphorus) from wastewater can be used to grow microalgae, and can be recycled, promoting the simultaneous polishing treatment of the effluent and the production of biomass. The project's research has shown that algal biofertilisers improve soil conditions, increasing crop yields and nutrient efficiency and reducing the requirements for chemical fertilisers.

Biofuel production has, in the last decade, come to the forefront due to climate change and the dwindling availability of fossil fuel resources. One of the main priorities for the production of sustainable biofuels from algal biomass is the economical production of biomass at large scale. To this end, the project is optimising technology for algal cultivation using wastewater at demonstration scale (300 000L raceway) in order to ascertain the potential of algal biofuels in the South African context. The project is establishing methods to reduce the costs of algal mass cultivation by integrating wastewater treatment with algal biomass production.



SUCCESS STORIES

An indigenous halophilic cyanobacterium capable of producing blue pigment phycocyanin was isolated from a hypersaline environment in KwaZulu-Natal. Preliminary research indicated that the compound had a high antioxidant activity, i.e. $90.0 \pm 0.045\%$ scavenging activity at 0.08 mg mL^{-1} and reducing power efficiency of $85.15 \pm 0.012\%$ at $150 \mu\text{g mL}^{-1}$. A high yield and purity (analytical grade) C-Phycocyanin was extracted and found to be stable up to 45°C with an optimum pH range between 5.0 and 7.0. C-Phycocyanin has great biotechnological and commercial value as a natural dye in the food and cosmetics industries, fluorophore in diagnostics therapeutics and fluorescent applications, and various health-promoting properties.

Whole algal biomass grown in poultry litter and lipid-extracted microalgae were evaluated for their potential use as fertiliser in a mung bean crop. An increase in soil organic carbon (59.5%) and dehydrogenase activity (130.8%) was observed as compared to commercial chemical fertiliser. The study demonstrated the use of waste water-grown whole and lipid-extracted algal biomass as fertiliser in agronomic practices. The results could form the basis for the development of an algae-based biorefinery in the production



of biofuels and fertilisers from algal biomass grown in agro-industrial and municipal wastewater.

Microalgae, *Scenedesmus obliquus* and *Chlorella sorokiniana*, have been identified as robust algal strains due to a high-range tolerance of organic loading and physiological stress. It has shown greater potential for removing organic matter, nutrients and pathogens. The project has successful cultures, a consortium of algae with *Scenedesmus* sp. and *Chlorella* sp. remaining dominant throughout the year and producing, on average, more than 20% lipids. Further optimisation is underway and the outlook is promising.



WHY SHOULD DONORS ASSIST?

Algae have unique properties to help them survive, even in harsh conditions. During stress conditions, algae are known to produce certain metabolites and compounds to help them survive. These unique metabolites often have special properties and, in addition, can be considered as bioactive compounds. Since only 30% of all algal species have been identified and collected, there is a huge resource available to be exploited in not only the food/feed but cosmetic and pharmaceutical industry as well.

It is imperative to find sustainable alternatives to chemical fertilisers and to develop technologies that enhance nutrient uptake efficiency, simultaneously reducing the environmental impacts. Microalgae take up the nutrients from wastewater by removing the nitrogen and phosphorus – this prevents negative

environmental impacts when the wastewater is discharged. The microalgal biomass can have several applications, including the production of biofertilisers. This will enable nutrient recycling, reducing the requirement of fertilisers produced in a non-environmentally-friendly way.

The production of biofuels from renewable, sustainable sources has far-reaching implications. Use of fossil fuel sources plays a large role in greenhouse gas production, the consequences of which are already starting to be felt globally. Algal biofuels are not only a replacement source of energy but they also actively utilise and biologically bind carbon, making it carbon neutral. When the cultivation of algae uses waste substrates, it further reduces environmental stress and aids moving towards a circular economy rather than the current linear model practised. Advances in the technology and the biorefinery concept have significantly reduced the cost of production.

1000s

of algal species only

30%

identified

collected



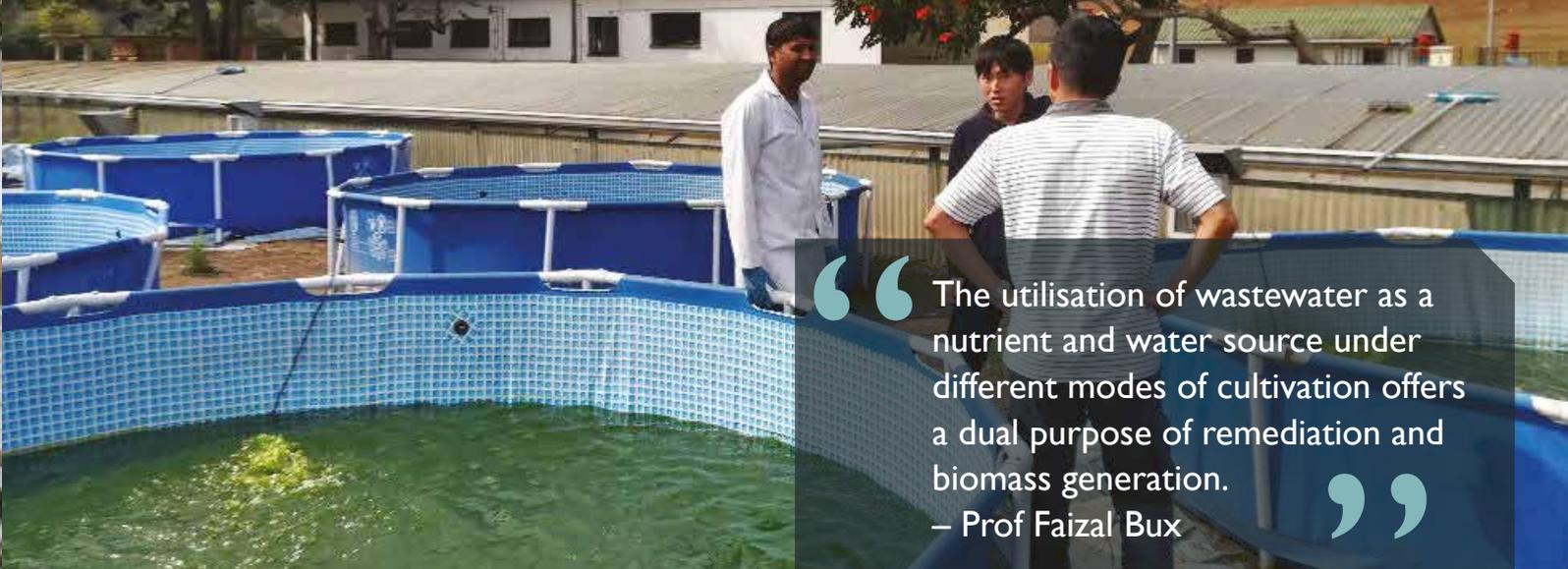
LESSONS LEARNT

Microalgal biomass applications range from the production of food and feed to high-value products for biotechnological applications. Due to their biodiversity as well as biochemical and molecular strategies for coping with stress conditions, microalgae can synthesise various bioactive chemicals. Furthermore, microalgae biochemical composition can be manipulated by changing the culture conditions to induce them to produce high concentrations of a compound of interest. There is a need to identify compounds and their activities in the treatment and prevention of various diseases, moreover to continue to search for other, not yet detected metabolites from indigenous strains.

Agro-industrial waste (poultry litter) has shown great potential to be used as a nutrient source for microalgal cultivation. Further studies will be conducted on the

use of other types of agro-industrial wastewater for microalgal cultivation and biomass production. Further work needs to be done to isolate indigenous algal strains from agricultural fields and different types of wastewater to evaluate their potential for nutrient removal, biomass production, and use as a bio-inoculant/biofertiliser in the modern agronomic practices. Strains with higher nutrient removal, higher biomass production and ease of harvesting will be selected for further studies on algae-mediated wastewater treatment and biomass production for biofuel and fertiliser applications.

The main lesson learned in large-scale cultivation is that extrapolation of findings from laboratory scale and small pilot scale are very different to actual results obtained in the field. Large-scale cultivation of algae comes with its own unique set of challenges, which cannot be foreseen. It has taught the project team to be adaptable and to adjust to an ever-changing environment in order to meet challenges.



“ The utilisation of wastewater as a nutrient and water source under different modes of cultivation offers a dual purpose of remediation and biomass generation. ”
 – Prof Faizal Bux



BUDGET

	2020	2021	2022	TOTAL
Running	R150 000.00	R159 000.00	R168 540.00	R477 540.00
Consumables	R200 000.00	R212 000.00	R224 720.00	R636 720.00
Equipment	R300 000.00	R318 000.00	R337 080.00	R955 080.00
Ad hoc labour	R40 000.00	R42 400.00	R44 944.00	R127 344.00
Local travel	R25 200.00	R26 712.00	R28 314.72	R80 226.72
Contingencies	R71 520.00	R71 520.00	R7 152.00	R150 192.00
				R2 276 910.72



PROJECT LEADER, TEAM AND CONTACT DETAILS

Prof Faizal Bux

Dr Trisha Mogany, Dr Faiz Ansari, Dr Sachitra Ratha, Dr Nirmal Renuka, Luveshan Ramanna, Keith Chetty and Ismail Rawat

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TIMELINE

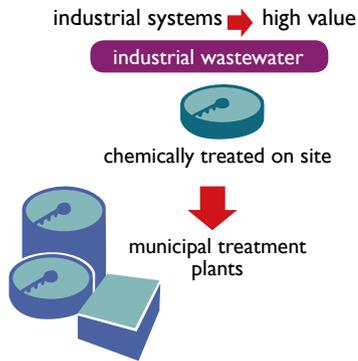
2020-2022

BIOMASS AND WASTE VALORISATION



SUMMARY

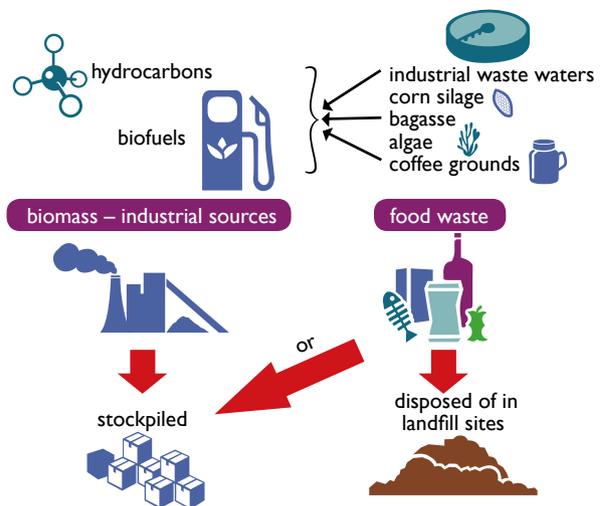
The energy crisis and proper waste disposal are two major challenges facing most nations. With the increasing demand for clean and affordable energy that is environmentally friendly, production from renewable resources is the way of the future. South Africa, like most countries, is over-dependent on fossil fuels like coal and crude oil but the classifications that are used to produce bioenergy can significantly contribute to reducing greenhouse gases (GHG) emissions. The use of fossil fuels accumulates GHG in excess of what the cycle of the individual gases (NO_x , CO_2) can accommodate. Biofuels have more friendly emission properties for both man and the environment. Agricultural biomass, food waste, wastewater and algae have demonstrated potential as starting blocks for high-value hydrocarbons and biofuels. In South Africa, several industries produce millions of cubic metres of wastewater annually, with large volumes released into water bodies after treatment on-site.



Industries in most parts of the world continue to battle against effluent discharges of poor quality, which affect ecosystems. Effluent with high carbon content and nutrients have the potential for transformation into valuable bioproducts. In addition, the agricultural sector and food industry produce large volumes of waste, which contains valuable biomass that can be converted into useful bioproducts.

The proposed research focuses on integrated systems to produce high-value hydrocarbons and biofuels from suitable industrial wastewaters, bagasse, corn silage, spent coffee grounds, algae and locally available biomass. Finding alternative renewable resources that are affordable and reliable are also the focal point of the United Nations' Sustainable Development Goal 7. Currently, industrial wastewater is chemically treated on-site and fed in to municipal treatment plants or water bodies. Biomass from agricultural sources are stockpiled or together with food waste, disposed of in landfill sites. Anaerobic digestion in a biogas plant is a well-proven process as organic matter is broken down gradually without the presence of oxygen to generate biogas and the digestate. The co-digestion of these substrates with sewage sludge and industrial

effluent enhances the conventional digestion process, which produces biohydrogen and biomethane. The secondary treatment of sludge through anaerobic co-digestion produces abundant biogas, as the main goal is to reduce the amount of sludge that needs to be disposed of. The addition of biomass from agricultural or food waste sources further enhances the yield of biogas. Bagasse, corn silage and food waste such as spent coffee grounds, are an alternative for high-value hydrocarbons that are conventionally produced from fossil fuels. Green synthesis, with an emphasis on green solvents, further aids the transformation into valuable bioproducts. Biomass, as a potential alternative, ensures a sustainable feed source for these biohydrogens, which have widespread use in replacing those produced from fossil fuels. The growth of algal biomass in industrial wastewater for the production of hydrocarbons can be enhanced by airlift raceway ponds. The biomass growth rate is dependent on the strain of algae, the hydrodynamics of the raceway design and the carbon-nutrient content in industrial effluent.





AIMS AND OBJECTIVES

The project aims to ascribe value to locally available biomass and waste using green engineering principles for the production of biofuels and high-value hydrocarbons:

- To produce biogas from biomass and waste, including wastewaters
- To produce high-value biohydrocarbons as starting blocks for the chemical and allied industries using biomass and waste



IMPACT

The use of local substrates and raw materials reduces the carbon footprint, allows opportunities for industrial partnerships in the treatment process, and the application of multiple technologies fed by sustainable resources. The treatment of large volumes of industrial wastewater will mitigate the effects to the ecosystems and prompt a culture of zero waste if the benefits show economic value. A lifecycle analysis will be incorporated into this study together with an economic analysis of implementing these interventions as an alternative to conventional disposal methods for biomass and waste, which includes wastewater.



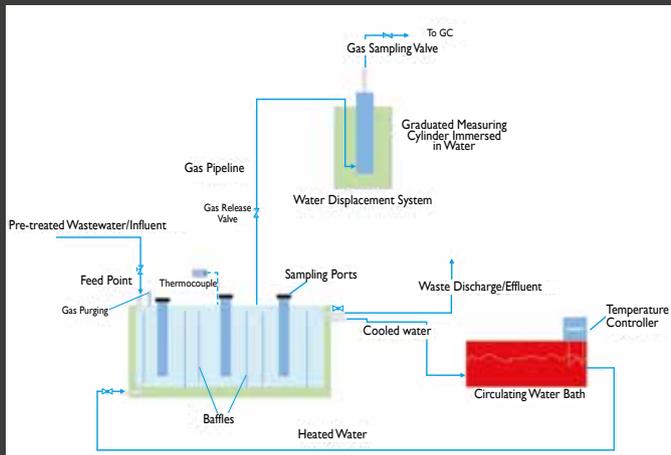
WHAT IS UNIQUE?

The focus is on waste from local industries from Durban and surrounding areas. There are currently limited studies on valorisation of industrial effluent. This project combines industrial wastewater treatment with biomass to produce biofuels and biohydrocarbons from renewable resources.



SUCCESS STORIES

A novel-type reactor has been designed and is soon to be commissioned to grow algae in industrial wastewater and one configuration has already been commissioned. These are the largest lab-scale reactors in South Africa (the new design may be the largest lab-scale reactor, perhaps globally). Since work on valorisation of industrial effluent is limited within Durban and the surrounding areas, the municipality is keen to partner with the Institution to roll out a strategic plan for greater participation from industry in the treatment of their effluent.



Dark fermentation for production of biohydrogen from industrial wastewater.





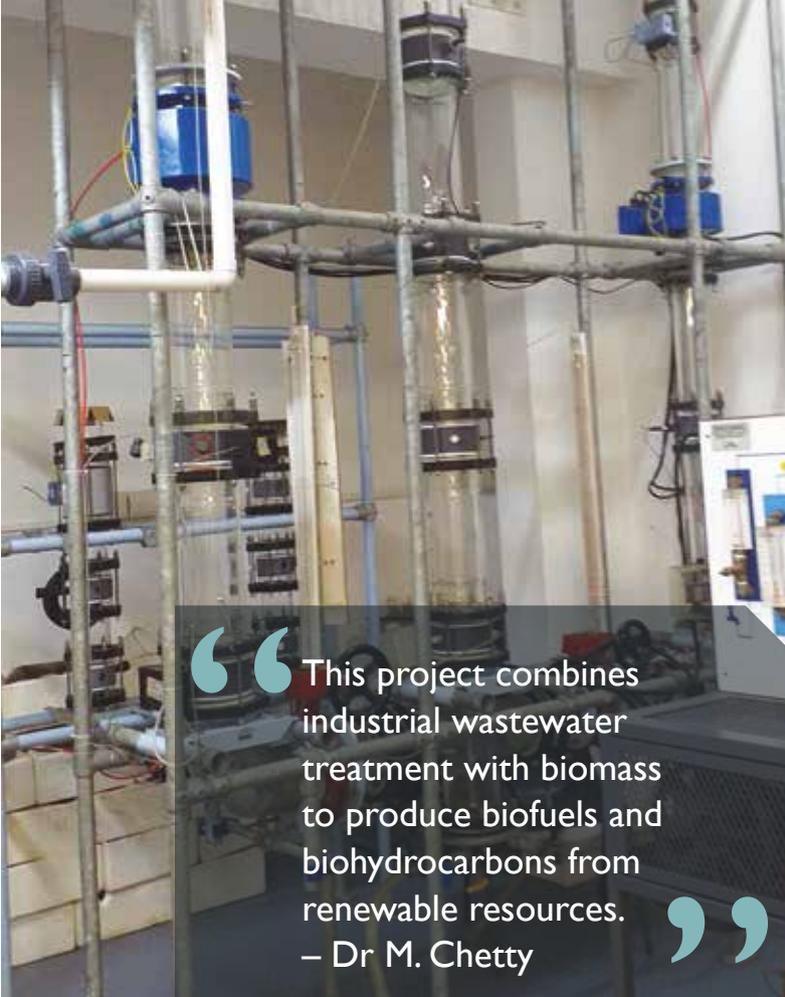
WHY SHOULD DONORS ASSIST?

The project aims to use green engineering principles in all research undertaken. The technologies adopted aim to use renewable alternatives to conventional technologies and incorporate green solvents, catalysts and chemicals like ionic liquids, which are a sustainable option.



LESSONS LEARNT

A screening process on effluent from local industries needs to be undertaken and a partnership established on valorisation projects. The project also aims to refine the methodologies adopted to embrace greener methods – from the raw materials to the final product – with the environmentally-friendly disposal of by-products.



“ This project combines industrial wastewater treatment with biomass to produce biofuels and biohydrocarbons from renewable resources. ”
 – Dr M. Chetty



BUDGET

	2021	2022	2023
Instrumentation/equipment			
Reactors	R500 000	R150 000	0
GCMS	R500 000	0	0
Online biogas analysers	R100 000	0	0
Ultrasound	R150 000	0	0
Water baths	R80 000	0	0
Consumables			
Test kits, solvents, chemicals	R150 000	R100 000	R100 000
Glassware and auxiliary items	R50 000	R25 000	R25 000
Data logging			
Hardware, software and licences	R200 000	R50 000	R50 000
Capacity development			
Research assistant/ Postdoctoral fellow	R200 000	R200 000	R200 000
Scholarship Master's	R60 000	R60 000	R60 000
Scholarship Doctorate	R120 000	R120 000	R120 000
	R1 990 000	R585 000	R435 000



PROJECT LEADER, TEAM AND CONTACT DETAILS

Dr M. Chetty

Prof Nirmala Deenadayalu, Edward Armah, Donald Kukwa, Jeremiah Adedeji, Boldwin Mutsvene, Dan Odayar, Sne Bly, Velile Chile, Raletsoa Motalingane, Nikita Singh and Bheki Mhkonto

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TIMELINE

2021-2023



DUT BURSARY FUND



SUMMARY

The DUT Bursary Fund augments the current National Student Financial Aid Scheme's (NSFAS) allocation to DUT with a specific focus on students who fall between the cracks, either due to insufficient funds or coming short of the national allocation criteria. Donations of any amount towards this fund ensure that academically deserving students are not denied the opportunity to study due to financial constraints.





AIMS AND OBJECTIVES

- To ensure that students are able to obtain a tertiary qualification – for many, they are the first in their families to attend a tertiary institution
- To further enhance the opportunities afforded to students
- To assist students in becoming active citizens of the country and contributing positively towards society



IMPACT

A significant proportion of students come from disadvantaged, underprivileged backgrounds and donor investment in their lives makes it possible for them to achieve their goals and aspire to greatness, thereby positively impacting their lives and livelihoods. Furthermore, education, as a basic right, is not affordable to a substantial percentage of the student population. The NSFAS allocation is not able to cover all students. The DUT Bursary Fund attempts to address this problem and in so doing, makes education and learning available to the future leaders of the country.



SUCCESS STORY

After unsuccessfully applying for funding from NSFAS in 2017, Nokuphila Yvonne Biyela could not register at DUT for her second year of study for a National Diploma in Marketing, access her results, the library, textbooks or exam venues, as she still owed money for her first year of study. She finally looked to the Alumni Bursary Fund for help. “The first time I met Mr Ngubane (of the Advancement and Alumni Relations Office) I was crying. I asked if it was a crime to be poor. I wanted to change my home, community and my entire village!” said Biyela.

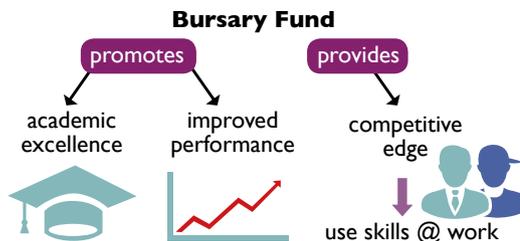
In 2019, thanks to the Fund, she graduated with four distinctions, having received the first university diploma in her family. She is now studying towards her advanced diploma. Her qualification has allowed her to gain part-time experience as a tutor and as an admin assistant in the DUT Department of Marketing and Retail. She is currently temporarily employed as an intern in the DUT Faculty of Management Sciences’ postgraduate office.

Biyela plans to contribute to the Fund when she lands a permanent job. “Potential funders: I am a product of the Bursary Fund. Some of us have dreams but because of financial hurdles, we cannot fulfill them. We need more people to contribute. I went from being a Shoprite assistant to a graduate – you can do the same for others!”



WHY SHOULD DONORS ASSIST?

The Advancement and Alumni Relations Office is passionate about improving the lives and livelihoods of its students. The Bursary Fund promotes academic excellence and improved performance as well as provides students with the competitive edge to utilise their skills in the work environment.





“ Thank you for making my registration possible. I was amazed by the attention you gave me, even though it was short notice. I appreciate your financial support, which was really needed. I will be forever thankful for that. I hope that one day I will be the one giving back to others. ”
– Bongmusa Mngadi, DUT student



PROJECT LEADER, TEAM AND CONTACT DETAILS

Mr Zwakele Ngubane – Director: Advancement and Alumni Relations

Nishie Govender – Manager: Fundraising and Alumni Relations

Pretty Zulu – Fundraising and Stewardship Officer

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TIMELINE

The DUT Bursary Fund was conceptualised in 2010. This is an ongoing project aimed at alleviating the financial stress experienced by students when it comes to funding their studies. Continuation of the Fund is dependent on the generosity and contributions of donors.



BUDGET

The average cost per student per year is approximately R100 000. This includes the cost of tuition, accommodation and meals.



AIMS AND OBJECTIVES

- Offering Chinese language and culture courses for local communities such as schools or universities
- Providing a platform or venue that supports virtual conferences, workshops or training courses aimed at vocational skills training



IMPACT

The project will provide an excellent opportunity to extend DUT and its CI's influence on the local community and provide a social service focusing on:

1. Broadening the youth's horizons
2. Creating more cooperative opportunities that students and the youth would greatly benefit from
3. Learning the Chinese language and culture
4. Accessing opportunities to study abroad
5. Learning entrepreneurship and skills

The project can gradually spread across the Province through establishing more remote classrooms, utilising CI's teaching resources (both lecturers and teaching materials) to offer the Chinese language (Mandarin) course weekly and organise online cultural events. By combining current skills training programmes (agriculture, Chinese vocation, Chinese enterprise internship programme, etc.), the project would also showcase and organise relevant training sessions based on the needs of the local society.



WHAT IS UNIQUE?

It is the first of its kind in KwaZulu-Natal and the first attempt by DUT and the CI to help more youth to access outstanding resources and opportunities without the hindrance of distance or unequal distribution of teaching resources.

6500 learners

offered
CHINESE
中文
language culture
programmes

>100 cultural events co-hosted
220000 participants



>20 high-calibre students

recommended to work in LOCAL Chinese enterprises



SUCCESS STORIES

Since its formal operations in 2014, the DUT CI has successfully offered different programmes of Chinese language and culture to more than 7 000 registered learners, and more than 100 cultural functions and events have been hosted or co-hosted by the DUT CI with around 220 000 participants from the local and Chinese communities in South Africa. Moreover, hundreds of Mandarin learners from DUT CI have attended the winter/summer camps and were offered the opportunity to study in China for short-term courses or other exchange programmes. Three groups of graduates were sent to China to receive JUNCAO Technology training and more than 20 high-calibre students were recommended to work in local Chinese enterprises.



WHY SHOULD DONORS ASSIST?

This project will contribute to the economic development of local communities by introducing skills and vocational training workshops and offer various possibilities for youth, including various exchange programmes and internships or study opportunities. The CI is aiming to promote this project widely across the Province so that people who have a strong desire to make a difference could benefit by accessing these opportunities. Therefore, a teaching or training platform/network could be established to strengthen the radiated impact of the project with donors' support.



“The DUT CI is committed to promoting the mutual understanding and people-to-people exchange between China and South Africa. Moreover, it has been dedicated to providing social service to local society, contributing to the economic development of local communities by providing solutions for social challenges.”
– Frank Lin Wu



PROJECT LEADERS, TEAM AND CONTACT DETAILS

Frank Lin Wu and Phumzile Xulu
Confucius Institute and DVC: RIE Community Engagement
Email: linw@dut.ac.za



TIMELINE

Pilot period: September 2020 – September 2021



BUDGET

The costs of this project include the server room, the main classroom and the remote classroom. CI could cover the cost of the main classroom (around R750 000) located in the ML Sultan campus. It is currently looking for funding support to cover the cost of the server room and remote classroom at DUT and the potential cooperative schools, universities or TVET colleges, respectively, which is around R700 000 in total.

COMMUNITY CLEAN-UP



SUMMARY

A Community Clean-up Programme was initiated in response to the DUT Strategy Map as part of ENVISION 2030, which emphasises being a university that is people-centered and engaged. Community engagement programmes are now seen as playing a significant role in informing our approach to the University's offerings and development.



The project is about environmental management and building entrepreneurship spin-offs to sustain community spaces as ideal places for human settlement. This, in the initial stages, will ensure that our communities are clean and green – being able to show and teach community members about the importance of clean-living environments and recycling. Recycling will be introduced to ensure that it's linked to income generation and that sustainable businesses are created.

The project also fosters stakeholder relations, community engagement and skills transfer among DUT students and the community in order to create environmental sustainability awareness and green business. The continuous Clean-up Campaign was initiated in 2018, and it has grown bigger, attracting more partners. In 2019, The Midlands Entrepreneurship Centre hosted three clean-up campaigns and a workshop on environmental sustainability and green business.



AIMS AND OBJECTIVES

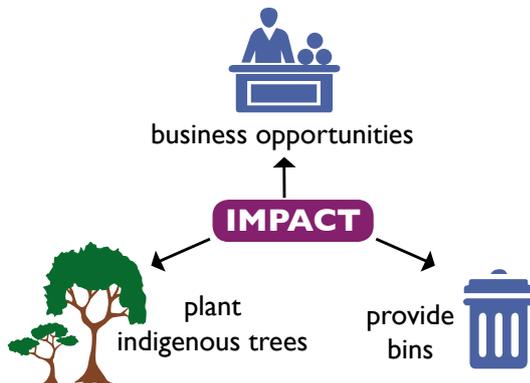
Besides starting small-scale recycling businesses and keeping their community and DUT clean, students will be encouraged to educate other community members on recycling. Project leaders will hold workshops to teach them about what can and should be recycled and what the available platforms on which to recycle these goods are. They will also assist students by having recycling bins within the campus where they can collect the recyclable goods. This will also help both students and the Institution to become eco-friendly and encourage a recycling mindset.



IMPACT

Students will be educated about not creating illegal dumping spots, to keep their environment clean, and to see the possibility of business opportunities in these recyclable goods. Planting indigenous trees in some of these areas will also help to keep them green, and bins will be provided, which will prevent littering.

The project can be implemented anywhere in South Africa as we have a big problem with illegal dumping; it's essential to keep our environment clean, and it will also help alleviate the high unemployment rate that we are currently facing.



WHY SHOULD DONORS ASSIST?

This project encourages and supports going green and taking care of our ecosystem through recycling. Donors will play a massive part in this and in helping unemployed youth to create their own job opportunities. Entrepreneurship is critical in an economy suffering from high unemployment; the project will teach people that there are many ways of earning a living besides formal employment.



“ The project is about environmental management and building entrepreneurship spin-offs to sustain community spaces as ideal places for human settlement. ”
– Nontokozo Ngcobo



PROJECT LEADERS AND CONTACT DETAILS

Nontokozo Ngcobo: Centre Manager

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Tel: 033 845 9056



TIMELINE

August 2020 to 2021



BUDGET

R85 000

DESALINATION OF INDUSTRIAL WASTEWATER



SUMMARY

There are many treatment methods to remove contaminants from industrial wastewater and these are usually conducted in order to meet discharge limits and/or to reuse the treated water. One of the contaminants is salt content. The discharge limits for salts at the moment is not restrictive enough to force industries to implement treatment for this contaminant. This project aims at the evaluation of membrane technology (forward osmosis – FO, reverse osmosis – RO and a combination of the two) to remove these salts so that the treated water may be reused within the specific plant.



AIMS AND OBJECTIVES

The main aim is to evaluate the viability of using the technology on a lab scale and then upscaling to a pilot plant. The specific objectives are to:

- Investigate the permeate flux that is possible for various wastewaters using FO, RO and FO-RO systems
- Evaluate the salt rejection from these technologies for the various industrial waters at optimised conditions
- Evaluate flux recoverability initiatives of the membranes so that their lifespan is increased



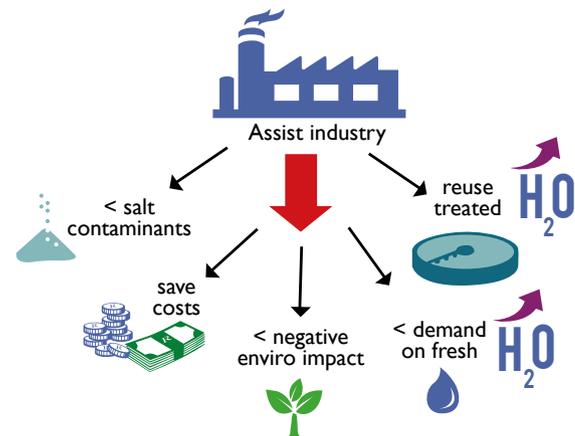
WHAT IS UNIQUE?

The project specifically deals with the reduction of salts from wastewaters. Many industries have technologies to remove other contaminants to bring the wastewater to discharge standards but no specific technology to remove salts so that the water may be reused. This project aims to be a polishing step specifically to reduce salt content.



IMPACT

The project will assist industries to reduce the salt contaminants and possibly reuse the treated water within the plant, thus saving costs, reducing the negative environmental impact as well as reducing the demand on fresh water.

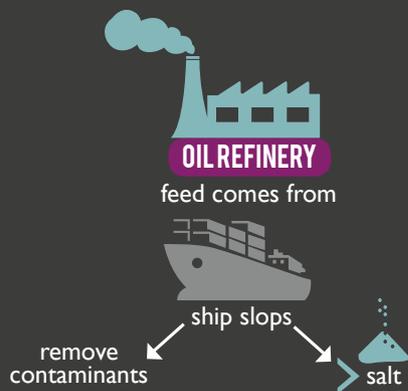




SUCCESS STORIES

A specific wastewater from a local oil refinery with high salt content has initiated the project. Results from current experimental work is proving successful on a lab scale, however, this will have to be expanded to a pilot-scale unit to obtain scale-up benefits.

One specific oil refinery is excited about the outcomes as it will provide a real solution to the current problems being experienced – it has a feed that comes from ship slops with extremely high salt content. Although its current technologies have some reduction of salts with the removal of other contaminants, it still requires a final polishing step for salt reduction.



WHY SHOULD DONORS ASSIST?

In keeping with the international sustainable development goals, technologies need to make sure that the use of fresh water is reduced and efforts are made to treat and reuse industrial wastewaters. The project aims to provide industries with a solution of bringing their wastewaters to reuse specifications. This will greatly reduce our demand for large amounts of fresh water, which is a precious commodity.



“ The project will assist industries to save costs, reducing the negative environmental impact as well as reducing the demand on fresh water. ”
– Prof Sudesh Rathilal



PROJECT LEADER, TEAM AND CONTACT DETAILS

Prof Sudesh Rathilal

Elorm Ezugbe and the possibility of two new MEng students

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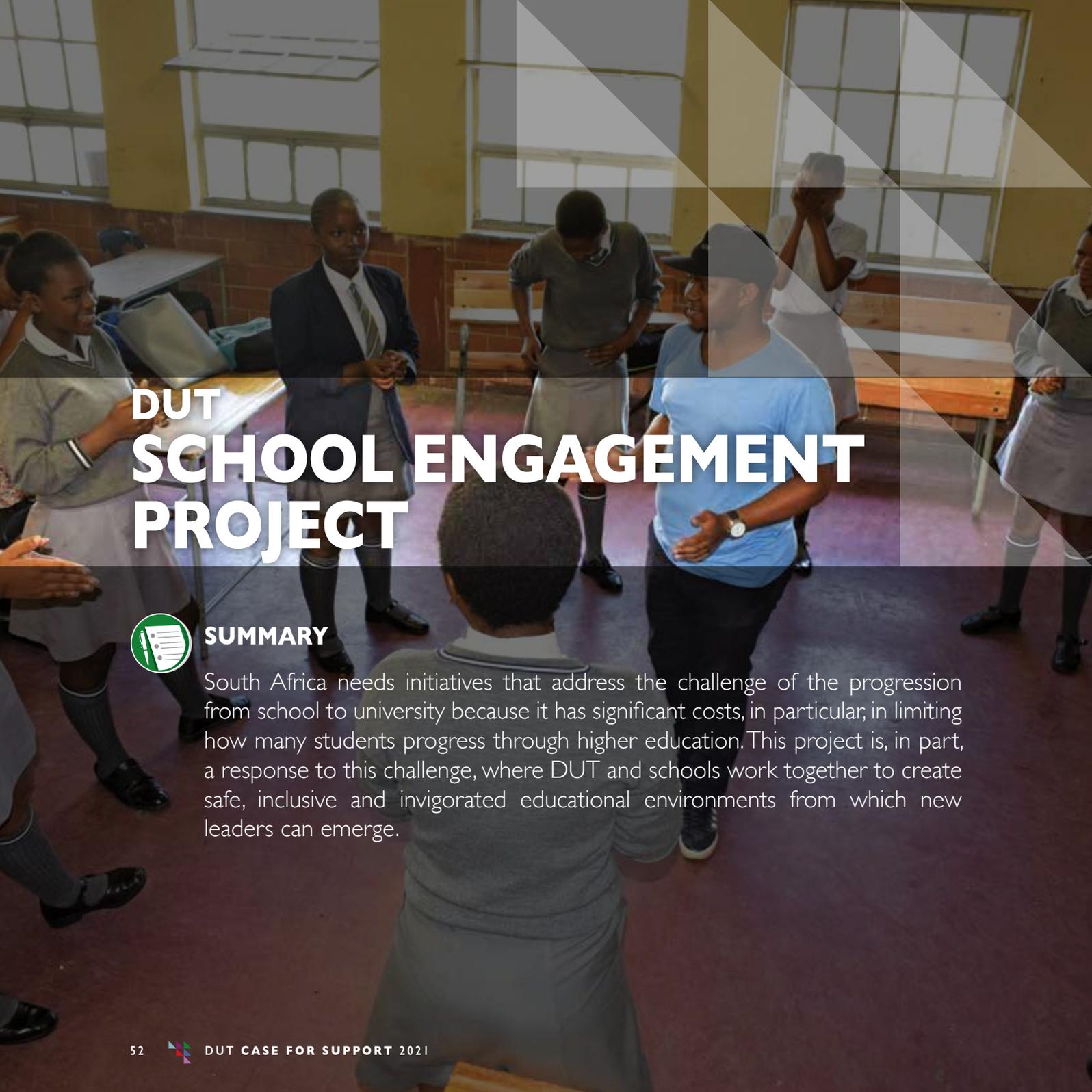
TIMELINE

The project started in June 2019 and the first phase should end by June 2021. The next phase of investigating many other industrial effluents and the development of a pilot-scale unit will start in February 2021 and end in December 2022.



BUDGET

Membranes for lab unit	R20 000
Pilot-scale unit	R100 000
Analysis	R30 000

A group of school students and a man in a blue shirt and cap are interacting in a classroom. The man is wearing a blue t-shirt, a black cap, and a watch. He is standing in the center, surrounded by students in school uniforms. Some students are looking at him, while others are looking away. The classroom has wooden desks and benches, and large windows in the background.

DUT SCHOOL ENGAGEMENT PROJECT



SUMMARY

South Africa needs initiatives that address the challenge of the progression from school to university because it has significant costs, in particular, in limiting how many students progress through higher education. This project is, in part, a response to this challenge, where DUT and schools work together to create safe, inclusive and invigorated educational environments from which new leaders can emerge.

Gateway Subjects: Learners are offered revision classes by DUT tutors in Maths, Science, Accounting and English at the grade level determined by the participating schools to enhance possibilities for further study in tertiary institutions.

Peace Clubs: DUT students help develop these clubs in participating schools to build conflict resolution skills in order to harness diversity and reduce school violence so that learning can take place in a safe and supportive environment.

Social Entrepreneurship Clubs: Mentored by DUT students, teams of Grade 10 and 11 learners in participating schools implement workable solutions to problems facing their school communities, and prepare for tertiary education and the world of work by developing entrepreneurial competencies.

Sports Tournaments: Learners from participating schools take part in sports tournaments at DUT, which develop life and leadership skills and allow them to be selected by the DUT Sports Department for further developmental opportunities.

School Management: The assistance of a retired school principal as coach/support is offered to six participating schools to enhance the school leaders' capacity to manage schools for quality teaching and learning.

70% South African learners
have no access to technology + data



AIMS AND OBJECTIVES

- Cultivate a culture of peace and possibility in schools where conflict is managed in productive ways
- Improve school academic results, particularly in the gateway subjects
- Offer opportunities for Master's and PhD students at DUT to develop their skills through work placement while strengthening the capacities of the schools
- Develop leadership skills among both school students and DUT students involved in the project
- Foster a strong relationship between the schools and DUT that attracts school students to DUT and generates further opportunities for collaboration and research



WHAT IS UNIQUE?

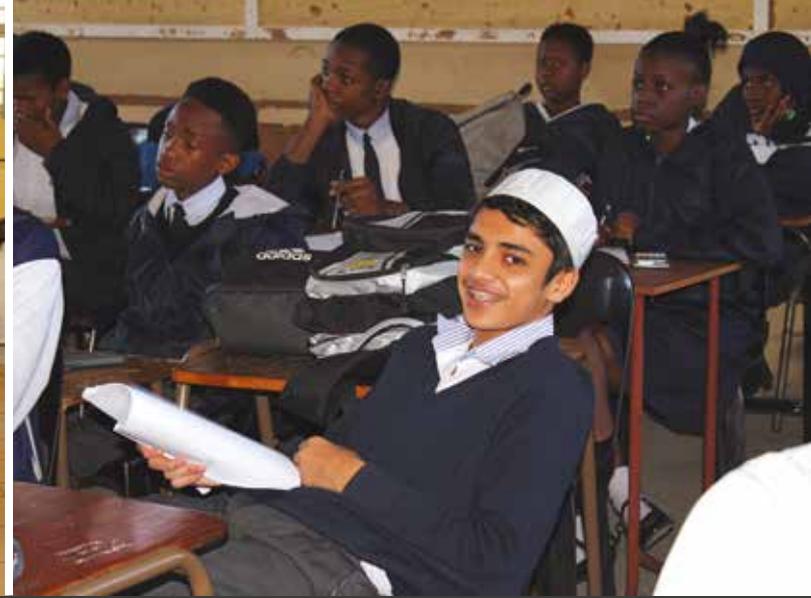
The project is a holistic education intervention that offers support where it's needed most. Once students are at a tertiary education institution, they have a much better chance of successfully completing their qualification as they have developed 'success skills'. The DUT students who become tutors in the project also benefit by acquiring success skills, e.g. emotional intelligence, accountability, time management, communication skills – thus becoming more employable, and effective leaders in the Well-Being Economy. The project offers a model for other tertiary institutions to emulate in their implementation of community engagement.



IMPACT

There is evidence that many of the learners who participate in the Tutorial programme in the gateway subjects display improved motivation and results for their academic subjects. The learners also build relationships with DUT tutors, who act as mentors. Learners develop conflict resolution skills in the Peace Clubs to deal with stress and conflict in a non-violent way and become peace ambassadors at home and school. Social Entrepreneurship Clubs develop valuable skills of entrepreneurship so that learners can build the South African economy by starting their own businesses when they

leave school. They also leave a legacy in their school: the clubs implement projects such as creating a school library, creating a school museum, developing sports facilities, fixing school infrastructure, creating a science laboratory, etc. Cutting across all the pillars of the project are the values of ubuntu, commitment, reliability, integrity and punctuality, which create a culture of caring and accountability. The learners and tutors are encouraged to actively live these values and as they do, they see the impact in their lives of improved relationships, less stress and more fulfilment. As leaders, the impact of learning to live these values is huge and inspires their peers, families and friends.



SUCCESS STORIES

As soon as the COVID-19 lockdown started, the project moved to an online Whatsapp learning platform – the Incredible Nerds Club (INC) – as it was the most accessible to learners and not too data heavy. More than 1 000 Grade 10, 11 and 12 learners from six partner schools as well as many other schools in KwaZulu-Natal were taught Maths and Maths Literacy, Physical Science and Life Science, English, Economics, Accountancy, Life Skills and Study Skills. INC replicated the experience of being at school by adhering to a timetable and code of conduct, and followed the format of a typical classroom lesson with a trained tutor. Tutors monitored the progress of learners through tests and assignments and provided the opportunity for learners to send questions and assignments between classes. This project has touched so many learners' lives, given them hope for the future and a clear plan to reach their dreams.

>1 000
Grade 10, 11 and 12
TAUGHT

6
partner
schools

“Our learners never showed great interest in challenging subjects, but ever since the inception of the project, we have had great interest. It’s unlike our conventional, orthodox approach of teaching where the teacher assumes the parental role; the students are using a more peer-to-peer approach.”

– Mrs Thiye, Principal, Wiggins Secondary School.

“Some children have faced challenges at home or school but they have been empowered to cope with these situations. They feel confident to share their issues in a group that shows respect and understanding. The club has offered learners a 'haven in a heartless world'.”

– Ms Gowthum-Seebadri, Educator in charge of Peace Club, Hunt Road Secondary.



WHY SHOULD DONORS ASSIST?

Previously disadvantaged learners benefit by acquiring life and workplace skills and improved academic results, which open up possibilities of various career paths and tertiary education after school. The project enables learners to get free after-school tuition in schools where parents generally would not be able to afford this. The peace and social entrepreneurship clubs develop learners as active citizens who have the will and capacity to help others in their communities.

The project offers a model for other tertiary institutions to emulate in their implementation of community engagement. Students at school and university are offered the opportunity to become ethical leaders and change makers who can spearhead a Well-Being Economy; this, in turn, meets a crucial current need in South Africa.

DUT students involved in this project become more employable through gaining valuable workplace experience and learning the skills of time management, accountability, resourcefulness, creative problem solving and follow through. At the same time, the school students are mentored to acquire these skills and are inspired by their DUT role models to plan their career paths: once they arrive at university, they have a much better chance of completing their degrees successfully and using their leadership skills to the benefit of society.



FUTURE ENDEAVOURS

Although the project currently provides career guidance as part of its Life Skills tutorials on the online learning platform, the DUT Cooperative Education Department is willing to assist in organising workplace experience in the school holidays for motivated learners. The project invited more like-minded schools and collaborators to become partners in 2020 and the project is becoming part of a national and international conversation on school engagement. It also plans to go back to real schools this year..



PROJECT MANAGER, TEAM AND CONTACT DETAILS

Berenice de La Croix

Project team: project manager; deputy project manager; school coordinators; tutors; coach for school management teams

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Mr Crispin Hemson: Director of the International Centre of Non-Violence, DUT (Project Host Department)

Mr Zwakele Ngubane: Director Advancement and Alumni Relations, DUT (Project Partner Department)



TIMELINE

July 2018 – present. Online from March to December 2020. Back in schools in 2021.





BUDGET

Budget 2021: Eight High Schools

PROJECT MONTH	TOTAL (R'000)
	2021
Project manager	360
Trainee project manager	120
Coaching school management: 1 retired principal	60,5
Catering: meetings and workshops	6,75
Tutoring: 30 tutors 2020; 40 tutors 2021	612
Subject specialists: 3 retired teachers	148,5
Holiday conference: training	22
Holiday conference: catering	18,5
Printing	25
Training materials	10
Project T-shirts	32
Administration: ICON	66
Graduation ceremonies: prizes	75
	1 556

“ Tutoring Science made me learn the subject even to a greater level for giving learners more accurate information. Tutoring improves my speaking, writing and readings skills, since I have to make sure that I communicate with learners clearly. ”

– Nomonde Ndlovu, Science tutor



“ I’m a very committed learner and it’s all thanks to the excellent tutors. They have taught me to be committed, motivated and dedicated. ”
– Thandolwenkosi Ngcobo,
Durban Girls Secondary learner

ENHANCED FISH FEED FOR THE AQUACULTURE INDUSTRY

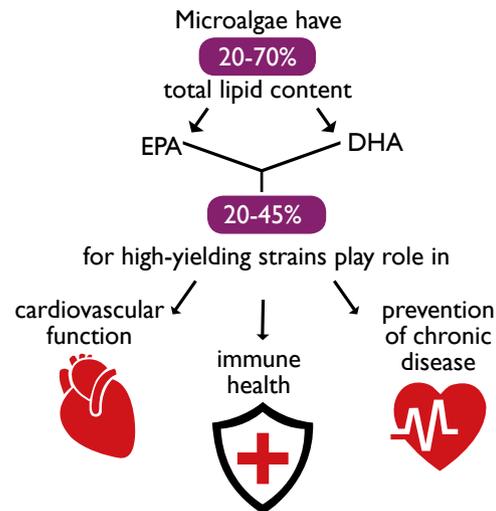


SUMMARY

Microalgae play a vital role in the aquatic food chain and are popularly used in the rearing of molluscs, shrimps and fish at different growth stages. Algae can be used directly as a live culture or as a value-added feed supplement. The formulated, enhanced fish feed using microalgal supplementation should satisfy the nutritional requirements of the fish with a high acceptability. Scientific investigation of microalgae for their nutritional content and impact on fish health and quality for human consumption is required in order to quantify the outcome of the microalgal addition.

Microalgal biomass contains several important biochemical constituents such as proteins, lipids, carbohydrates and various types of pigments, vitamins and minerals, which are considered important feed ingredients. Microalgae typically have a total lipid content ranging from 20% to 70% dry weight, the omega-3 long-chained-polyunsaturated fatty acids (LC-PUFAs), i.e. eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) can range from 20% to 45% for high-yielding strains. These fatty acids have been found to play a role in healthy aging, cardiovascular function, immune health, and the prevention of various chronic diseases. High-value carotenoids such as β -carotene and astaxanthin are widely used in aquaculture for their potent colouring and antioxidant properties, both of which can significantly improve the quality and value of farmed fish.

The use of algae as an additive in aquaculture has received a lot of attention due to the positive effect it has on weight gain, increased protein and lipid content, improved resistance to disease, increased fish digestibility and antioxidant properties. Previous research conducted at the Institute for Water and Wastewater Technology (IWWT) showed that microalgae *Scenedesmus obliquus* could be successfully used as a protein source in Tilapia feed to enhance growth and morphological characteristics. During this study, microalgae was added to Tilapia feed as a protein source at varying concentrations. The fish's specific growth rates, protein efficiency ratio, protein productive value, body weight gain, feed conversion



ratio and metabolic growth rate was assessed at different stages. The supplementation of whole algal biomass as well as lipid extracted algal biomass in Tilapia feed showed significant improvement in the weight and length of the fish.

The main source of EPA and DHA for human consumption is marine fish; many commercial fish such as Tilapia only contain small amounts of these essential oils. Furthermore, fish, like other animals, do not efficiently synthesise these PUFAs themselves, but obtain and accumulate them via the marine food chain from microalgae. Thus, the project's current research focuses on improving the nutritional quality of Tilapia by evaluating the effects of supplementation of marine microalgae containing omega-3 PUFAs.



AIMS AND OBJECTIVES

The major focus of the work is to evaluate algal supplementation to aquaculture feed and impact on the nutritional quality of Nile Tilapia (*Oreochromis niloticus*).

The objectives of this study are:

1. The isolation of high lipid-producing marine microalgae and to screen for potential PUFA-producing strains
2. To enhance lipid production in microalgae by optimising nutrients and cultivation conditions
3. To prepare different fish feed formulations using algal biomass as a nutritional supplement
4. To assess the effect on growth and nutritional quality of Nile Tilapia



IMPACT

Application of microalgae supplement feed will provide new business opportunities to farmers and fish feed producers and it has the potential for local communities to partake in the aquaculture industry. In the future, pilot-scale algae cultivation ponds can be set up for small localities and villages, which could be a source of income. Furthermore, fish consumption with a better nutritional profile (omega fatty acids, antioxidants, etc.) will help to decrease the risk of cardiovascular diseases in South Africa. The aquaculture industry in South Africa will be the principal beneficiary of the offerings, which will contribute significantly to the gross domestic product of South Africa.



WHAT IS UNIQUE?

The aquaculture industry is one of the fastest-growing food sectors in the world. The industry is now facing a huge challenge to provide quality feed to fish. Feed is one of the major markers that decides profit and loss in aquaculture and fishmeal is extensively used as a source of protein and oil. These two ingredients are most important in fish diets, which significantly impact fish growth performance and nutritional value. However, limited availability and the high price of fishmeal is restrictive. Therefore, some plant-based feed ingredients such as soybean meal are used as an alternative due to their low cost and easy availability. Their main disadvantages are a lack of essential amino acids, pigment and the presence of anti-nutritional factors, which inhibit the growth performance and nutritional quality of fish.

Microalgae have great potential as an important fish feed ingredient and many advantages over plant-based feed sources. Microalgae can grow throughout the year and contain proteins, oil, carbohydrates, vitamins and pigments. Microalgae contain essential amino acids and polyunsaturated fatty acids, their biomass has high palatability value and they can provide all the essential ingredients for fish growth. The application of microalgae in the aquaculture industry may reduce the cost of production and improve the nutritional value of fish, which will ultimately open a new gateway for business.





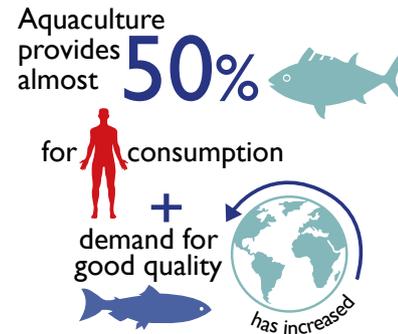
SUCCESS STORIES

The aquaculture industry generates a huge amount of wastewater, which is rich in nutrients such as nitrate, nitrite, ammonia and phosphate. It is important to treat aquaculture wastewater prior to discharging it into water bodies. Wastewater rich in nutrients can be used as a nutrient source and medium for microalgae growth and biomass production. Simultaneous fish rearing and the use of aquaculture wastewater in algae cultivation will make the industry more economical and viable.



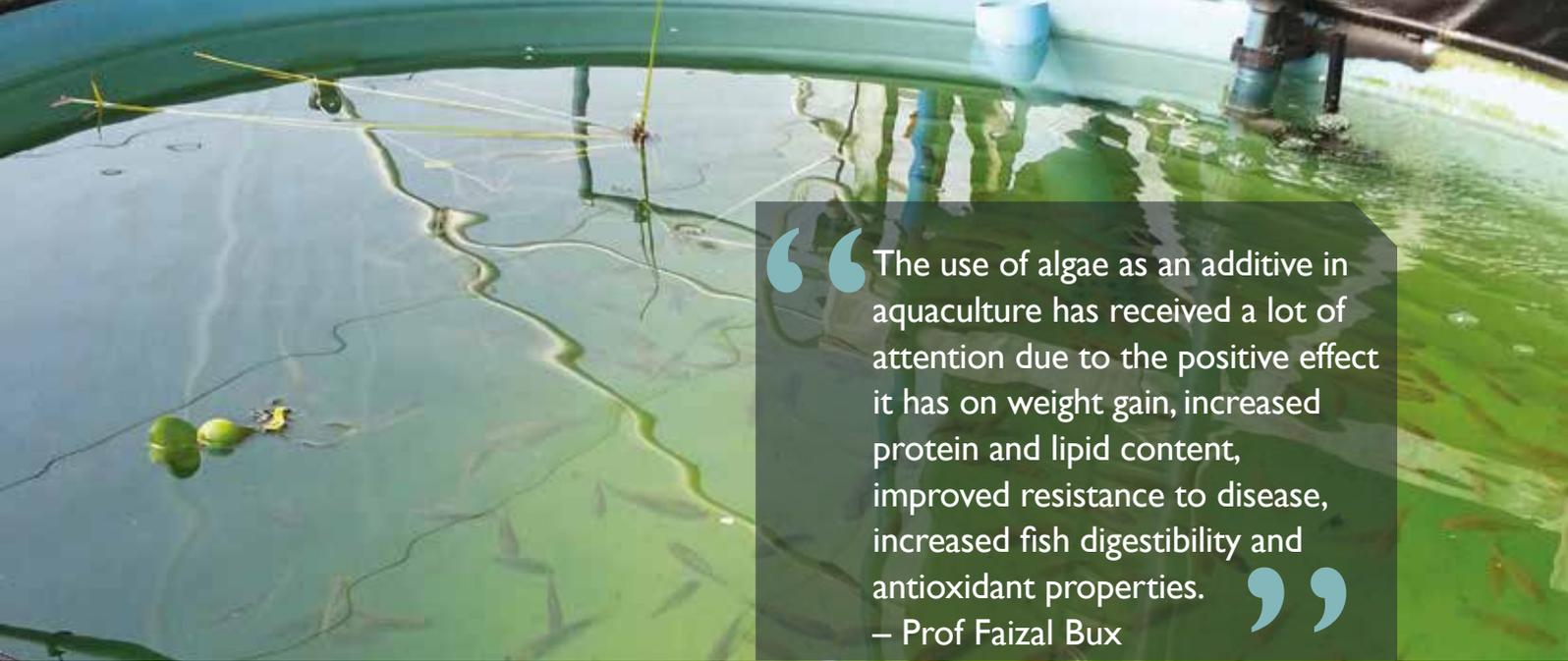
LESSONS LEARNT

The use of algae supplemented feed led to an almost 25% increase in fish production and significantly reduced the cost of production as compared to conventional feed. Algae supplemented feed also improved fish health and took less intensive care for water management compared to conventional feed. This project provided an opportunity to learn about the most vital parameters for developing algae-supplemented feed and to study fish growth performances. The project team are looking forward to evaluating the potential of developed algae supplemented feed at a demonstration level.



WHY SHOULD DONORS ASSIST?

Aquaculture provides almost 50% of fish for human consumption and the demand for good quality fish has increased globally. Due to the limited supply of fishmeal in fish feed, most of the feed-producing companies are using terrestrial plant-based feed ingredients. These feed sources provide basic ingredients but lack many essential ingredients, e.g. amino acids (thymine, lysine, etc.) as they cost more to add. The application of algae in the aquaculture industry can provide good-quality fish and increase profit share. Additionally, this is an excellent opportunity for the algae industry to support aquaculture.



“ The use of algae as an additive in aquaculture has received a lot of attention due to the positive effect it has on weight gain, increased protein and lipid content, improved resistance to disease, increased fish digestibility and antioxidant properties. ”
 – Prof Faizal Bux



BUDGET

	2020	2021	2022	TOTAL
Running	R80 000.00	R84 800.00	R89 888.00	R254 688.00
Consumables	R85 000.00	R90 100.00	R95 506.00	R270 606.00
Small equipment	R75 000.00	R79 500.00	R84 270.00	R238 770.00
Local travel	R12 000.00	R12 720.00	R13 483.20	R38 203.20
Contingencies	R25 200.00	R26 712.00	R28 314.72	R80 226.72
				R882 493.92



PROJECT LEADER, TEAM AND CONTACT DETAILS

Prof Faizal Bux

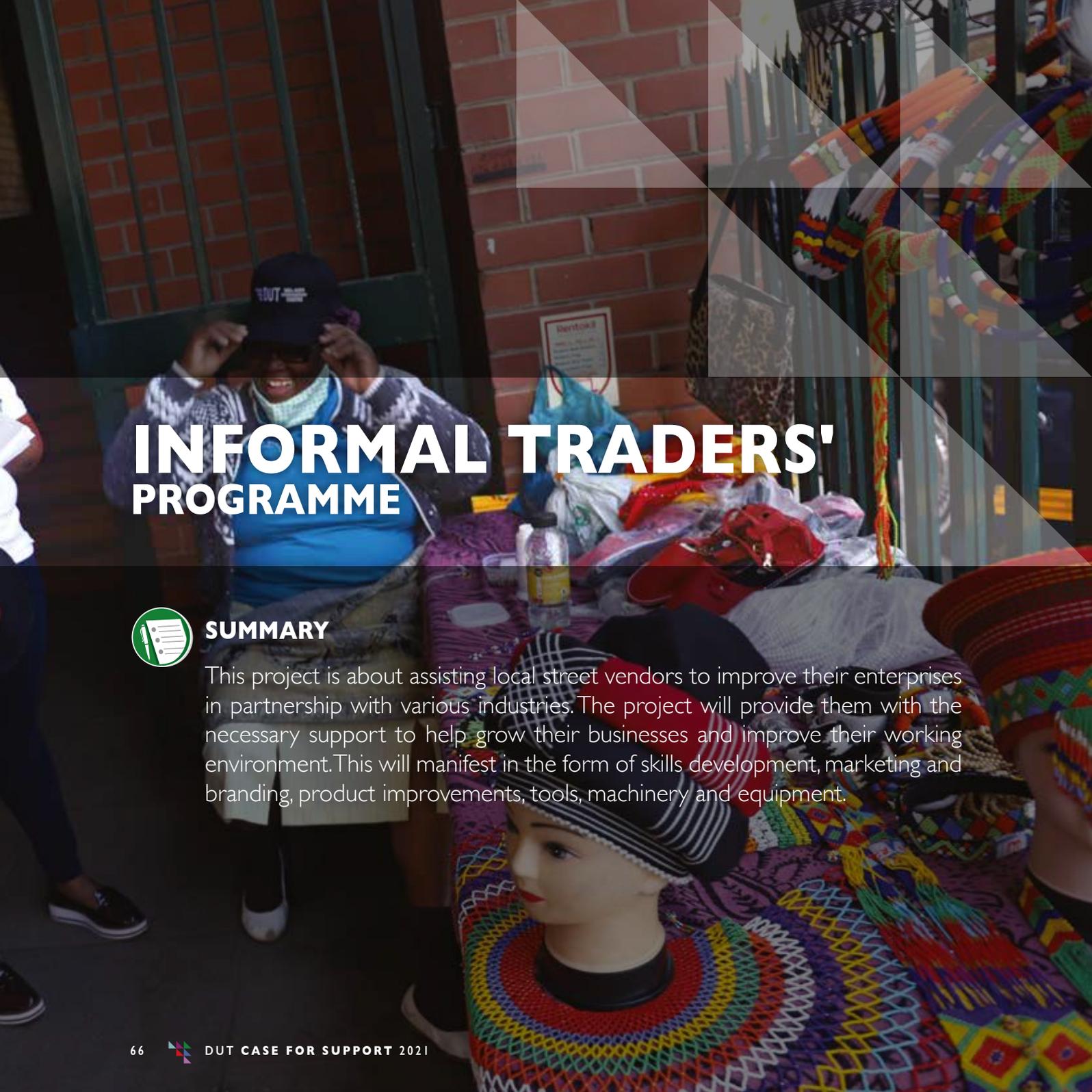
Dr Faiz Ansari, Dr Sachitra Ratha, Dr Trisha Mogany and Ismail Rawat

Tel: 031 373 2346 | Email: iwwt@dut.ac.za



TIMELINE

2020-2022

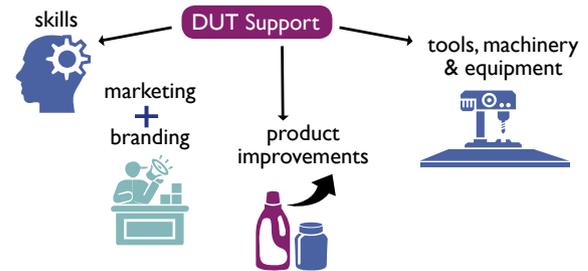


INFORMAL TRADERS' PROGRAMME



SUMMARY

This project is about assisting local street vendors to improve their enterprises in partnership with various industries. The project will provide them with the necessary support to help grow their businesses and improve their working environment. This will manifest in the form of skills development, marketing and branding, product improvements, tools, machinery and equipment.



Eighteen percent of South Africa's labour force is employed in the informal sector. In the first quarter of 2008, women comprised 45% of the relaxed sector employment composition, which decreased to 37% in 2016. Informal enterprises contribute 5.2% (Stats SA, 2015) to South Africa's GDP, of which trade accounts for 13% of the municipal GDP. The profits from informal activities sustain many dependents in households located in lower-income sectors of our cities and towns.

Midlands (Msunduzi) informal activities are as follows:

Manufacturing:	2 241 (8%)
Construction:	3 530 (13%)
Trade:	13 555 (50%)
Transport:	2 402 (9%)
Finance:	1 724 (6%)
Community Services:	3 677 (14%)



AIMS AND OBJECTIVES

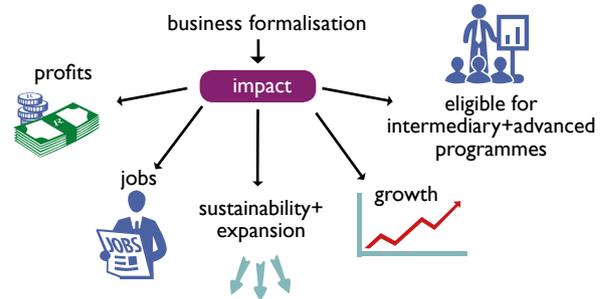
Introduce a mindset shift for South African informal, small and micro-enterprises/co-operatives to grow and run vibrant businesses through the following interventions:

- Improve the entrepreneurial skills of informal traders
- Provide start-up and technical skills training
- Provide mentorship and coaching
- Assist with business compliance
- Present various business workshops
- Provide business support and advice
- Develop a sustainable informal traders' ecosystem through partnerships with other stakeholders



IMPACT

The Midlands Entrepreneurship Centre, under its community engagement office, established the informal traders' programme to address the challenges of a lack of access to training, finance, banking institutions, land and property, and excessive government regulations. The second set of challenges, which is more infrastructural, includes a lack of working premises, water, storage facilities and toilet accessibility. The project is about assisting local informal traders to improve their businesses and livelihoods in partnership with various industries. Some of the support the project provides to this particular group is basic skills development covering technical, basic managerial skills, and computer literacy. The project has partnered with the Msunduzi Municipality for a much more significant impact, especially in addressing the issue of trading permits and intervention, easing some of the sector's daily difficulties.



Although the project was put on hold due to the COVID-19 pandemic, some of the projected impacts should include the following:

- Increase in profits
- Job creation
- Business sustainability and expansion
- Growth in asset base
- Eligibility for intermediary and advanced programmes
- Business formalisation



WHY SHOULD DONORS ASSIST?

Street vendors come across many challenges in the environment in which they work and thus being able to assist them will go a long way towards growing their businesses and boosting the informal economy in the Midlands.



PROJECT LEADER, TEAM AND CONTACT DETAILS

Nontokozo Ngcobo: Centre Manager
Email: NontokozoN@dut.ac.za
Tel: 033 845 9065



TIMELINE

January 2020 – December 2021



BUDGET

R150 000

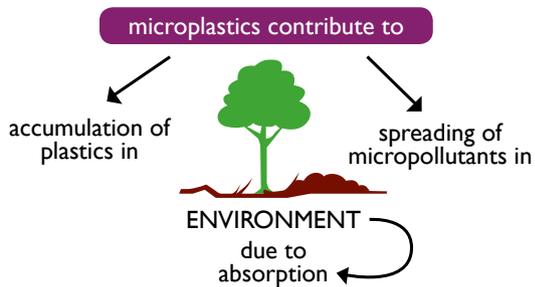
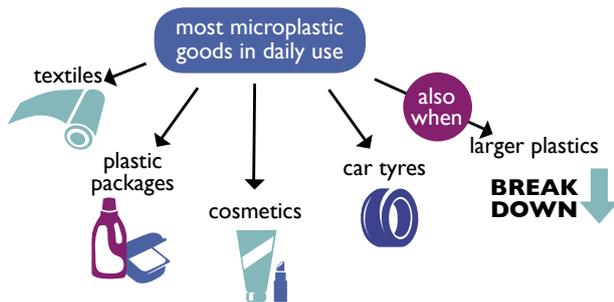
“ The project has partnered with the Msunduzi Municipality for a much more significant impact, especially in addressing the issue of trading permits and intervention. ”
– Nontokozo Ngcobo

INVESTIGATIONS ON MICROPLASTICS AND PLASTIC- ASSOCIATED BIOFILMS IN WASTEWATER TREATMENT



SUMMARY

Microplastics are plastic particles that are less than 5mm in size and cause great concern as they pose threats to aquatic species and human beings due to their potential entry into the food chain. Most microplastics are derived from goods that are in daily use such as textiles, plastic packages, cosmetics and car tyres, but they can also be formed when larger plastics break down. They not only contribute to the accumulation of plastics in the environment, but due to absorption, they can also contribute to the spreading of micropollutants in the environment. Studies have indicated the presence of micro and nano plastics in wastewater treatment effluents, which can lead to further contamination of the receiving aquatic environment.



It has been known for years that wastewater treatment plants (WWTPs) serve as reservoirs for diverse microbial communities and potentially antibiotic-resistant bacteria (ARB). The microplastics in wastewater, therefore, could serve as potential carriers of microbial pathogens and antibiotic-resistant genes (ARGs) through biofilm formation based on the type and available surface area of the plastics. The association between microplastics and microbiota in WWTP, however, is understudied globally, and in South Africa in particular.



AIMS AND OBJECTIVES

This project proposes to address the challenges caused by outbreaks related to the occurrence and microbial association of these microplastics in selected full-scale WWTPs of South Africa.

Objectives:

1. To develop a method to detect, quantify and characterise microplastics from wastewater treatment plants
2. To assess the fate and comparative removal of microplastics in full-scale wastewater treatment plants
3. To determine the conditions supporting biofilm formation on microplastics in wastewater
4. To characterise plastic-associated microbial communities recovered from different stages of wastewater treatment plants
5. To identify potential antibiotic-resistant bacteria and genes in microplastic-associated microbial communities



IMPACT

The first significant impact of the project is a methodology for the detection and isolation of microplastics from organic-rich environments such as wastewater and sludge. Additionally, the project is expected to provide information on the occurrence and characteristics of microplastics in wastewater and help to determine the efficiency of wastewater treatment systems in KwaZulu-Natal in the removal of microplastics. Finally, it will provide information on the potential of microplastics as carriers of pathogens and antibiotic-resistant genes in the aquatic environment.



SUCCESS STORIES

The project has so far succeeded in developing a methodology for the detection, isolation and quantification of microplastics from organic-rich samples such as wastewater and sludge. It has also been successful in demonstrating the ideal conditions for biofilm formation on microplastics within wastewater through laboratory experimentation.



WHY SHOULD DONORS ASSIST?

The passion behind this project stems from the fact that the impact of microplastics as carriers of pathogens and ARBs may far exceed their direct impact on our ecosystem and most especially, human health. However, this has not received enough attention, therefore, the project provides much-needed information for instituting appropriate guidelines concerning plastic use and disposal.



“ The impact of microplastics as carriers of pathogens and ARBs may far exceed their direct impact on our ecosystem and most especially, human health. ”
 – Dr Sheena Kumari



LESSONS LEARNT

A critical lesson learnt from this project is stakeholder engagement or dialogue. For instance, some of the high-end equipment (FTIR, SEM, pyro-GC/MS) required for the project is not available in our laboratory, however, stakeholder discussions have made it possible to access these at other laboratories, albeit for a fee.



BUDGET

	2020	2021	2022	TOTAL
Running	R 120 000.00	R 127 200.00	R 134 832.00	R 382 032.00
Consumables	R 275 000.00	R 291 500.00	R 308 990.00	R 875 490.00
Local travel	R 25 200.00	R 26 712.00	R 28 314.72	R 80 226.72
Contingencies	R 42 020.00	R 44 541.20	R 47 213.67	R 133 774.87
				R 1 337 748.72



PROJECT LEADERS, TEAM AND CONTACT DETAILS

Dr Sheena Kumari and Prof Faizal Bux

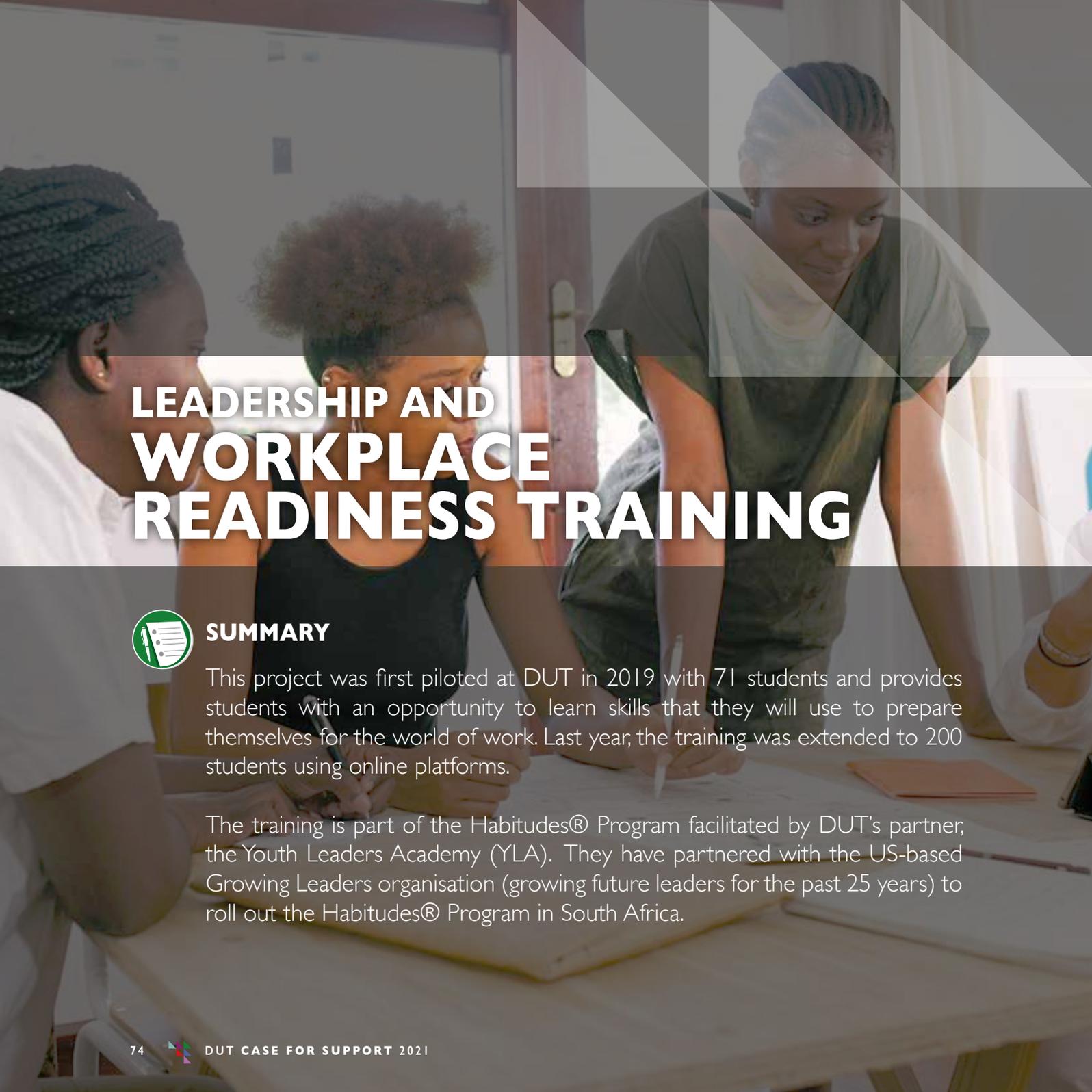
Dr Isaac Dennis Amoah, Dr Khalid Muzamil Gani, Dr Leanne Pillay, Ms Fitsum Mammo Kassa

Tel: 031 373 2782 | Email: sheenak1@dut.ac.za



TIMELINE

2020-2022



LEADERSHIP AND WORKPLACE READINESS TRAINING



SUMMARY

This project was first piloted at DUT in 2019 with 71 students and provides students with an opportunity to learn skills that they will use to prepare themselves for the world of work. Last year, the training was extended to 200 students using online platforms.

The training is part of the Habitudes® Program facilitated by DUT's partner, the Youth Leaders Academy (YLA). They have partnered with the US-based Growing Leaders organisation (growing future leaders for the past 25 years) to roll out the Habitudes® Program in South Africa.

Habitudes® uses the power of images, conversations and experiences to illustrate habits and attitudes that all employers desire in team members. Habitudes® is utilised in 72 countries; over 500 000 young leaders have been trained with it; and 8 000 schools, colleges and organisations are using it. The book used for the programmes is *The Art of Launching Your Career* and the lessons have been customised to meet local needs.

2019 = 71
2020 = 200 STUDENTS
(online platforms)



2021 R300⁰⁰⁰
= train 300
2022 R400⁰⁰⁰
= train 400
R700⁰⁰⁰
for 2 years




AIMS AND OBJECTIVES

The main aim is to equip students with the necessary skills to prepare them for the world of work.

Objectives are:

- To facilitate career readiness for students to meet the demands of the 21st century workplace
- To fill the gap between the workplace and the university campus
- To equip students to launch into a career, rather than linger after graduation
- To move students from backpack to briefcase



IMPACT

Leadership training increases student confidence in facing daily challenges and improves their skills, imparting positive mentorship.

The training reduces the gap that often exists between employers' expectations of the skills and knowledge of employees entering the workplace, and the actual levels of awareness of business and commercial processes that new students have during their studies.

Students are better prepared to be productive at work and have an improved sense of what is expected in a workplace. Appropriate dress, improved communication, understanding of policies, procedures and the values and ethics of a company/organisation are imparted to them.



SUCCESS STORIES

Training of 200 DUT students was conducted between June and July in 2020. The feedback from students was very positive:

“The training is very engaging. The fact that everyone can participate and contribute toward the discussions is innovative and informative. I’m glad to have had the opportunity to learn skills that would normally be acquired over a significant length of time.”

“The training provided me with skills to help overcome every challenge and problem that comes my way, no matter what they look like. I have developed resilience and tenacity.”



WHY SHOULD DONORS ASSIST?

Students intuitively understand that they need guidance, direction and help because they are wired to want to be meaningfully engaged when they enter the workforce. The response from participating students has been overwhelming and they have shared that all students should get an opportunity to attend this training. Employers who have placed some of these students have seen a vast improvement compared to those who had not participated; this difference is in the manner in which they conduct themselves and their ability to adjust to the workplace.



LESSONS LEARNT

Students are hungry for this kind of training, are looking for mentors and are willing to participate even after hours. The training was conducted online and even though it is not the best option, students are still finding it very interactive and can conduct the class exercises with other students.



PROJECT LEADERS, TEAM AND CONTACT DETAILS

Prof Sibusiso Moyo, DVC: RIE, DUT and Dr Mahmoud Youssef Baker, Chairman, IQRAA TRUST

Project Manager – Ms Phumzile Xulu, Community Engagement Practitioner, DVC: RIE Office, DUT

Project Facilitator – Advocate Mohamed Vahed, CEO, Youth Leaders Academy

Project Advisor – Dr Themba Msukwini, External Engagement Co-ordinator, Cooperative Education, DUT

Ms Phumzile Xulu – **Email: phumzilex@dut.ac.za | Cell: 082 422 9487**



TIMELINE

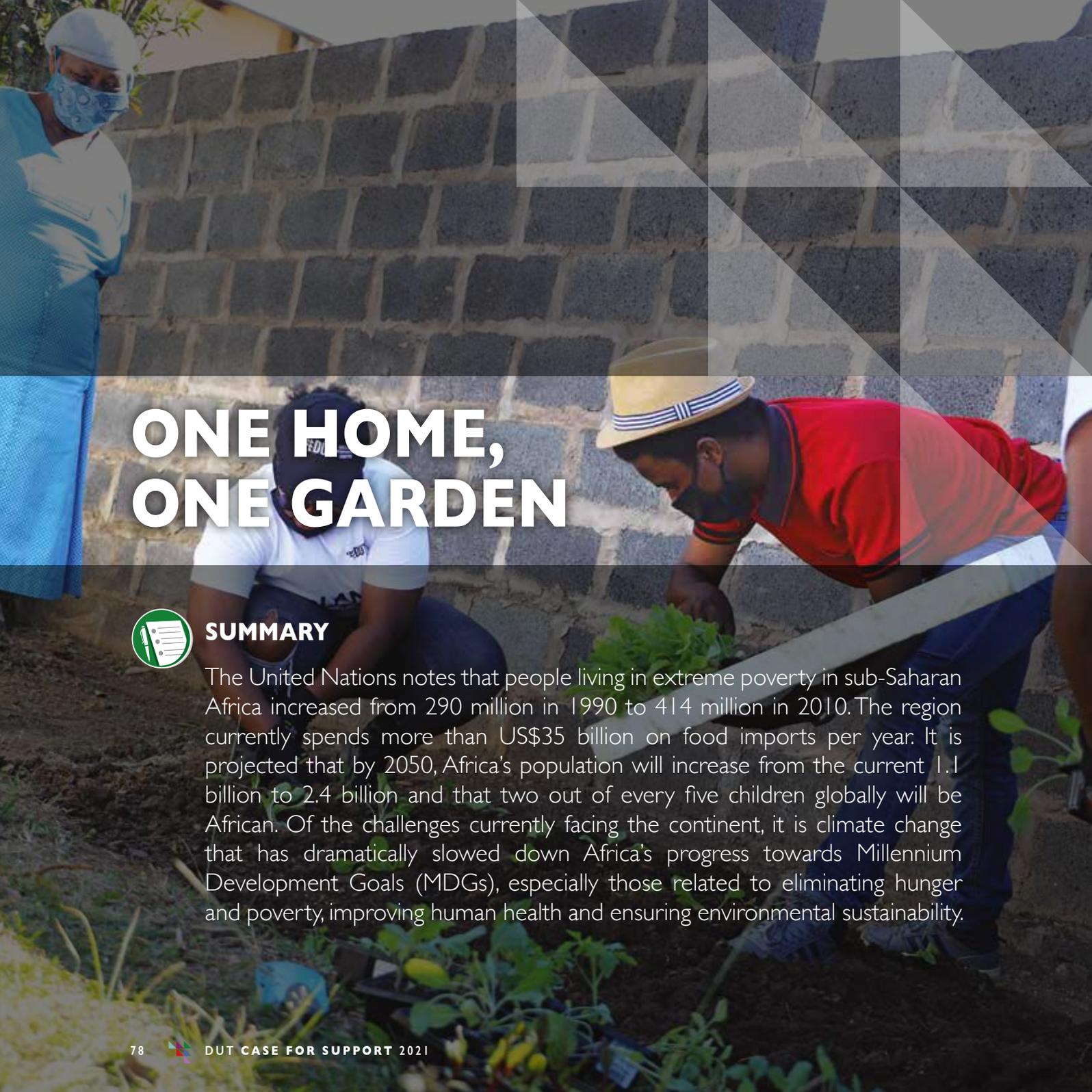
Inception date: July 2019. Duration: 2019-2022



BUDGET

2021: R300 000 will train 300 students; 2022: R400 000 will train 400 students

Total: R700 000 for two years.



ONE HOME, ONE GARDEN



SUMMARY

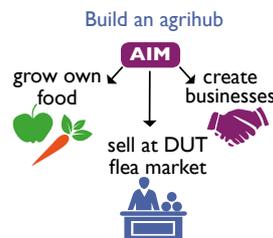
The United Nations notes that people living in extreme poverty in sub-Saharan Africa increased from 290 million in 1990 to 414 million in 2010. The region currently spends more than US\$35 billion on food imports per year. It is projected that by 2050, Africa's population will increase from the current 1.1 billion to 2.4 billion and that two out of every five children globally will be African. Of the challenges currently facing the continent, it is climate change that has dramatically slowed down Africa's progress towards Millennium Development Goals (MDGs), especially those related to eliminating hunger and poverty, improving human health and ensuring environmental sustainability.

As a response to these statistics and the triple challenge of inequality, poverty and unemployment as well as the national government strategic plan (the National Development Plan), and ENVISION 2030, the DUT Midlands Entrepreneurship Centre & Student Desk has set up an Agri-hub, which will seek to build agri-preneurs, both within and outside the University, in line with ENVISION 2030. As such, neighbouring communities have been approached and community gardens have been developed. The initial approach was to help these poverty-stricken community members by providing seedlings of cabbage, beetroot, spinach, onion and tomatoes. An agricultural specialist will then assist them with the necessary knowledge on how to plant and maintain their garden, provide them with fertilisers and educate them on how to get rid of pests. Most importantly, the project will teach them how to turn their gardens into a sustainable source of income, leading to commercialised business concerns.



AIMS AND OBJECTIVES

This project will be implemented in phases; this was the first phase. Phase two will comprise community members, orphanages and old age homes beginning their gardens and maintaining them. The Agri-hub will assist more community members, who will also be taught about hydroponics and how technology has improved the way we grow vegetables, herbs, and flowers, and they will be assisted to turn these gardens into a source of income within their communities. The project will



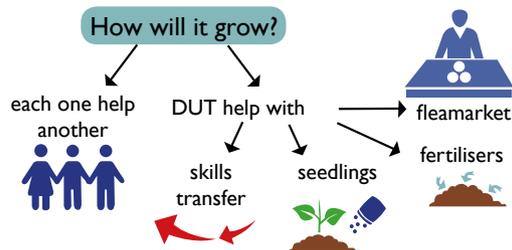
also provide a platform for them to sell their vegetables on a weekly or monthly basis – a fleamarket that will take place on campus. Training will also be provided on which vegetables grow best during which season.

With the increase in unemployment in our country, it has become increasingly important for people to create their own employment. Workshops will be held to teach community members about how best to market and sell their vegetables, and a platform will be made available to sell these vegetables to community members.



IMPACT

A sustainable food and income source for households in DUT's community is no small thing. The project will teach community members about the importance of growing their organic vegetables and encouraging healthier eating habits. The Agri-hub will facilitate the sale of seedlings to community members to sustain their gardens, teach them about the available methods of growing vegetables, and encourage an entrepreneurial mindset. These community gardens will be turned into lucrative businesses, the project will provide them with the required support structure to help them start and sustain their vegetable businesses, and a platform will be provided for them to sell their products – the fleamarket on campus.



SUCCESS STORIES

The project has been able to attract potential funders who will help to start a new project where community members will be assisted in creating sustainable businesses and provide a market for them to sell their vegetables.



WHY SHOULD DONORS ASSIST?

South Africa is a resource-rich country – we have the perfect climate and soil to grow different types of vegetables, and we have a very high unemployment rate. This project will provide community members with the necessary support to create employment. It will encourage people not just to wait to get employed but to create their own employment, and when their businesses grow, they will be able to engage other community members and employ staff. The project will provide them with the necessary support to start and run a sustainable business.



LESSONS LEARNT

The project leaders need to improve on necessary continued support and facilitate professional expertise from agricultural specialists. Through this, they will be able to improve how these vegetables can be grown and also learn new and innovative ways to start and run these gardens using technology.



PROJECT LEADERS, TEAM AND CONTACT DETAILS

Nontokozo Ngcobo: Centre Manager

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TIMELINE

June 2020 till December 2021



BUDGET

R250 000

“ People living in extreme poverty in sub-Saharan Africa increased from 290 million in 1990 to 414 million in 2010. ”
– United Nations



PHAKIMPILO PROGRAMME (SERVE LIFE)



SUMMARY

Food insecurity is a complex phenomenon affecting a large number of South African households. DUT, as a microcosm of South Africa's larger society, is also impacted by this problem. To help alleviate some of the food insecurity issues of DUT students, the Institution is engaging with civil society partners to assist students who have not received funding or are awaiting funding.



AIMS AND OBJECTIVES

To provide interim support for DUT students in the form of food parcels or vouchers.



IMPACT

If a student does not have food, physical and psychological effects are evident, which, in turn, impact on the academic performance of the student. In counselling, it is difficult to assist with a student's emotional well-being if their physical basic needs of hunger are not met. Not all students are funded by NSFAS, especially in their first year of studies. Students come from rural and poverty-stricken backgrounds in the hope of becoming the first in their family to obtain a university qualification. Many who have received help from this project have gone on to graduate.



PROJECT LEADERS, TEAM AND CONTACT DETAILS

Candice Leith – DUT Student Counselling and Health

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Thokozani Sithole – Midlands

Tel: 033 845 8900/2282 | Email: phakimpiloPMB@dut.ac.za



TIMELINE

Current and ongoing



BUDGET

Funding is needed to sustain the project throughout the academic year – 300 students at a cost of R600 000 p/a (25 students per month @ R50 000 x 12 months).



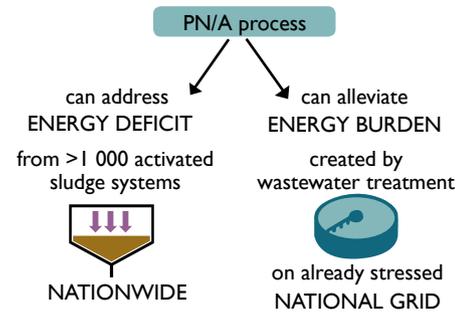
UPSCALING PARTIAL NITRITATION-ANAMMOX (PN/A) PROCESS FOR THE TREATMENT OF ANAEROBIC SLUDGE DIGESTER EFFLUENT – A PILOT-SCALE STUDY



SUMMARY

Nitrogen compounds, particularly in the form of ammonia, constitute a significant fraction of the polluting organics in domestic and industrial wastewater streams, which may cause serious environmental problems, including eutrophication. The major challenge affecting the performance of the wastewater treatment process worldwide is the efficient and cost-effective removal of nitrogenous compounds, especially ammonia. The anammox process represents a cost-effective and environmentally-friendly technology for ammonia removal from wastewater. Technology has currently been employed for biological nitrogen removal from different wastewater streams at the full-scale level, globally. In South Africa, though the initiative was taken by different research groups to develop anammox reactors, it has never been successful due to the lack of anammox culture enrichment and appropriate technology transfer.

Previously, DUT's Institute of Water and Wastewater Technology (IWWT) had demonstrated the lab-scale application of the anammox process – an emerging energy-efficient treatment technology – for treating synthetic wastewater. This current project is, therefore, set to upscale this technology for the treatment of ammonia-rich, real wastewater (digestate) in a bid to achieve sustainable wastewater management and sanitation.



AIMS AND OBJECTIVES

The project aims to upscale the single-stage moving bed biofilm reactor (MBBR) PN/A system to a pilot-scale system and to study the feasibility of the system to treat the anaerobic sludge digester effluent under real-time operational conditions.

Objectives:

1. To design and start up a 200L biofilm-based partial nitrification-anammox reactor using anaerobic sludge digester effluent
2. To evaluate the effect of operational conditions on the performance and stability of the reactor
3. To assess the microbial community structure within the reactor using the metagenomic approach
4. To undertake a feasibility study for full-scale applications



IMPACT

Development of a sustainable and efficient nitrogen removal process for the wastewater sector process has been identified as a low-cost alternative process of nitrogen removal from wastewater. Therefore, this technology has the potential to address the energy deficit being created by the over 1 000 activated sludge systems currently in use nationwide and alleviate the energy burden created by wastewater treatment on the already stressed national grid. The development of a functional pilot-scale, side stream PN/A process locally has the potential for a scale-up of the developed technology, targeting high-strength industrial wastewater streams. The project encompasses human resource capacity development in novel and specialised technology. The project will also facilitate scientific collaboration between the local municipality (eThekweni) and DUT in developing anammox technology for the South African water sector.



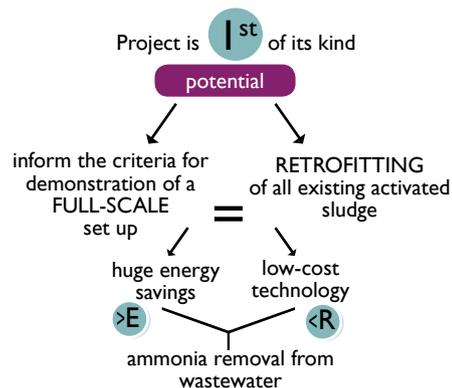
WHAT IS UNIQUE?

With the current energy crisis and sustainability in mind, a treatment scheme that efficiently removes pollutants with minimal energy input while maximising resource recovery from the wastewater is most desirable. Anammox has been accepted as a sustainable alternate technology to aerobic nitrogen removal from wastewater with high nitrogen removal activity (>80%) coupled with shock resistance for high-strength ammonium wastewater.



WHY SHOULD DONORS ASSIST?

This project is a first-of-its-kind pilot-scale PN/A process for ammonia removal in South Africa, which has the potential to inform the criteria for a full-scale demonstration set up and retrofitting of all existing activated sludge. This will result in substantial energy savings for the water sector and in the development of a sustainable low-cost technology for ammonia removal from wastewater.





SUCCESS STORIES

The project has successfully demonstrated anammox bacterial consortium enrichment and efficient nitrogen removal via the anammox process with five different lab-scale anammox reactors at IWWT.

As part of the anammox success story, the Institute recently secured living labs – Orange Knowledge Programme (a Dutch government initiative). The programme aims to entrench an action-learning and co-creating approach in the form of living labs for students, innovators at the University and municipalities, as well as practical staff training.

The project can be replicated not only by universities, but across the wastewater treatment sector in South Africa. At the end of the project, a workshop facilitated by the Water Research Commission (WRC) will inform wastewater sector practitioners in universities, municipalities and the private sector.





LESSONS LEARNT

During the first phase, the study was performed across different reactor configurations to select the optimum design for the scale-up. The process performance was most stable in the moving bed bioreactor (MBBR); its operation was simple, and the start-up of the anammox process was faster in MBBR compared to suspended growth systems such as sequential batch reactor (SBR), upflow sludge blanket reactor (UASB) and gas lift reactor (GLR).





“ A treatment scheme that efficiently removes pollutants with minimal energy input while maximising resource recovery from the wastewater is most desirable. ”
 – Dr Sheena Kumari



BUDGET

	2020	2021	2022	TOTAL
Running	R75 000.00	R79 500.00	R84 270.00	R238 770.00
Consumables	R100 000.00	R106 000.00	R112 360.00	R318 360.00
Reactors	R300 000.00			R300 000.00
Local travel	R12 000.00	R12 720.00	R13 483.20	R38 203.20
Contingencies	R48 902.00	R51 836.12	R54 946.29	R155 684.41
				R1 051 017.61



PROJECT LEADER, TEAM AND CONTACT DETAILS

Dr Sheena Kumari and Prof Faizal Bux

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TIMELINE

2020-2022



WASTEWATER-BASED EPIDEMIOLOGY FOR COVID-19 DETECTION IN WASTEWATER



SUMMARY

The current COVID-19 pandemic has so far claimed more lives than the other three earlier coronavirus outbreaks, which necessitates the need for an early warning system for a faster response to similar outbreaks. With the economic and practical limits of medical screening for SARS-CoV-2/COVID-19 coming sharply into focus worldwide, scientists are now turning to wastewater-based epidemiology (WBE) as a potential tool for assessing and managing the pandemic. Wastewater-based epidemiology is a promising approach to understanding the prevalence of viruses in a given wastewater treatment plant (WWTP) catchment population.

This approach can have an important effect on health systems and facilitate informed decisions on movement restriction for the local population, especially in resource-constrained countries like South Africa. Thus far, several studies reported from the Netherlands, USA, Australia and France have demonstrated that SARS-CoV-2 can be detected and quantified in wastewater, allowing the total number of community infections to be estimated as well as monitoring whether the virus has returned to a community after elimination. However, further research is required to improve the quantification of the virus, to better detect it at low levels and to ensure that wastewater samples are representative of the community under surveillance.

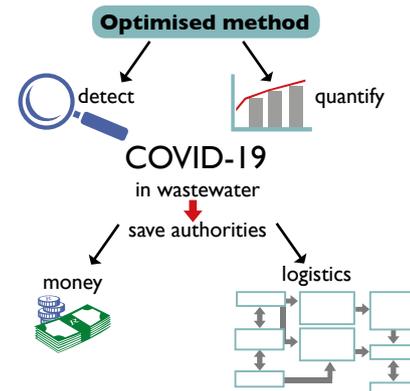


AIMS AND OBJECTIVES

The project focuses on the development and optimisation of new, advanced molecular methods for the detection and quantification of SARS-CoV-2 RNA in wastewater.

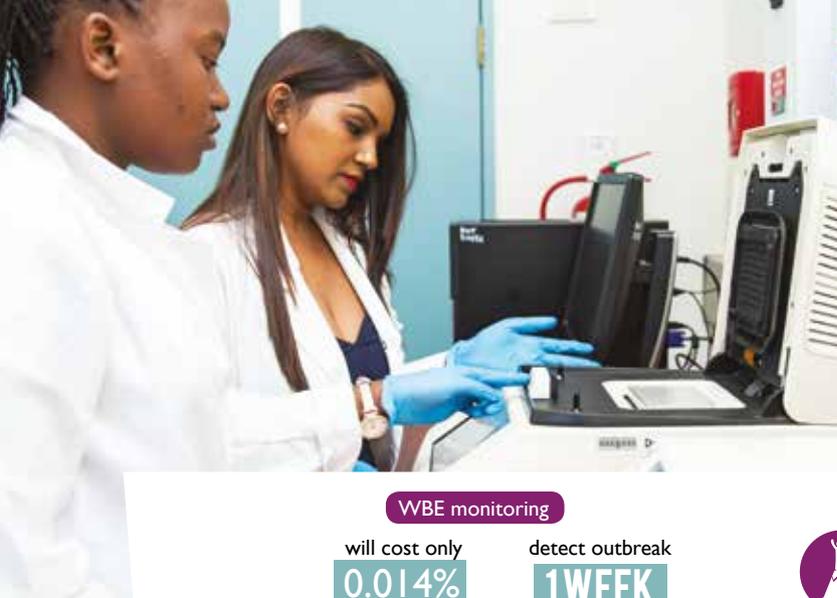
Objectives:

1. To develop a sensitive and accurate method for the detection and quantification of coronavirus in wastewater
2. To observe the dynamics of infection levels through the monitoring of viral loads in wastewater

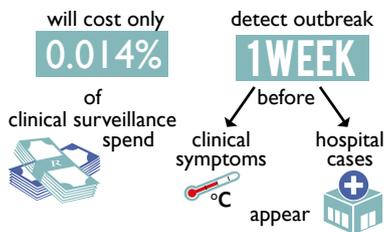


IMPACT

The project will provide an optimised method for the detection and quantification of SARS-CoV-2 virus in wastewater. This will provide an effective system for the early detection of infections in populations and provide data to track the infection dynamics. This approach will save authorities money and logistics required for person-to-person testing.



WBE monitoring



WHAT IS UNIQUE?

Surveillance of COVID-19 infections currently depends on clinical testing, which is very expensive and time-consuming. WBE has been used in monitoring the consumption of illicit drugs, pharmaceuticals and poliovirus infections, therefore, this project has the potential to save health authorities money and time in monitoring COVID-19 infections. For instance, it is estimated that WBE monitoring will cost only about 0.014% of what is spent on clinical surveillance systems (Hart and Halden, 2020). Additionally, this approach can detect outbreaks in a population almost a week before clinical symptoms or hospital cases appear. Therefore, WBE may give us a better early warning system, which is critical in such circumstances.



SUCCESS STORIES

The project so far has been successful in optimising methodologies for the detection and quantification of SARS-CoV-2 viral RNA in wastewater. This shows the proof of concept for WBE due to an observed change in viral load, which may indicate a trend or change in infection numbers within the population.



WHY SHOULD DONORS ASSIST?

The socio-economic impact of this pandemic may still be felt years after the development of a vaccine and possible containment of infections. COVID-19 has shown the loopholes in our health systems and has highlighted the inadequacies in our disease-monitoring approaches, which are dependent upon clinical testing or numbers of cases reported in health centres. The WBE approach gives a much more efficient way of monitoring such outbreaks and will ensure that we are ready for a 'second wave' of COVID-19 infections and other pandemics in the future.



LESSONS LEARNT

This project can be replicated in any university in South Africa with access to a dedicated molecular laboratory featuring basic polymerase chain reaction (PCR) equipment. The main approach involves having a good sampling regime, RNA extraction protocols and an understanding of basic reverse transcription polymerase chain reaction (RT-PCR) principles. The additional skill required is an understanding of wastewater characteristics and interpretation of data, which will be critical in decision-making based on the PCR results.



BUDGET

	2020	2021	2022	TOTAL
Running	R150 000.00	R159 000.00	R309 000.00	R238 770.00
Consumables	R600 000.00	R636 000.00	R1 236 000.00	R318 360.00
Ad hoc labour	R100 000.00	R106 000.00	R206 000.00	R300 000.00
Local travel	R50 000.00	R53 000.00	R103 000.00	R38 203.20
Contingencies	R90 000.00	R95 400.00	R185 400.00	R155 684.41
				R1 854 000.00



PROJECT LEADERS, TEAM AND CONTACT DETAILS

Prof Faizal Bux and Dr Sheena Kumari

Kriveshin Pillay, Dr Isaac Dennis Amoah, Dr Leanne Pillay, Dr Oluoyemi Olatunji Awolusi, Dr Khalid Muzamil Gani, Dr Taher Abunama and Nashia Deepnarian

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TIMELINE

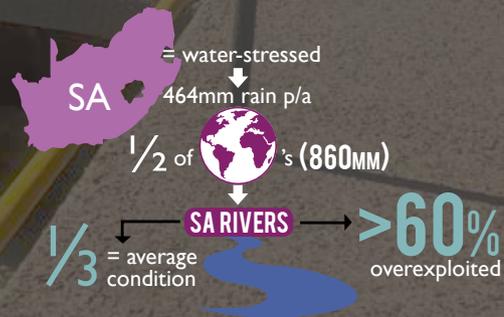
2020-2021

WASTEWATER REUSE AND PUBLIC ACCEPTANCE IN DURBAN



SUMMARY

International standards have classified South Africa as a water-stressed country with an average annual rainfall of 464mm, which is about half of the world's average rainfall (860mm). Only one third of South Africa's major rivers are in average condition, with more than 60% of rivers being overexploited.



The recent drought pattern highlights increasing demands, which require new and innovative solutions to the water supply problem. The Department of Water and Sanitation (DWS) has thus identified the reclamation of wastewater as an essential strategy. Umgeni Water and the Water and Sanitation Department of the eThekweni Municipality (EWS) has initiated a few wastewater reuse projects at the demonstration level scale.

Wastewater reuse without doubt can be a key strategy in the conservation of water resources and a significant solution to today's global water challenges. However, public acceptance is the foremost threat for the successful implementation of reuse projects. Therefore, this project will investigate the public perception of water reuse and will further evaluate challenges and strategies for the application of water reuse in the public domain.



AIMS AND OBJECTIVES

To identify the social aspects of wastewater reuse in Durban and develop strategic recommendations for public acceptance of wastewater reuse.

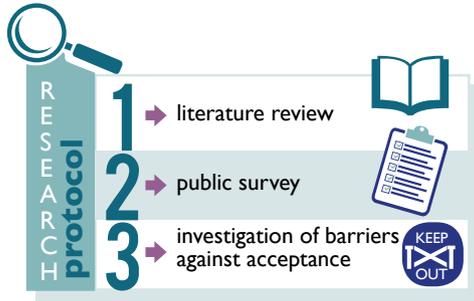
Objectives:

1. To evaluate significant factors affecting public perception and acceptability of recycled wastewater in Durban
2. To assess the religious perspectives regarding wastewater reuse in household applications
3. To assess the role of knowledge on public acceptance of recycled water
4. To model the behaviour of the public towards the reuse of wastewater



IMPACT

The project will investigate the underlining factors that can be a potential barrier in the successful implementation of wastewater reuse. A framework of strategic recommendations will be developed from the findings that can help local water service providers to effectively communicate with the public regarding wastewater reuse. The study outcomes and strategy can be implemented at the local level, as well as extended lessons can be supportive at national level to establish wastewater reuse schemes in the country. Holistically, the study will aid in the planning and implementation of the wastewater reuse as an alternative water resource in South Africa.



WHAT IS UNIQUE?

The project will employ a three-phased research protocol consisting of 1) literature review, including interpretive white papers from different social science disciplines, public health and environmental engineering scientists; 2) a public survey for evaluating the perception of the local public; and 3) an investigation of various barriers that stop the public from accepting recycled wastewater for direct applications. What is noteworthy about this project is that it will increase knowledge about the social aspects of wastewater recycling in South Africa.



SUCCESS STORIES

A demonstration project titled REMIX has recently been implemented by the eThekweni Municipality in Durban. The project team is working with the Municipality team and local representatives to increase awareness about wastewater reuse.



WHY SHOULD DONORS ASSIST?

Wastewater reuse can be an alternative strategy for augmentation of current water supplies. An option of treating wastewater up to the quality of potable use is technically possible, however, public acceptance can cause the failure of this project. Recycling is the future trend in water research, which is multi-dimensional, ranging from technical feasibility to behavioural change among the public. With this project, public acceptance of recycled wastewater is sure to improve.



LESSONS LEARNT

The project will help to determine the factors in Durban that influence public perception towards wastewater reuse. Knowledge derived from the project can be used by local municipalities to design their communication strategies for wastewater reuse projects with the public in mind.



BUDGET

	2020	2021	2022	TOTAL
Running	R60 000.00	R63 600.00	R67 416.00	R191 016.00
Consumables	R120 000.00	R127 200.00	R134 832.00	R382 032.00
Local travel	R25 200.00	R26 712.00	R28 314.72	R80 226.72
Contingencies	R20 520.00	R21 751.20	R23 056.27	R65 327.47
				R653 274.72



PROJECT LEADER, TEAM AND CONTACT DETAILS

Prof Faizal Bux

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TIMELINE

2020-2021

“ This project will increase knowledge about the social aspects of wastewater recycling in South Africa. ”
– Prof Faizal Bux

WITHDRAWAL MANAGEMENT INTERVENTION FOR HOMELESS PEOPLE WITH OPIOID USE DISORDERS DURING COVID-19



SUMMARY

A week before the level 5 COVID-19 lockdown was instituted, a group of State and non-State organisations undertook to provide shelter, food, medical services and ablution facilities to Durban's homeless population. The primary aim was to ensure that homeless people who use drugs remained in the safe spaces created by the City to avoid vectors of transmission of COVID-19 in a bi-directional manner. The secondary aim was to provide evidence-based services to reduce the trauma associated with forced withdrawal from opioids. At the height of lockdown, there were 260 people on the programme in two lockdown facilities. DUT's Urban Futures Centre (UFC) led a private medical team who provided opioid substitutes to 250 homeless people in a state of moderate-to-severe withdrawal.

This project continues to run in lockdown level 1, and is likely to continue in the long term with the support of the eThekweni Municipality and the local business community. Presently, people who use drugs from homeless and low-income backgrounds can access evidence-based interventions at what is now called the Bellhaven Harm Reduction Centre.



AIMS AND OBJECTIVES

Provide homeless and low-income people addicted to heroin with evidence-based interventions to prevent mass withdrawal and overdose; link them to health and welfare services; prevent the burden on the public health system during the COVID-19 lockdown; ensure testing for COVID-19, TB, HIV and hepatitis; provide hope during this fear-provoking period; provide a model for running an urban-based out-patient facility. At present, the UFC is working with a range of NGOs, Urban Lime and Mass Design Architects to deliver a state-of-the-art harm-reduction facility in Durban. Together with the Bellhaven Harm Reduction Centre (capacity: 200 and up and running since lockdown level 2), they will provide a model for comprehensive harm-reduction intervention in low to middle-income countries. There are already spaces of peer learning; professional development; policy development; and data collation for publication.

Pre-lockdown



Opioid substitutes provided to



IMPACT

During level 5 lockdown, this programme prevented homeless people from leaving safe spaces in search of drugs, and allowing them (mostly young men) to go through 'withdrawal' without experiencing severe and traumatic withdrawal symptoms (both physical and psychological). It significantly eased the load on the public health system during lockdown. Every day, around 15 new homeless people with a heroin addiction joined the programme since the institutionalisation of Bellhaven Harm Reduction Centre and received daily observed medical assistance. Recipients showed remarkable changes in quality of life; many are reunited with their families and are now taking care of their personal hygiene and general well-being. Those who had chronic illnesses are now

adhering to medication for the first time and the majority are abstaining from drug use or have radically reduced their use to be able to normalise their lives. Durban has been one of the few cities in the world that has ensured that homeless people received harm-reduction services during COVID-19. This project has been lauded by the eThekweni Municipality and by the National Department of Health and has also focused positive attention on DUT. In October 2020, the Deputy Minister of Social Development Ms Hendrietta Bogopane-Zulu formally launched Bellhaven Harm Reduction Centre, stating that it was evidence of best practice community health and social development in the country. A letter of support for these harm-reduction centres has also been received from previous Vice-President Kgalema Motlante and from the United Nations Organisation of Drugs and Crime (UNODC).



“ The project is a unique public/private partnership in the governance of health at a city level. ”
– Prof Monique Marks



WHAT IS UNIQUE?

This project provides the best example of a low-threshold programme for resolving opioid use disorders in South Africa. It is run from a government facility but it is a private initiative, which makes it a unique public-private partnership in the governance of health at a city level. This is a critical modelling initiative given Government's intention for a new national healthcare arrangement. It is an excellent example of plural governance in the health sector, and can be modelled in other areas of healthcare and urban governance. Since the move to level 3 lockdown and the shift to a new location for the harm-reduction centre, both a methadone and a

needle syringe programme are now on offer. It also provides testing, referrals and counselling for TB, HIV and hepatitis at Bellhaven Harm Reduction Centre.

The project brings together the skills, capacities and knowledge of a range of State and non-State actors. The University will act as the primary node in this governance arrangement, giving credibility and certainty to the project. The primary role of the University is also unique: most often it is either government or an NGO. In addition, having the University play this critical role means that the outcomes will include both service provision and path-breaking research.



SUCCESS STORIES

The greatest success came in gaining support from government for this project. This was solidified when the City declared in July 2020 that Bellhaven Memorial would be utilised as a harm-reduction centre for homeless and low-income people. The local government is now convinced that harm-reduction is a preferred approach in dealing with drug use disorders, which is a radical philosophic and political shift.

In interviews conducted with police, officers stated their unequivocal support for programmes that provide opioid substitutes and they are keen to have an overdose prevention space established in Durban – the only city in South Africa that has been able to secure this buy-in.

Another highlight was the very positive insert that *Carte Blanche* filmed during level 5 lockdown and screened in June 2020, which created great public awareness, interest and in-kind contributions to the project. DUT, through the UFC, was lauded.

In July 2020, the Deputy Mayor, together with four councillors, paid a visit to the centre and deliberated with the project team as to how to get greater buy-in from the City. Faith leaders demonstrated their support by sending drug users for assistance. The Cardinal personally donated clothes, blankets and other goods to project beneficiaries, and the Muslim community provided food.

Two peer-reviewed articles are in process, and focus on the role of law enforcement and on the transformative role that the methadone programme has played in the life of beneficiaries. Two academic staff members from the Photography Programme at DUT, Liza du Plessis and Angela Buckland, undertook a photographic intervention to document the methadone programme participants during lockdown at Moses Mabhida car park in collaboration with UFC and the Dennis Hurley Centre. The aim was for participants to see themselves in a new light during their recovery to bring about positive self-awareness. To conclude the photography, a focus group was held using the photo voice methodology facilitated by Prof M. Marks, including psychiatrist Dr Salduker. This photographic essay was exhibited at a national launch in October 2020 and a future exhibition is planned at the offices of Urban Lime and at drug policy conferences, both locally and internationally. The major measure of the project's success is the massive quality of life changes experienced by its beneficiaries.





WHY SHOULD DONORS ASSIST?

During lockdown level 5, funding for the programme was raised from the public, which covered the operational costs and the short-term opioid substitution until September 2020. Funding will be required for operational costs and capital expenses to retrofit the buildings that the programme will be run from. This will be raised from the private sector with the assistance of Urban Lime and the office of the eThekweni Deputy Mayor. This fully-fledged harm-reduction centre will be the first of its kind not only in South Africa, but on the continent. For this reason, and because of

the critical role this centre will play in the alleviation of the social and economic burden of COVID-19, it will receive substantive international recognition. Harm-reduction centres such as Bellhaven and the one currently being co-created with Urban Lime not only provide much-needed healthcare intervention, they also play a crucial role in reducing crime, and ultimately in urban regeneration. With urban regeneration comes greater investment in the City. This is hugely advantageous to local business and is also important for universities given the prospects of opening up the market economy for recently graduated students.



LESSONS LEARNT

The biggest learning is how critical this service is to the drug use community in Durban. Harm reduction has proven to work far better than abstinence-based programmes. A project such as this is best sustained through local ownership and investment. Bellhaven Harm Reduction Centre is a locality for service provision, but also for trans-disciplinary learning and scholarship.



PROJECT LEADER, TEAM AND CONTACT DETAILS

Prof Monique Marks

Co-project manager – Michael Wilson from Advanced Access and Delivery; a part-time medical practitioner; three full-time registered nurses; two social workers and a researcher
moniquem@dut.ac.za | Cell: 084 403 3934



TIMELINE

The longer-term goal is to establish a harm-reduction centre that will offer a range of other WHO-recommended services/interventions – the first of its kind not only in South Africa, but on the continent – indefinitely.



BUDGET

Please note that DUT will enter into an MOU with the City. The project has budgeted for a one-year period, which will provide long-term intervention.

Operating Budget Harm-Reduction Centre

REASON FOR INCLUSION	UNIT COST	NUMBER OF UNITS	TOTAL
Direct Operational Costs			
Programme documentation	R750.00	1	R9 000.00
Stickers, dispensing supplies, ECD paper	R2 000.00	1	R24 000.00
Detox and sleep aid	100mg, 200mg and 25mg	up to 200 on programme	R600 600.84
20 ml/person (varying levels across two sites)	R750.00	up to 200 on programme	R1 449 000.00
Treatment for side effect management, basic pain, etc.	R5 000.00	1	R60 000.00
Transportation for nursing team	R2 500.00	4	R120 000.00
Facility rental	R30 000.00	1	R360 000.00
			R2 622 600.84
Personnel			
Manage daily project operations for project across partners	R80 000.00	0,6	R576 000.00
Medication administration, build upon established relationships, and support public-funded HIV testing and treatment adherence programme	R25 000.00	3	R900 000.00
Provide ongoing psychosocial support to programme. Lead individual and group sessions across safe sites. Also referral to health and social programmes and critical to reporting	R20 000.00	2	R480 000.00
Compile weekly data, assist in reporting	R10 000.00	0,5	R60 000.00
Dispensing, consultation	R100 000.00	0,2	R240 000.00
			R2 256 000.00
TOTAL COSTS			R4 878 600.84



“ This fully-fledged harm-reduction centre will be the first of its kind not only in South Africa, but on the continent. For this reason, and because of the critical role this centre will play in the alleviation of the social and economic burden of COVID-19, it will receive substantive international recognition and attention. This is a big drawcard for funders.”

– Prof Monique Marks



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Donations in kind include new equipment, assets such as property or vehicles, shares in a listed company or stock from your own business. You can also claim a tax deduction for donations in kind you make to DUT as the Institution is a Section 18A approved organisation.

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Account holder: Durban University of Technology

Account number: 05 023 9007

Institute/Name of the bank: Standard Bank

Branch code: 04 0026 (Kingsmead)

SWIFT code: SBZAZA JJ

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Country: South Africa

Deposit reference number: Insert name of DUT initiative or unit you wish to support or reference 'unrestricted' for DUT discretion.

NB: Please email proof of donation to ziphoc@dut.ac.za or prettyz@dut.ac.za, or for enquiries, call 031 373 3018/19.

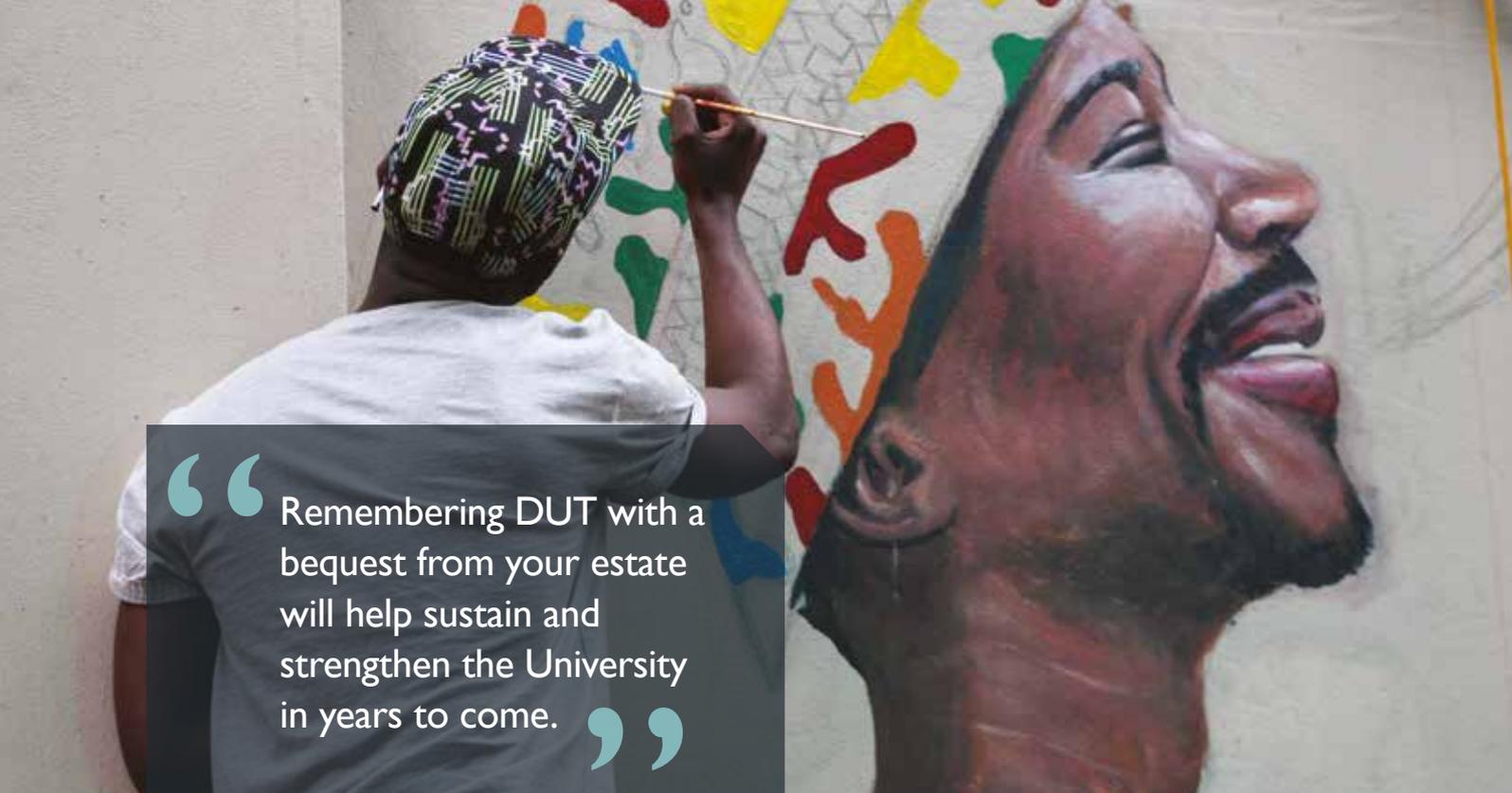
DEBIT ORDER

Download the pledge forms here:

<https://www.dutalumni.com/copy-of-bursary-fund-l>

BEQUESTS AND ESTATE PLAN GIFTS

A bequest is a gift from your estate, a transfer of cash, securities or other property made through your estate plans. You can make a bequest to DUT by leaving a portion of your estate to the University in your will or living trust, or by designating DUT as a beneficiary of your retirement account or life insurance policy.



“ Remembering DUT with a bequest from your estate will help sustain and strengthen the University in years to come. ”

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- Enjoy tax benefits – gifts and grants are tax deductible in South Africa
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- Invest in the social engagement of the University



“ Giving to DUT is an excellent way to invest in the social engagement of the University. ”



CONTACT US TO IMPROVE LIVES AND LIVELIHOODS

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