



RESEARCH COLLABORATION REPORT

2011 - 2013

CSIR/NMMU



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RESEARCH COLLABORATION 2011 - 2013: CSIR/NMMU



Foreword



Dr Sibusiso Sibisi
Chief Executive Officer
CSIR



Prof Derrick Swartz
Vice-Chancellor
Nelson Mandela Metropolitan University

The Council for Scientific and Industrial Research (CSIR) and Nelson Mandela Metropolitan University (NMMU) research relationship focuses on research and development (R&D) and human capacity development (HCD) primarily in science, engineering and technology (SET). The collaboration has entailed undertaking mutually beneficial R&D activities, as well as training researchers with funding from South African and international sources.

The relationship has been developed and managed in the context of the CSIR mandate, which emphasises partnerships and alliances, the CSIR strategic objectives, particularly strengthening the science and technology base of the organisation and developing human capacity, as well as the organisation's research impact areas, specifically health, energy, the natural environment and advanced manufacturing.

In order to achieve its strategic priority to create and sustain an environment that encourages and supports a vibrant research, scholarship and innovation culture, the NMMU has committed itself to establishing and expanding research partnerships, collaborations, networks and linkages in South Africa and internationally. These partnerships are critical to enable the NMMU to fulfil its vision to be a dynamic African university, recognised for its leadership in generating cutting-edge knowledge for a sustainable future.

Overview



Dr Rachel Chikwamba
Group Executive
Strategic Alliances and
Communication
CSIR



Prof Thokozile Mayekiso
Deputy Vice-Chancellor Research
Engagement
Nelson Mandela Metropolitan University

The relationship between the CSIR and NMMU was formalised through a Memorandum of Understanding (MoU) in 2011. The MoU identifies several collaboration areas, namely: synthetic biology, textile science, materials science, natural resource management, information communication technology, nanotechnology, renewable energy and laser research.

The collaboration has been enhanced by access to facilities and equipment, most notably available through the CSIR Nonwovens and composites research group, the South African Research Networks (SANReN), Applied Centre for Climate & Earth Systems Science (ACCESS) consortium, and the CSIR Laser Center Rental Pool Programme. Key NMMU facilities which have supported the collaboration included Atomic Force Microscopy, RAMAN and Fourier Transform Infrared Spectroscopy (FTIR).

Over the last three years, researchers at the CSIR and NMMU have produced a significant number of high-quality outputs from this collaboration. CSIR researchers have studied towards higher qualifications – primarily in ICT and textile science, at NMMU, some have supervised students and lecture at the university, while others have been appointed extraordinary professors. NMMU staff serve on CSIR research panels to further knowledge transfer between the two organisations.

Summary of joint outputs

Research

	2011	2012	2013
 Collaborative research projects implemented	17	10	9
 Joint outputs resulting from supervised and joint research	29	24	15

Human Capital Development

	2011	2012	2013
 CSIR researchers lecturing / supervising students	6	6	7
 Students supported by the CSIR / NMMU scholarship programme	0	1	1
 CSIR staff studying at NMMU	6	13	9
 Students who graduated	3	2	1
 CSIR staff who hold extraordinary professorships	7	6	7
 NMMU staff appointed to CSIR research advisory panels	2	2	2

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Economic growth will not be sustainable on the back of raw material-based exports only. It is imperative to continue developing a diversified, beneficiation and export-oriented manufacturing base.

Highlights and Achievements

Collaboration in textile science

Prof Lawrance Hunter, NMMU

The Department of Textile Science at NMMU has collaborated with the CSIR since 1967. At its inception, the department introduced a three-year diploma programme, a four-year BSc degree course, as well as Master's and Doctoral research degrees in textile science which have produced 77 graduates. The diploma and BSc programmes have been discontinued; the last students in these programmes graduated in 1974. Since then, the department has only offered postgraduate programmes.

Through the Nonwovens and composites research group in Port Elizabeth, the CSIR has for many years, supported the department with its staff and facilities. At present, the department has six staff members – two CSIR staff members who have been appointed Honorary Professor and Head of the Department, and Associate Professor respectively; three Research Associates; and one postdoctoral fellow. These staff members are supported by other senior researchers from CSIR Nonwovens and Composites research group.

One of the requirements for enrolment for postgraduate studies in the department is that students should have access to appropriate research facilities. Most of these are available at the CSIR Nonwovens and composites research group in Port Elizabeth which has been designated a Department of Science and Technology Biocomposites Centre of Competence. It has a state-of-the-art nonwoven and biocomposite laboratory and processing facility, as well as a textile library, and pilot plant.

The university benefits from this collaboration from the training subsidy that it receives for students and for qualifying publications from the

Department of Higher Education. The CSIR benefits from the postgraduate students working on its research projects, as well as from the training of some of its staff at NMMU.

The Department of Textile Science is multidisciplinary. It cooperates with the NMMU High Resolution Transmission Electron Microscopy Centre and the NMMU departments of Physics and Chemistry which have complementary facilities, such as RAMAN spectroscopy and FTIR.

The department has extensive collaboration with other South African universities, such as the University of Cape Town, Walter Sisulu University, Durban University of Technology and Stellenbosch University.

The Eastern Cape is the natural fibre hub of South Africa, since it produces virtually all South Africa's mohair and a large proportion of wool. Agro-industries, based on other natural fibres, such as hemp, flax, cashmere and agave Americana are being established in the province. There is a need to beneficiate these fibres locally and create employment and the associated skills. The focus of the department, in collaboration with the CSIR, on natural fibres is, therefore, highly appropriate.



Health care properties of mohair

Dr Anton Botha, CSIR
Prof Lawrence Hunter, Dr Sharlene Govender, Lisha Gerber, NMMU

Background

Globally, there is an increasing awareness of the benefits of textiles, notably apparel textiles, on wellness (for example, health, comfort) and environmental issues. Health and wellness properties, largely relating to moisture management and/or antimicrobial properties, are increasingly being used to promote textile products. However, these claims are rarely supported by scientific evidence. It is widely believed that natural fibres, such as mohair, have superior moisture management and antimicrobial properties. Mohair South Africa and the Technology and Human Resources for Industry Programme (THRIP), therefore, funded a project to investigate the moisture management and anti-microbial properties of mohair relative to those of other fibres.

Response

Research was carried out at the CSIR and NMMU. The moisture management and anti-microbial properties of various natural (mohair, wool, cashmere and cotton) and man-made fibres (acrylic, viscose-regenerated bamboo, nylon, polypropylene and polyester) were measured and compared.

Progress

It was found that none of the fibres possess inherent anti-microbial properties. However, certain natural fibres, such as mohair and wool, which are hydrophilic, possess good moisture management properties,

because they have high moisture absorption (i.e. hygroscopicity), and therefore can present a less attractive microclimate for the multiplication (proliferation) of micro-organisms, than hydrophobic artificial fibres. They, therefore, have a health and wellness advantage.

*Health and wellness properties, largely relating to **moisture management** and/or anti-microbial properties, are increasingly being used to promote textile products.*

Outputs

Students trained ————— 1 —————



Titanium Centre of Competence: Friction processing of titanium at NMMU

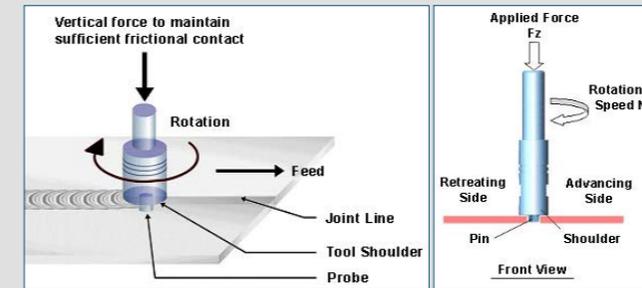
Dr Willie du Preez, CSIR
Prof Danie Hattingh, NMMU

Background

NMMU hosts a Friction Processing Research Unit within an engineering innovation and technology transfer group, known as eNtisa. This group has developed expertise in various friction-based joining and repair techniques, which include friction stir welding (FSW), friction taper stud welding and friction hydro pillar processing.

The joining of Ti-6Al-4V is one of the research areas at NMMU. The research team is considering developing FSW for joining of high-melting temperature, light-alloy applications requiring superior strength and dynamic endurance properties. This research is supported by the Titanium Centre of Competence and is expected to advance process knowledge and create new applications within the automotive, medical and aerospace industries. The FSW expertise developed at NMMU will contribute to the establishment of a titanium industry, which is aligned with the Advance Metals Initiative.

*The increased use of **titanium alloys** in the aerospace, shipbuilding, **medical** and **automotive industries**, demands better **joining methodologies**.*



FSW has various benefits which include the ability to join a wide range of alloys which is difficult with conventional welding processes; joint properties that are similar to parent plate properties; minimal distortion and full automation; as well as reduced fumes and radiation during the welding process.

Progress

The first Ti-6Al-4V titanium weld was attempted in 2007 at NMMU using the I-STIR process. These welds were completed with various heat-input process conditions and showed ultimate tensile strength of about 1020 MPa, which was within the range of parent material properties.

The potential of the FSW technique is large and new applications are explored as process knowledge and joint performance characteristics are developed. Other related friction stir processes (FSP) are also imminent and will impact the way certain materials and components are joined, repaired and processed. The increased use of titanium alloys in the aerospace, shipbuilding, medical and automotive industries, demands better joining methodologies.

eNtisa, in collaboration with the NMMU, hosts postgraduate students

with projects that focus on the development of FSP of titanium.

Outputs

Students trained	_____ 9 _____
Peer-reviewed conference papers	_____ 7 _____
Peer-reviewed journal articles	_____ 18 _____
Book chapter	_____ 1 _____
Patents	_____ 2 _____





***ICT** underpins the **development**
of a **connected information society**
and a **vibrant knowledge economy**
that is more **inclusive** and **prosperous**.*

Collaboration in ICT

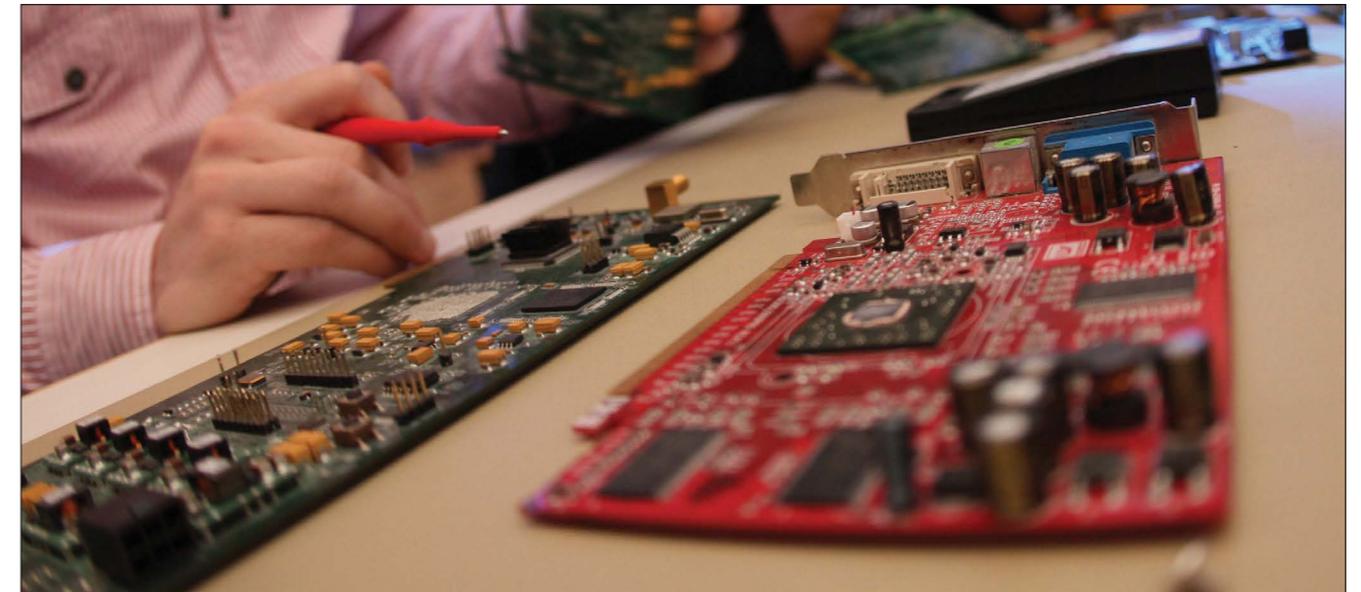
Prof Paula Kotzé, CSIR

CSIR Meraka Institute collaborates extensively with NMMU School of Information and Communication Technology (ICT). The collaboration was formalised in April 2009 with the appointment of three CSIR researchers as adjunct professors in the School of ICT. Since then, two more CSIR researchers were appointed as research associates in the School of ICT.

Although the initial collaboration was based on student supervision which resulted in the training of 10 students, it has grown and also involves implementation of large research projects which were initiated through two CSIR collaboration grants. The first grant in 2009/2010 supported the establishment of a joint research programme in enterprise engineering and process modelling. The programme focused primarily on the health information systems as application domain. Through this programme, several research projects were identified, most notably on eHealth standardisation and interoperability, and enterprise architecture skills development. The eHealth standardisation and interoperability project resulted in the national Department of Health contracting the CSIR to develop the South African National Health Normative Standards Framework (HNSF) for Interoperability in eHealth.

The 2010/2011 grant supported the identification of user needs and requirements for developing community-driven mobile health care services in rural areas. The outcomes of this project are now used in the Siyadala Living Laboratories of NMMU and in other NMMU eHealth projects. The project also contributed to the literature base of the CSIR m-health flagship project and is used as foundational material to assist new students doing research in user experience in the eHealth space.

*The first grant in 2009/2010 supported the establishment of a joint research programme in **enterprise engineering and process modelling.***



Another prominent collaboration is the bursary and vacation work programme between CSIR Meraka Institute (SANReN Competency Area) and NMMU School of ICT. The three-year programme was established in the 2011/12 financial year and has funded one full-time PhD and two Master's students. The Master's students have visited CSIR Meraka Institute to explore potential topics for their dissertations. Through the collaboration, NMMU students were hosted by CSIR Meraka Institute and one was subsequently employed by the

organisation in 2012. A new collaboration between CSIR Meraka Institute and NMMU School of ICT aims to establish a Centre for Broadband Communication. This involves collaboration on the Square Kilometre Array programme in association with SANReN and the National Broadband Research, Planning and Implementation programme.

Collaboration between CSIR Meraka Institute and the NMMU Department of Computing Sciences was initiated recently. NMMU has successfully participated twice (2012

and 2013) in the CSIR Centre for High Performance Computing (CHPC) Student Cluster Competition. The competition gives undergraduate students at South African universities exposure to the High Performance Computing industry.

Collaboration between the CSIR and NMMU on ICT has led to numerous joint publications in accredited journals and peer-reviewed conference proceedings, as well as graduations of several students.

Normative standards framework for eHealth

Prof Paula Kotzé, Funmi Adebesein, CSIR
Prof Darelle van Greunen, Alida Veldsman, Dr Rosemary Foster, NMMU

Background

There is growing concern world-wide about the fragmentation and inability of health care information systems (eHealth systems) to exchange pertinent information that can empower health care professionals to make informed decisions regarding the care of patients. The ability of the systems to share and exchange information (interoperate) is essential to facilitate the quality and effectiveness of health care services.

The South African health care information system is fragmented primarily due to the decentralisation of the National Health Care Management Information System (NHC/MIS). Because of varying capabilities in the provinces, not all the components of NHC/MIS have been implemented as envisaged and the provinces have systems that are not compatible or interoperable with each other.

One method of achieving interoperability in eHealth systems is through standardisation. The national Department of Health (NDoH) eHealth Strategy South Africa 2012-2016 provides a roadmap for the envisioned state of integrated national health care systems based on agreed eHealth standards that support interoperability and produce efficient and effective health care outcomes. However, the large number of eHealth standards makes the selection of appropriate standards to support interoperability difficult, especially since some of these standards also conflict with one another.

Response

Although standardisation is key to addressing the fragmentation in the health care environment, eHealth standardisation can be difficult for many reasons, one of which is understanding of the eHealth interoperability standards landscape. This project, which is specifically aimed at the African health informatics community, aims to understand of eHealth interoperability and the significance of standardisation in its achievement.

eHealth is one of the most complicated and challenging areas of standardisation, because:

- eHealth systems inherently involve large data sets, such as multimedia diagnostic images, patient records, test results, research samples and financial codes;
- eHealth standards do not address one unified area of technology but multiple areas, such as standardisation of content (e.g. patient data, diagnostic images and medical research), devices, software systems (e.g. mobile applications, database management systems), process management, infrastructure and network management (e.g. telecommunication systems, security and identification and authentication);
- eHealth standards involve competing or overlapping standards initiatives in different institutions, many of which charge fees for accessing or implementing standards in products. This can increase the cost of eHealth products or discourage innovation based on eHealth standards.

Progress

An in-depth study of eHealth standards, their development and the degree of participation by African countries in their development was conducted. Many prominent eHealth standards that have been widely adopted, especially by developed countries, as well as some of the factors that affect their adoption in Africa, were

reviewed. Global initiatives to address the identified barriers were also studied. Although the work is specifically aimed at the African community, its findings would be applicable to many developing countries.

It was found that a multitude of eHealth standards are being published, many of them without implementation guidelines. To overcome this problem, a generic method, called the Standards Selection Method for eHealth Interoperability (SMeHI) that could guide the selection of eHealth standards (particularly for developing countries), was developed to support the interoperability of eHealth systems.

In 2012, the CSIR in cooperation with NMMU was appointed by NDoH to:

- Develop the South African National Health Normative Standards Framework for Interoperability in eHealth (HNSF).
- Do a landscape analysis of the current health information systems deployed in the public sector and their ability to interoperate.

SMeHI was used in the development of the HNSF.

The HNSF provides guidelines on appropriate standards when interoperability between eHealth systems in South Africa is of primary concern. The HNSF was published in the Government Gazette of April 2014. This notice mandates compliance with the HNSF at national level for both public and private health care information systems.

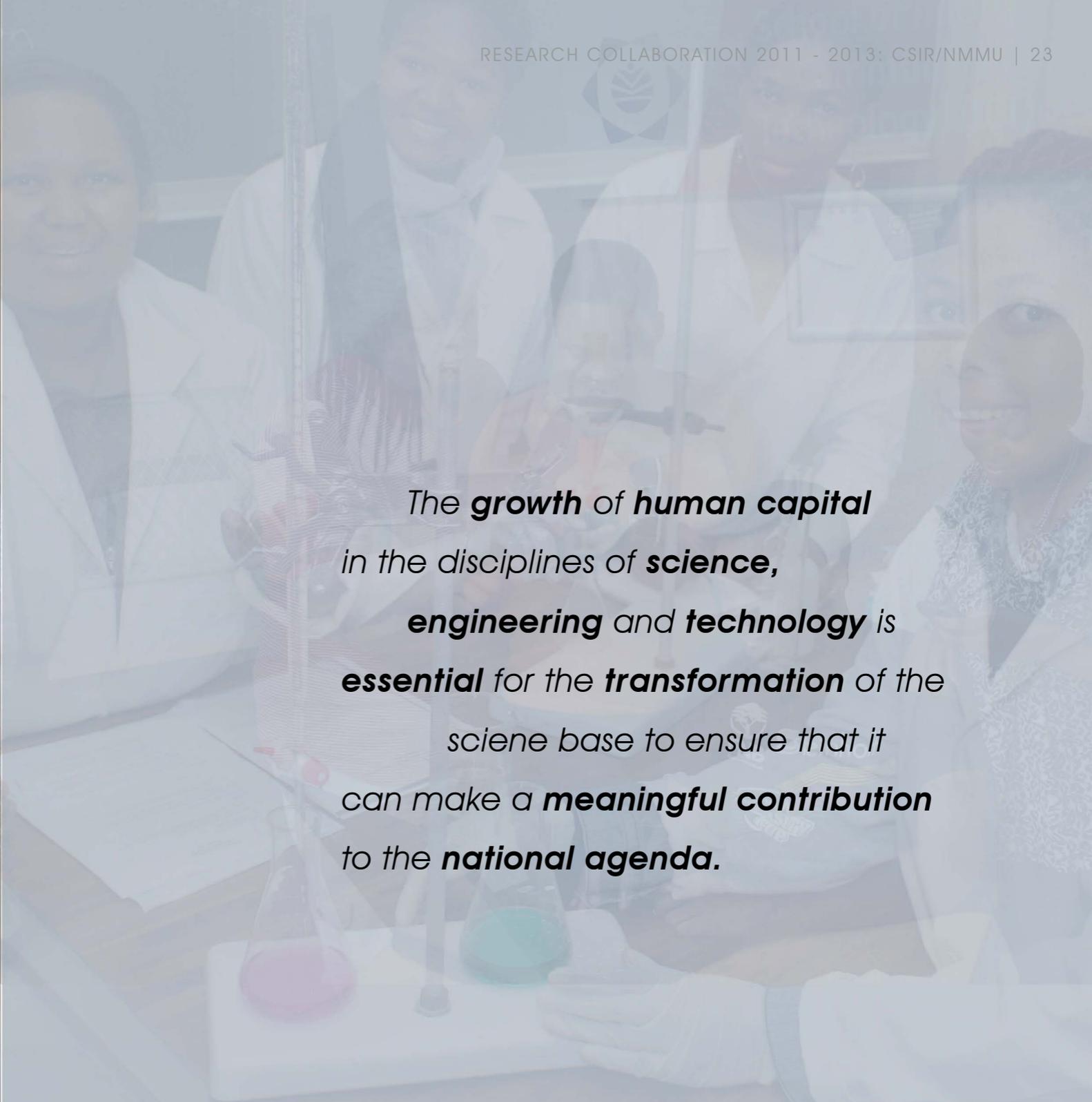
Outputs

Peer-reviewed journal article — 1 —

Peer-reviewed conference papers — 2 —

National policy — 1 —

Students trained — 1 —



The **growth** of **human capital** in the disciplines of **science, engineering** and **technology** is **essential** for the **transformation** of the science base to ensure that it can make a **meaningful contribution** to the **national agenda**.

Collaboration through HCD

Pinda Sifunda, CSIR
Dr Blanche Pretorius, NMMU

Human capital development (HCD) entails investment in skills and competencies. The CSIR and NMMU support HCD through a joint scholarship programme, as well as through a national programme for accessing laser research infrastructure which is managed by the CSIR. The two institutions have also developed capacity through participation in two national earth sciences and ICT programmes - ACCESS and SANReN.

The students who are supported through HCD programmes provide a pool of qualified researchers who can contribute to both the CSIR and the country.

Seventeen CSIR staff members (7 Master's and 10 Doctoral) studied for postgraduate qualifications, primarily in ICT and textiles, at NMMU between 2011 and 2013; six of them have graduated. Eleven CSIR staff members were involved in the supervision and/or lecturing of students at NMMU in the areas of information technology, natural resource management and textile science. Seven CSIR staff members held extraordinary professorships at NMMU and two NMMU staff members serve on CSIR advisory panels.

*The students who are supported through **HCD programmes** provide a pool of qualified researchers who can contribute to both the **CSIR** and **the country**.*

Student testimonials

Cyrus Tshifularo is studying for a PhD in textile science.

*"My research is on the **performance of nonwoven geotextiles made from natural and synthetic fibres**.*

By testing different types of fibres, we will have an idea of how the end products will perform. Testing includes processing parameters that influence pores, strength, puncture resistance, transmissivity and durability.

My research work includes identifying natural fibres which can be planted in South Africa and separating the fibres from plants. Both these aspects will result in job creation. Some natural fibres can perform the same function as synthetic fibres. In order to minimise costs, natural fibres can be given first preference as they are cheaper. In South Africa, we have the problem of potholes on roads and the results of my research can possibly be used to help minimise this problem."

Roderick Mooi is studying for an MTech in information technology.

*"I am specialising in **information and network security**.*

The topic of my dissertation is 'A model for security incident response in the South African National Research Network.' I am researching

and developing this model which is based on combinations of computer security incident response team, computer-science annual workshop (CSIRTC-SAW) and warning advice and reporting point concepts. The research is important because there are no clear models for national research networks in developing country environments. The results of the research can be applied to establish a computer security incident response capability for SANReN and possibly for national research networks in other developing countries."

Karien Bezuidenhout is an MSc student in zoology.

*"I am investigating genetic and demographic **connectivity among sandy beach populations in a suite of macrofauna species**.*

Persistence of populations and species depends partly on the movement of individuals between populations. Natural barriers – such as large rocky coasts – could impede the movement of beach species. Impacts such as development, erosion, sea level rise and pollution could cause habitat destruction and increase the fragmentation of beach habitats - and hence the distance between populations. In addition, some species are expected to have a greater dispersal potential than others due to their life history (e.g. larval dispersers) or as a result of the position that they occupy on a beach (e.g. low-shore species). This study, therefore, will investigate the role of distance among populations, beach zonation and life history in macrofauna connectivity. The findings have important implications for the management of coastlines."

Joint teaching

Management of estuaries in South Africa

Lara van Niekerk, CSIR
Prof Janine Adams, NMMU

Background

There are about 300 functional estuaries along the South African coast. Many have become focal points for development. Increased abstraction and pollution of freshwater in river catchments, the increase in the number of holiday and residential homes and growing industrial zones all contribute to the pressure on estuaries.

The Department of Environmental Affairs is required by various legislation and protocols to manage estuaries in a coordinated and efficient manner. This requires an understanding of the value and functions of estuaries, the impacts that threaten their integrity, as well as the development of estuary management plans and the capacity to implement them.

Purpose

NMMU in collaboration with the CSIR has hosted an annual short course on the management of estuaries in South Africa since 2008. The long-term impact of this training should be improvement in the sustainable management of estuary-related resources in South Africa. Participants in this training programme have come from diverse backgrounds and typically represent government departments and non-governmental organisations. Over the years, funding for the course has been provided by Framework Programme for Education and Training in Water, the CAPE estuaries programme and the Department of Environmental Affairs.

Curriculum

Value, structure and function of estuaries	_____	Daniel Lemley
Activities that threaten estuaries	_____	Dr Gavin Snow
Estuary management protocol	_____	Ntombovuyo Madlokazi
Environmental water requirements, legislation	_____	Lara van Niekerk
Implementation and monitoring of environmental management plans	_____	Lara van Niekerk
Techniques used to monitor estuaries	_____	Dr Gavin Snow



Supervised research

The investigation of alternative processes for the oxidation of phenol

Basanda Pongoma
Supervisor: Prof Ernst Ferg, NMMU

Background

The electrochemical oxidation of phenol is an important process for producing value-added products such as hydroquinone and catechol, or for removing the phenol from waste water streams to form carbon dioxide. This process was extensively studied with focus on the type of anode material used. Although the anode material could be made from a number of materials, this study focused on the use of lead dioxide (PbO_2) as an anode material that was made using lead-acid battery principles in designing a microporous electrode.

Response

The focus was on using lead dioxide as an anode material that was made using the formation principles used in the manufacturing of lead-acid batteries. This allowed the construction of an electrochemical flow-through microporous reactor that contained PbO_2 as the anode and Pb as the cathode, allowing for a solution containing phenol to flow through the cell continuously. By applying a suitable potential across the cell, the almost complete oxidation of phenol would occur to form benzoquinone, which was followed by the sequential reduction to other products such as hydroquinone and catechol. The system was shown to be made up of tightly packed microporous material that has a very high surface area-to-volume ratio.

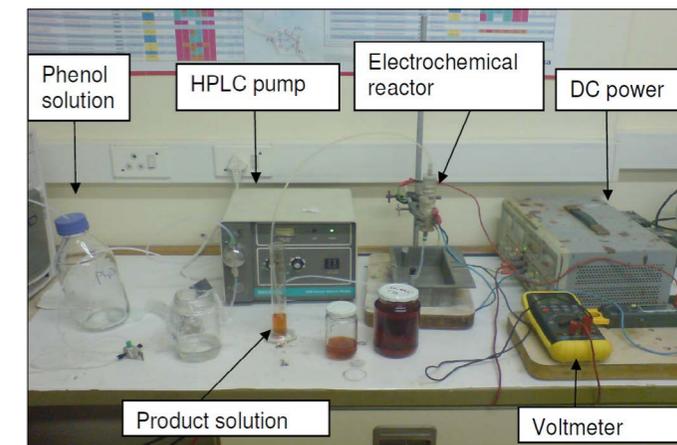
Progress

The study showed that almost all of the phenol could be converted in one continuous flow process using a relatively low-cost electrochemical microflow cell that can easily be scaled up to accommodate larger volumes and concentrations by using electrode manufacturing principles used in the lead-acid battery industry.

Outputs

Peer-reviewed journal article	1
Student trained	1

*The focus was on using **lead dioxide** as an anode material that was made using the formation principles used in the **manufacturing of lead-acid batteries.***



Indicators of change: Habitat boundaries between salt marshes and terrestrial vegetation

Dimitri Veldkornet

Supervisors: Lara van Niekerk, CSIR; Prof Janine Adams, NMMU

Background

Inappropriate land use and development in low-lying areas, such as land reclamation, mining and infrastructure have had a major influence in and around estuaries. The boundary of an estuary is a critical component in cooperative estuary management. The five-metre topographical contour is the established convention in the demarcation of the lateral boundary of an estuary. However, this generic convention may leave critical elements of the salt marsh vegetation outside its boundary, resulting in inappropriate development pressures on an ecological system. The border between salt marsh and terrestrial vegetation is important, as it is often an area of great biodiversity. However, these areas are frequently preferred for development. This results in the loss of connectivity between these two vegetation types.

Response

The aim of the study was to identify boundaries and establish the connectivity between salt marsh and terrestrial vegetation and to identify whether salt marsh biodiversity is related to the surrounding terrestrial biome; determine which environmental factors are important in forming boundaries; and determine the extent to which the five-metre contour line is effective in accounting for estuarine functionality. The study was done in the Olifants, Berg, Verlorenvlei, Uilkraals, Goukou, Gouritz, Keurbooms and Kabeljous estuaries.



Progress

The research identified boundaries and established the relationship between salt marsh and terrestrial vegetation. Distinctive fringe vegetation could be recognised as the boundary or buffer between salt marsh and terrestrial vegetation. The salt marsh habitat had lower species richness compared to the fringe and terrestrial environment because of stressors such as high-salinity and low-sediment moisture content. Low-growing shrubs and annual species characterised the fringe zone. In the warm temperate zone, these species showed affinities with subtropical thicket and afro-montane forest. The fringe habitat also had some unique species such as *Carpobrotus murii* which is a near-threatened species with its range extending from Stilbaai to Riversdale. Populations are threatened due to ongoing habitat loss resulting from coastal development, wheat cultivation and alien plant invasion.

Sediment characteristics in the different habitats (salt marsh, fringe and terrestrial) are factors that could be used as indicators of change. At all sites, the salt marsh habitat had the highest sediment electrical conductivity and sediment moisture content. No terrestrial vegetation occurred where sediment electrical conductivity was greater than $2.6 \text{ mS}\cdot\text{cm}^{-1}$. The supratidal zone was characterised by a greater depth to groundwater (73-86 cm) compared with the intertidal zone.

Some estuaries, such as the Goukou, Kabeljous and Olifants, had distinct boundaries compared to boundary zones which would be an ecotone with overlap. In these estuaries, there was a sharp elevation change between the salt marsh and terrestrial habitats. In contrast, in the Gouritz, Keurbooms Verlorenvlei and Uilkraals estuaries, there were distinct ecotones with distinctive groundwater characteristics.

Developments such as cultivation and urban buildings resulted in the

loss of estuarine habitat and connectivity with terrestrial habitats. Under these conditions, there is little opportunity for landward migration of species due to increased sea level rise and increased tidal inundation.

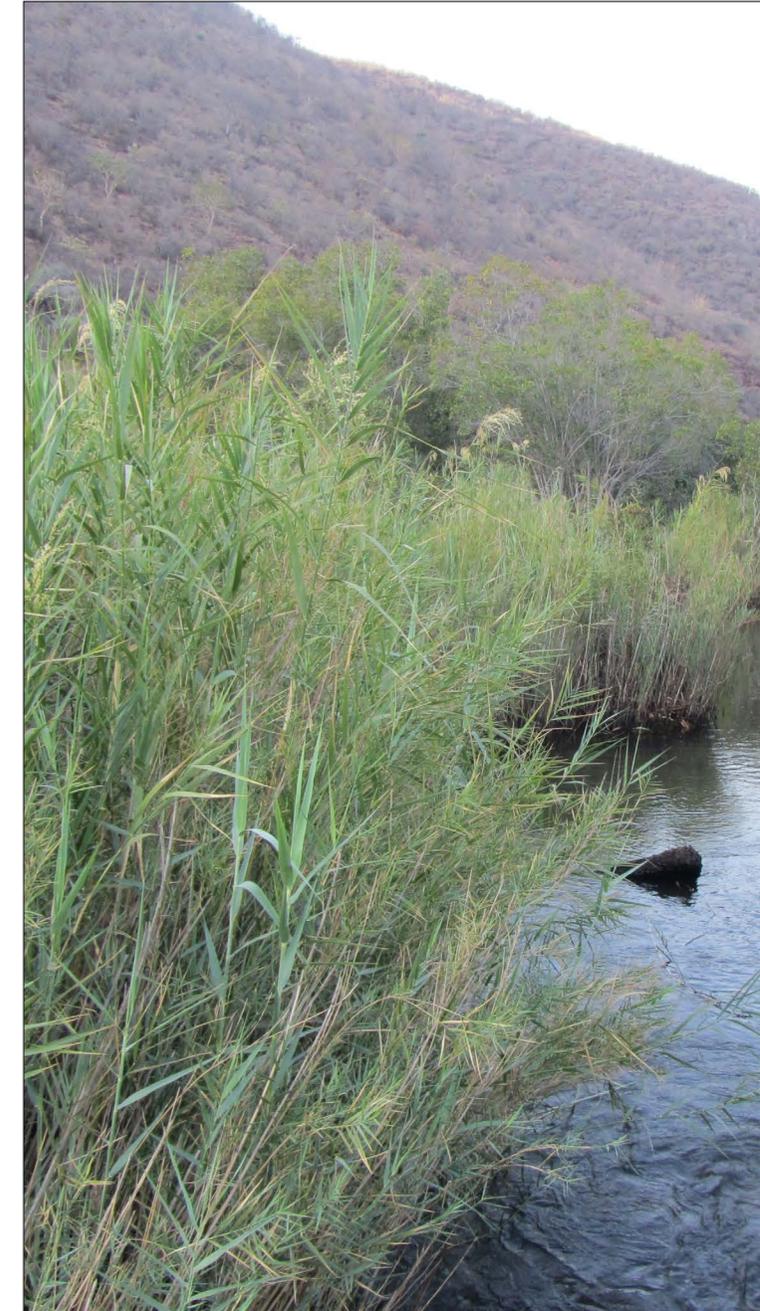
Future work

This study provided insight into the habitat characteristics of salt marsh and terrestrial fringes. It is the first step to understanding the factors separating salt marsh from terrestrial vegetation. The combination of these environmental conditions in association with species composition can be used to delineate the salt edge or functional zone.

Outputs

Peer-reviewed journal articles — 2 —

*Populations are **threatened** due to **ongoing habitat loss** resulting from coastal development, wheat cultivation and **alien plant invasion**.*



Conceptual model of an access-technology-agnostic delivery mechanism for information communication for development services

Mokone Ishmael Makitla

Supervisors: Prof Marlien Herselman, CSIR; Prof Reinhardt Botha, NMMU

Background

Information and Communication Technology for Development (ICT4D) is an emerging research area that is concerned with the design and development of innovative technologies for resource-constrained environments for application in key areas of social development such as health, agriculture and education. The ICT4D initiatives, therefore, contribute to three main activities, namely: developing the required infrastructure (connectivity, electricity and computing devices); building the required ICT human capacity; and providing access to digital content and services.

Response

The study was conducted according to the Design Science Research methodology, which is especially suited for technical studies and allows for the utility of the developed Access-Technology-Agnostic Delivery Mechanism to be evaluated. The study:

- Addressed the lack of mechanisms to facilitate access to digital content and services by end-users through the technologies that these users already possess. This lack of innovative delivery mechanisms is both an impediment to achieving equitable access to digital content and service and an opportunity to innovate.

- Developed a set of technical and socio-technical requirements that delivery mechanisms should satisfy.
- Investigated whether the Service Delivery Platform concept from the telecommunication engineering domain is a technically viable basis for the required delivery mechanisms.
- Developed a conceptual model of a possible delivery mechanism that facilitates equitable access to digital content and services (i.e. Access-Technology-Agnostic Delivery Mechanism).

Progress

The relevance of the conceptual model has been established and, through a prototype and its technical feasibility and utility, been demonstrated. This has been done using standards-based, open-source technologies. The proof of concept clearly demonstrates that the access-technology-agnostic delivery of digital content and services is achievable.

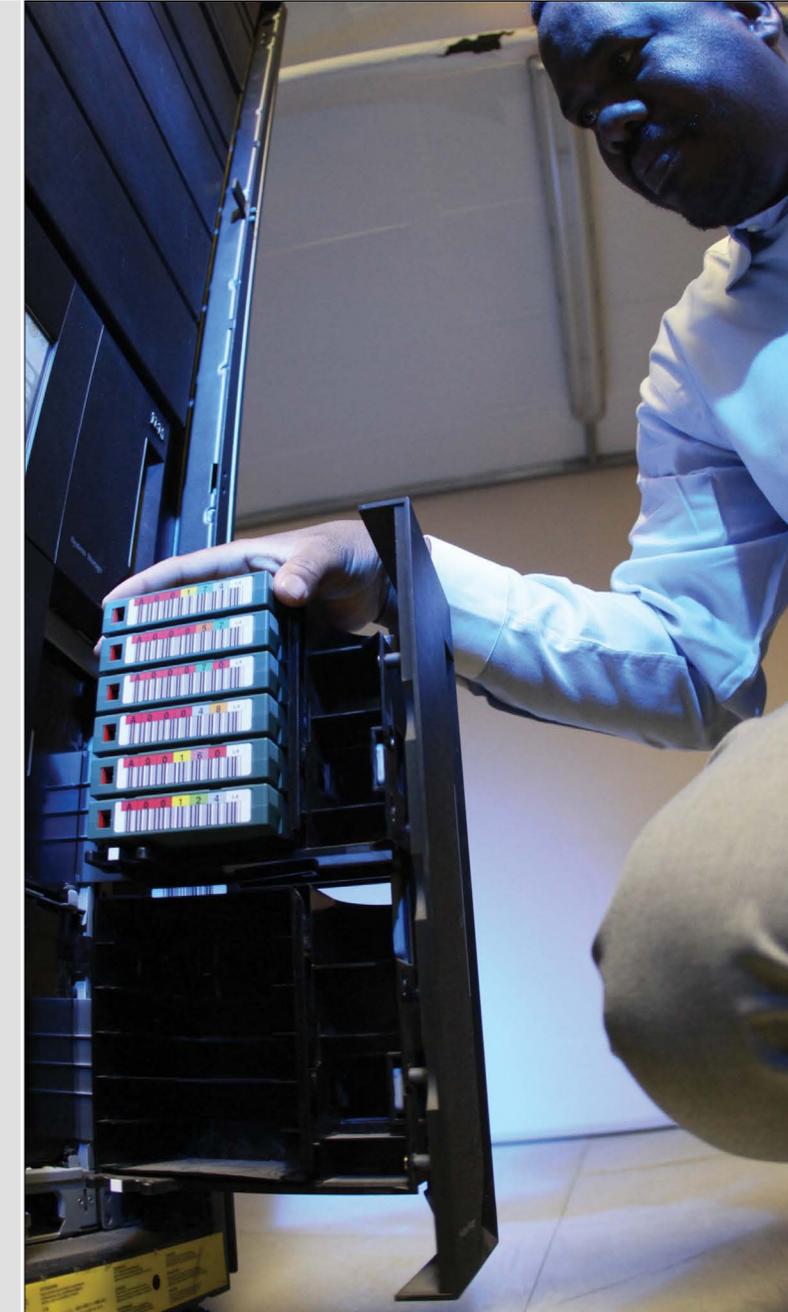
The study has contributed to providing access to digital content and services in an access-technology-agnostic manner. It has also provided the theoretical basis for the Mobi4D Communications Service Delivery Platform which has been developed by CSIR Meraka Institute.

The service delivery design pattern advocated by the study has also been adopted for the development of Mobi4D platform.

Outputs

Peer-reviewed conference paper — 4 —

Student trained ————— 1 —



Studies on acoustic properties of nonwoven fabrics

Mlando Mvubu

Supervisors: Prof Rajesh Anandjiwala, CSIR; Dr Asis Patnaik, NMMU

Background

Industrialisation and population growth and its density have resulted in substantial noise pollution. The impacts of noise pollution include noise-induced hearing impairment; interference with speech communication; disturbance of rest and sleep; psycho-physiological, mental-health and performance effects; effects on residential behaviour and annoyance; as well as interference with intended activities. Sound insulation is one method of mitigating the propagation and effect of noise.

Various materials are used for sound insulation. Nonwoven materials have excellent acoustic properties and seem to be the most economical to produce due to the large quantities required and the variety of sound insulation products that can be manufactured from these fabrics.



Response

This study focuses on developing needle-punched, nonwoven fabrics for sound insulation, using natural fibres (such as wool, hemp, flax and agave) blended with polyester (PET) fibres. The study aims to optimise production parameters and their influence on sound insulation properties.

Progress

Many samples classified by (PET/natural fibre) composition (e.g. 50% PET / 50% natural fibre, by weight) have been produced. A factorial design of the experiment was followed using the Box-Behnken experiment design method. The purpose of this method was to study the influence of process and material parameters on sound insulation properties. Samples were tested for sound insulation properties using the Impedance tube set up. Samples were also tested for area weight and thickness. The data were analysed by the SYSTAT software.

Future work

The data analysis for the first phase is nearing completion and will be communicated in a peer-reviewed journal paper. The second phase will explore the use of the nonwoven samples in combination with other building materials to explore their efficacy in creating sound insulation.

Outputs

Peer-review journal article — 1 —

*The study aims to optimise
production parameters
and their influence on sound
insulation properties.*



The **CSIR** and **NMMU** have
also developed **HCD** through
**participation in national
research programmes**

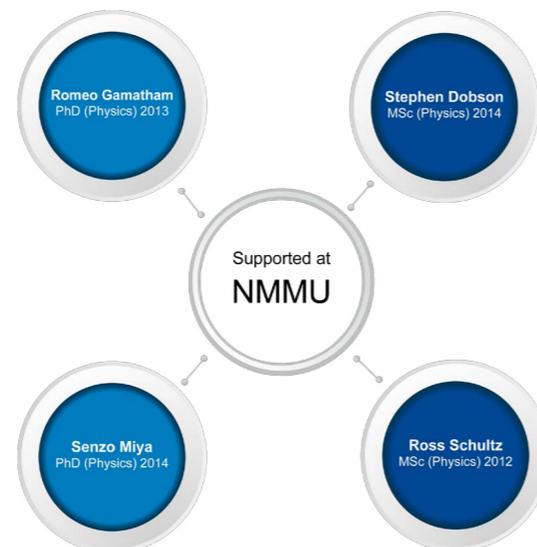


Laser Rental Pool Programme

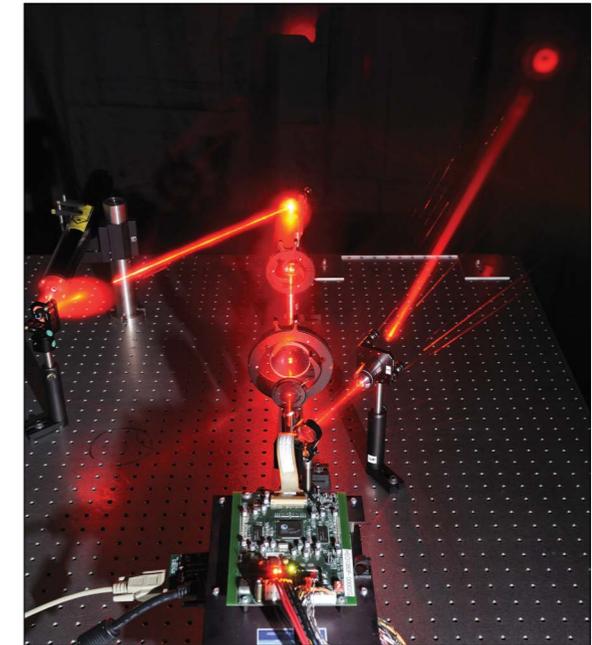
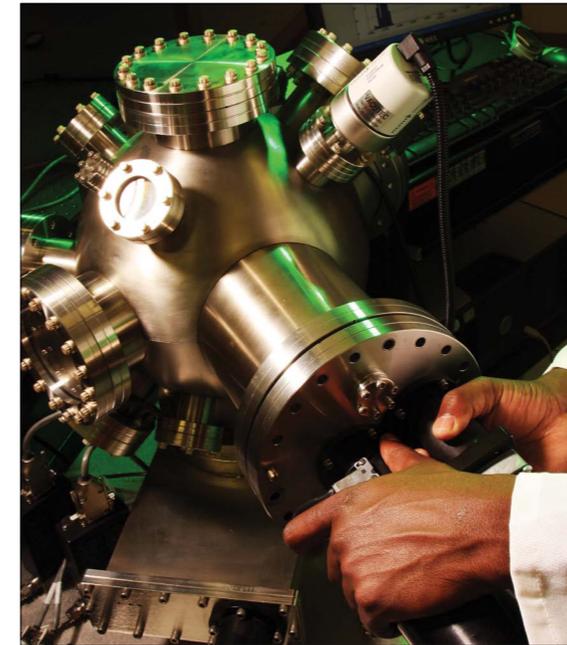
Dr Paul Motalane, CSIR

The CSIR National Laser Centre Rental Pool Programme offers South African higher education institutions access to state-of-the-art lasers, laser diagnostic equipment and laser laboratories. Through this programme, MSc and PhD students are trained, in line with the national mandate of developing skilled human resources in science, engineering and technology (SET). Access to costly high-technology laser equipment situated centrally results in significant cost savings while strengthening the laser science community.

The CSIR National Laser Programme has supported the training of about 150 Master's and Doctoral students each year for the past three years (2010/11-2012/13). Two PhD and two MSc students were funded at NMMU.



*"The Laser Rental Pool Programme is a **very successful national programme** that builds key scarce SET expertise through MSc and PhD training."* Dr Paul Motalane, CSIR.



*"The outputs anticipated from this work will result in **high-quality publications** in international journals, the training of PhD students and possibly patents (we currently have one SA patent) and will contribute to **establishing a niche industry** in South Africa involving the production of photo-detectors."* Prof Reinhard Botha, NMMU.

Collaboration on the SANReN Programme

Dr Colin Wright, CSIR



The SANReN competency area at CSIR Meraka Institute was formed as a Department of Science and Technology (DST) initiative to provide ICT connectivity to research and education institutes in South Africa, as well as to develop and support valuable services for the research and education community. Together with the CHPC and the Data Intensive Research Infrastructure of South Africa (DIRISA), SANReN forms a key component of the comprehensive National Cyber Infrastructure Initiative for South Africa.

The School of ICT at NMMU and CSIR Meraka Institute signed a Memorandum of Agreement in 2012 focusing on enhancing human

capital development. CSIR Meraka Institute provided funds for SANReN/NMMU scholarships. One Doctoral (2013) and two Master's scholarships (2014) have been awarded. Two SANReN employees are studying for Master's degrees at NMMU.

In 2012, six NMMU BTech students did three weeks of holiday work at SANReN and in the following year, three BTech students and the one scholarship student spent three weeks at SANReN.

"The SANReN/NMMU working agreement is a wonderful initiative, especially for the students.

Both parties involved are benefiting from this relationship."
Prof Rossouw von Solms, NMMU.



Collaboration on the ACCESS Programme

Dr Neville Sweijd, CSIR

The Applied Centre for Climate and Earth Systems Science (ACCESS) is a consortium of research institutions that have combined expertise to deliver outputs aligned to the DST's Global Change Grand Challenge.

It provides a platform for integrated research throughout the value chain in response to opportunities and challenges emanating from a changing environment, collectively referred to as Earth Systems Science. ACCESS provides an opportunity for cooperation between students and supervisors across disciplines. This reflects the interconnected nature of the Southern African Earth System.

Human capital development is a key activity of the Centre.



Two NMMU Doctoral students completed their research in 2013. Their work was on habitat boundaries between salt marshes and terrestrial vegetation, and genetic and demographic connectivity among sandy beach populations in a suite of macro-fauna species.

Research at ACCESS is undertaken through several programmes:

- Earth systems modelling and biochemical cycles.
- Seasonal/inter-annual climate predictability.
- Water resource dynamics.
- Urban and rural land use.
- Ecosystems services and livelihoods.
- Long-term climate and impacts.
- Marine and coastal estuarine systems.

ACCESS provides an opportunity for cooperation between **students and supervisors** across disciplines.



Collaborative research projects implemented

CSIR researchers	NMMU researchers	Name of project	2011	2012	2013	Research area
Dr Anton Botha, Prof Lawrence Hunter	Mzwamadoda Notayi, Prof Japie Engelbrecht, Prof Sam Chikwembani (WSU), Prof Mike Lee (WSU)	Quantitative analyses of mohair and blends	•	•	•	Textile science
Dr Anton Botha, Prof Lawrence Hunter	Jim Rapakgadi, Dr Chris Franklyn (NECSA)	Sterilisation of wool bales		•	•	
Dr Anton Botha, Prof Lawrence Hunter	Lisha Gerber, Dr Sharlene Govender	Health care properties of mohair	•	•		
Dr Anton Botha, Prof Lawrence Hunter	Papali Mokobori	Measurement of kemp and diameter distribution of wool and mohair	•	•	•	
Dr Anton Botha, Sunshine Blouw, Enn Fortuin, Prof Lawrence Hunter	Dr Sharlene Govender	Mohair research (Health care and wellness and kempy fibres)	•			
Prof Rajesh Anandjiwala	Prof John Gonsalves	Mechanics and composite fibrous materials	•			ICT
Christiaan Kuun, Dr Colin Wright, Leon Staphorst	Prof Rossouw von Solms, Prof Reinhardt Botha	SANReN/NMMU Research Collaboration		•	•	
Prof Paula Kotze	Prof Dalenca Pottas, Prof Darelle van Greunen	Health socio-technical systems	•	•		
Prof Paula Kotze, Prof Alta van der Merwe	Prof Darelle van Greunen	Enterprise architecture	•	•		
Prof Paula Kotzé, Dr Nicola Bidwell	Prof Darelle van Greunen	Situated knowledge management (Indigenous Knowledge Systems)	•	•	•	
Prof Paula Kotzé, Funmi Adebesein	Prof Darelle van Greunen	Normative standards framework for e-health		•	•	

CSIR researchers	NMMU researchers	Name of project	2011	2012	2013	Research area
Dr Willie du Preez	Prof Danie Hattingh	Titanium Centre of Competence: Friction Processing		•	•	Materials science
Dr Willie du Preez	Prof Danie Hattingh	Titanium Centre of Competence (Joining of Titanium)	•			
Charl Smal	Prof Khaled Abou El-Houssein	Porous titanium samples for biomedical applications	•			
Herman Burger	Prof Danie Hattingh	Comparison of fatigue properties of laser and friction stir welded titanium	•			
Richard Bean, Asley Bhugwandin	Prof Danie Hattingh	Magma Simulation Centre			•	Laser research
Dr Sisa Pityana	Prof Annelize Els-Botes	Laser forming process design	•			
Dr Kittessa Roro	Prof Reinhardt Botha	Development of laser interference lithography system for patterned growth of ZnO nanostructures	•			
Dr Brian van Wilgen	Prof Richard Cowling, Tineke Kraaij	A comprehensive assessment of pine-based plantation forestry in the Western and Eastern Cape	•			Natural environment
Lara van Niekerk	Prof Janine Adams, Dr Gavin Snow	Estuary management course	•			
Lara van Niekerk, Susan Taljaard, Andre Theron, Jean Nel	Prof Janine Adams, Prof Tris Wooldridge, Dr Gavin Snow	National biodiversity assessment	•			
Lara van Niekerk, Susan Taljaard	Prof Janine Adams, Prof Tris Wooldridge, Dr Gavin Snow	Freshwater inflow requirements and training workshop for the Bot Estuary	•			
Dr Pravesh Debba, Jennifer Holloway, Renee Koen, Nontembeko Duden-Tlhone	Prof Igor Litvine	Regional electricity demand forecasting			•	Built environment

Joint outputs resulting from supervised and joint research

Authors	Title of publication	Publication
Peer-reviewed journal articles		
Roux DJ; Nel JL	Freshwater conservation planning in South Africa: Milestones to date and catalysts for implementation	Water SA, Vol. 39(1), Pages:151-163, Jan 2013
Blignaut J; Elser KJ; De Wit MP; Le Maitre D; Milton SJ; Aronson J	Establishing the links between economic development and the restoration of natural capital	Current Opinion in Environmental Sustainability, Vol. 5(1), Pages: 94-101, Mar 2013
Linganiso LZ; Bezer R; Bhat S; John M; Braeuning R; Anandjiwala RD	Pultrusion of flax/poly(lactic acid) commingled yarns and nonwoven fabrics	Journal of Thermoplastic Composite Material, Vol. DOI: 10.1177/0892705713486137 May 2013
Kumar R; Ofosu O; Anandjiwala RD	Macadamia nutshell powder filled poly lactic acid composites with triacetin as a plasticiser	Journal of Biobased Materials and Bioenergy, Vol. 7 DOI:10.1166/jbmb.2013.1387 2013
Hunter L; Smuts S; Botha AF	Characterizing visually objectionable and no objectionable medullated fibers in mohair	Journal of Natural Fibers, Vol. 10(2), Pages: 112-135, June 2013
Adebesin F; Foster R; Kotzé P; Van Greunen D	A review of interoperability standards in e-health and imperatives for their adoption in Africa	South African Computer Journal Pages: 55-72, Jul 2013
Kraaij T; Cowling RM; Van Wilgen BW	Fire regimes in eastern coastal fynbos: Imperatives and thresholds in managing for diversity	Koedoe, Vol. 55(1), Pages: 1-9, Apr 2013
Moyo D; Anandjiwala RD	Studies on waterjet impact forces in the hydroentanglement process	Textile Research Journal, Vol. 83(16), Pages: 1717-1727, Oct 2013
Ruxwana N; Herselman M; Pottas D	A generic quality assurance model for successful e-health implementation in rural hospitals in South Africa	Health Information Management Journal, Vol. DOI. org/10.12826/1833575.2013.006. May 2013
Kumar R; Anandjiwala RD	Compression-moulded flax fabric-reinforced polyfurfuryl alcohol bio-composites: Mechanical and thermal properties	Journal of Thermal Analysis and Calorimetry, Vol. 112, Pages: 755-760, May 2013

Authors	Title of publication	Publication
Van Niekerk L; Adams JB; Bate GC; Forbes AT; Forbes NT; Huizinga P; Lamberth SJ; MacKay CF; Petersen C; Taljaard S; Weerts SP; Whitfield AK; Wooldridge TH	Country-wide assessment of estuary health: An approach for integrating pressures and ecosystem response in a data limited environment	Estuarine, Coastal and Shelf Science 130, Pages: 239-251, Sep 2013
Rashamuse K; Sanyika W; Ronneburg T; Brady D	A feruloyl esterase derived from a leachate metagenome library	BMB Reports, Vol. 45(1), Pages: 14-19, Jan 2012
Kumar R; Kumar R; Anandjiwala R	Biofilms from soy protein isolate and polyfurfuryl alcohol	Plastics, Rubber and Composites, Vol. 41(1), Pages: 1-7, Feb 2012
Ndlovu GF; Roos WD; Wang ZM; Asante JKO; Mashapa MG; Jaffa C; Mwakikunga BW; Hillie KT	Epitaxial deposition of silver ultra-fine nano-clusters on defect-free surfaces of HOPG-derived few-layer graphene in a UHV multi-chamber by in-situ STM, ex-situ XPS and ab initio calculations	Nanoscale Research Letters, Vol. 7, Article 173, Mar 2012
John MJ; Tlili R; Anandjiwala RD; Boudenne A; Ibos L	Effect of amphiphilic coupling agent on heat flow and dielectric properties of flax-polypropylene composites	Composites Part B: Engineering, Vol. 43(2), Pages: 526-532, Mar 2012
John MJ; Anandjiwala R; Oksman K; Mathew AP	Melt-spun polylactic acid fibers: effect of cellulose nanowhiskers on processing and properties	Journal of Applied Polymer Science, Vol. 127(1), Pages: 274-281, Apr 2012
Kraaij T; Cowling RM; Van Wilgen BW; Schutte-Vlok A	Proteaceae juvenile periods and post-fire recruitment as indicators of minimum fire return interval in eastern coastal fynbos	Applied Vegetation Science, Vol. 15(2), Pages: 1654, May 2012
Winschiers-Theophilus H; Bidwell NJ; Blake E	Altering participation through interactions and reflections in design	Co-Design: International Journal of Co-Creation in Design and the Arts, Vol. 8(2-3), Pages: 163-182, Jun 2012
Taljaard S; Whitfield AK; Bate GC; Adams JB; Cowdely PD; Froneman PW; Gama PT; Strydom NA; Theron AK; Turpie JK; Van Niekerk L; Wooldridge TH	A review of the ecology and management of temporarily open/closed estuaries in South Africa, with particular emphasis on river flow and mouth state as primary drivers of these systems	African Journal of Marine Science, Vol. 34(2), Pages: 163-180, Jun 2012

Authors	Title of publication	Publication
Godfrey L; Scott D; Difford M; Trois C	The effect of data on waste behaviour: The South African waste information system (Part II)	Waste Management, Vol. 32(11), Pages: 2163-2176, Jun 2012
Butgereit L; Botha RA; Van den Heever M	Key identifiers and spelling conventions in MXit-lingo as found in conversations with Dr Math	Journal for Transdisciplinary Research in Southern Africa, Vol. 8(1), Pages: 30-50, Jul 2012
Winschiers-Theophilus H; Bidwell NJ; Blake E	Community consensus: Design beyond participation	Design Issues, Vol. 28(3), Pages: 89-100, Jul 2012
McConnachie MM; Cowling RM; Van Wilgen BW; McConnachie DA	Evaluating the cost-effectiveness of invasive alien plant clearing: A case study from South Africa	Biological Conservation, Vol. 155, Pages: 128-135, Oct 2012
Kraaij T; Baard JA; Cowling RM; Van Wilgen BW; Das S	Historical fire regimes in a poorly understood, fire-prone ecosystem: Eastern coastal fynbos	International Journal of Wildland Fire, Pages: 1071-1163, Oct 2012
Kraaij T; Cowling RM; Van Wilgen BW	Lightning and fire weather in eastern coastal fynbos shrublands: Seasonality and long-term trends	International Journal of Wildland Fire, Pages: 1071-1163, Oct 2012
Chapple S; Anandjiwala R; Sinha Ray S	Mechanical, thermal and fire properties of polylactide/starch blend/clay composites	Journal of Thermal Analysis and Calorimetry, Pages: 10973-12277, Nov 2012
Godfrey L; Scott D; Difford M; Trois C	The role of waste data in building knowledge: The South African waste information system (Part I)	Waste Management, Vol. 32(11), Pages: 2154-2162, Nov 2012
Cordeiro N; Gouveia C; Jacob John M	Investigation of surface properties of physico-chemically modified natural fibres using inverse gas chromatography	Industrial Crops and Products, Vol. 33(1), Pages: 108-115, Jan 2011
Nel JL; Reyers B; Roux DJ; Impson ND; Cowling RM	Designing a conservation area network that supports the representation and persistence of freshwater biodiversity	Freshwater Biology, Vol. 56(1), Pages: 106-124, Jan 2011
Engelbrecht JAA; Van Rooyen IJ	The influence of various dielectric parameters on the reststrahlen region of SiC	Physica B: Condensed Matter, Vol. 406(3), Pages: 593-596, Feb 2011
Patanaik A; Jacobs V; Anandjiwala RD	Role of jet path on uniformity of electrospun nanofibers	Journal of Nanoscience and Nanotechnology, Vol. 11(2), Pages: 1103-1110, Feb 2011

Authors	Title of publication	Publication
O'Farrell PJ; De Lange WJ; Le Maitre DC; Reyers B; Blignaut JN; Milton SJ; Atkinson D; Egoh B; Maherry A; Colvin C; Cowling RM	The possibilities and pitfalls presented by a pragmatic approach to ecosystem service valuation in an arid biodiversity hotspot	Journal of Arid Environments, Vol. 75(6), Pages: 612-623, Jun 2011
Jacobs V; Patanaik A; Anandjiwala RD; Maaza M	Optimization of electrospinning parameters for chitosan nanofibres	Current Nanoscience, Vol. 7(3), Pages: 396-401, Jun 2011
Reitmaier T; Bidwell NJ; Marsdena G	Situating digital storytelling within African communities	International Journal of Human-Computer Studies, Vol. 69(10), Pages: 658-668, Sep 2011
Bidwell NJ; Winschiers-Theophilus H; Kapuire GK; Rehm M	Pushing personhood into place: Situating media in rural knowledge in Africa	International Journal of Human-Computer Studies, Vol. 69(10), Pages: 618-631, Sep 2011
Kraaij T, Cowling RM, Van Wilgen BW.	Past approaches and future challenges to the management of fire and invasive alien plants in the new Garden Route National Park	South African Journal of Science, Vol. 107(9/10), 11pp, Sep 2011
Bidwell NJ; Winschiers-Theophilus H; Koch-Kapuire G; Chivuno-Kuria S	Situated interactions between audiovisual media and African herbal lore	Personal and Ubiquitous Computing, Vol. 15(6), Pages: 609-627, Nov 2011
Butgereit L; Botha RA	A model to identify mathematics topics in MXit lingo to provide tutors quick access to supporting documentation	Pythagoras, Vol. 32(2), Pages: Art. 59, Nov 2011
Jacobs V; Patanaik A; Anandjiwala RD	Optimization of process and solution parameters in electrospinning polyethylene oxide	Advanced Science Letters, Vol. 4(11-12), Pages: 3590-3595, Nov 2011
Conference papers peer-reviewed		
Butgereit L; Botha RA	Can micro-volunteering help in Africa?	IST-Africa 2013 Conference & Exhibition, Nairobi, Kenya, 29-31 May 2013, 6pp, May 2013
Adebesin F; Kotzé P; Van Greunen D; Foster R	Barriers and challenges to the adoption of e-health standards in Africa	Health Informatics South Africa, Port Elizabeth, 3-5 July 2013 9pp, Jul 2013
Butgereit L; Botha RA	An architecture for synchronous micro-volunteering in Africa using social media	4th International Workshop on Pervasive Collaboration and Social Networking (PerCol), San Diego, California, 18-22 March 2013 Pages: 175-180, Mar 2013

Authors	Title of publication	Publication
Butgereit L; Botha RA	A comparison of different calculations for N-Gram similarities in a spelling corrector for mobile instant messaging language	South African Institute for Computer Scientists and Information Technologists, 7-9 October 2013, East London, South Africa, 7pp, Oct 2013
Makilla I; Herselman M; Botha A; Van Greunen D	Access-technology agnostic conceptual model	Proceedings of M4D 2012, New Delhi, India, 28-29, Feb 2012
Reitmaier T; Bidwell NJ; Siya JS; Marsden G; Tucker WD	Communicating in designing an oral repository for rural African villages	IST-Africa 2012, Dar es Salaam, Tanzania, 9-11 May 2012, May 2012
Butgereit L; Botha RA	Automated topic spotting provides added efficiency in a chat based tutoring environment	IST-Africa 2012, Dar es Salaam, Tanzania, 9-11 May 2012, Pages: 11pp, May 2012
Bidwell NJ; Winschiers-Theophilus H	Audio pacemaker: walking, talking indigenous knowledge	Annual Research Conference of the South African Institute of Computer Scientists and Information Technologist, Centurion, South Africa, 1-3 October 2012, Pages: 149-158, Oct 2012
Mentz J; Kotzé P; Van der Merwe A	A comparison of practitioner and researcher definitions of enterprise architecture using an interpretation method	Advances in Enterprise Information Systems II: Proceedings of the 5th International Conference on Research and Practical Issues of Enterprise Information Systems, Aalborg, Denmark, 15-18 October 2011, Pages: 11-26, Oct 2012
Kotzé P; Tsogang M; Van der Merwe A	A framework for creating pattern languages for enterprise architecture	Trends in Enterprise Architecture Research & Practice-Driven Research on Enterprise Transformation, Barcelona, Spain, 23-24 October 2012, 20pp, Oct 2012
Van Greunen D; Veldsman A; Ngassam E; Kandie W	The socio-economic landscape of a rural community: a view of Rietfontein	IST-Africa 2011 Conference, Gaborone, Botswana, 11-13, May 2011
Smit D; Herselman M; Eloff JHP; Ngassam E; Venter E; Ntawanga F; Chuang C-H; Van Greunen D	Formalising Living Labs to achieve organisational objectives in emerging economies	IST-Africa 2011 Conference, Gaborone, Botswana, 11-13 May 2011, May 2011

Authors	Title of publication	Publication
Jacobs D; Kotzé P; Van der Merwe A; Gerber A	Enterprise architecture for small and medium enterprise growth	1st Enterprise Engineering Working Conference, Antwerp, Belgium, 16-17 May 2011, Vol. 79(3), Pages: 61-75, May 2011
Butgereit L; Botha RA	Stop words for "Dr Math"	IST-Africa 2011 Conference, Gaborone, Botswana, 11-13 May 2011, 9pp, May 2011
Chelule E; Van Greunen D; Herselman M; Veldsman A	Mobi-incubation user experience for rural entrepreneurs in emerging economies	IST-Africa 2011 Conference, Gaborone, Botswana, 11-13 May 2011, May 2011
Grobler M; Flowerday S; Von Solms R; Venter H	Cyber awareness initiatives in South Africa: A national perspective	Proceedings of the First IFIP TC9/TC11 Southern African Cyber Security Awareness Workshop 2011. 12 May 2011, Gaborone, Botswana, 10pp, May 2011
Adam R; Kotzé P; Van der Merwe A	Acceptance of enterprise resource planning systems by small manufacturing enterprises	13th International Conference on Enterprise Information Systems (ICEIS 2011), Beijing, China, 8-11 June 2011, Pages: 229-238, Jun 2011
Ruxwana N; Herselman M; Pottas D	The Generic Quality Assurance Model (GQAM) for successful e-health acquisition in rural hospitals	IADIS International Conference e-Health. 20-22 July 2011, Rome, Italy, Pages: 113-120, Jul 2011
Bidwell NJ; Lalmas M; Marsden G; Dlutu B; Ntlangano S; Manjingolo A; Tucker WD; Jones M; Robinson S; Vartiainen E	Please call ME.N.U4EVER: Designing for 'callback' in rural Africa	10th International Workshop on Internationalisation of Products and Systems (IWIPS 2011), Kutching, Malaysia, 11-14 July 2011, 21pp, Jul 2011
Botha A; Herselman M	From digital divide to digital difference: a mobile Living Lab approach to communities in developing contexts	Annual Conference on WWW Applications (ZAWWW 2011, Johannesburg, South Africa, 14-16, September 2011, Sep 2011
Rodill K; Winschiers-Theophilus H; Bidwell NJ; Eskildsen S; Rehm M; Koch Kapuire G	A new visualization approach to re-contextualize indigenous knowledge in rural Africa	13th IFIP TC 13 International Conference: Human-Computer Interaction (INTERACT 2011), Lisbon, Portugal, 5-9 September 2011, Pages: 297-314, Sep 2011

Authors	Title of publication	Publication
De Vries M; Van der Merwe A; Kotzé P; Gerber A	Using the interaction model to identify replication potential between business units	International Conference on Industrial Engineering, Systems Engineering and Engineering Management for Sustainable Global Development, Stellenbosch, South Africa, 21-23 September 2011, 14pp, Sep 2011
Butgereit LL; Botha RA	Using N-grams to identify mathematical topics in MXit lingo	Annual Conference of the South African Institute of Computer Scientists and Information Technologists (SAICSIT 2011), Cape Town, South Africa, 3-5 October 2011, Pages: 40-48, Oct 2011
Smith A; Reitsma L; Van den Hoven E; Kotzé P; Coetzee L	Towards preserving indigenous oral stories using tangible objects	2nd International Conference on Culture and Computing, Kyoto, Japan, 20-22 October 2011, 6pp, Oct 2011
Funchall D; Herselman M; Van Greunen D	People innovation capability maturity model for measuring SMMEs in South Africa	Prato CIRN Community Informatics Conference, Prato, Italy, 9-11 November 2011, Pages: 14pp, Nov 2011
Ouma S; Herselman M; Van Greunen D	Factors that influence m-health implementations in resource constrained areas in the developing world	Prato CIRN Community Informatics Conference, Prato, Italy, 9-11 November 2011, 9pp, Nov 2011
Coleman A; Herselman ME; Potass D	E-health readiness assessment for e-health framework for Africa: a case study of hospitals in South Africa	4th ICST International Conference on eHealth, Malaga, Spain, 21-23 November 2011, Pages: 162-169, Nov 2011
Chapter in a book		
John MJ; Thomas S	Natural polymers: an overview	Natural Polymers, Volume 1: Composites, Pages: 1-7, Aug 2012
Carroll M; Kotzé P; Van der Merwe A	Securing virtual and cloud environments	Cloud Computing and Services Science, Pages: 73-90, March 2012

CSIR researchers lecturing/supervising students

Name of researcher	Research area as defined in MoU	Type of collaboration	2011	2012	2013
Dr Alta van der Merwe	Information technology	Supervision	•	•	
Prof Marlien Herselman	Information technology	Supervision	•	•	•
Prof Paula Kotzé	Information technology	Supervision	•	•	•
Lara van Niekerk	Natural resource management	Supervision	•	•	•
Prof Rajesh Anandjiwala	Textile research	Supervision	•	•	
Dr Brian van Wilgen	Natural resource management	Supervision	•	•	
Dr Martin Mgangira	Civil engineering	Supervision, lecturing			•
Dr Sonali Das	Statistics	Supervision			•
Dr Anton Botha	Physics and textile science	Supervision	•	•	•
Lonji Kalombo	Biotechnology	Supervision			
Dr Laurie Butgereit	Information technology	Research associate			•

Students supported by the CSIR/NMMU scholarship programme

Name	Area of study	NMMU supervisor	2011	2012	2013
Cyrus Tshifularo	PhD (Textile Engineering)	Prof Lawrence Hunter		•	•

CSIR Staff studying at NMMU

Name	Degree programme	Name of CSIR supervisor	Name of NMMU supervisor	2011	2012	2013
Nobuntu Tshem	LLM	None	Willie Kruger		•	•
Luyolo Geza	MA (Human Resource Management)	None	None		•	
Laurie Butgereit	PhD (Information Technology)	Prof Marlien Herselman	Prof Reinhardt Botha		•	
Ishmael Makitla**	MTech (Information Technology)	Prof Marlien Herselman	Prof Reinhardt Botha	•	•	
Kevin Draai	MTech (Information Technology)	None	Bertram Haskins, Prof Reinhardt Botha			•
Funmi Adebesein	PhD (Information Technology)	Prof Paula Kotzé	Prof Darelle van Greunen		•	•
Roderick Mooi	MTech (Information Technology)	None	Prof Reinhardt Botha		•	•
Lara van Niekerk	PhD (Natural Science)	None	Prof Janine Adams		•	•
Valencia Jacobs*	PhD (Textile Science)	Prof Rajesh Anandjiwala	Prof Rajesh Anandjiwala	•		
Adele Botha*	PhD (Information Technology)	Prof Marlien Herselman	Prof Darelle van Greunen	•		
Basanda Pongoma*	MTech (Chemistry)	None	Dr Ernst Ferg	•		
Graham von Maltitz	PhD (Botany)	None	Prof Christo Fabricius		•	•
Doice Moyo***	PhD (Textile Science)	Prof Rajesh Anandjiwala	Prof Lawrance Hunter	•	•	
Mlando Mvubu	PhD (Textile Science)	Prof Rajesh Anandjiwala	Dr Asis Patnaik		•	•

Name	Degree programme	Name of CSIR supervisor	Name of NMMU supervisor	2011	2012	2013
Nobuhle Biyana	MSc (Textile Science)	Dr Valencia Jacobs, Dr Maya John	Dr Valencia Jacobs		•	•
Osei Ofosu	PhD (Textile Science)	Prof Rajesh Anandjiwala	Dr Maya John		•	•
Sunshine Blouw**	PhD (Textile Science)	Prof Rajesh Anandjiwala	Prof Lawrance Hunter	•	•	

Year of graduation: *2011; **2012; ***2013

CSIR staff holding extraordinary professorships

Name of researcher	Area of expertise	2011	2012	2013
Dr Alta van der Merwe	Information and communication technology	•		
Prof Paula Kotzé		•	•	•
Dr Nicola Bidwell		•	•	•
Prof Marlien Herselman		•	•	•
Prof Lawrance Hunter	Textile science	•	•	•
Prof Rajesh Anandjiwala		•	•	•
Dr Valencia Jacobs				•
Dr Sondli Das	Statistics	•	•	•

NMMU Staff serving on CSIR advisory panel

Name of Staff	Area of Research Expertise	2011	2012	2013
Prof Danie Hattingh	Mechanical engineering	•	•	•
Prof Andrew Leitch	Physics	•	•	•

Acknowledgements

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NMMU:

Prof Lawrence Hunter, Dr Sharlene Govender, Lisha Gerber, Prof Dannie Hattingh, Dr Blanche Pretorius, Karien Bezuidenhout, Dimitri Veldkomet, Prof Darelle van Greunen, Alida Veldsman, Dr Rosemary Foster and Prof Reinhard Botha.

Supervisors

Prof Ernst Ferg, Lara van Niekerk, Prof Janine Adams, Prof Reinhardt Botha, Prof Marlien Herselman, Prof Rajesh Anandjiwala and Dr Asis Patnaik.

Other information

Tsholofelo Ramatlhodi, Ntombifuthi Shezi, Strategic research managers (CSIR).

Editors and reviewers

Dr Thabo Ditsele, Kagiso Keatimilwe (CSIR).
Estelle Walmsley (External).

List of Abbreviations

ACCESS	- Applied Centre for Climate & Earth Systems Science
CSIR	- Council for Scientific and Industrial Research
CHPC	- Centre for High Performance Computing
DST	- Department of Science and Technology
DIRISA	- Data Intensive Research Infrastructure of South Africa
eHealth	- Electronic Health
FSP	- Friction Stir Processes
FSW	- Friction Stir Welding
FTIR	- Fourier Transform Infrared Spectroscopy
HCD	- Human Capital Development
HNSF	- Health Normative Standards Framework
ICT	- Information and Communication Technology
MoU	- Memorandum of Understanding
NDoH	- National Department of Health
NSF	- Normative Standards Framework
NMMU	- Nelson Mandela Metropolitan University
NHC/MIS	- National Health Care Management Information System
SANReN	- South African National Research Network
SET	- Science Engineering and Technology
THRIP	- Technology and Human Resources for Industry Programme

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