

Programme 5: Socio-Economic Partnerships
Sub-programme: Science and Technology for Economic Impact
Unit: MANUFACTURING, LOCAL INNOVATION

Description:

The Unit comprises two sub-units that coordinate the strategy and policy work of the Department in the areas of Advanced Manufacturing and Local Innovation.

Purpose of the Unit:

To support and develop technology initiatives in the advanced manufacturing sector. To develop policies and a support framework for regional innovation systems.

List of Key Initiatives:

Advanced Manufacturing Technology Strategy

 Bio-composites

 Micro-sensors

 Light weight materials

 Advance Production technologies

 Micro-manufacturing

 HCD-Prime & Leap programmes

 FabLabs

Regional Innovation Systems

 Regional Innovation Forums

Science Parks

 National Science Park Strategy

Contact Person/s:

Greg Mitchell, Johan Strauss

Contact details:

(021) 469 5400

Greg.Mitchell@dst.gov.za

Johann.Strauss@dst.gov.za

KEY INITIATIVE TITLE: **Advanced Manufacturing Technology Strategy**

WHAT IS IT ABOUT: Enhancing the use of innovation for a competitive manufacturing industry

WHAT IS IT TRYING TO ACHIEVE: A sustainable and competitive advanced manufacturing sector.

WHO IS THE IMPLEMENTING AGENCY/IES? AMTS Implementation Unit

WHO'S RESPONSIBLE IN DST: Greg Mitchell

READ FURTHER:

The [*Advanced Manufacturing Technology Strategy*](#) (AMTS), established in 2003 by the Department of Science and Technology (DST), is aimed at developing competencies in key technologies to strengthen the technological base of the South African manufacturing sector. The intention is to leverage South Africa's role to be more than just a manufacture and assembly location by the development of technology platforms that increase current, and create new, competitive advantages. Emphasis is also placed on the growth of relevant scarce skills and balancing technical knowledge acquired through targeted research projects at public research institutions, higher education institutions and companies.

To date three *Flagship Programmes* have been established in the following categories (with focus areas in brackets):

- Advanced Light Materials (metals, fibre-reinforced composites),
- Advanced Production Technologies (efficient manufacturing processes), and
- Advanced Electronics (sensors).

R&D projects in these Flagship programmes commenced in 2006. Building and continuation of partnerships between project participants and the broader industry network are of the utmost importance in ensuring the development and uptake of South African developed technologies. The research and development projects are applicable to any technology-based industry and have been particularly applied in the automotive and aerospace industries, where South Africa has the potential to add immense value to local industries. Through the emphasis on pre-competitive research, the AMTS is firmly committed to stimulating technological development, increasing the manufacturing capability of smaller enterprises and establishing common ground for these organisations to compete at an international level, thereby stimulating the local economy.

Initiatives for accelerated *Human Capital Development* have also been established. The Programme for Industrial Manufacturing Excellence (PRIME) designed to enhance the competitiveness of industry by optimizing manufacturing processes, introducing new manufacturing technologies and cutting the costs of operation in manufacturing firms, whilst building critical knowledge and capacity in South African industry and linking human capacity development with technology needs. Interns are recruited to work on these projects at selected companies and mentored throughout the one year placement. The Leading Expert Access Programme (LEAP) funds working visits for limited

periods or workshops by world experts in areas relevant to the AMTS programme with the aim to disseminate their knowledge to the wider South African industry..

Technology Transfer Vehicles established under the AMTS include the Advanced Manufacturing Laboratories (AMTLs) and Fabrication Laboratories (FabLabs). The AMTLs are world-class laboratories that provide facilities for the design, development and proto-typing of new products and the development and transfer of relevant skills to support industry. Key characteristics are of the AMTLs are:

- Shared access to key capital equipment or software;
- Skills development for specific platforms;
- Continuous learning opportunities through appropriate short courses;
- Access to local R&D capacity through students at the hosting organisation;
- Development of long-term partnerships between industry and academia

Three AMTLs are currently operational

- Nelson Mandela Metropolitan University – where the focus is on robotics, mechatronics and cost orientated automation, primarily applicable to the automotive industry;
- Cape Peninsula University of Technology – where the focus is on adaptronics, including smart/intelligent materials and devices and Micro-Electro-Mechanical Systems (MEMS) for the electronics and UAV communities; and
- Aerosud – where the focus is on aviation, including smart materials and direct manufacture for the aviation industry.

Bio-Composites

The main reason for the growing demand for biodegradable materials as opposed to their synthetic counterparts is the increased awareness for environmental protection, reflected in protocols and legislations on protection of resources, reduction of CO₂ emissions and recycling. Bio-composites offer a new way of disposing of industrial waste: biological decomposition. At the same time, bio-composites offer similar weight saving and structural integrity compared to their synthetic counterparts, at lower cost.

Automotive and aircraft manufacturers have already embraced natural fibre-reinforced bio-composites in components such as door panels, package trays and bins, cover panels, etc. Initiatives such as the European “Clean Sky” Joint Technology Initiative and the European ‘Vision 2020’ are components of a roadmap towards prescriptions on biodegradable content.

The Bio-Composites focus of DST’s Advanced Manufacturing Technology Strategy aims to develop a range of competencies across the value chain of bio-composites manufacture, linked to economic opportunities within the automotive, aerospace, and packaging industries, amongst others. The initiative aims to address plant fibre recovery technology, new bio-composite materials development and characterization, and the manufacture of bio-composites based products.

Thus far, two major projects have been launched in this area. The first one, called [NATFIBIO](#), is a joint project between Airbus and a South African consortium for the development of an ‘aerospace

compliant' biodegradable panel for use in non load-bearing aircraft internal parts. The second one, called **GREENPAC**, is a collaborative project between a consortium of four South African R&D organisations, aimed at developing bio-degradable packaging for the Fresh Fruit Export sector, including both external cartons and internal film packaging.

NATFIBIO

The objective of this project is to develop a new generation of composites based on natural fibre-reinforced thermoplastic materials for secondary (non load-bearing) structures in aircraft cabin and cargo areas. The project will focus on the delivery of a sample composite panel in accordance with Airbus specifications.

This project will contribute to the development of sustainable and competitive industrial infrastructure in the proposed technology within South Africa.

GREENPAC

A major component of the export value chain of the South African Fresh Fruit Industry is comprised of packaging in the form of plastic/cardboard cartons and internal plastic film. Owing to the environmentally unsustainable use of petroleum-based plastic packaging, the industry is under threat of losing market share in the wake of impending EU and UK policy and legislation on environmental protection (such as already seen in the automotive and aerospace industries). This is of particular concern to the South African Fresh Fruit Industry - South Africa packs a total of 2 926 Million kg of fruit for the export market alone (2007 data), which translates to around R2.5 Billion of packaging cartons.

This initiative aims to address this challenge, through a collaborative network of complimentary technology platforms involving four R&D partners – CSIR (Centre for Fibres, Textiles and Clothing in Port Elizabeth), Experico (the R&D arm of Capespan), the Institute for Advanced Tooling (Western Cape), and Cape Peninsula University of Technology. The technology involves the use of a natural fibre-reinforced polylactic acid based composite material for (a) the manufacture of injection moulded “bio-plastic” cartons and (b) the manufacture of extruded film for internal packaging. The initiative will also allow state-of-the-art engineering analysis for airflow and structural performance optimisation of the products.

To achieve additional benefits for environmental protection, the unique characteristics of biodegradable plastics will be evaluated for possible application as affordable modified atmosphere packaging for fruit. This will contribute to improving overall fruit quality maintenance and control of decay, which typically develops during transit. In turn, this should enable replacement of certain post-harvest fungicides, which can be harmful from a health and safety point of view.

The ultimate aim of GREENPAC is to develop packaging solutions, which over time, will enable the transition from plastics made from petroleum-based resources, to those made from renewable resources, thereby reducing the carbon footprint and long-term landfill residues.

Micro-sensors Technology and MEMS

Night vision cameras and systems that can detect infrared radiation have, until recently, been highly sophisticated, expensive and difficult to move around since their infrared sensors required constant cooling. Furthermore this technology has almost exclusively been restricted for military use. However, this has all changed since the development of uncooled infrared micro-sensors, known as microbolometers. These micro-sensors are based on micro-electro-mechanical (MEMS) device technology.

Infrared cameras have now become much more affordable and products for security companies, health (temperature sensing at border control points) and medical (disease diagnostics) applications and fire fighters can readily be developed. Even certain high end motor vehicles have night vision displays fitted to them. The ability to see at night without illumination is a huge step forward for society and its benefits have not yet fully been grasped. This technology is likely to also find its way into the cellular phone industry soon. As this technology is becoming commercialized, more uses will emerge. Even artists are nowadays using infrared photography.

Locally, there is already a large market and the demand is growing fast with the global market for microbolometers growing at 20% pa.

The main objective of this initiative is to establish a MEMS industry in South Africa. The initial manufacturing capability will be established through licensed technology so that the project is able to deliver a saleable product within two years. It is intended, though, to develop a locally designed and manufactured microbolometer. The project will benefit from the AMTS research Flagship programme in Advanced Electronics.

The national benefit for this technology will be new capital investment, a competitive South African MEMS Industry with strategic benefits and export potential. A viable MEMS capability will open up exciting new application possibilities, including medical diagnostic kits for a number of common diseases.

The micro-sensor project currently consists of the following members: SAMES, UP, DETEK, OPTOCON, CPUT and SST.

Micro Manufacturing

In response to future demand for ever smaller parts and systems at a reasonable cost and with superior performance, a number of universities and the CSIR developed a coordinated approach to micro-manufacturing activities. The study was managed under the auspices of the AMTS within the Advanced Production Technologies Flagship Programme and resulted in an industry micro-manufacturing strategy document.

Micro-manufacturing is an important new technology because:

- It is an *enabling* technology for the widespread exploitation of nanoscience and nanotechnology developments – bridging the gap between the nano- and macro worlds;

- It is a *disruptive* technology that will completely change our thinking as to how, when, and where products will be manufactured – e.g., on site, on demand in the hospital operating room or on board a warship;
- It is a *transforming* technology that will redistribute manufacturing capability from the hands of a few to the hands of many – micro manufacturing becomes a cottage industry; and
- It is a *strategic* technology that will enhance competitive advantage – reduced capital investment, reduced space and energy costs, increased portability and increased productivity.

Two micro-manufacturing projects are being funded within the Advanced Production Technologies Flagship programme:- (1) *Micro-Fluidics*- This project focussed on the science of designing, manufacturing and formulating devices which deal with volumes of fluid in the order of nanolitres or picolitres. The devices themselves have dimensions ranging from millimetres to micrometres. These components can then be merged to form sub-systems, with applications such as mixing drug components, essential oil processing or the development of specialised materials. (2) *Micro-Systems* - This project focuses on the development of a micro fuel cell as a technology demonstrator to build skills and capacity in the micro-systems domain. The micro fuel cell could be used for portable electronic devices such as cell phones, notebooks, etc.

The aims of these projects are the

- Establishment of the first Micro-Manufacturing Laboratory in South Africa.
- Development of skills and capacity in micro-fluidics and micro-systems.
- Development of the capability to manufacture critical components such as micro-valves, micro-pumps, micro-channels, micromixers and separators.

A second round of funding for R&D projects in micro-manufacturing is currently under consideration.

Fabrication Laboratories (FabLabs)

FabLabs are hands-on laboratories with advanced desktop equipment that enables users to locally conceptualise, design, develop, fabricate and test a wide range of products. The engineering capability for design and fabrication at micron length and microsecond time scales opens up numerous possibilities for innovative solutions to common problems.

The average FabLab includes a laser cutter that makes 2D and 3D structures, a sign cutter that plots in copper to make antennas and circuits, a high-resolution milling machine that makes circuit boards and precision parts, and a suite of electronic components and programming tools for low-cost, high-speed micro-controllers.

The AMTS has, to date, established six FabLabs in the North West, Western Cape, Free State, Northern Cape and two in Gauteng respectively. The North West and Northern Cape FabLabs were launched in 2007. These are located to encourage learners and disadvantaged communities to participate in and have access to advanced manufacturing environments.

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The DST funded FabLab internship programme has enabled the facilities to provide trainee electrical, mechanical and IT graduates to gain the necessary experience, while bridging the technical gaps to optimise ordinary user's experience. This has increased the capacity of FabLabs to make a meaningful impact.

KEY INITIATIVE TITLE: Regional Innovation Systems

WHAT IS IT ABOUT: To create awareness and enhance the use of innovation within a regional context

WHAT IS IT TRYING TO ACHIEVE: To guide the components within the triple helix (business, institutions, government) partnership at a local level to develop their Regional Innovation Systems

WHO IS THE IMPLEMENTING AGENCY/IES? None

WHO'S RESPONSIBLE IN DST: Johann Strauss

READ FURTHER:

RIS Strategic Framework

Global economic growth will increasingly depend on innovation and specifically within a regional context. A regional innovation system (RIS) refers to how businesses, institutions and government (Triple Helix) jointly and individually play a part in promoting the innovation process within a region. Innovation can be defined as the introduction of new products, processes or services to a market. Regional innovation networks include businesses, research and technology organisations, innovation support agencies, venture capitalists and local/provincial/national government.

Linkages between these various bodies are essential for turning knowledge into competitive economic advantage. This all demands active and continuous efforts by enterprises along with supportive government policies that create the right conditions for businesses to innovate within a specific region. The uniqueness of successful regional innovation systems can diverge, but thriving systems normally display general characteristics of intense co-operation among firms, superior available labour force, flexible work structures, concentrated infrastructures of supporting institutions and organisations, a culture of innovation and a regional government that actively promotes and facilitates the RIS initiative. By their very nature, the South African provincial and local governments have a direct and immediate impact on the regions and communities they serve. The way in which these government organisations innovate and change determines the impact on local economic and community development.

The broad aim of the DST RIS Strategic Framework is to guide the actors within the triple helix partnership at a local level to further enhance and develop their Regional Innovation Systems.

Provincial Innovation Forums and Contacts

Provincial Innovation Forums are viewed as strategic partners to DST and other National Government Departments within the RIS Framework. These Forums are aimed at:

- RIS strategic planning
- Promoting networking amongst RIS stakeholders within the Province

- Coordination of innovation programmes and initiatives
- Creating awareness on innovation in the Province
- Act as gateway to innovation programmes and initiatives

The Innovation Forums are in a process of being constituted and launched in the following provinces:

- Northern Cape - Initiated by DST in partnership with the Department of Education in the Northern Cape and the National Institute for Higher Education (NIHE)
- Eastern Cape - Initiated by DST in partnership with the Department of Economic Development & Environmental Affairs and the Nelson Mandela Metropolitan University
- Western Cape - Initiated by DST in partnership with the Department of Economic Development & Tourism and the University of the Western Cape

If you would like to be part of your province's Innovation, Forum please email your details to the Unit for Manufacturing and Local Innovation. These Forums will be rolled out to other provinces within the next financial year of 2010/11.

Regional Information

Provincial Innovation Studies

- Limpopo Integrated Innovation Strategy (To be published)
- Northern Cape Regional Development Platform Method (RDPM) data
- Free State RIS study initiative (To be published)
- Eastern Cape RIS study initiative (To be published)

KEY INITIATIVE TITLE: Science Parks

WHAT IS IT ABOUT: Developing a strategy and framework for Science Parks in South Africa

WHAT IS IT TRYING TO ACHIEVE: Create awareness and a supportive environment for Science Parks.

WHO IS THE IMPLEMENTING AGENCY/IES? None

WHO'S RESPONSIBLE IN DST: Johann Strauss

READ FURTHER:

National Science Park Forum

As a result of the important role played by science parks and also the interest shown by the various RIS stakeholders, DST initiated the South African Science Park Initiative (SASPI), an initiative aimed at the establishment of a functioning Science Park (SP) Forum and the formulation of a strategy or support framework for Science Park development in South Africa. The Forum was launched on 25 June 2008. It is aimed at encouraging knowledge sharing and coordinating activities on SP developments across the country. A Steering Committee was selected to play an oversight role in the activities of the Forum. This forum has been very instrumental in the development of a strategic plan to support SP initiatives in the country.

National Science Park Development Plan

The National SP Plan was developed in a series of workshops in consultation with all relevant stakeholders. It aims to guide the Department in supporting SP developments in the country. The main objectives of this plan are to:

- Create awareness of the role and value of science parks in economic and social development
- Create a supportive environment for science park development in the country
- Develop capacity for science park management

Regional Science Park Initiatives

- Gauteng: [The Innovation Hub](#)
- North West Science Park in Potchefstroom
- Eastern Cape: a new initiative in partnership with the East London Industrial Development Zone and the Walter Sisulu University
- Western Cape: a new initiative driven by the Cape Higher Education Consortium