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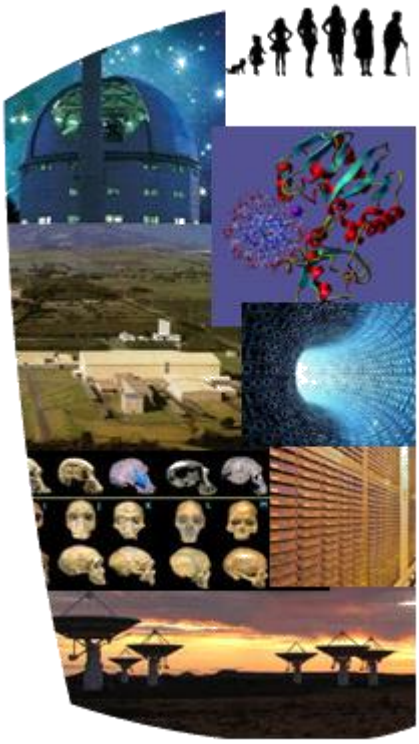
MoRI newsletter

MANAGEMENT OF RESEARCH INFRASTRUCTURE

Research Infrastructure is increasingly seen as the backbone of a national system of innovation. We need a new understanding of what it is and how it differs from our own laboratories.



We need to think differently

Research equipment, physical infrastructure, research infrastructure, innovation infrastructure, knowledge infrastructure, cyber-infrastructure, e-infrastructure…? These are all terms being used today by various policy making and funding agencies and science administrators. But do we know exactly what we are talking about? Definitions for the different types of infrastructure are evolving in South Africa and the rest of the world. The European Strategy Forum on Research Infrastructures (ESFRI) has taken a lead in this thinking. South Africa is currently developing a Research Infrastructure Roadmap which requires a new paradigm of thinking which includes facilities, resources and services used by the scientific community across all disciplines for conducting cutting edge research for the generation, exchange and preservation of knowledge. It includes major facilities, equipment or sets of instruments, collaborative networks and knowledge-containing resources such as collections, archives and data- and biobanks. Research Infrastructure may be "single-sited", "distributed", or "virtual" (the service being provided electronically).

MoRI

MoRI is an independent platform creating a framework for understanding, planning, designing, managing and offering services related to the ***Management*** of Research Infrastructure (RI). It assists you, the RI owner, researcher, policy maker, administrator, funder and beneficiary to execute your tasks better, be more competitive or collaborative, provide better access to your RI, market and brand it better and to increase your impact on your client or user base.

The need for RI thinking at South African universities

Lucas Venter

Universities world-wide are increasingly experiencing a strong transformation drive. On the one hand, the resources available to universities are being limited by the world-wide recession. On the other hand, there is increasing pressure from society on universities to increase and diversify their outputs. This is especially so in the case of research outputs. The reasons for this pressure are diverse and well-known. A further factor putting pressure on universities is the trend towards managerialism, whereas in the past universities were governed in the spirit of academic debate leading to agreement or consensus. All of these factors are compounded in South African universities by the very special interpretation given to the concept of "Transformation".

Given these realities, universities are looking at ways of minimising inputs while at the same time maximising their outputs. In the research environment, a research infrastructure policy (RI policy) can contribute significantly towards achieving this goal. This implies in the first place a planned approach towards the procurement, maintenance and utilisation of research equipment.

A RI policy will imply that the following factors will be considered in the planning process for the establishment of new infrastructure:

- Alignment of the RI: Is it aligned with the university research policy, with national imperatives, international trends in research, etc.
- Levels of application: Is the equipment of a very general nature, to be used within a basic training facility, specialised or dedicated multi-user equipment used in an interdisciplinary way that is fundamental to do research or train advanced students, or is it advanced equipment used by specialists to push the boundaries of scientific discovery?
- Utilisation patterns: Will the RI be used by a single person or specialised group, by a specific Department or Faculty, or can it be used across the boundaries of faculties or even universities/countries/continents?
- The physical placement of the equipment, with a healthy relationship with similar or related equipment, and in an environment where the utilisation and outputs are properly managed.
- Full life-cycle planning of the RI.
- Budgeting for sustainability and growth of the RI.

Most universities in South Africa have some policy on the funding and procurement of expensive equipment. However, these policies will very rarely consider all of the aspects mentioned above. Researchers are in general not used to think in terms of managing the various aspects of their research equipment. They will not share the utilisation of their equipment with other researchers in another faculty of their own university, but will gladly collaborate with colleagues from a different continent. Worse, the funding cycles of sponsors (1-3 year guaranteed funds) makes full life-cycle planning extremely difficult. Hence, in order to move towards a RI policy, the change-management of the mind-set at all levels of the university system will need to be given priority.

However, the news is not all bad. As mentioned above, many researchers are quite used to sharing equipment. In South Africa, there are a number of inter- and multi-disciplinary so-called national facilities, e.g. the HPC (High Performance Computing) facility. The CTA (Cherenkov Telescope Array) - if the bid is awarded to Namibia - and SKA (Square Kilometer Array) will be shared by the international community. Hence, the idea of sharing of equipment is not new or foreign to the research community. Another example is suggested by the THRIP funding program of the dti/NRF. Participants in this program are quite used to sharing infrastructure and staff between universities and industry partners.

It is clear that South African universities need to optimise their efforts in the research sector. A change of mind-set towards the RI paradigm will obviously help towards achieving this goal.

Research vs Innovation

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Research is when you put *money* in to get *knowledge* out

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Innovation is when you put *knowledge* in to get *money* out

Tapani Saarinen

A South African Research Infrastructure Roadmap

The Department of Science and Technology in conjunction with the European Commission have embarked on a process to develop a Research Infrastructure Roadmap for South Africa, learning from what Europe has learnt over the past 7 years since the production and acceptance of their first roadmap. To achieve this, the Minister of Science and Technology has requested a four member expert team comprising European and local experts to advise the ministry on the development of a long term research infrastructure roadmap. A workshop was held in Cape Town in June 2013 to solicit inputs from a broad representative base of researchers.

Prof Lucas Venter is Institutional Director: Research Support at the North West University in Potchefstroom

Nanomedicine in malaria treatment

Paula Melariri

Malaria is a leading cause of sickness and death in the developing world. Approximately half the world's population is at risk of being infected by the disease. The most vulnerable are young children, pregnant women and non-immunised travellers. In sub-Saharan Africa where more than 90% of morbidity and death occurs, a child dies of malaria every 12 seconds. Currently no effective malaria combating vaccine is available. Current treatments have several limitations that include short half life (half life is the time for the drug to lose half its strength), poor bioavailability (bioavailability is the fraction of an administered dose of drug that reaches the systemic circulation) and toxicity (poor clearance of drug above therapeutic level from the blood stream). These pose a huge challenge to malaria treatment and containment.

Nanomedicine, the application of nanotechnology in medical treatment, has made a significant impact in therapies for diseases treating cancer. Doxil, a nanomedicine formulation of the anthracycline drug doxorubicin, is used to treat cancer in AIDS-related Kaposi sarcoma and multiplemyeloma. Doxil has improved efficacy and lowered cardiotoxicity. However, the use of nanotechnology is not only limited to the treatment of cancer and other illnesses.

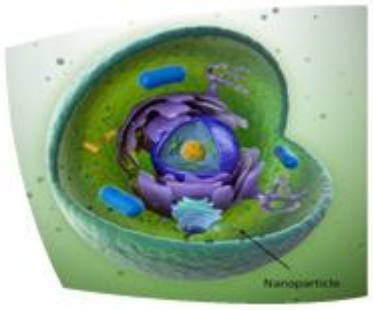
Nanomedicine has shown promising potential in addressing challenges to malaria treatment. The Centre of Excellence (CoE) in Nanomedicine Research at the Council for Scientific and Industrial research (CSIR), is exploring the application of nanomedicine based drug delivery systems (NMDDS) in the treatment of poverty related diseases (PRD) using malaria as a case study. Nanotechnology can be effectively expedited to revolutionise current therapies for poverty related diseases such as malaria but lacks the necessary velocity.

In a recent study, antimalarial drugs were reformulated in NMDDS by applying novel technology in nanomedicine. Free and reformulated drugs in NMDDS evaluated in mice recorded significant enhancement in the bioavailability and elimination half life of the drugs formulated in NMDDS, when compared to the free drug.

The results provide evidence that nanomedicine drug delivery systems have the potential to enhance drug bioavailability and pharmacokinetic properties of therapeutic agents. This enhancement could lead to a reduction in pharmaceutical dose and dose frequency of patients. Such reduction in the dose and duration of treatment reduces toxicity and enhances patient compliance, leading to a delay or prevention of any resistance. Furthermore, this technology has promising potential which could address the challenges or limitations of failed drugs and therapeutic actives. Lead compounds which have been abandoned by researchers and pharmaceutical companies could now possibly be restored to the market.

This article illustrates breakthrough research utilising South African Research Infrastructure

"In sub-Saharan Africa where more than 90% of morbidity and death occurs, a child dies of malaria every 12 seconds"



Dr Paula Melariri is from the Encapsulation and Drug Delivery Unit, Polymer and Composites, CSIR

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mysciencework.com

Centre for HRTEM at the NMMU

Jan Neethling

In 1983 a committee of prominent South African scientists investigated the need for an advanced electron microscope facility in South Africa and identified a serious shortage in scientists skilled in the interpretation of advanced electron microscopy results. It was concluded that unless this problem was rectified, technological and academic developments in South Africa would be significantly hampered. Almost three decades later, on 11 October 2011, the first Centre for High Resolution Transmission Electron Microscopy (HRTEM) was launched at Nelson Mandela Metropolitan University (NMMU).

The establishment of the Centre was primarily funded by the Department of Science of Technology (DST), through the National Research Foundation (NRF). The National Research and Development Strategy identified the need to create centres and networks of excellence in science and technology as a key component of human capital development and economic growth. Additional funding was obtained from the Department of Higher Education and Training (DHET), Sasol, the NMMU trust, THRIP and Dr Greg Olsen (GHO Ventures, USA). A panel of international experts assisted the NRF and the NMMU with the selection of the most suitable HRTEM for the Centre.

The new Centre for HRTEM building is located on the NMMU South Campus in Port Elizabeth. The building took two years to design (2008-2009) and was influenced by a number of international Electron Microscope Centre designs and site visits to Europe. Special consideration needed to be taken to ensure that the building would meet the required specifications to allow the HRTEM to work at maximum proficiency. This included taking into consideration mechanical and acoustic vibrations, air pressure pulses, magnetic fields, stable electrical supply, air flow, air temperature, humidity and stable cooling water. The tender and building process commenced in 2010 and the practical completion of the building was achieved in April 2011.

The Centre houses a JEOL HRTEM and three other supporting state-of-the-art electron microscopes, as well as the complete enabling infrastructure for sample preparation and data processing. The gem of the Centre is the JEOL JEM-ARM 200F double aberration corrected HRTEM. With a resolution of 0.08 nm, the JEOL ARM can image and chemically analyse materials down to the atomic scale - a feat previously unattainable in South Africa. The Centre for HRTEM has become a leading global facility in materials characterisation on the nano- and atomic scale. It collaborates with research institutions across the world and in South Africa.

The significance of the nano- and atomic scale electron microscopy research covers a wide range of key technologies – from identifying single iron atoms in graphene to obtaining information that could improve the safety of future nuclear reactors and extend the life of diamond drill bit inserts in oil drills. With the HRTEM it was possible to solve problems that have been mysteries to international researchers for many decades, e.g. the release mechanism of radioactive silver in pebble bed type reactors, the phase of a specific platinum-silver alloy and the thermal degradation mechanism of diamond drill bit inserts. Atomic resolution imaging has also provided important new information on nanoparticle catalysts, platelets in natural diamond, steel exposed to high temperature and stress conditions in coal fired power plants and radiation damage in oxide dispersion strengthened steel and silicon carbide.

JEOL JEM-ARM200F double Cs corrected HRTEM

The Centre has already generated an impressive number of publications in a wide range of journals such as Nature Communications, Nano Letters, Journal of Nuclear Materials, Minerals Engineering and Nuclear Engineering and Design.

Prof Jan Neethling is professor in Physics at the NMMU and Head of the Centre for HRTEM

The need for training, talking and showing

Anthon Botha

Research infrastructure is much more than facilities built to service researchers from owner institutions and requires a new paradigm in training and management of the custodians and users of such research infrastructure.

Training

Human capacity development for research infrastructure refers to those specialist skilled people that plan, develop, manage, use and evaluate research infrastructure. Perhaps the most important task is to identify and train research infrastructure managers and their management teams. Staffing the research infrastructure over its entire life cycle requires a variety of professional skills. This life cycle includes the initial conception and incubation, following the roadmap as a strategy; the conceptual and technical design phases; the construction phase; commissioning; operation; maintenance and expansion and eventually the decommissioning phase.

Research infrastructure management along the entire life cycle is complex and requires different skills sets. TechnoScene, through its MoRI initiative is in the process of developing such a training course. The course will enable participants to participate in the new debates about research infrastructure. It will, amongst others, address different styles of management for different types of research infrastructure over its life cycle, being able to draw up research infrastructure strategies and management plans, forming partnerships, understanding the funding mechanisms for research infrastructure and increase its productivity.

More information about the course is available on:
http://www.technoscene.co.za/mori/course.htm

Talking

Not enough conversation among research infrastructure owners and users is taking place on a local level. This often leads to ignorance about what is available in neighbouring research institutions and how to access such research infrastructure. Joint strategies for infrastructure expansion and use, the formation of partnerships and optimising expenditure on expensive research infrastructure are thus not developed among different host institutions. This reflects negatively on optimising the contributions of research infrastructure to the competitiveness of a national innovation system. TechnoScene, through its MoRI initiative is offering a service for organising and facilitating such workshops to enable participants to identify research infrastructure in the locality, address collaboration and competition, design local mini-roadmaps for the expansion of the research infrastructure, linking local research infrastructure with national, continental and global ones, prepare policy input to be considered at national level, decide on the correct branding and marketing of research infrastructure and to draw industry into the research infrastructure debate.

More information about the workshops is available on:
http://www.technoscene.co.za/mori/workshops.htm

Showing

The success of research infrastructure investment and utilisation lies in its outcomes. Just as important is an awareness of what is available and what can be done. Researchers attend a large variety of conferences where they present their work, based on results obtained utilising research infrastructure. However, very little is said about the management of research infrastructure at such events. A need has been recognised for a continental conference on the management of research infrastructure. Such an event should provide an opportunity to discuss best practice management techniques and styles, a platform for exhibiting what research infrastructure is available and briefing on and demonstration of new developments in research infrastructure by vendors.

TechnoScene, through its MoRI initiative has suggested creating a *forum for Research Infrastructure collaboration in Africa* (afRIcA). Guided by experience it has gained in being a partner in the European Union 7th Framework programme, PAERIP (Promoting African European Research Infrastructure Partnerships) and exposure to creating global research infrastructure platforms this conference will focus on the evolving world of research infrastructure and its management challenges, the role of research infrastructure in scientific breakthroughs, the formation of research infrastructure partnerships, research infrastructure and socio-economic development, exhibitions including poster sessions on research infrastructures and their offerings and vendors and suppliers to research infrastructures.

More information about the conference is available on:
http://www.technoscene.co.za/mori/conference.htm

Dr Anthon Botha is the Managing Director of TechnoScene (Pty) Ltd and initiator of MoRI