science & technology
Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

NRF National Research Foundation | RISA Research and Innovation Support and Advancement

SOUTH AFRICAN RESEARCH CHAIRS INITIATIVE

Directed and thematic research areas

for awarding of 62 new Research Chairs in 2011/12

1. Introduction

The White Paper on Science and Technology and the National Research and Development Strategy (NR&DS) put emphasis on the need for South Africa to transform its Science, Engineering and Technology (SET) workforce. Other policies and strategies of government, including the Human Resource Development Strategy (HRDS) and the Medium Term Strategic Framework (MTSF), note the shortage of high-level skills as a significant constraint in the development of the economy and society. In this regard, South Africa must produce a greater number of highly skilled individuals; particularly in the fields of SET to achieve the goal of "*an equitable, sustainable, and inclusive growth path that brings decent work and sustainable livelihoods, education, health, safe and secure communities, and rural development*".

The South African Research Chairs Initiative (SARChI) was established in 2006 by the Department of Science and Technology (DST) and is managed by the National Research Foundation (NRF). It is a strategic intervention of the South African government designed to attract and retain excellence in research and innovation at South African universities. In particular, the programme is aimed at increasing scientific research capacity through the development of human capital and stimulating the generation of new knowledge. It is also intended to support the realisation of South Africa's transformation into a knowledge economy, in which the generation of knowledge translates into socio-economic benefits.

SARChI is designed to significantly expand the scientific research base of South Africa in a way that supports implementation of national R & D Strategies.

2. SARChI Objectives

The main goal of the initiative is to strengthen and improve research and innovation capacity of universities for producing high quality postgraduate students, research and innovation outputs. Some of the objectives of SARChI are to:

- Expand the scientific research and innovation capacity of South Africa;
- Improve South Africa's international research and innovation competitiveness while responding to social and economic challenges of the country;
- Attract and retain excellent researchers and scientists;
- Increase the production of masters and doctoral graduates; and
- Create research career pathways for young and mid-career researchers, with a strong research, innovation and human capital development output trajectory.

3. Focus of the 2011/12 SARChI call for applications

The outlined distribution of Research Chairs is indicative and intended to support research areas of national priority as informed by the NR&DS, the Ten Year Innovation Plan and other government strategies. This indicative distribution takes into account the current spread of awarded Research Chairs while focusing on the need to grow strategic priority areas of the country. In ensuring an equitable spread of Research Chairs across priority research areas, the indicative distribution gives preference to areas that are currently under-supported by SARChI. Therefore, areas that already have a fair share of Chairs, though not excluded, will have less priority in this Call.

In an attempt to cater for both broad and specific priority areas, the call is directed and theme based. Eight (8) directed disciplines and six (6) thematic areas have been identified and are elaborated upon in Section 4.

4. Distribution of Research Chairs

This section elaborates on the directed and thematic areas identified for awarding the 62 new Research Chairs.

4.1. Directed research areas

Eight (8) directed research areas have been identified with the intention to support two (2) of the five (5) Grand Challenges identified in the Ten Year Innovation Plan. The two (2) Grand Challenges are: Global Change and Bio-economy (Farma to Pharma).

The **Global Change Grand Challenge** provides a framework for improving the scientific understanding of global change through research; building capabilities for the development and deployment of innovative technologies that support appropriate responses to the negative impacts of environmental changes, particularly climate change; and ensuring that decision-makers use improved scientific understanding and technology development to achieve sustainable development in South Africa and Africa. To guide research over the period of the Ten Year Innovation Plan (2008-2018), the Ten Year Global Change Research Plan was finalised in 2010, and a large-scale research programme on Global Change, Society and Sustainability is being finalised. Therefore, three (3) Chairs (4.1.1; 4.1.2; and 4.1.3) are earmarked for supporting Global change research.

4.1.1. Climate Change Policy

South Africa developed Long-Term Mitigation Scenarios (LTMS) to guide its policy response to climate change mitigation, which include its international negotiating positions. It is envisaged that research in this area will focus on the development of high-level analytical capacity that can support policy development and climate change multilateral negotiations.

4.1.2. Social Learning Systems

Social learning has been identified as an important element in effective natural resource management. Social learning occurs through social interactions and processes, where individual learning is complemented by behaviour change, where change extends beyond individuals and is situated within wider social units or communities of practice. Thus research in this area is expected to support a deeper understanding of social learning systems in the context of global change.

4.1.3. Innovation for Adaptation and Resilience

Over the next few decades, South Africa and the African continent will be required to respond to the impact of a changing climate and other environmental changes. Research in this area is intended to focus on developing capabilities that can support the development of innovations in

social systems and sectors of society that enable socio-ecological resilience to global change impacts.

The concept of a **bio-economy** is mainly about the transition and integration of the biotechnology industry into the mainstream economy; and its' potential to provide solutions to some of the world's intractable challenges for sustainable management of natural resources, sustainable production, improving public health, mitigating climate change and integrating and balancing social development. The Organisation for Economic Co-operation and Development (OECD) defined the bio-economy as an "*aggregate set of economic operations in a society that use latent value incumbent in biological products and processes to capture new growth and welfare benefits for citizens and nations"*. In South Africa, the focus of a bio-economy strategy would be on transforming the agriculture, healthcare and industrial sectors on the basis of directed interventions in research, development and innovation. The research areas defined below fall within the three broad sectors of the bio-economy (health, agriculture and industry) and are aimed at strengthening research excellence in specific disciplines.

4.1.4. Chronic Disease

Chronic diseases are diseases that persist for a long time, lasting three months or more and generally cannot be prevented by vaccines or cured by medication. Cardiovascular disease, diabetes, chronic respiratory disease, certain cancers and neuropsychiatric conditions (including schizophrenia, bipolar disorder and epilepsy) have steadily emerged as major threats to health in South Africa. Prevention, early detection and effective monitoring and management of chronic diseases can improve the quality of life and reduce the burden of disease and mortality rates in the country. Research in this area is therefore expected to focus on:

- the development of new technologies such as diagnostics for early detection;
- medical devices e.g. for applications in telemedicine;
- therapeutics for the treatment and management of chronic diseases; or
- the application of genomics, proteomics and metabolomics for the prevention of chronic diseases.

4.1.5. Health Research for Development

Health research for development is concerned with the impact of a healthy nation on development and poverty reduction, and conversely, with the impact of development policies of government on the achievement of health goals. "*A long and healthy life for all South Africans*" is

one of the key outcomes for the priorities of the Medium Term Strategic Framework, as good health is central to human happiness and well-being and contributes to economic activity.

This Research Chair shall focus on improving our understanding of the links, mechanisms, approaches and best practices; and the implementation of these elements to achieve health, equity and development - especially in low and middle income countries.

This Research Chair will be funded through a partnership between the Department of Science and Technology (DST) and the Council on Health Research for Development (COHRED) which is an international Non-Governmental Organisation (NGO) based in Geneva, Switzerland. It is envisaged that this Research Chair will be located in a School or Faculty of Health Sciences with links to a School of Public Health.

4.1.6. Drug Discovery Sciences

This Research Chair is intended to focus on small molecule drug discovery in order to strengthen research and innovation capabilities in the country.

4.1.7. Industrial Biotechnology

The focus of this Research Chair is intended to be on optimisation of microbial and other living cells (cell factories) for the production of biomaterials with potential industrial applications or other applications, for example, in healthcare and in agricultural processing.

4.1.8. Animal Biotechnology

Animal biotechnology refers to the application of scientific and technology principles to manipulate the bio-processing or production of materials by and from animals (including aquatic species) to provide improved or quality goods and services. This Research Chair is expected to focus on the application of biotechnology to improve productivity, consistency and quality; or to develop environmentally friendly agricultural practices. The Research Chair could also focus on developing transgenic animals for applications in agriculture, medicine or industry.

4.2. Thematic research areas

These 54 new Research Chairs are grouped into six (6) thematic research areas, of which 16 are specifically earmarked for the Social Science and Humanities research. The following are the six (6) thematic areas for awarding of the 54 new Research Chairs:

- Technology Missions (Information Communication Technologies, Biotechnology, Advanced Manufacturing, Advanced Metal Initiatives and Emerging Research Areas);
- Science Missions (Research in areas of geographic advantage);
- Priority Research Areas (Grand Challenges);
- Science and Technology for poverty alleviation, sustainable rural development and local/regional innovation;
- Innovation, Engineering and Applied Technology Development and Commercialisation; and
- Open category with a focus on Fundamental Disciplines, Scarce and Critical Knowledge Fields.

The indicative number of Chairs to be awarded to each research theme is reflected in Table 1 at the end of this document. Table 1 is intended to be a guide for the awarding of the Research Chairs to the different themes and as such, there will be some flexibility that will be informed by the quality of the applications received. While Table 1 specifically identifies three (3) thematic areas in which a total of 16 Chairs will be awarded in the social sciences, all thematic areas are open to applications from researchers in the social sciences.

4.2.1. Technology Missions

The NR&DS identifies a number of technology missions for significant targeted investment to achieve parity or dominance within key technology fields or industrial domains. These include the two technology platforms of the modern age, namely biotechnology and information technology. Other missions identified are technologies for advanced manufacturing and technologies to leverage resource based industries such as agriculture, fishing and forestry, mining and minerals and energy production. The NR&DS identifies the following technology missions and technology platforms:

- Information Communications Technology (ICT);
- Biotechnology;
- Manufacturing and Resource-based Industries;
- Advanced Manufacturing;
- New Emerging Research Areas such as Nanotechnology; Synthetic Biology; Aptamers and Robotics.

Research Chairs under this thematic area will therefore establish research programmes to implement government approved strategies such as the ICT Research and Development Strategy , NR&DS, National Biotechnology Strategy, Advanced Manufacturing Technology Strategy (AMTS), Advanced Metals Initiative (AMI), Integrated Manufacturing Strategy, Industrial Policy Action Plan and other relevant government strategies in order to advance South Africa's research and innovation competitiveness.

Significant investment has historically been made within this theme, particularly in the area of Biotechnology. However, given the importance of research for economic development and social priorities of government, investment needs to be continued with a focus on providing support to the Advanced Manufacturing Technology Strategy (AMTS), the Advanced Metals Initiative (AMI), the Integrated Manufacturing Strategy, the Industrial Policy Action Plan and the ICT Research and Development Strategy; with the latter focussing on the use of ICT in the delivery of quality education and health services, crime preventions and other government social services. It is anticipated that eight (8) new Research Chairs will be awarded under this theme.

4.2.2. Science Missions

The Science Missions were conceptualised to exploit the geographic advantages of the country and hence to strengthen scientific research competitiveness in those areas. The geographic advantage areas, as identified in the NR&DS, are:

- Astronomy;
- Biodiversity;
- Marine Biosciences;
- Human Palaeontology;
- Archaeology;
- Antarctic Research; and
- Indigenous Knowledge Systems.

The current Research Chairs in Astronomy have a focus on technology development and radio astronomy and the area of optical astronomy has lagged behind in the awarding of Research Chairs. While based on headcount alone, the area of Astronomy has enjoyed a relatively large number of awarded Chairs compared to other disciplines, this number is still not sufficient to advance the frontiers of Astronomy in the country. There has also been limited investments in Indigenous Knowledge Systems (IKS), palaeontology and archaeological sciences, as well as

other areas mentioned above such as Biodiversity, Marine Biosciences and Antarctic Research. It is therefore anticipated that five (5) Research Chairs will be awarded under this theme.

4.2.3. Priority Research Areas

The Ten Year Innovation Plan identifies five (5) priority research areas called Grand Challenges and these are intended to support South Africa's transformation from a resource-based economy to a knowledge economy. The five (5) priority research areas or *"Grand Challenges"* are:

- Bio-economy;
- Space Science and Technology;
- Energy Security;
- Science and Technology for Global Change (including Climate Change); and
- Human and Social Dynamics for Development.

Proportionally, these priority areas have received the highest level of investment through SARChI. Given the importance of these areas for the country's transformation into a knowledge-based economy and, the need for further research and innovation to bring about the required social and economic development, eight (8) new Research Chairs will be awarded, with particular attention to Space Science and Technology (earth observation, communication, navigation and engineering); Energy (clean coal energies, nuclear, renewable energy technologies and hydrogen and fuel cell technologies) and Social and Human Dynamics. While the Bio-economy and Global Change Grand Challenge areas received specific attention under the eight (8) directed Chairs, proposals from universities to host Research Chairs in these areas will also be considered under this theme.

Six (6) of the eight (8) Research Chairs in this thematic area are earmarked for Human and Social Dynamics for Development (HSDD). The HSDD Grand Challenge aims to position South Africa as a unique and globally relevant knowledge hub for research on human and social dynamics. Research under the HSDD Grand Challenge is intended to be socially relevant, to inform policy and public debate and to identify and examine key current and future social issues. The Science Plan sets out the four (4) areas of research focus for this Grand Challenge, *viz.*:

- Science, technology, and society;
- The dynamics of human and social behaviour;
- Social cohesion and identity; and

- Societal change and the evolution of modern society.

Research programmes within this theme should satisfy the complementary demands of high scientific payoff (research excellence) and response to pressing development concerns with a focus on, among others:

- Language, in particular African languages;
- Cultural diversity and social integration;
- Cultural heritage;
- Education Research, in particular research on the post-school education and training system;
- Growth, employment and competitiveness in a knowledge-based economy;
- Socio-economic and scientific indicators;
- Crime, social pathology and violence; and
- Sustainable human settlements and enhanced service delivery.

4.2.4. Science and Technology for poverty alleviation and local/regional innovation including sustainable rural development.

Government has identified the eradication of poverty as a national priority to ensure a better life for all, to consolidate and deepen the country's democracy and to enhance social cohesion. Rural and poor communities should have access to innovations that accelerate development and provide new and more effective solutions than those utilised previously. Given the broad nature of this theme, priority will be given to basic, applied and development research in the following areas:

- Food security, agriculture and nutrition;
- Water and sanitation;
- Health;
- Land tenure and reform;
- Land use management;
- Rural development;
- Development economics;
- Urban policy; and
- Public sector planning, monitoring and evaluation.

Thirteen new Research Chairs are earmarked for this theme and of these, five (5) are designated for Social and Human Dynamics for Development and the remaining eight (8) are intended to have a focus on the use of Science and Technology research and innovations for improving quality of life and services for rural and poor communities.

4.2.5. Innovation, Engineering and Technology Development and Commercialisation

The 2008 review of South Africa's National System of Innovation identified an 'innovation chasm' which is due to inefficiencies in taking research results to socio-economic outcomes. Other studies have identified the 'engineering gap' which is due to failure to produce the requisite critical number of skilled engineers. South Africa commits itself to growing the base of highly skilled innovators and engineers in areas offering the most economic potential over the long term.

Research Chairs under this theme are expected to play a role in strengthening the manufacturing, mining, services and other sectors of the economy. The focus includes the promotion of wealth creation to ensure that the natural wealth of the country is shared and developed locally, and the acceleration of the creation of decent work opportunities in manufacturing and services through fostering innovation, technology development and transfer.

It is intended that the 10 Research Chairs to be awarded under this theme will be in the following broad areas:

- **Industry-based research**

  These Research Chairs would focus mainly on conducting basic or applied research that is intended to support industry needs and development, with a focus on research questions that bring knowledge closer to the market or to commercialisation. These innovations could include the improvement of processes, products, systems or services.
- **Research development and technology transfer**

  These Research Chairs would focus on research to support the innovation value chain such as intellectual property management, commercialisation, technology management and product development.

4.2.6. Open category, including Fundamental Disciplines, Scarce and Critical Knowledge Fields

While it is important to steer SARChI research programmes towards national priorities and strategies, it is equally important to provide the opportunity to pursue research that may not have immediate application or impact or fall outside the directed and thematic areas. It is also important to continue to invest in fundamental disciplines that support applied or technological research.

The Department of Higher Education and Training identifies a number of Classification of Educational Subject Matter (CESM) categories falling under scarce and critical skills. Research Chairs under this theme will be in the Scarce and Critical skills areas such as:

- Clinical human health;
- Animal and plant health;
- Mathematics;
- Statistics;
- Financial Sciences;
- Computational Sciences; and
- Environmental Sciences, in particular water research.

It is anticipated that 10 Research Chairs will be awarded in the open category with five (5) of these Research Chairs being earmarked for the Scarce and Critical CESM categories in the Social Sciences and Humanities.

Table 1: Indicative Distribution of the 54-theme based Research Chairs

Research Theme	Proposed number of Chairs to be awarded
Technology Missions (ICT, Biotechnology, Advanced Manufacturing and Emerging Research Areas)	8
Science Missions (Geographic Advantage Research Areas)	5
Priority Research Areas Grand Challenges Social Sciences within priority research areas	 2 6
Poverty Alleviation, Sustainable Rural Development and Local/Regional Innovation All disciplines within these areas Social Sciences with these areas	 8 5
Innovation, Engineering and Technology Development and Commercialisation	10
Open category with a focus on fundamental disciplines, Scarce and Critical Knowledge Fields All disciplines within these areas Social Sciences within these areas	 5 5
TOTAL	**54**

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