



12TH ANNUAL MEETING OF AFRICAN
SCIENCE ACADEMIES (AMASA)

POVERTY REDUCTION Proceedings Report



science
& technology

Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA



20
YEARS

Applying scientific
thinking in the
service of society

ASSAf
ACADEMY OF SCIENCE OF SOUTH AFRICA



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The Academy of Science of South Africa (ASSAf) was inaugurated in May 1996. It was formed in response to the need for an Academy of Science consonant with the dawn of democracy in South Africa: activist in its mission of using science and scholarship for the benefit of society, with a mandate encompassing all scholarly disciplines that use an open-minded and evidence-based approach to build knowledge. ASSAf thus adopted in its name the term 'science' in the singular as reflecting a common way of enquiring rather than an aggregation of different disciplines. Its Members are elected on the basis of a combination of two principal criteria, academic excellence and significant contributions to society.

The Parliament of South Africa passed the Academy of Science of South Africa Act (*Act 67 of 2001*), which came into force on 15 May 2002. This made ASSAf the only academy of science in South Africa officially recognised by government and representing the country in the international community of science academies and elsewhere.

This report reflects the proceedings of the 12th Annual Meeting of African Science Academies held on 7 and 8 November 2016 at the Garden Court - OR Tambo Hotel, Johannesburg, South Africa. Views expressed are those of the individuals and not necessarily those of the Academy nor a consensus view of the Academy based on an in-depth evidence-based study.

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DAY 1

WELCOME ADDRESS FROM ASSAf

(PROF BARNEY PITYANA, VICE-PRESIDENT, ASSAf)

It is my honour today to welcome you to this important Annual Meeting of African Science Academies (AMASA). The recently elected President of the Academy of Science of South Africa (ASSAf) is Prof Jonathan Jansen. Prof Jansen resigned as Rector and Vice-Chancellor of the University of the Free State and has assumed a research fellowship at Stanford University. He sincerely regrets that he could not be here to welcome us on behalf of ASSAf. Prof Brenda Wingfield of the University of Pretoria is also a Vice-President of ASSAf, and sends her apologies because she is attending a research fellowship programme in the USA. That leaves me as Vice-President to do the honours.

Let me take this opportunity to acknowledge the immediate past-President of ASSAf, Prof Daya Reddy, who stood down at the last Annual General Meeting (AGM). Prof Reddy steered ASSAf over the last three years and successfully extended the reach and partnerships of ASSAf throughout Africa and internationally.

I am also delighted to welcome Prof Robin Crewe who has served a distinguished career as President of ASSAf, as well as President of the Network of African Science Academies (NASAC). Prof Crewe continues his association with ASSAf and with the science community across the world.

May I also take the opportunity to welcome members of the Executive Committee and Council of ASSAf, in particular Prof Himla Soodyall, General Secretary of ASSAf.

On behalf of ASSAf, I extend a word of welcome to NASAC who are co-hosting AMASA 12 with ASSAf. The Board of NASAC will be holding their Meeting and AGM alongside this event.

Welcome to our guests and partners. The Department of Science and Technology (DST) of South Africa, the University of the Western Cape Centre for Excellence in Food Security, and GenderInSITE. I also welcome our overseas partners: the German National Academy of Sciences, Leopoldina; InterAcademy Partnership (IAP); United Nations Educational, Scientific and Cultural Organisation (UNESCO); United States Agency for International Development (USAID) and the New Zealand High Commission in Pretoria.

ASSAf is honoured to host AMASA 12 in South Africa. ASSAf also hosted the 2010 meeting and we are delighted to welcome you back. Over the ten previous meetings, we have journeyed together with our partners, the USA, Germany, UK and elsewhere.

At AMASA 11, specific actions were taken to establish an operational strategy to enhance the work of the African Academies of Science. NASAC is a partner in this endeavour. Our collective contribution to the advancement of science in Africa, the quality of advice to governments, and our values of independence and evidence-based scholarship should take Africa a step closer to realising the dream so eloquently espoused in Agenda 2063 and adopted by member states of the African Union (AU). I thank my colleagues in NASAC for this partnership, namely Prof Yousuf Maudarbocus, Vice-President of NASAC, and Ms Jackie Olang, Executive Director.

On behalf of ASSAf, I welcome all of you to AMASA 12 and trust that you will see it as a learning experience, and an opportunity to establish networks and affirm our contributions to science.

You are aware that we have invited you back to South Africa to join ASSAf in celebrating its twentieth anniversary since its establishment in 1996. The idea of a national science academy was passionately driven and pioneered by, among others, Prof Wieland Gevers, who unfortunately could not be with us today. Prof Gevers is the doyen of research scientists in our country. South Africa needed to make a fresh start in keeping with its Constitution adopted in 1996. The Constitution's vision is eloquently stated in the Preamble, namely that the new democratic and constitutional dispensation is to "improve the quality of life of all citizens and free the potential of each person". The previously established science academies, the *Akademie vir Wetenskap en Kuns* and the Royal Society, were steeped in the apartheid and colonial past and could not be expected to become the scientific voice of the new Constitution. ASSAf was therefore established with the commitment to advance science for society and to help scientists recognise that science and knowledge ultimately enhance the well-being of humanity. For 20 years and with over 500 Members, ASSAf has pursued this mission. AMASA 12 affirms the importance of that mission not just for South Africa, but for Africa as a whole.

The theme for this conference, Poverty Reduction, is well chosen as it fits into the strategic vision of both the AU and the United Nations (UN). The theme was conceptualised in partnership with ASSAf's Standing Committee on Science for the Reduction of Poverty and Inequality. The 2030 Agenda for Sustainable Development has highlighted the prevailing and persistent scandal of poverty in the world today. Following the mixed success of the Millennium Development Goals, sustainability has now been introduced into

the Sustainable Development Goals (SDGs). One of the architects of the SDGs, Jeffrey Sachs (Director of The Earth Institute at Columbia University), said that the SDGs will need the “unprecedented mobilisation of global knowledge operating across many sectors and regions”.

Occupying pole position among the 17 SDGs is SDG 1. It says “We are determined to end poverty and hunger in all their forms and dimensions and to ensure that all human beings can fulfil their potential in dignity and equality, and in a healthy environment”. The issue of extreme poverty is the responsibility of all nations, not just in terms of the provision of development aid, but also in establishing conditions for fair trade, the advancement of science and technology, industrialisation and agricultural and health priorities. This is a comprehensive project in which the science world must thrive.

The AU Agenda 2063 is just as assertive about these aspirations. It states that Africa must be “a prosperous Africa based on inclusive growth and sustainable development”. The AU Heads of State and government equally affirm the determination to “eradicate poverty in our generation and build shared prosperity through social and economic transformation of the Continent”.

There is a welcome recognition in the AU Agenda 2063 that these aspirations are meaningless without advanced science and technology, good governance and a citizenry that is both engaged and accountable. It therefore states that these aspirations must be driven by “well educated and skilled citizens, underpinned by science, technology and innovation for a knowledge society that has become the norm”. The undertaking therefore is to “build and expand an African knowledge society through transformation and investments in universities, science and technology, research and innovation”.

In light of the above, it is appropriate to welcome Dr Mamphela Ramphele as our guest speaker this morning. Dr Mamphela's academic life and social activism have spanned the contours of the theme we seek to address at AMASA 12. She is a health activist, researcher and academic administrator, as well as a latter-day business person. As a budding social scientist, Dr Mamphela worked on the research team that produced the study on poverty in South Africa in the 1980s, *Uprooting Poverty*, under the leadership of Prof Francis Wilson. During her tenure at the World Bank, she was confronted with the debilitating challenge of poverty across Africa. As scientists we should seek viable and sustainable strategies to relegate poverty in Africa history within our lifetime.

Welcome Dr Ramphele. Once again welcome to all of you.

WELCOME FROM PARTNER ORGANISATION

(PROF YOUSUF MAUDARBOCUS, VICE-PRESIDENT, NASAC)

On behalf of Prof Mostapha Bousmina, Chairperson of NASAC, it gives me great pleasure to welcome you to AMASA 12.

Before proceeding, I would like to enlighten you on the origin of AMASA. You might find it confusing that we are holding AMASA 12, whereas AMASA itself was only established in 2012. AMASA is the successor of the African Science Academies Development Initiative (ASADI) annual conferences. ASADI was a partnership between African science academies and the United States National Academies of Science (US NAS), which received substantial funding from the Bill and Melinda Gates Foundation. The first ASADI conference was held in Nairobi, Kenya in 2005 with the theme Improving Public Policy to achieve the Millennium Development Goals in Africa: Harnessing Science and Technology Capacity. It is significant that AMASA 12 is looking at poverty reduction, which is SDG 1. ASADI conferences were held in Cameroon in 2006; Dakar, Senegal in 2007; London in 2008; Ghana in 2009; South Africa in 2010; and Uganda in 2011. The conferences covered a wide range of subjects including food security, safe water, impact of science policies, health and access to energy. At the 2012 Annual Meeting, held in Nigeria with the theme of Climate Change, the decision was taken to rename the event the Annual Meeting of African Science Academies (AMASA). The objective was to create a voice for African academies through evidence-based research to assist policymakers to put science, technology and innovation at the forefront of national and continental development.

In spite of the renaming of ASADI to AMASA, the numbering of the conferences was not altered. Hence AMASA 9 was held in Addis Ababa, Ethiopia in 2013 with the theme Biodiversity and Biotechnologies for National Development. AMASA 10 was held in Uganda in 2014 with the theme Ensuring Country Ownership in Africa's Development Agenda beyond 2015. This was very pertinent for me because during my tenure at the UN, we talked about technical assistance (and later on technical cooperation) to developing countries. When I retired, we were talking about partnerships in development, which were addressed at the 2014 conference. AMASA 11 was held in Kenya with the theme Non-Communicable Diseases: Post-2015 Development Agenda. The theme for the current AMASA 12 is Poverty Reduction. I would like to congratulate the organisers on having chosen such an important and topical issue as the theme of this conference. SDG 1 emphasises the need to end poverty, in all its forms, everywhere, by 2030.

It has been estimated that more than 800 million people worldwide still live in extreme poverty. In the developing regions, one in five persons lives on less

than US\$1.25 per day, with the vast majority living in southern Asia and sub-Saharan Africa. AMASA 12 will address food security and agriculture, social determinants of health, water, energy, and gender, which are all important factors that could contribute to ending poverty. From my point of view, there are many other factors that have contributed to poverty, the main one being poor governance, which has greatly contributed to poverty in the regions mentioned. Armed conflicts, discrimination and exclusion are also factors that contribute to increasing poverty, and these too deserve our attention.

On behalf of NASAC, I wish to take this opportunity to express our deepest appreciation to ASSAf and to the South African Department of Science and Technology for the excellent organisation of this important conference and for hosting this conference in the beautiful city of Johannesburg. I would like to see a city tour of Johannesburg added to the agenda, which I believe would contribute to the topic of the programme.

Another important initiative of ASSAf has been the preparation of the *Policymakers, Booklet on Social Protection in Africa: Overview for Policymakers*, which I understand will be launched during this conference. This will also assist us in taking steps towards poverty reduction.

I end by wishing all of you a very fruitful and enjoyable conference.

KEYNOTE ADDRESS

(DR MAMPHELA RAMPHELE, NELSON MANDELA FOUNDATION)

Africa is a continent of infinite possibilities, yet in socio-economic development terms it remains the most underperforming region in the world. The challenge that we as the academics of science in Africa face is how to use our position as thought leaders to challenge our fellow Africans to imagine a continent without poverty.

Es'kia Mphahlele, an eminent African literature and education expert, spoke of the importance of imagination as a driving force for change when he said "the beauty of this adventure is that the imagination does not wait for the day when we shall have rid ourselves of tyranny. It overarches history and may get there long before the event. I would like to propose that we as Africa's thought leaders have fallen into the trap of believing the biblical saying that the poor will always be with us".

Post-colonial Africa has largely accepted the inherited patterns of inequality and the assumptions of authoritarian governance systems that have condemned the majority of Africans to poverty, unemployment and inequality. I would like to challenge us to re-imagine an Africa without poverty, and sec-

ond, to explore what it would take to make that re-imagined Africa a reality using our position as scientists. Third, I would like us to explore how we engage our fellow citizens in the context of science and for society.

It is difficult to re-imagine Africa without poverty. Post-colonial African education systems have neglected the teaching of African studies. African history, particularly the antiquity period, is an essential foundation to anchor our pride in our identity as Africans. It is difficult for Africans to imagine themselves as contributors to the foundations of the global knowledge system we have today without that knowledge of African history.

Cheikh Anta Diop, a Senegalese national, dedicated his life and academic career to challenging the negation of the contribution of black Africans to civilisation. He devoted his life to documenting the contributions of Africa to global civilisation as we know it, by tracking the Nubian Egyptian knowledge system which in his view should be treated in the same way as the Graeco-Roman system. Diop's work complements the work of many academics challenging the notion of European superiority. The rise and fall of nations across the globe remain complex issues driven by multiple factors in various combinations across space and time. The rise and fall of the Egypto-Nubian empires gave way to others in both the east and west. The first Europeans to explore sub-Saharan Africa's west coast were amazed at what they encountered. According to Diop, "when they reached the Bay of Guinea and alighted at Vaida, the captains were astonished to find well-planned streets bordered for several leagues by two rows of trees; for days they traversed a countryside covered by magnificent fields, inhabited by men in colourful attire that they had woven themselves! More to the south, in the Kingdom of the Congo, a teeming crowd clad in silk and velvet, large states, well ordered down to the smallest detail, powerful rulers and prosperous industries. Civilised to the marrow of their bones! Entirely similar was the condition of the lands on the east coast, Mozambique. The revelations of the navigators from the fifteenth to the eighteenth centuries provide positive proof that Black Africa, which extended south of the desert zone of the Sahara, was still in full bloom, in all the splendour of harmonious, well-organised civilisations. This flowering the European conquistadors destroyed as they advanced".

The most important damage wrought by imperial and colonial conquest is the cultural and mental murder of indigenous Africans. The systematic looting of natural, mineral and human resources of Africa was justified on the basis that indigenous people were inferior beings who were less than human. What started as a convenient distortion of reality became embedded as a racist way of life. Reality and myth merged to become a way of life. Dehumanisation of the 'other' has become part of the standard operating procedure for subjugation and exploitation. Africa is often depicted as a continent that invented nothing, created nothing and contributed nothing to human civilisation.

At the heart of persistent poverty and inequality is the combination of the legacy of authoritarian traditional leadership structures and the devastating exploitative colonial systems. That legacy impoverished African citizens emotionally, spiritually and materially. Poverty in this context is more than the lack of material well-being, but the assault on the self-respect and dignity of people.

History matters. The African continent needs to be freed from the social pain of the wounds of the legacy of the colonial period. Acknowledgement, forgiveness and active programmes to right the wrong are all critical elements on the pathway to sustainable reconciliation. South Africa is a poster child of the cost of leaving socio-economic restructuring out of the reconciliation process. Our persistent poverty, inequality and unemployment, and the recent resurgence of violent racist tensions, are a direct result of our failure to heed the lessons of the German example. To add insult to injury, post-colonial Africa continues to suffer the impact of post-liberation leadership systems that have failed to live up to the principles of good governance. Poverty persists because of the failure to put human rights and dignity at the centre of national development efforts.

Post-liberation African leaders have yet to make the transition from liberation politics towards democratic politics. The values of liberation politics focus on 'them and us', the lack of transparency, the winner takes all, and the end justifies the means. These are in stark contrast to democratic values. Their excuse is that neo-colonial interests could reverse the gains of liberation. Unfortunately for African countries, many of the values and ethics of liberation politics run counter to the requirements of democratic governance. We should not be surprised at the reversals of democratic gains in much of our beautiful continent. Life-long presidencies are back in fashion, as is impunity in dealing with political opponents.

The notion of the citizen as sovereign in our democratic systems is yet to be established. Most African governments are leader-driven rather than people-centred. There is little accountability to citizens as the focal point of public service. For example, South Africa's transition to democracy is celebrated and underpinned by a highly regarded Constitution. The commitment that South Africans made in the preamble to that Constitution was to "heal the divisions of the past and establish a society based on democratic values, social justice and fundamental human rights". The question before us today is why we have done so poorly in establishing this envisaged society where social justice and human rights (including socio-economic rights) reign supreme.

At the heart of our underperformance as a society is our underestimation of the importance of healing the wounds of the past. We have to acknowledge that both citizens and leaders are wounded by a system that undermines the

precepts of the fundamental African philosophy of Ubuntu, which is “I am, because you are”. Millennia of wisdom in Africa have been encapsulated in the understanding that human beings are created for connectedness to others. When we break that connectedness, we disable our capacity to see ourselves in others and for them to see themselves in us. This connectedness enables empathy that drives social relationships, with human rights at the centre.

Poverty is not the absence of resources but an expression of the inequity of the allocation of resources in a given society. In the South African context, persistent poverty, unemployment and inequality reflect our failure to heal the wounds of divisions of the past. The face of poverty and unemployment remains black, and predominantly female. This poverty profile matches the social-engineering targets of the colonial and apartheid projects. Only a strategic restructuring of our socio-economic system can undo the systemic poverty-generating process that is embedded in our society.

Persistent apartheid geographic profiles of our cities and towns are testimony to our failure to transform our urban landscapes to create environments for equitable access to the resources essential for sustainable livelihoods and well-being. The poorest people live furthest from the centre of our cities and towns, making poverty very expensive; the costs include transport to and from workplaces, poor neighbourhoods with poorer quality public services and the lack of access to rich cultural assets. The same patterns pertain in many other African countries.

Education worldwide is regarded as the sure and tested way out of poverty. Confucius' wisdom posits that “only educated people can be free people”. The most successful countries in Africa are those that have paid attention to building education systems that are efficient, effective and of a high quality. For example, Mauritius pulled itself out of poverty by focusing on transforming its education system to the success it is today. The same applies to Botswana and post-genocide Rwanda. Africa needs to transform its education systems into accessible high-quality systems that place African history, culture and languages at the centre. In South Africa, we could have done better if we had listened to Es'kia Mphahlele's advice. “A genuine programme of non-racialism, in which we Africans must play a major role, tapping the best minds amongst other population groups, must eventually lead to the Africanisation of our institutions of learning. This goes beyond simply filling our schools and colleges with a majority of blacks. It means revolutionising the whole range of our curricula, giving them a new direction, a humanistic thrust distinct from the tyranny of didactic approaches that have choked up all the channels of education”.

Our education systems need to prepare African citizens for the twenty-first century going beyond the focus of developing technical capabilities to promote a higher consciousness of citizenship with its rights and responsibilities. No democracy can flourish without active citizens, yet civic education hardly features in any curriculum in our countries' education systems.

I would like to propose that the African academies of science give leadership to the strengthening of the development of civic consciousness in all our countries. Citizens are the only guarantors of robust democracies in which leaders can be held accountable. African countries are not investing sufficiently in resource material and intellectualism to ensure that we develop informed active citizens that drive the sustainable development of a country. The failure of our education systems to teach the history of science to highlight Africa's contribution to the foundations of scientific knowledge has created major distortions. In South Africa, young student protestors are calling for the decolonisation of science that has been positioned by their professors and others as a Western invention. It is a crying shame that we have denied young Africans sufficient depth of knowledge to embrace science as part of African culture. Tertiary education institutions should take responsibility for correcting this distortion to enable Africa's people to embrace science as a global public good to which many cultures have contributed. The eradication of poverty can only be possible in an environment where all African citizens have access to quality education that enables them to adopt modern knowledge and technical solutions to the problems that flow from poverty and perpetuate poverty.

Africa also needs to break from the trap of state capture by its leaders across the continent. State capture is enabled by the conflation of the person of the leader, the party, the government and the state. The capture of the state creates distortion in the allocation of resources that deprives the majority of people of basic public services, such as high-quality education and healthy living environments that are essential for sustainable livelihood. At the heart of persistent poverty in Africa is poor governance. The Ibrahim Index of Good Governance has been measuring African countries' performance over the last ten years. Countries that have done best on this index and those that have improved the most have significantly reduced or eradicated poverty. The top performers are Cape Verde, Botswana, Mauritius, and the most-improved country is Rwanda. South Africa's performance on the Ibrahim Index has deteriorated remarkably over the last few years due to increasing levels of corruption, nepotism, incompetence, mal-administration and growing levels of state capture.

It is not the poverty of resources but the quality of governance that matters. My question for the academies is, in what way can we use our scientific knowledge and understanding to promote better governance in our individual countries

and the continent as a whole? Are we as scientists seeing good governance as a legitimate area of concern for us to play an active role as citizens of our individual countries and the continent as a whole? It is inconceivable that the African continent, with the youngest population profile, can eradicate poverty without considerable investment in the development of the talents of each of its children and young people. Such investments would have to come from appropriate utilisation of our enormous natural and mineral resources to drive sustainable development across the continent. Good governance will make it possible for African countries to enhance intra-Africa trade, intra-African collaboration in science and technology, and Africa's voice in the global community. This will enable the continent to play a meaningful role in shaping the nature of global political, social and economic relations.

The question for the African academies of science is how to promote a paradigm shift in the approach to leadership and governance in Africa. At the end of the day, the quality of public leadership matters. Are the African academies of science ready to play their leadership role to help Africa to re-imagine itself as a continent where poverty can be history?

Discussion

Prof Phaswana-Mafuya (Human Sciences Research Council) commented that whilst the continent has the capacity to eradicate poverty, the driver would be the willingness to take on the challenge.

Mr Acemah (Uganda National Academy of Sciences) acknowledged that science academies had been challenged to play a leadership role. He posed the question of what action is needed to shift the mindset of senior academic colleagues who still subscribe to the mindset of colonialism.

Mr Kruger (South African Department of Planning, Monitoring and Evaluation) commented that the focus on re-imagination was contrary to the agenda of the conference. He commented that having studied at a South African university, he had learned more Roman history than African history. It was often said that colonialism was the emergence of civilisation of Africa. He queried how the concept of imagination could be linked to bad governance and emphasised that our leaders should be imagining different ways of governing so that everybody could benefit from the differences.

Dr Ramphela responded that black South African citizens had been forced into re-imagining themselves differently. They had been referred to as non-Europeans and had systematically accepted the non-person designation. Africans must acknowledge that they need to have a mindset shift. One cannot have a successful Africa that is looking elsewhere for leadership. This requires looking inward and learning the stories that our grandparents

told us. She argued that we cannot build the country of our dreams if we do not identify intimately with it and make it what defines us. We cannot build a country united in its diversity if we do not put the country first in our souls and hearts. We have lost our confidence, and blame others for our problems. The non-person designation is what ultimately enabled black South African people to be afraid and fearful of failure. We have failed to transform our economy to become one that gives everyone opportunities to live in dignity as contributors to building our country. We need to identify who we are in order to become psychologically, physically and materially free. The challenge is that we have lost the narrative of consciousness that as citizens we can own our country. Those conversations can be greatly enabled by simple interventions such as civic education in the school system. The South African school system offers Life Orientation as a subject, but this tends to be regarded as a free period with no guidance from teachers. Learners and teachers should be embracing the opportunity to explore what it means to be a South African citizen and how they can make their country one they can be proud of as owners. Citizens need to have conversations in their homes, in their schools, in the universities and in workplaces to identify what it means to be a South African. Many young people do not know that we are the cradle of humanity, as they are not taught this at school and we as adults do not pursue this.

THEME 1: FOOD SECURITY AND AGRICULTURE

(FACILITATOR: PROF HIMLA SOODYALL, HUMAN GENOMIC DIVERSITY AND DISEASE RESEARCH UNIT, UNIVERSITY OF THE WITWATERSRAND)

Prof Soodyall revisited the statement made by Dr Ramphela on why history matters. Agriculture had only become part of the domestic culture during the Neolithic era. Prior to that, humans had subsisted on hunting and gathering. The Neolithic era had brought about the introduction of agriculture and animal husbandry, which revolutionised the way in which present day society subsists. This, together with our cultural revolution, has put great demands on food resources and issues related to security amongst others. Some of these issues are within our mandate to change, whilst others are also an act of what happens in the global environment.

The Scramble for Africa's Food Security: Food and Nutrition Trends in the sub-Saharan Economic Powerhouses (Prof Julian May, Director, DST-NRF Centre of Excellence in Food Security, University of the Western Cape)

The scramble for Africa's food security was in part made by the former colonial powers, but was also a scramble that had been made by African countries themselves.

Both were seeking to obtain food security within their own boundaries, as well as new markets and opportunities in other African countries.

In terms of food security, the continent is facing a series of trilemmas. South Africa is facing the trilemma of poverty, unemployment and inequality which adversely contribute to food insecurity and exacerbate the problems of malnutrition through under-nutrition, over-nutrition and micro-nutrient deficiencies. Women face a triple burden – women are responsible for child-bearing and child-rearing, they perform domestic tasks, and they must spend considerable times travelling between their homes and the fields. This burden, together with domestic and reproductive activities, severely constrains the amount of time available to women to contribute towards the goal of attaining food security.

Despite reports that under-nourishment has declined, there are still 880 million under-nourished people and two billion people who are affected by micro-nutrient deficiencies. A new form of food insecurity is also evident in the one and a half billion adults who are either overweight or obese.

In recent years, Africa has been portrayed as an area of economic growth and potential. Africa's 12 powerhouses are home to about 61% of the continent's population of 1.2 billion people, of whom 60% comprise the under-five population and 68% comprise the total urban population. The two forces contributing to food security are the large number of young people coming into the labour market, and migration from rural to urban areas. Food security will be dependent on transportation, logistics and urban economic efficiency in order for food to move freely around the countries.

Economic growth in Africa has been rapid and more volatile than in the past. The region's gross domestic product (GDP) growth is expected to rise to approximately 4.2% in 2016 and 4.7% in 2017. The combined gross national income of the 55 countries that make up the African continent is around US\$5 billion. The 15 largest economies include Nigeria, Egypt and South Africa; at one point Nigeria became the largest economy in Africa, offsetting South Africa's economy into holding third place. The economies of these 15 countries were almost three times larger in 2013 than at the beginning of the decade. However, the continent has seen dramatic changes. Ethiopia, for example, had a very slender economy in 2000 and is now one of the fastest growing economies in Africa, offering major opportunities for economic development.

Africa has three mega-cities where the population is greater than ten million people, namely Cairo, Kinshasa and Lagos. These mega-cities are supplemented by over 100 secondary cities that are growing equally rapidly with populations of around one million people. The expansion of secondary

cities would affect the under-nutrition of children, which is measured by the percentage of children who are stunted. Currently the appearance of stunting is most severe in countries such as Ethiopia and South Africa. South Africa has one of the largest economies in the region, but about a quarter of its children are stunted for their age. It is a matter of concern that this figure has remained largely unchanged for 20 years despite programmes and grants targeting these children. This phenomenon has also been seen in other African cities which have relatively high levels of income and high levels of stunting. Urbanisation, combined with the economic structure, has seen a rising middle class throughout Africa. The growing middle class is one of the key factors driving international retail expansion across Africa. Consumption choices typical of this class, such as internet usage, private health care, formal retail, as well as car and property ownership are rising. This is evidence of an emerging class that has disposable income and is able to spend their money on consumables other than food security.

Economic integration has become a major feature on the African continent as countries have started linking to each other both economically and in terms of the infrastructure that is available to transport goods. This includes not only goods but the information revolution that is taking place across Africa. African organisations are becoming dominant players in local markets and expanding their presence across the rest of the continent. South African retailers are a prime example of being among the most aggressive in expanding across the continent; however, there are also examples from other countries, such as Zambia, Botswana and Kenya expanding into the greater East African Community region, and Nigeria into the rest of West Africa.

Infrastructure development is crucial to the moving of food and other goods. Whilst the continent has been enjoying the development of highways and transport networks, research has shown that immense costs might come from transport and trade both due to inefficiencies at the borders, as well as corruption challenges. Whilst there is certainly an opportunity to see greater integration of the African economies, economic and other constraints are also evident. A typical constraint is that the African continent has three different gauges of railway lines that will need to be changed at some point in time.

Water is one of the main challenges facing the African continent. Many rivers and lakes in Africa serve as national boundaries. The actual borders are often not clearly defined, which gives rise to disputes over scarce water resources. When the colonial powers defined African borders in the late 19th century, they generally used the courses of rivers and lakes in determining the borders. Many colonial maps are imprecise and there is considerable uncertainty over exactly where the dividing lines run. Conflicts are seen throughout Africa over the usage of water, particularly in the construction of dams such as the

Grand Ethiopian Renaissance Dam because of its impact on the Nile River downstream. There are, however, still many opportunities to be explored from smaller water courses that could assist with the production of food. Of the six million hectares presently equipped for irrigation in sub-Saharan Africa from large-scale schemes, approximately one million hectares are under-utilised as a result of infrastructure that is not operational.

The disease profile in Africa is changing. Africans are moving away from traditional staple foods towards more highly processed foods, which has resulted in an increase in non-communicable diseases such as hypertension and diabetes. The region has the highest proportion of undiagnosed diabetes; Africa also has the highest rate of diarrhoea in the world. Whilst Africa has seen a positive improvement in food security due to economic growth, countries such as Zambia and Swaziland are still experiencing food deficits despite relatively high economic growth. Of utmost importance are the links that need to be addressed between gross national income and under-five stunting and adult female obesity as economic growth takes place in Africa. Diets in developing countries are changing as incomes rise. The share of staples, such as cereals, roots and tubers, is declining, while that of meat, dairy products and oil crops is rising. There has also been a shift towards consuming different kinds of staples such as rice and wheat, which are imported into Africa. Agricultural imports into Africa increased by 62% between 2007 and 2011, which has significantly altered the price of food.

The future of food security and water resources is affected by a range of external drivers. The key drivers have potential impacts, namely demographic change, climate change, economic markets and governance. Food security and water service issues are affected by, and have impacts upon, a range of drivers important for human well-being. Humanity's demand for increased food, fodder and fibre is on a trajectory towards fundamental detrimental impacts on ecosystem services, and immediate action is required to manage food production systems. It is all too evident that agricultural practices need to become more deliberately systemic, with synergies between production systems and ecosystem health, and ensuring productive and resilient landscapes for multiple benefits. Appropriate strategies, safeguards, options and technical solutions need to be developed and applied to ensure that water can provide for a wide set of ecosystem services, including agriculture, diversified incomes and food security, in an environmentally sustainable manner. The pressure of consumption and demand by the processing industry for certain characteristics of produce could be a major impact on production. There is great need for additional knowledge on how these drivers change agricultural production systems and what the consequences are for water and ecosystem services. The knowledge and skills to achieve change will be critical at both farm and management levels in order to improve food production systems. Ultimately, multiple drivers will need to be explored in

combination to identify and best characterise more sustainable agricultural productions systems. Such efforts are urgently needed to find synergistic pathways of development for addressing food security and sustainable water and ecosystems management.

Opportunities for joint projects exist for scientists and researchers to improve nutrition through smart agriculture, smart nutrition and nutrition-sensitive interventions. Social protection programmes are essential to reducing poverty. Social protection plays multiple roles in achieving inclusive development. It is linked to inclusive development through various transmission channels, such as the reduction of inequality, increased labour participation, productive assets protection and accumulation, human capital development, and the strengthening of social and collective citizenship rights, institutions and local economic multiplier effects. Slightly less than half the population of sub-Saharan Africa lives on less than US\$1.25 a day. The recognition that risk and vulnerability have a high impact on the well-being of the poor means that social protection is no longer seen as a luxury reserved exclusively for rich countries, but as a key element on the post-2015 agenda. South Africa was one of the first countries to establish a social protection scheme, and this is slowly being adopted in most African countries.

Improved food economics has not translated into the improved status of our children and their well-being. Millions of people worldwide lack access to improved water supply and access to improved sanitation. An estimated two million people die every year due to diarrhoeal diseases, most of them children under the age of five. The most affected are populations in developing countries living in extreme conditions of poverty, normally peri-urban dwellers or rural inhabitants. Among the main problems responsible for this situation are the lack of priority given to the sector, lack of financial resources, lack of sustainability of water supply and sanitation services, poor hygiene behaviours, and inadequate sanitation in public places including hospitals, health centres and schools. Providing access to sufficient quantities of safe water and the provision of good water sanitation services are of crucial importance to reduction of the burden of disease caused by these risk factors. Sanitation in particular is a cornerstone of public health; it contributes enormously to human health and well-being and is a major challenge facing the African region.

How to Look at Food Security as a Complex Issue (Dr Patrick Caron, Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), France, and Chairperson, High-Level Panel of Experts of the Committee on World Food Security)

2015 was an extraordinary year, with the adoption of the UN's Agenda 2030, which has brought about many challenges for the scientific communities,

with food security being at the heart of a complex nexus. The second Sustainable Development Goal (SDG2) aims to end hunger, achieve food security and improved nutrition, and promote sustainable agriculture. This formulation makes the link between hunger and agriculture more important than the one between poverty (addressed through SDG 1) and hunger. Yet, these concerns are highly connected. Food insecurity is usually presented as a direct consequence of the global population growth, which is expected to increase to 9.3 billion by 2050. Population growth is certainly a significant determinant of agricultural production but will no longer be the main driver; food consumption patterns and their evolution within an urbanisation context will play a major role for food security and nutrition (FSN) and beyond for the whole set of SDGs, in particular through land use changes.

Technology will be an important factor in contributing to the required transformation of agriculture production. Future research needs to study how nations with lower agriculture production performances should invest in better technology to increase their ability to address FSN while, in the same time addressing rural poverty and environment health. But the question should no longer be "how to feed an increasing population?". It should rather explore pathways for consumption and production, and their implications for feeding the planet. Which consumption patterns? Who will feed who? Which patterns for production? And which environmental and social footprint/impact? Which market regulation for FSN?

The needed transformation is of the same magnitude as agricultural green revolution and calls for deeply recrafting the food systems. Yet, we have to move away from the illusion of the 'magic bullet' and design and implement local specific pathways. Within such a perspective, agriculture should be considered as a lever to address problems and this requires reviewing the way performance is assessed, intellectual frameworks and relevant metrics. Because of the intense on-going transitions, Africa is the continent where the future of the planet will be written and FSN in Africa will be a key component of this transition. There is a need for strong African scientific communities to undertake such a shift, and solutions designed elsewhere are just insufficient. Development through research will be key.

Research activity is needed in a diverse set of areas to improve the understanding of agriculture's vulnerability to climate change, food price dynamics, food waste and consumption patterns. Monitoring technologies are required, as well as multidisciplinary investigation of regionally appropriate responses to climate change and food security challenges. Making these changes is not only a technical challenge, but calls for urgent and coordinated action and partnership at international, national and local levels.

Increased and sustained investment in regular monitoring, on the ground and by public-domain remote-sensing networks, is essential to track changes

in land use, food production, climate, the environment, and human health and well-being worldwide. Spatially explicit data and decision-support systems that integrate biophysical and socio-economic information should be implemented. To address food price volatility, improved transparency and access to information in global food markets, as well as investment in interlinked information systems are needed. Research and investment components focusing on reducing waste from production to consumption, by improving harvest and postharvest management and food storage and transport, should be included in sustainable agriculture development programmes. Opportunities exist for reducing consumer and food service sector waste through the use of public campaigns, advertising, taxes, regulation, purchasing guidelines and improved labelling. To improve overall food supply and access, scientists should investigate opportunities to improve agricultural productivity and resilience to climate change through effective deployment of existing and new technologies for producing, processing and distributing food.

The Committee on World Food Security has requested its high-level panel of experts to establish a report on critical and emerging issues in the area of food security and nutrition. Being an inclusive process, the panel has launched a consultation to involve the scientific and knowledge community by requesting this community to provide documented inputs on issues that are considered critical and emerging for food security and nutrition. Scientific communities are expected to provide inputs by the end of November 2016.

Strategy for Agricultural Transformation in Africa (2016 - 2025): Feed Africa (Mr Joseph Coomson, Agriculture and Agro-Industry Department, African Development Bank)

Agriculture is a major source of income in Africa. However, untapped agricultural potential has contributed to persistent poverty and deteriorating food security, resulting in a projected increase in the number of under-nourished people. Currently 49% of Africans or 420 million people live under the poverty line of US\$1.25 per day (2014); those living in poverty will rise to 550 million by 2025. This can be addressed by job creation and providing sustainable livelihoods. Currently 33% of African children live in chronic hunger; 40 million children under the age of five are stunted. It is essential to ensure food security for all under-nourished Africans and to strive towards zero hunger and malnutrition.

Falling commodity prices for a broad range of natural resources are creating an increasing imperative for African nations to diversify their exports and reduce current account deficits. At the same time, increased food demand and changing consumption habits driven by demographic factors, such as population growth and urbanisation are leading to rapidly rising net food

imports. Currently, the continent imports a staggering amount of food totalling US\$35.4 billion per annum (2015), and net imports are projected to increase to US\$111.0 billion per annum by 2025 if the region carries on business as usual. In order to alleviate rising costs, Africa needs to eliminate large-scale imports of commodities that can be produced in Africa and selectively begin to export.

The conditions for transformation are beginning to materialise in a number of African countries, such as in the horticulture and floriculture sectors in Kenya and Ethiopia respectively; Rwanda's rapid and material reductions in the level of malnutrition; Nigeria's large-scale registration of farmers on an electronic-wallet system to facilitate fertiliser subsidy payments; and the transformation of the rice sector in Senegal. These instances show that localised transformation in Africa is possible, and point the way for larger-scale shifts in African agriculture.

As part of the African Development Bank's (AfDB) High 5 agenda and the objectives of Feed Africa, the bank is elaborating a strategy for its support to the four specific goals of the Comprehensive Africa Agriculture Development Programme (CAADP), namely:

- to contribute to eliminating extreme poverty in Africa by 2025;
- to end hunger and malnutrition in Africa by 2025;
- to make Africa a net food exporter;
- to move Africa to the top of export-orientated global value chains where it has comparative advantage;

Feed Africa will ensure that key outcomes beyond growth of the agricultural sector include enhanced capacity of governments and multilateral institutions to support this growth, increased representation for women and the youth, and improved resilience to climate variability and shocks. The project intends to contribute to the elimination of extreme hunger, malnutrition, poverty, and increased prosperity, in partnership with alliances including farmers, agribusiness and civil society, and exploiting regional comparative advantages and opportunities for trade and collaboration.

Feed Africa takes a commodity-focused integrated approach by addressing multiple bottlenecks across entire prioritised agricultural commodity value chains and within related agro-ecological zones. Certain crops pertinent to food security were selected – wheat in North Africa; sorghum, millet, cowpea and livestock across the Sahel region; rice in West Africa; maize, soybean, livestock, and poultry across the Guinea savannah; and tree crops (including cocoa, coffee, cashew, and oil palm), horticulture and fish farming across Africa in general.

Fulfilling Africa's potential in each of these areas requires different emphases in the types of support needed to catalyse investment, but overall each

commodity and agro-ecological zone transformation requires seven sets of enablers:

- to increase productivity by catalysing the development of effective input-distribution systems and reduction in post-harvest waste and loss;
- to realise the value of increased production by facilitating increased investment in output markets and supporting market incentives for value addition;
- to increase investment in enabling infrastructure, both hard infrastructure (such as roads, energy and water), as well as soft infrastructure (especially ICT, which can have positive effects);
- to create an enabling agribusiness environment with appropriate policies and regulation;
- to catalyse flows of capital (especially commercial lending and private investment) to scale agribusinesses;
- to ensure that transformation delivers on broad-based needs of Africans, by ensuring inclusivity, sustainability and effective nutrition beyond what the market may deliver;
- to coordinate activities to kick-start transformation, align activities and investments of different actors, and guide initial activities to the point where private sector actors can be crowded in.

The AfDB has several flagship initiatives:

- 1 Technologies for African Agricultural Transformation, with the aim of raising farmer productivity and incomes by creating a repository of proven agricultural transformation technologies that are tailored for the African context and can be scaled beyond pilots through CGIAR (formerly the Consultative Group for International Agricultural Research) and partner delivery mechanisms.
- 2 Agropoles, agro-industrial processing zones and corridors: This objective has been structured for countries such as Nigeria, South Africa and Gambia. The intent is to create an enabling environment within high-potential areas providing aggregation, processing, market information, market linkages and small to medium-enterprise linkages for farmers and agri-businesses.
- 3 ENABLE Youth programme will increase youth participation in agriculture by providing business training, seed capital for youth-led agribusiness enterprises, mentorship and placement in agribusiness companies.
- 4 Agricultural Risks Sharing and Financing Mechanism is intended to achieve increased bank lending to small and medium enterprises (SMEs) through de-risking credit activities and attracting new capital to the sector.
- 5 Agro-Inputs Network Development/Input Finance is intended to raise farmer productivity by increasing financing to large-scale domestic input producers, expanding market access for smallholders, and supporting policy reform for greater inputs access.

- 6 The On-Farm Capex Hiring and Investment Support Mechanism envisages raising farmer incomes by allowing farmers to lease mechanised equipment for more efficient production.
- 7 The On-Farm and Post-Harvest Waste and Loss objective will raise farmer incomes by making post-harvest loss technologies more readily available through growth capital investments in suppliers and on-lending for farmer leasing.
- 8 Warehouse Receipt Models Replication systems will allow farmers to store their produce in licensed warehouses and be issued with a warehouse receipt, which will act as an asset for sale or use as collateral for loans.
- 9 Africa Risk Insurance will improve the region's resilience to agro-climatic shocks by building a continent-wide sovereign insurance solution.
- 10 Infrastructure finance will catalyse financing for the build-out of agricultural infrastructure in support of the Agricultural Transformation Agenda by providing co-funding and project development assistance to value chain projects.
- 11 The African Agriculture Trade Finance Facility will facilitate trade and improve global competitiveness of African agricultural exporters by providing access to finance for banks and export aggregators.
- 12 Farmer e-Registration: The African e-Payments Platform for Input Distribution will raise farmer productivity and incomes by helping countries create databases of their farmers and thereby directly distribute input vouchers and other vital services to farmers through mobile payment systems.
- 13 The Agricultural SME Finance Capacity Building initiative will build long-term sector capacity and support the development of innovative SME financing vehicles by funding a variety of non-bank financial institutions and ecosystem actors.
- 14 Affirmative Financing Action for Women in Africa (AFAWA) will raise women's incomes by increasing their access to credit to grow agribusinesses.
- 15 The Climate Resilience Fund for Agriculture will raise farmer productivity and incomes by investing in funds and projects that have already displayed success in improving farmer resilience to climate shocks and land degradation.
- 16 The African Nutrition Trust Fund will improve food security and prevent malnutrition by increasing support for community-led nutrition programmes in high-need countries.

Achieving Feed Africa's goals to transform African agriculture requires investment in the order of US\$ 315 - 400 billion over the next decade, which could unlock US\$85 billion of revenue annually from 2025. Current funding for agriculture development in Africa requires urgent transformation. Currently, total investment finance is US\$7 billion annually, leaving a funding gap of

between US\$25 and US\$33 billion. In terms of the Maputo Declaration, African leaders made a bold commitment to reverse the under-investment that had held back the agriculture sector. Through the Maputo Declaration, African heads of state committed to allocate at least 10% of national budgets to agriculture and to achieve at least 6% annual agricultural growth. To date, this has not been realised; only nine African countries, including Burkina Faso, Malawi, Mali, Ethiopia, Niger and Guinea, have invested 10% of their national budgets in agriculture. The AfDB intends to increase agriculture lending to US\$2.4 billion annually. Partnerships have been formed and some foundations, as well as NGOs and the private sector, have already expressed interest.

New Zealand-based Opportunities for Africa to Enhance its Agriculture (Prof Hazel Chapman, University of Canterbury, New Zealand and Founder and Director, Nigerian Montane Forest Project, Nigeria)

The food supply problems in Africa are exacerbated by the phenomenon of rapid urban expansion and the concentration of migration flows to regional capitals. Africa has the fastest-growing population in the world, which is projected to double by 2050. Its urban population is also expanding more rapidly than any other region at 3.3% a year. If current trends continue, by 2050 more than half the continent's population will be living in cities. Agricultural productivity therefore needs to keep pace in order to feed the growing urban population. However, rural productivity in sub-Saharan Africa ranks among the lowest in the developing world. This is caused by a broad spectrum of factors, including extreme climatic conditions, the persistence of traditional methods of subsistence farming rather than using high-technology inputs and modern methods, and low investment in rural infrastructure. The extreme climatic conditions that frequently afflict the continent often result in the loss of harvests and livestock, large-scale famine and massive displacement of populations.

Although the continent may be characterised as being in a situation of chronic food deficit, more than 85% of the rural poor live on land that has a medium to high potential for increased productivity. If harnessed properly, this untapped potential could help to alleviate the chronic food security problem.

Climate change has placed considerable pressure on food security as food production is affected by floods and drought. Pests and diseases are changing their distribution patterns, for example, a new species of ticks has begun moving across West Africa causing chaos to cattle populations. Humans are also changing their distribution patterns; over-population, lack of grazing lands due to floods and drought have put pressure on traditional Fulani ways of life which has led to an increase in the number of Nigerian Fulani people moving southwards.

Protein and energy malnutrition is the most lethal form of malnutrition and affects a quarter of children worldwide. There is not just a need for more food to feed the people, but a need for smart food which gives more protein and micronutrients. New Zealand's economy is based on farming exports and exercises a science-based response to changing climate, crop pests and diseases, animal disease problems, land use intensification and production of high-quality protein smart foods. Thirty-three per cent of New Zealand's science budget is allocated to agricultural research. This is reflected in the country's farming landscape, which is the result of scientific research, precision technology and high-quality agricultural training of farmers. Science also underpins farming with low-tech solutions such as mixed cropping (i.e. mixed legume-grass swards). Legumes extend the grazing season and can reduce the need for earlier additional pasture or feed. New Zealand imported alien grasses and legumes, which were bred to be adapted to the country's conditions. Research workers were successful in discovering longer-lasting strains of perennial ryegrass and white clover which in terms of ecosystem benefits, has resulted in soil organic matter and soil erosion being minimised through year-round ground cover, which reduces tillage on at least half the pasture.

In Nigeria, much of the arable land is negatively affected by soil erosion. Forest areas are being lost, which not only adversely affects the country's ecosystem services, but also food production. New Zealand is well placed to provide the transfer of information on better breeds of cattle, knowledge on better forage cultivars and production, and better control of pests and diseases. New Zealand is able to offer low-tech solutions and training in various fields, such as the use of solar electric fences that could be used to control pasture management and rotational grazing, both of which would be hugely advantageous to food production. The use of appropriate legume-grass mixes would aid in improving fields with variable soil types and poor drainage. Hillside stabilisation through plants would effectively arrest soil erosion. In Africa, agricultural resources are unequally distributed due to the lack of connective infrastructure between areas for the production, collection and distribution of food products, which heightens food insecurity in all sub-regions.

New Zealand is currently working on improving forage production in Kenya. Brachiaria grass has been specially bred and the endophytic fungus added to it to perform better under Kenyan conditions. Brachiaria grass has proven to be very beneficial and sustainable for fodder production. Brachiaria grasses are tolerant to drought, recover fast after grazing, show high plant vigour and give good-quality forage to animals. With regard to ecosystem services, native forests need to be protected as they protect water sources, keep streams clean and are home to animals and birds, which assist in crop farming.

The Nigerian Montane Forest Project is aimed at combining scientific research with education at both tertiary and local community level in order to develop long-term sustainable management of Nigeria's montane forests. The project involves the community in the management of the montane forest ecosystems and in developing small businesses. It also works with schools to develop conservation awareness. It is envisaged that the research station will also become a research centre for African culture. The project is already working with two Nigerian universities in terms of agricultural training where students undertake their studies in Nigeria and do their research in the fields in their own country.

New Zealand is leading the way in the production of functional foods that have high levels of micronutrients and proteins. The country is also a leader in the use of bio-control agents to control weeds and pests. The agricultural sector accounts for 46% of New Zealand's emissions, which is a serious challenge given the large ruminant population. In terms of environmental health, New Zealand scientists are leading the world in developing on-farm technologies to help reduce methane gas emissions from livestock.

To quote Paul Moughan of the Riddet Institute, "New Zealand is well placed to become leaders in the transfer of agricultural knowledge and exporters of clever agrifood technology and education. The world will need many more agricultural and food scientists, veterinarians, nutritionists and ecologists. New Zealand has always excelled in research and advanced training in these areas and we are ready to play our part over the next 30 years".

Discussion

A question was directed to Prof Chapman as to whether any programme had been established in Nigeria to support collaboration.

Prof Chapman (University of Canterbury, New Zealand) responded that whilst funding is limited, Nigeria has a non-governmental tertiary education trust fund, which is charged with the responsibility for managing, disbursing and monitoring the education tax to public tertiary institutions in Nigeria. It supports early-career academics at universities to undertake PhDs overseas.

Dr Akinbile (Global Young Academy) enquired whether the research undertaken by Prof Chapman in New Zealand and Nigeria could be shared with other research councils, which could result in collaboration between the parties.

Prof Chapman responded that there is every possibility of collaboration. The Taraba facility in Nigeria had proven to be viable due to the buy-in of the local community, and their enthusiasm and drive kept the project alive. Such participation would be crucial for the survival of similar centres.

Prof Yambayamba (Zambia Academy of Sciences) commented that the poverty levels in Nigeria and South Africa were lower than in many other African countries. He asked whether there was a relationship between agricultural productivity and poverty reduction and what the reason was if this was the case.

Prof May (University of the Western Cape) responded that economic growth leads to poverty reduction. South Africa has very poor poverty elasticity and is not good at turning economic prosperity into social well-being. However, the country's poverty line was fairly small in comparison with the rest of Africa. In measuring poverty, poverty lines appropriate to South Africa would need to be used. Using the same methodology in South Africa and Lesotho produced two different poverty lines. The methodology in Lesotho produced a poverty line that was a lot lower than in South Africa. This was because the things that people value and deem important in South Africa differ from what is deemed important in Lesotho. In South Africa, people spend far more on transport than in Lesotho, which contributes to the poverty line. When talking about indicators such as food security or outcomes of children, South Africa and Africa in general have performed poorly in turning economic prosperity into better health in children. This could be attributed to various factors, such as poor water sanitation systems which economic growth would not necessarily correct.

Dr Caron (CIRAD) added that there is no relationship between productivity on the one hand and poverty reduction on the other. It is usually assumed that an increase in agricultural production would positively impact on poverty and hunger; however, this is not always the case. And assessments should further look at better taking into account the generation of employment and income. Africa is seeing an increased number of young people arriving on the market without the capacity for employment. Agriculture is therefore confronted with the challenge of providing a diverse range of opportunities for employment not only in farming, but also in services and in particular in research and scientific fields.

A comment was made that the costs for the flagship projects of the AfDB would be very high. Concern was expressed whether these projects could succeed when some African countries had not been able to meet the Maputo Declaration in terms of investment in agriculture.

Mr Coomps (AfDB) responded that despite its importance, agricultural productivity in Africa remains dismal and undermines Africa's overall productivity, food security, poverty reduction and inclusive growth. In the past, indirect and direct taxes distorted prices and prevented farmers from adopting modern inputs such as fertilisers. In addition, many African governments established agricultural marketing boards that purchased

products from farmers at fixed prices and resold the products in domestic and international markets at prevailing market prices, while controlling exchange rates to protect the local market. This scheme controlled prices to ensure income stability to the farmers. The implication was a lack of incentive to invest in intermediate inputs such as fertilisers. The AfDB is currently funding a number of studies to reactivate agriculture development banks and to implement mechanisms to ensure their sustainability. On the political side, advocacy is being exercised to encourage various political leaders to make good their pledges of 10%.

Prof Yambayamba asked how much emphasis the AfDB placed on science and how much of the bank's annual budget was dedicated to scientific research to back up the bank's desire to promote agriculture.

Mr Coompson responded that the bulk of resources in the budget were earmarked for member countries and that the issue of allocation to various sectors was dictated by those countries. Approximately five years ago, the AfDB had mobilised resources to support the CGIAR group and looked at collaboration with various research institutions in terms of the technologies that could be used to promote agriculture.

A figure of approximately US\$800 million had been earmarked for this project.

A comment was made that an increase in agricultural productivity does not necessarily translate to poverty reduction. A question was posed as to what the other actions envisaged by the AfDB for Africa were and how gender equality would be addressed in these plans.

Gender plays a key role in all the bank's interventions. The AfDB's Gender Strategy is based on the reality that gender equality is integral to Africa's economic and social development and is thus a central part of the bank's ambitious vision for Africa. The vision included creating opportunities for women, disadvantaged and marginalised people, and communities so they can participate in and benefit from the development of their communities and nations.

Prof Yambayamba enquired how food deficits were defined when Zambia was particularly productive in agriculture.

Prof May responded that his reference to the food deficit in Zambia was in assessing the necessary amount of food an individual needs to live. If a person gets less than a certain calorific intake per day, that person will die or weaken. Whilst Zambia might be highly productive in agriculture, the productivity lay in less nutritional crops, which would increase the nature of food scarcity.

Dr Akinbile commented that the shortage of water and the problems around wastewater negatively impacted on food production in Africa. The dietary preference for rice and its distribution and access had not been adequately addressed. He asked if this commodity would be included in future reports.

Prof May responded that more wastewater would be generated with urbanisation and that ways to manage and treat wastewater and to recycle water are a priority that all African countries should be addressing. The issue of groundwater and groundwater pollution is another important area that should be researched. The UNESCO Chair in Hydrogeology was established in 2001 at the University of the Western Cape following the introduction of the South African National Water Act (*Act 36 of 1998*). The chair focuses mainly on groundwater-related education, research and outreach and strives to contribute to sustainable utilisation of groundwater resources in South Africa, Africa and the developing world. African governments should promote an enabling environment, including appropriate legislation, partnerships, community involvement and economic incentives that will foster water infrastructure development for sustainable economic growth and assist in poverty reduction.

Prof May commented that with regard to food security, women play a vital role in production, as curators of food cultures and in the nurturing of young children. In South Africa, one of the key ways to address food insecurity and child-stunting is related to breastfeeding as South Africa has a very low rate of breastfeeding mothers.

Mr Coompson added that women and children were the most vulnerable when it came to the redistribution of wealth and taking people out of poverty in Africa. African women are more economically active as farmers and entrepreneurs than women in any other region of the world. Women grow most of Africa's food and own one-third of all businesses. However, African women are held back from fulfilling their potential and spend far too much time on unproductive pursuits, such as fetching water and firewood. Although women work 50% longer hours than men, the pay gap between men and women was very wide.

To help inform policymaking to further mainstream gender, which will lead to more inclusive growth, the AfDB launched the first-ever Gender Equality Index. The index is the most comprehensive assessment of the state of gender equality on the continent, examining the role of women as producers and economic agents, in human development, and as leaders in public life. Three mutually reinforcing pillars were identified as being key to addressing the underlying causes of gender inequalities in Africa, namely: strengthening women's legal and property rights, promoting women's economic empowerment, and enhancing knowledge management and capacity building on gender

equality. The AfDB had been mainstreaming gender equality work in its five operational priorities: infrastructure development, regional integration, private sector development, governance and accountability, and skills and technology.

The AfDB places research and knowledge-sharing at the heart of its activities. Generating and sharing knowledge are key components in reducing poverty and fostering development on the continent. The AfDB has systematically emphasised the critical role that knowledge is expected to play in the transformation of African economies to ensure sustainable development and poverty reduction. Africa should not depend on the transfer of knowledge of innovative technology that is designed elsewhere in the world, but should develop it on the continent itself. This would need the input of all African communities.

Prof Woldehana (Ethiopian Academy of Sciences) commented that with regard to the opportunities and challenges of food security, the major challenge was that countries did not consume the foods they produced but exported it to other countries. This leads to the risk of land grabs across the continent.

Prof May (University of the Western Cape) responded that land grabs are not only from outside of Africa but also from within Africa. There has been a growing demand for land characterised by the purchase or long-term lease of vast tracts of land from mostly poor developing countries by wealthier, food-insecure nations and private investors. This has highlighted how land grab represents a major shift from public to private sector control over agricultural investment, and from domestic to foreign control over crucial food-producing lands. This has consequently led to the displacement of populations, which could ultimately lead to poverty.

Summary

The speakers summarised their studies as follows:

Prof May (University of the Western Cape) commented that consumers need to make choices with respect to the food they prefer to eat. Consumers should know how the foods are produced, whether they generate jobs and what their impact is on the environment. In making these choices, consumers should be active citizens in terms of the food they eat.

Dr Caron (CIRAD) stated that poverty reduction was at the heart of the future of humanity and Africa's development. Science academies and conferences force people to think differently about their future. Poverty reduction and food security are complex issues which challenge the relationship between

scientific knowledge and decision-making. Representatives of government, the scientific community and other stakeholders in science need to better debate what efforts should be invested to make science advance in response to the efforts to eradicate hunger and poverty in the African region.

Mr Coomps (African Development Bank) noted that in order to get the youth more interested in agriculture, the industry would need to be made attractive and more businesslike and that it would be necessary to change the perception that agriculture was a way of life to it being more of a business. Agriculture has to be dynamic and profitable to attract the youth.

Prof Chapman (University of Canterbury, New Zealand) responded that the environment must never be forgotten, as without a protected environment, society will not be able to produce clever food.

Prof Soodyall responded that very often issues are spoken about but not synthesised for review against the human dimension to address the challenge of hunger and food security. The AfDB's 16 projects set the yardstick in which other activities on the African continent could participate in, in order to realise the ambitions identified. The use of scientific methodology from the New Zealand experience and the translation of this information in Africa, provide opportunities to utilise the expertise and technology that have been successful in that country. African countries should embrace this opportunity in an effort to improve agricultural methodologies in their endeavours to reduce hunger and poverty.

THEME 2: SOCIAL DETERMINATION OF HEALTH

(FACILITATOR: DR OLADOYIN ODUBANJO, EXECUTIVE SECRETARY, NIGERIAN ACADEMY OF SCIENCES)

It was previously believed that malaria was transmitted through the air but it had now been proven that the disease was contracted by a certain species of mosquito. Nowadays, conversations encompassed social determinants of health and not just germs, hospitals and drugs. In this session, other topics would be discussed that contribute to the social determination of health.

Urbanisation as a Social Determinant of Health Imperative: Addressing Spatial Inequality while Meeting Rapid Urbanisation – Who Gets Left Out? (Dr Olufunke Fayehun, Nigeria Young Academy of Science)

Health inequities exist between and within countries and these inequities are a result of a combination of poor social policies and programmes, and unfair economic and social arrangements. Researchers made decisions based on facts and figures but left out the human dimension by not addressing inequality.

Whilst the global mortality rate of children aged under five years had reduced, the rate still remained very high in sub-Saharan Africa. In 2012, approximately half the world's deaths in children aged less than five years occurred in sub-Saharan Africa. Nigeria accounted for approximately 13% of these deaths, which were caused by communicable diseases, such as malaria, diarrhoea, measles, cholera and respiratory infections. While these deaths were preventable and treatable, the lack of effective health intervention policies resulted in a high under-five child mortality rate in which the highest figures were in the rural and poor areas. More than half of these early child deaths were due to conditions that could have been prevented or treated with access to simple and affordable interventions.

In 2009, the World Health Assembly passed a resolution on reducing health inequities through action on the social determinants of health based on the work of the Commission on Social Determinants of Health. Health inequities exist because of the conditions in which people are born, grow, work, live and age. Living conditions, health and lifestyle are significantly associated with the place of residence. It has also been assumed that people living in the same areas are likely to have comparable opportunities, risks and vulnerabilities and that there is a comparative advantage of urban residence over rural residence with regard to health care services, water and sanitation infrastructure, and good housing. However, the increased movement of people from rural areas to cities affects both the physical and social environment. It has been predicted that over the next four decades, the population growth of the world would occur in urban centres because of the attraction for wealth generation and economic development. It is estimated that by 2020, there will be 25 mega-cities in Africa with more than ten million people per city.

Rapid urbanisation brings different levels of socio-economic development, uneven distribution of resources and different standards of living. Urban settings are a social determinant of health. Many poor groups live in overcrowded urban slums and shanty towns where they are exposed to a multitude of health challenges, such as insufficient basic infrastructure, inadequate access to safe water, poor quality of housing, suboptimal sanitation, inadequate access to health facilities, resource constraints and low utilisation of available health facilities. Approximately one-third of the developing world's urban population lives in slums, accounting for close to one-quarter of the total global urban population. Overcrowded living conditions cause exposure to pollution and an increased risk of acute respiratory infections, asthma, lead poisoning and tuberculosis. The burden of infectious diseases, such as HIV/AIDS, tuberculosis, diarrhoea, amongst others, is exacerbated due to slum culture and lifestyle. Furthermore, urbanisation leads to a change in physical activities and dietary patterns, which increases the risk of non-communicable diseases, such as diabetes, hypertension, obesity and cardiovascular diseases.

Inadequate health facilities, insufficiently skilled health professionals and the lack of modern medical equipment undermine health care, particularly in rural areas. Investments should be made in education and household environments to accelerate improvements in child survival. Spatial inequality needs to be addressed by the provision of safe and improved drinking water and solid waste management. Urban planning must cater for all citizens to ensure that no member of society is left out. There should be easy access to functional and affordable primary health care facilities, social support and welfare services, civil security services, educational institutions and youth-friendly centres. Urban planning should also include disability-friendly transport systems, sidewalks and pedestrian crossings. Health care bodies throughout the sub-Saharan African region should increase the coverage of health care interventions such as antenatal care, immunisation, insecticide-treated nets, and the treatment of acute conditions, such as pneumonia, malaria and diarrhoea, with an emphasis on equity in access and utilisation.

A concerted and coordinated effort is required in all sub-Saharan African countries to promote good urban planning, to ensure equal coverage of basic amenities and to ensure participatory urban governance by encouraging the involvement of all communities. Academia needs to increase the knowledge base on urban health and living so that they are able to inform policymakers on appropriate interventions.

The Disease Burden – Health Infrastructure, Social Cohesion and/or Exclusion that Affect Social Determinants of Health: HIV/AIDS, Ebola, Zika Virus and Other Communicable Diseases (Ms Janine White, School of Public Health, University of the Witwatersrand)

Illness can negatively affect an individual's social position by compromising employment opportunities and reducing income. Certain epidemic diseases can similarly affect the functioning of social, economic and political institutions.

Although disease patterns change constantly, communicable diseases remain the leading cause of mortality and morbidity in the least and less-developed countries. Communicable diseases spread from person to person by breathing in airborne viruses, through insect bites and contact with body fluids and blood. In 2012, communicable, maternal, neonatal and nutrition conditions collectively were responsible for 23% of global deaths.

The Zika virus is transmitted by mosquitoes, and evidence suggests that once contracted, the disease may spread from person to person through body fluids, as well as in-utero transmission from mother to child resulting in microcephaly and other neurological disorders. The epidemic is ongoing with cases being reported from around the world.

Since March 2014, West Africa experienced the largest outbreak of Ebola in history with multiple countries affected. The Ebola virus is transmitted among humans through close and direct physical contact with infected body fluids, the most infectious being blood, faeces and vomit. The Ebola virus has also been detected in breast milk, urine and semen.

HIV/AIDS deaths decreased slightly from 1.7 million in 2000 to 1.5 million in 2012. However, it remains one of the top ten causes of death by a communicable disease. Statistically, tuberculosis and HIV/AIDS are referred to as co-epidemics. Tuberculosis was among the ten leading causes of death in 2012 and it still remains among the 15 leading causes of death, resulting in over nine million deaths in 2012, mostly in Africa. Malaria is not caused by polluted air, but is a mosquito-transmitted disease caused by a parasite. In 2015, an estimated 214 million cases of malaria occurred worldwide. The deaths from malaria in 2015 were mostly among children in the African region.

Social determinants of health create conditions for the transmission of communicable diseases and require multifaceted integrated interventions. A multifaceted approach is key to addressing the complex interconnectedness between the conditions in which we live, work and play and the ability to foster and recover from diseases. The recent focus of global health has been on the social determinants of health, particularly the call for health in all policies and the SDGs. The social determinants of health are the health system, infrastructure, social cohesion and social exclusion. Health systems can be upstream or downstream determinants. As an upstream influence, the health system impacts on the broader socio-political determinants of health. As the downstream determinant, its influence is seen in the extent to which the health system acts as the barrier or allows access by the disadvantaged to health services. Health systems that fail to address the social determinants of health perpetuate inequity. When the health system provides no social empowerment, it is a barrier to access for marginalised groups. This is further exacerbated by exclusionary practices by health workers through their actions and attitudes, which results in an imbalance in which health inequity is further perpetuated.

Cuba has a modest infrastructure and a strong public health strategy. Achievements to date have resulted in the control of infectious diseases and a reduction in infant mortality. The country has also seen progress in the control of chronic diseases and the establishment of a research and biotechnology industry, both of which are important to a functioning health system and health systems infrastructure.

During an outbreak of the Ebola virus, an adequate public health system would be able to rapidly identify cases, trace contacts, and isolate infected and exposed patients. This was not the case in Guinea, Liberia and Sierra

Leone, which ranked the lowest in global development and essential public health infrastructure. The crisis destroyed an already-minimal health care system; hospitals were closed and poor infection control contributed to the deaths of already scarce medical staff during the epidemic. Poor water sanitation also played a negative role in the epidemic.

Social cohesion is defined as the willingness of members of a society to cooperate with one another in order to survive. Optimal functioning of communities is through social cohesion and organisations in social networks. Social networks can spread or reduce the transmission of communicable diseases. Social relationships are increasingly associated with greater individual-level risks of contracting diseases. Sex workers are at a higher risk of HIV infection, which is exacerbated by social and structural factors, inequitable laws and policies, police brutality and a lack of non-discriminatory health care services. India has introduced the Avahan Initiative, which is a HIV-prevention intervention built on the principles of social cohesion to reduce HIV infection by including sex workers in their programme.

Other interventions include peer education, sex worker friendly health services and the formation of organisations led by and with sex workers to facilitate programme ownership.

Social exclusion deprives people of choices and opportunities in accessing health services. Men, women and children who are discriminated against often end up being excluded from society, the economy and political participation. They are discriminated against in public institutions, legal systems and education and health services, as well as in the household and the community. Social exclusionary processes therefore take place across various levels, namely social, political, economic and cultural dimensions, leading to health inequalities. The malaria burden is highest in the least-developed countries with the lowest human development, and within disadvantaged populations. Social exclusionary practices based on ethnicity may lead to poor access to malaria prevention and treatment. Barriers to access can also create mistrust in public services, influence norms and attitudes and frequently lead to higher rates of malaria infection. In Panama, 85% of malaria cases occur in the indigenous populations who constitute only 10% of the country's population.

The relative importance of the social determinants of communicable diseases – social, medical, biological or environmental – should no longer be debated; they are all important. No single person or group can effectively address all communicable diseases. A multiple skills set is required with knowledge of communicable diseases, public health and the social determinants of health. Skills would need to include the ability to work with local communities, governments and non-governmental organisations.

It is essential for governments and stakeholders to understand the social determinants of communicable diseases and how clean, safe water supplies and good sanitation can assist in combating the scourge of disease. Academies of science have an increasingly important role to play, individually and collectively, in helping to achieve the goals for a healthier Africa.

Innovative Approaches to Improving Social Determinants of Health: How STI Can be Used to Achieve This (Ms Eunice Gnay Namirembe, Digital Editor, Change Corp – IT/Mobile Tech for Development)

Within developed countries, the penetration of cell phones and the Internet has risen considerably almost to the point of market saturation. In contrast, the African continent has been characterised by more uneven progress, with the penetration of cell phones considerably outpacing the penetration of the Internet.

The health of individuals, households and communities in Africa can be strengthened and sustained by improving health-seeking behaviour. The bulk of Uganda's disease burden is from preventable diseases resulting from lack of information and education. The provision of easy access to timely and relevant health information increases empowerment and health outcomes for individuals, households and communities.

The rise of digital health in Africa has seen rapid growth in access to information and communication technology, particularly mobile phones and network connectivity. This has created opportunities for health programmes and systems to harness technologies to positively impact health in the African region. Various pilot projects in digital health have been established, enabling people to be reached with timely and pertinent information. The short message service (SMS) offers a cost-effective and efficient method of providing outreach services in awareness and education applications. Results have shown that interactive message campaigns have greater ability to influence behaviour than traditional means, offering information about testing and treatment methods, available health services, and disease management in areas such as AIDS, tuberculosis, maternal and reproductive health. SMS messages offer recipients confidentiality in environments where diseases such as HIV/AIDS are often taboo. SMS messages have proven effective in targeting remote and rural populations.

For example, in Uganda, SMSs were sent to advise communities of free HIV testing at clinics; this saw an increased uptake of health services. Holistic medical care is afforded to clients with tuberculosis, HIV/AIDS and cancer. Reminders to clients to take their antiretroviral (ARV) medication resulted in an 87% increase in adherence after the SMS and an increase in the number of patients attending clinics.

The gathering of patient data and keeping the information updated and accessible on a real-time basis can be more effectively and reliably undertaken via mobile phones. The use of mobile phones for remote monitoring of patients could become crucial in countries with limited hospital facilities. The mobile phone is equipped with specialised software applications for use in diagnostic and treatment support. Once patient data are entered and the symptoms of a patient are captured, remote medical professionals are able to diagnose and prescribe. Mobile software applications undertake surveys and polls that create a dynamic content for user engagement. Participants are incentivised with airtime, merchandise and health products.

Call centres offer immediate quality health care attention, making health care services accessible and affordable by a telephone, SMS, video chat and social media. Call centres work in partnership with hospitals, insurance companies, corporates, NGOs and any institution seeking to innovatively expand their services to a wider section of the public through telemedicine and remote medical monitoring services. The call centre also has an ambulance service which by using the Google API Console and Google Maps records patient information and tracks patient locations. It is crucial for call centres to work with government and development agencies, academia and the private sector in order to promote mobile health.

The challenges facing the project include the hesitancy of many organisations to approach digital development from a research point of view. Progress requires moving from silos of technology towards an integrated ecosystem of smart solutions. Health system transformation demands research. Research should address challenges to data integrity and develop robust procedures for aggregation and analysis. Systematic review of the science, technology and innovation-based support has been minimal in Africa. There is a lack of infrastructure for cellular network coverage, particularly in low-income countries where handsets, voice, data and text pricing for wireless services are relatively high. Mobile health initiatives promoted by developed countries have often been developed using the English language. This hinders the use of mobile technology in medicine due to the lack of language translation abilities within the software solution. It is therefore imperative that developers facilitate multi-language support to enhance the usability of mobile health technologies. Furthermore, telecommunication companies often take time to finalise the registration of mobile phones.

The collection of local content is time-consuming. Many successful mobile health pilot projects do not scale up to regional or national level programmes, largely due to a lack of funding and coordination among relevant bodies. Furthermore, low levels of mobile literacy, the lack of technical support in rural areas and the lack of technical knowledge in the use of mobile phones and associated applications add complexity to contextual factors such as

language barriers. A further challenge is the confidentiality of a patient's personal health information; security and privacy issues are especially critical in low-income areas where mobile phones are often shared among family and community members.

Mobile health care services and devices can only be effective if adopted by health care professionals and patients. Health care solution providers must therefore focus on developing products and services that are easy to use. A cost-saving opportunity exists for government health care systems, health care professionals and insurance companies. Also, the mobile phone industry needs to take steps to address these challenges and establish its position in the mobile health care value chain.

Governments need to invest in mobile health technology; however, partnerships in both the public and private sector are crucial to creating fully-integrated health systems that incorporate mobile health strategies effectively.

Discussion

Dr Nowbuth (University of Mauritius) asked whether the health care service in Uganda was free for mobile phone users and whether medical staff were at risk of being sued in the case of incorrect medical information being imparted.

Ms Namirembe (Change Corp – IT/Mobile Tech for Development) responded that whilst the SMS service and calls to medical call centres were toll-free to the end-user, the partners bore the costs. With regard to medical staff being sued for information, all calls are recorded for security and clarification purposes. People who cannot be assisted by the call centre are referred to health institutions. The call centre, whilst it assists patients with health problems, is predominately used to educate people to go to health facilities.

Prof May (University of the Western Cape) commented that social exclusion could involve an aspect of adverse inclusion. People are predominantly included on qualitative terms. He questioned the role of mobile phones to reduce exclusion. With regard to gender and ICT in Uganda, women with ICT qualifications often found it difficult to get jobs in ICT.

Ms Namirembe) responded that social exclusion is largely dependent on access to mobile networks, knowledge of technology and mobile phone literacy. While there is recognition of the potential of ICT as a tool for the promotion of gender equality and the empowerment of women, people need to learn to apply their ICT knowledge in their everyday lives and pursue their passion.

Ms White (University of the Witwatersrand) commented that social exclusion practices in health care are very complex, as the people who are excluded are often refugees and migrants. In many cases, this practice is found in the attitudes of health care professionals themselves. Social exclusion is often defined as the process whereby individuals or groups are wholly or partially excluded from the society in which they live. Social exclusion is an essentially contested concept, and the notion of adverse inclusion has come into use partly as an attempt to rename phenomena described as social exclusion. The use of the term 'adverse inclusion' was not correct. The linking of mobile technology and social exclusion could go far in addressing social exclusion and reducing the spread of disease and deaths.

Prof Yambayamba (Zambia Academy of Sciences) queried whether the solutions proposed by Dr Fayehun to resolve spatial inequality while meeting rapid urbanisation were aligned more for academic discussion rather than practical implementation.

Dr Fayehun (Nigeria Young Academy of Science) responded that the problem of health policies was not with the policies themselves but rather in the implementation of these policies. Policy implementation is one of the major problems confronting developing nations. In many instances there are insufficient resources to monitor the implementation of the policies. This results in laws not being enforced, services not being provided and regulations not being developed; these shortcomings are regularly attributed to the absence of political will.

Prof Muchenje (University of Fort Hare) commented that there were very few HIV/AIDS-related programme systems that were based on facts, and in some instances they were not very reliable. Prevention programmes should be implemented at policy level.

A comment was made that organisations should provide facilities for easy access to health care. Unchecked rapid urbanisation leads to the expansion of slum areas, which create enormous health challenges. Planned, smart urbanisation will give people easy access to health care when it is envisaged that 75% of future generation will be living in cities. Cities need to be planned to ensure that all citizens have easy access to health care. If one looks at rural areas where 25% of the future generation may be living for some time, the unit cost per head of providing health care will be extremely expensive, which will lead to urbanisation. Policies need to be in place to ensure that urbanisation is smartly managed to ensure that the areas of slum settlements are not increased. Furthermore the challenges of both communicable and non-communicable diseases would have to be addressed.

Dr Oni (South African Young Academy of Science) commented that countries needed to address the issues of healthy public policies as opposed to health

policies. She suggested the need for dialogue with representatives across the African continent in this regard.

Ms White responded that the principles of social cohesion and health systems were the same for both non-communicable diseases and communicable diseases, but the approach would be different. In conditions such as obesity, diabetes and mental health, the public would need to be educated so that the stigmas attached to these conditions are addressed. In the case of malaria eradication and the social determinants of health, health systems would need to be strengthened. Infrastructure in the form of hospitals and clinics to deal with cases of malaria would need to be addressed. Community and social relationships would also play a role in people taking responsibility for their own health. Healthy public policies are the strategy behind all health policies; however, if there is no political will, this will not be realised.

Mr Acemah (Uganda National Academy of Sciences) commented that in many instances it appeared that the political will to implement health policies was based on crises. He posed the question of what it would take to put out fires before such crises arose.

Prof Modisi (Botswana Academy of Sciences) commented that some of the infant mortality figures appeared to be rather high. He also enquired how the costs of social services as a social determinant affected patients and who bore these costs.

Dr Fayehun responded that crises should be dealt with before they occur. The cost of social responsibility lies with governments. Rapid urbanisation is caused by the search for wealth, inspiration and opportunities. However, if work was created in the rural areas, people would not find the need to migrate to urban areas.

Ms White agreed that social services should be the responsibility of government and that policies should be implemented before a crisis arises. In South Africa, the University of the Witwatersrand's School of Public Health had worked with government and other stakeholders prior to the sugar, sweet and beverage tax that is to be implemented in 2017. The policy was implemented before a crisis arose. Obesity, malaria, tuberculosis and HIV are major concerns in South Africa; statistics and narratives have been written, and this information needs to be submitted to policymakers in order for policies to be implemented before a crisis presents itself.

Dr Mutseyekwa (Zimbabwe Young Academy of Science) commented that there was a lot of talk about empowering communities so that they take ownership of their own health. She was concerned that governments would not scale up to incentivise programmes in communities once the projects had progressed beyond their pilot phase.

Ms Namirembe (Uganda National Young Academy) responded that programmes without incentives had been successful in Uganda, but that incentives encourage more public participation.

Dr Nowbuth reported that Mauritius was undertaking projects on nuclear science and technology in insect ecology. This was related to the fight against fruit flies that threaten valuable crops. The technique helps to guarantee the quality of fruits and vegetables and reduces the use of pesticides. Mauritius also has a system in place for the control of malaria. This information could be shared on the African continent, as the system had already proven itself.



DAY 2

KEYNOTE ADDRESS

(DR OMILOLA BABATUNDE, DEVELOPMENT PLANNING AND INCLUSIVE SUSTAINABLE GROWTH, UNITED NATIONS DEVELOPMENT PROGRAMME)

We are in a new era where we are talking about the 17 SDGs. One of the specific targets is to pronounce SDG 5, which is accelerating gender equality and women's empowerment.

From the Universal Declaration of Human Rights 68 years ago to the SDGs today, global attention remains focused on promoting human rights and eliminating discrimination and inequitable outcomes for women, men, girls and boys. Despite widespread recognition that African women have attained higher measures of economic and social well-being, the removal of inequalities for women has lagged behind. The intersection between political and economic processes presents a clear agenda for action in Africa and provides an approach to help African countries forcefully accelerate the progress on gender equality and women's empowerment.

The Africa Human Development Report 2016 analysed the political, economic and social drivers that hamper African women's advancement. Policies and actions to close the gender gap include addressing the contradiction between legal provisions and practice in gender laws, breaking down harmful social norms, transforming discriminatory institutional settings and securing women's economic, social and political participation. Deeply-rooted structural obstacles, such as unequal distribution of resources, power and wealth, combined with social institutions and norms that sustain inequality, hold African women back.

While the continent is rapidly closing the gender gap in primary education enrolment, African women achieve only 87% of the human development outcomes of men, driven mainly by lower levels of female secondary attainment, lower female labour force participation and high maternal mortality. Social norms are a clear obstacle to African women's progress, limiting the time women can spend in education and paid work, and access to economic and financial assets. African women still carry out 71% of water collection, translating to 40 billion hours a year, and are less likely to have bank accounts and access to credit. African women's health is severely affected by harmful practices such as under-age marriage, sexual and physical violence

and high maternal mortality. In some cases when young girls marry, they are not able to work and thus cannot meaningfully contribute to their societies. They are also in some instances not able to get the education they need. In the non-agricultural informal sector, the percentage of female employment differs across the various countries.

In terms of schooling in the age group of 25 and older, men in 2014 tended to have more years of schooling than women. In terms of women in African economies, significant economic and workplace disparities between African men and women continue to be the norm rather than the exception. These disparities are found across the African region in terms of access to economic assets, participation in the workplace, entrepreneurship opportunities, and use of and benefits from natural resources and the environment. Average annual GDP losses between 2010 and 2014 due to gender gaps in the labour market exceeded US\$90 billion, peaking at about US\$105 billion in 2014 in sub-Saharan Africa. Social norms and beliefs in sub-Saharan Africa have resulted in 71% of African women and girls performing the primary responsibility for care and domestic work.

Although the number of women in parliament has doubled globally in the last 20 years, in Africa only one in every five members of parliament is a woman, which is below the 30% threshold for minimum representation of either gender. In South Africa, women ministers comprise 41% of cabinet; women deputy ministers make up 47% of the total number of deputy ministers; and there is 41% representation of women in the National Assembly. Closing gender gaps in public administration helps to ensure democratic governance, restore trust and confidence in public institutions, and accelerate the responsiveness of government policies and programmes.

The following key drivers of encouragement have been identified to ensure that more women participate in parliaments in Africa:

- Women's political leadership: Women's political empowerment and leadership is fundamental to achieving gender equality.
- Women's participation in elections: Women need to become involved in politics at community-level and vote and be voted for.
- Legal instruments: In some African countries, women are deliberately prevented from being involved in the legal and political procedures.
- Women's advocacy: Women should be empowered, which would give them recognition as being equal.
- Changing social norms: It is essential to see boys and girls as important individuals who can both contribute to societies.
- Economic empowerment: Women's economic empowerment and gender equality can be achieved by extending women's opportunities for work that are productive and deliver a fair income, security in the workplace, access to social protection, and better prospects for personal and social development.

Many African countries still have a considerable number of discriminatory gender laws. Non-discriminatory laws need to be introduced across the continent to allow equality between men and women.

In terms of policy and institutional conduits for gender equality, countries need to ensure that their policies are responsive to gender equality. Many African women still do not have economic access in terms of land and landed properties. Many lack access to financial services, labour markets and technology. Policies and institutions need to address gender equality in household control to ensure task and resource allocations, and fertility and marriage decisions. In South Africa in 2015, maternal mortality was identified as a major concern. This led to studies showing that many women died during childbirth as they lacked the opportunity to control their own fertility and marriage decisions because of tradition. In terms of societal leverage, women need to engage more in terms of civil and political participation, and women's leadership needs to be expanded into organisations.

The UN has identified four strategic pathways for addressing gender inequality in Africa, namely:

- Supporting the adoption of legal reforms, policies and programmes to advance women's economic empowerment.
- Supporting national capacities to promote and increase the participation and leadership of women in decision-making in the home, the economy and society.
- Supporting capacity to implement multi-sectoral approaches to mitigate the impacts of discriminatory health and education practices.
- Supporting women to gain access to ownership and management of environmental resources. African women in many instances lack the right to inheritance.

The implementation of women's empowerment is the cornerstone to ensure gender equality of women and the end of poverty by 2030. Gender equality is a fundamental development objective and is essential to enabling women and men to participate equally in society and in the economy. It is clear that achieving gender equality will require not just transforming economies to reduce inequalities, but also countries accelerating the implementation of commitments they made to women.

Discussion

Prof Sulaiman (Sudanese National Academy of Sciences) commented that most of the data were on South Africa and west Africa and that other countries were not being represented properly. She commented that there is a high rate of females in higher education in Sudan. Most of the graduates

in the different categories, especially science, comprise more females than males, but females are not as prevalent in the higher levels of the workforce in the country as they should be.

Prof Phaswana-Mafuya (Human Sciences Research Council) commented that the conversations had not brought anything new to the table. Recommendations continue to be made; however the time for talk is over and actions need to be implemented. Women have a different set of challenges. Women multi-task in the workplace and at home. Governments are not interested in the welfare of women employees with children, and the rules of the workplace will need extensive readjustment.

Prof Endeley (University of Buea, Cameroon) enquired about the link between the United Nations Development Programme (UNDP) and universities to generate up-to-date data that could help explore problems and measure outcomes.

Dr Babatunde (UNDP) responded that his presentation was only a snapshot of the UN report, and hence Sudan and many other countries were not mentioned. The full report presents activities by country. Gender equality on the African continent has a long way to go; women lag behind men in most cases in terms of economic, social, political and environmental issues. The UN report called on policymakers and both the private and public sectors to address these issues. Pathways have been provided as to what can be done and the economic gains that African countries could make if gender gaps were closed. The year 2016 had seen the launch of the UN report, and 14 African heads of state had committed their countries to ensure that the findings of the report would be used to influence domestic policies in terms of reforms to cater for gender equality for women.

The link between the UNDP and universities to generate data was through collaboration with many universities. The UNDP and the Oxford University have jointly developed the Multidimensional Poverty Index (MPI), which is an international measure of acute poverty covering over 100 developing countries. Dr Babatunde advised that during his tenure as Chief Economist for the UNDP in South Africa, he had engaged with the University of the Witwatersrand to consider how the goals of South Africa's National Development Plan could be achieved. This involved bringing different stakeholders together to undertake studies and collect data, which is ongoing.

Dr Babatunde invited the audience to read the full UN report, which would give greater insight into his presentation.

THEME 3: GENDER AND POVERTY

(FACILITATOR: MS DOROTHY NGILA, INTERNATIONAL RELATIONS AND COOPERATION, NATIONAL RESEARCH FOUNDATION)

Ms Ngila thanked Gender in Science Innovation Technology and Engineering (GenderInSITE) Southern Africa for sponsoring the session. GenderInSITE is an international campaign that is spearheaded by the Organisation for Women in Science for the Developing World (OWSD) to support greater awareness by policymakers in relation to the role of women and men in science technology, innovation and engineering development, and the role of science in supporting the improvement of livelihoods in men and women.

To quote Chimamanda Ngozi Adichie, "gender as it functions today is a great injustice, yet gender is not an easy conversation to have. It makes people uncomfortable, sometimes even irritable. Both men and women are resistant to talk about gender or are quick to dismiss the problems of gender because thinking of changing the *status quo* is always uncomfortable".

In the field of science, technology and innovation and at the intersection of poverty reduction there are three key areas that ought to be the subject of conversations and actions, namely:

- 1 Gender culture and diversity: Increasing the number of women who participate in science, technology and innovation. In food security and agriculture, for example, there are more women on the African continent who are engaged in subsistence farming. The number of men and women graduates in the field of agriculture needs to be determined in order to increase the diversity of research teams at universities in the science of food security.
- 2 Gender research: Between 15% and 24% of the disease burden in sub-Saharan Africa is attributed to non-communicable diseases. If a woman suffering a heart attack enters a hospital's emergency department in any given country on the African continent, they are more likely to die than men, because heart attacks have always been diagnosed, prevented and treated as if they occur in men only; heart disease is very different in women and men. Whilst there is sufficient medical research to conclude that women and men can experience different types of heart disease, research is constantly changing and these changes need to be integrated into medical curricula.
- 3 Gender and policymaking: In the field of water and energy, 71% of the collection of water in Africa is done by girls and women. Countries should support and promote close and efficient collaboration among women on gender equality. Academies of science have a fundamental role to play in contributing to gender equality and equity. Women's under-representation in academies matters, because the

organisations act as sources of both role models and science-policy advice and should ensure that their panels and reports reflect diversity.

It is critical for African governments to fund science, technology and research. There is a need to create incentives to spur more women to join research academies. A concerted effort must be made to pool resources to move Africa forward through science.

Can Women in Science Help Alleviate Poverty in Africa? (Prof Jennifer Thomson, University of Cape Town and OWSD President)

Science is essential for poverty alleviation, which has contributed to the fact that developing countries are facing poverty. Women make up half of the population and are being lost in the workforce. There are very few African women scientists in Africa. The need for women in science is critical, as they approach science differently from men. Women look at what needs to be fixed and therefore, tend to look at further problems rather than just the current research subject. Women approach managing science differently. They tend to be more descriptive in accomplishing their goal and furthermore, are willing to work on joint research, which ultimately brings unity to the research project. Scientists should not work in ivory towers; bridges need to be built in order to bring unity amongst men and women scientists.

A gender lens is needed in research and policy development. For example, research undertaken on rats and the design of car airbags and safety belts. When a female scientist went into the laboratory, the rats were not scared. When a male scientist went in, they were terrified. This also applied when a female scientist entered the laboratory wearing a male scientist's laboratory coat. This highlighted the differences in the way research subjects approach the sex of workers. Women have breasts and car airbags were never tested on women; seatbelts were never tested on pregnant women. Research needs to be looked at through a gender lens.

In agriculture, women's crops feed people whereas men's crops make money; however, when a woman's crop starts to generate income, the question needs to be asked if the crop becomes a man's crop. Banana farmers in Uganda have reported such a problem. It must be remembered that hungry people cannot make money and that money must be made in order to escape poverty. In regard to water infrastructure, women and children carry the water. In energy deployment, rural women and girls in most parts of Africa spend large amounts of time fetching firewood. Crops from rural areas need to get to markets and therefore transport issues need to be addressed in rural areas. There are too many people on the planet; educated women know that too many children and overpopulation lead to poverty.

Academies can alleviate the above-mentioned problems as they have the ear of government. Science and technology departments should have a working gender desk, as should each government department, so as to obtain gender disaggregated data to influence policy. Academies should influence parents and teachers so that girls are taught that they can study science and have a career in science. Academies should ensure that their own memberships, committees and working groups include women. Academies need to influence funding agencies to give grants to more women scientists.

Practical ways to combat gender inequality in research environments could include holding meetings during school hours, extending the cut-off for 'young scientists' awards from the age of 35 to 45, encouraging equal gender representation at conferences, committees and workshops, providing technical support to women scientists during maternity leave, encouraging employers to pay for child-care and pre-school support, extending conference grants to include child support, and the establishment of working gender equity committees in universities, learning institutions and places of work. Science is crucial in the efforts to address poverty alleviation, and academies need to implement practical ways to increase gender participation in research.

Science, Technology and Innovation for Sustainable Development Goals: Opportunities for Women (Prof Joyce Endeley, University of Buea, Cameroon)

The mainstreaming of gender obliges academies to interrogate the intersection of gender to show how the construction of gender influences food security, social determinants of health, agricultural innovation and sustainable agriculture, water and energy, and in turn, poverty in Africa.

Households are normally gendered, and therefore poverty is often gendered. Household structures and intra-household dynamics affect how women and men are affected and situated in poverty. Women more than men face an increased risk of poverty because of changes in the household structures, employment opportunities, social safety nets and climate change, amongst others. Research and development have revealed that women face the brunt of unpaid work, combined with the fact that they have fewer assets and productive resources than men; they are exposed to gender-based violence and tend to be forced into early marriages. Gender indicators affect women's participation in the economy and benefits, as well as their predisposition to extreme poverty.

Situations of inequality affect women's effective participation in all spheres of development and their ability to exploit available opportunities and benefits for their personal welfare and that of families and communities. The UN

Agenda 2030 and AU Agenda 2063 can only be achieved by unleashing the potential of women and the youth. Poverty reduction programmes can only succeed if they take into consideration the existing social inequality between men and women.

The lack of understanding of how gender perspectives can be identified and addressed remains one of the most serious constraints. Political, economic and cultural discrimination against women constitute a central obstacle to social development. The lack of gender-specific data has been an obstacle to the development of long-term strategies to reduce women's poverty and has resulted in little success having been attained in integrating a gender-specific perspective into the poverty strategy's macro-economic framework. Integrated innovative approaches are needed to address the social and economic barriers that prevent women from achieving equality and empowerment that are essential to stall poverty reduction. Governments need to understand that there is a dire need to design poverty programmes that consider the gender link to poverty and ensure that data collection is relevant to the gendered aspect of poverty.

Gender mainstreaming offers a pluralistic approach that values the diversity among both men and women, but it cannot be achieved without explicit institutional commitment and systematic efforts to implement it. Advancing gender mainstreaming requires successful implementation through the commitment of positive political will and the establishment of effective accountability mechanisms. It is important to mobilise leadership, seek out allies, secure accountability, and establish links with organisations that share these goals, identify resources and look for ways to make the issues relevant to specific target audiences.

Whilst much has been done and learned, the lessons need to be more broadly shared and utilised to make changes, particularly at policy and institutional levels. Challenges to gender mainstreaming need to be identified and addressed. Incorporating gender perspectives in all areas of societal development is not only important for achieving gender equality, but essential for the eradication of poverty.

Discussion

Mr Acemah (Uganda National Academy of Science) commented that there had been much talk about men; however, women do not support women. This has been seen in nominations of women in academies of science.

Prof Chumbow (Cameroon Academy of Sciences) commented that in terms of increasing the age for young scientists from 35 years to 45 years, Mauritius had not been successful in its endeavours to address this issue. Surveys have

shown that most graduates from African universities do not obtain their PhD before the age of 35. This is an important argument that young scientists should pursue.

Dr Nowbuth (University of Mauritius) advised that whilst initiatives for women empowerment were being undertaken, guiding policies at national level would need to dictate what can happen. Talks about the SDGs were needed to address the implementation of policies.

Ms Ngila (National Research Foundation, South Africa) responded that although discussions were held about gender mainstreaming and gender equality, it was important to not forget about the equity part of the strategy. People should ask what can be done to help women to become important actors in science academies.

Prof Thomson (University of Cape Town, South Africa) advised that domestic issues and responsibilities constitute primary challenges that female science and technology professionals face, affecting their performance and progress in their field of study. The underrepresentation of women in science and technology needs to be addressed not only by governments, but also by science academies. Prof Thomson called on all science academies to establish women in science chapters and invited interested academies to contact her in this regard. Currently, an OWSD chapter was being established in Mauritius.

Prof Enderley (University of Buea, Cameroon) reported that competition amongst women was no rifer than competition amongst men, and that this occurred in all areas of industry. In every environment, there should be a mix of people and educational levels.

Prof Gaye (Ministry of Higher Education and Research, Senegal) reported that universities in Senegal grant 51% of applications to young girls attending university for the first time. Furthermore, there were a large number of scholarships available for Senegalese and international students wishing to pursue undergraduate, graduate, Masters and diploma programmes. The Ministry of Higher Education and Research has also initiated since 2013 a programme of grant called "Project to support the promotion of female teacher and researchers of Senegal (PAPES) which is a tool aimed at boosting the academic career of female university staff and researchers.

Prof Yambayamba (Zambia Academy of Sciences) commented that women in leadership tend to perpetuate poverty among fellow women particularly in the agricultural sector. This is evident in statements made by women speakers at discussion forums that refer to 'poor' women. He expressed concern that this statement perpetuates the perception of poverty.

Prof Endeley (University of Buea, Cameroon) responded that women cannot be labelled as poor unless the categories into which they fall show this. The perception that farmers are ignorant has been surpassed and they are now seen as participants and stakeholders. The household is a fundamental unit. The disaggregation of data must be looked into and the similarities, differences and diversities captured in order to determine what should be done to uplift that particular category of people.

Prof Chapman (University of Canterbury, New Zealand) enquired from Dr Babatunde what the likelihood was of the UN recommendations report being adopted into African legal systems, particularly in relation to child marriage and inheritance laws.

Dr Babatunde responded that the UN had made its recommendations but that countries could not be forced to adopt them. The UN would advocate for the recommendations to be made rules or norms that could be introduced into various policies and frameworks.

Prof Thomson requested that Prof Gaye share what Senegal was doing in relation to promoting women in science. NASAC was in the process of compiling a booklet on the achievements of women scientists to inspire girls who were thinking of going into science and suggest how mainstreaming gender in science education could be achieved in the African context.

THEME 4: WATER, ENERGY AND POVERTY (FACILITATOR: PROF SAMMY BEBAN CHUMBOW, VICE-PRESIDENT, CAMEROON ACADEMY OF SCIENCES)

Prof Chumbow advised that water was a crucial resource for Africa's development and that in most African countries, the demand outstripped the available water resources. Water was crucial to help meet the needs of a fast-rising population and the increasing demand for food and energy. Water was the source of life, and energy was crucial for the development of any nation. Methods would need to be found to increase the efficiencies of water and energy. Prof Chumbow reported that Morocco had successfully resolved its energy problem by developing capacity in electricity production from renewable energy such as solar farms and investment in offshore wind technology.

Intersections of Policy, Practice and Academia in Advancing Urban Sustainability (Mr Melusile Ndlovu, Capacity Building Specialist: South Africa Low Emissions Development Programme)

The African population is likely to double by 2030. Over 70% of all African urban population growth will be in smaller cities and those with populations

of less than half a million, where local government capacity constraints are most serious. Urbanisation presents many challenges and does not happen in parallel with economic development. South Africa has a population of over 52 million people, growing on average by 1.3% annually. South Africa is over 60% urbanised and experiencing rapid urbanisation which has increased demand for housing hence the proliferation of slums in most South African cities. South Africa, as of November 2016, had a total of 278 municipalities of which 184 of these municipalities are licensed electricity distributors. Electricity revenues are therefore important in some of the municipalities for cross-subsidising other social services. City development has not been efficiently addressed; new areas are generally located outside the cities. The growth of cities needs to be managed in order to address predicted challenges, such as access to basic amenities, areas of economic opportunity, energy consumption and general cost of living.

Municipalities should lead the transition to a sustainable future. Given the level of current urbanisation and the lack of capacity at municipal level, external players will be required to support municipalities to solve the energy poverty crisis and to seek innovative technologies and ways of alternative energy generation. Long-term relationships need to be built between municipal authorities, academia and non-government organisations.

The capacity challenges of local government to tackle the challenges posed by rapid urbanisation and sustainable energy imperatives are significant, and are likely to remain so into the future unless significant action is taken. What this calls for is external capacity support which could be from academia to be brought in to work with municipalities in addressing these challenges. The Supporting sub-Saharan African Municipalities with Sustainable Energy Transitions (SAMSET) project is pioneering an applied methodology for facilitating energy transitions at local government level. The project is a partnership with universities and development organisations in Africa and the UK, and six municipalities in Ghana, Uganda and South Africa. The project works with intermediary organisations in each African country – one at the Institute of Statistical Social and Economic Research at the University of Ghana, and one in the Faculty of the Built Environment at the Uganda Martyrs University, in addition to Sustainable Energy Africa in South Africa. Other partners in the project include the University College London (UCL) Energy Institute, Gamos, Durham University, and the Energy Research Centre at the University of Cape Town. The project challenges academia, as the source of knowledge, to work with municipalities to understand their problems, promote learning and capacity building and facilitate the development of a sustainable energy strategy for the municipality. In terms of basic household needs in South Africa, whilst municipalities have been formulating policies to electrify informal settlements, they also need to work with universities to look at alternative energy services.

NASAC's Journey to Inform Water Policy in Africa (Ms Jackie Olang, Executive Director, NASAC, Kenya)

NASAC, since its founding in 2001 has been a voice of science in Africa, and has a credible track record for policy advisory outputs to governments and other institutions.

Health, climate change adaptation and agricultural biotechnology all involve water. SDG 6 is aimed at ensuring access to water and sanitation for all. At least 1.8 billion people globally use contaminated sources of drinking water. Water scarcity affects more than 40% of the global population and is projected to rise. Some 2.4 billion people lack access to basic sanitation services, such as toilets or latrines. There is a critical need to ensure sustainable wastewater management systems and to look at hydropower as a renewable source of energy. The demand for food is the most important driver of water use in Africa. With a growing population, Africa needs more food and must secure the water and energy needed to ensure production.

The world has sufficient water to sustain the needs of humankind, but poor infrastructure and bad economics have resulted in an inadequate supply of water, sanitation and hygiene. The issue of water scarcity in terms of poor water quality has impacted food security and educational opportunities. Droughts afflict the world's poorest countries more, worsening hunger and malnutrition, and solutions need to be sought to reduce chronic or recurring shortages of fresh water.

Ms Olang highlighted some of the activities undertaken by NASAC since 2009:

- 2009: NASAC set up a water steering committee which looked at the initiatives using desktop studies.
- 2012: NASAC attended a water conference in Mauritius entitled Water Management Issues in Africa.
- 2014: NASAC hosted a session on water during the Science and Technology Ministerial Forum in Rabat, Morocco.
- 2015: The booklet the *Grand Challenge of Water Security in Africa* was launched.

In selecting the key messages of the booklet, NASAC held meetings with water experts who ensured that the content enhanced the visibility of existing scientific breakthroughs and showcased selected African success stories. A peer-review process was undertaken to guarantee the use of science to inform policy. NASAC members endorsed the booklet to secure academy ownership and foster avenues for dissemination. After the launch, communication events were held to foster dialogue between scientists and policymakers.

NASAC addresses the issue of water through continuous liaison with policymakers. Water cannot become the limiting factor for food security; education, knowledge and capacity development at all societal and institutional levels, as well as good governance, are key for efficient and sustainable water resource management and resource development. There is a need for further development of water resources to improve access to safe water and sanitation; governments and the private sector should develop appropriate and effective water quality treatment technologies and low-cost sanitation solutions.

Governments should focus on the management of supply and demand by investing in water infrastructure operations and maintenance and by promoting effective uses of water and water storage. Furthermore, cooperation among regional economic communities and stakeholders should be strengthened to assure just and equitable distribution of water resources at regional and national levels. Strategies and policies should be put in place to counteract the impact of climate change on water resources and incorporate climate change adaptation strategies such as early-warning systems. Governments should develop and implement transparent and evidence-based policies around water security.

Africa needs to increase its funding to build human and institutional capacities to effectively develop and utilise water resources.

NASAC's Contribution to the African Water Sector Targeting Poverty Reduction (Dr Yousuf Maudarbocus, Vice-President, NASAC)

The relationship between water scarcity and poverty cannot be overemphasised. Water is used in all economic sectors, including agriculture, manufacturing, mining, tourism and transport. Africa's environment is closely linked with its climate. Africa is one of the most vulnerable regions with respect to land degradation and climate change and is also subject to frequent droughts and famine. The situation has been exacerbated by El Niño, causing drought which has directly affected the region, leading to an increase in food insecurity and malnutrition. Drought and floods cause 80% of loss of life and livestock and 70% of economic losses related to natural hazards in sub-Saharan Africa. Quality drinking water is critical for the health and well-being of the population and is a common concern across the continent. The water problem is exacerbated by rapid population growth and the effect of climate change.

Against the above-mentioned background, the IAP meeting held in March 2009, at which 13 African academies of science were represented, resolved to establish a regional water programme for Africa under the auspices of NASAC. The principal objective was to assess and report on the water

resource status in Africa. In March 2012, with the assistance of the Royal Dutch Academy of Arts and Sciences and funding from the Royal Dutch Ministry of Foreign Affairs and the German Academy of Sciences Leopoldina, a major conference was held in Mauritius at which a number of conclusions were reached. This conference was followed by two further meetings within the context of the collaboration between NASAC and Leopoldina, resulting in the production of the booklet the *Grand Challenge of Water Security in Africa*. The booklet provides recommendations to policymakers on the importance of water in Africa and delivers nine key messages on how water security and related development and the well-being of the population can be achieved and sustained through targeted policy actions.

Key message 4 highlights that the water problem is more important for the poor. Wealthier populations have reservoirs, whereas the poor have to travel long distances to get water. The lack of access to quality water impacts on health and the production of food, apart from other concerns.

Key message 5 calls on governments to focus on the management of water supply and demand by investing in water infrastructure operations and maintenance and promote the effective use of water for economic growth. There is water for everybody, but judicious distribution remains problematic.

NASAC collaborates with all academies of science, not only in Africa but throughout the world, including the Inter-American Network of Academies of Sciences (IANAS). NASAC was represented at an IANAS meeting held in Panama City in 2014 with the theme of Bridging Science and Policy to Enhance Water Security in Africa and the Americas. A further meeting was held in Nairobi, Kenya in October 2015 with the theme Improving Water Resources Management for Sustainable Development in Africa and the Americas. The meetings predominately discussed water and energy, water purification, wastewater management and water in climate change.

NASAC is committed to contributing to the Africa Water Vision 2025, which is the equitable use and management of water resources for poverty alleviation, socio-economic development, regional cooperation and the environment. There are many new technologies that could be used, such as remote-sensing techniques to monitor water quality parameters, nanotechnology in water purification systems, and the installation of desalination plants and membrane chemistry on filtration and purification systems, amongst others. Scientists and engineers in Africa should be encouraged to develop innovative technologies that will contribute to higher water use efficiencies on the continent, and these efforts should be supported through government incentives and funding from the public and private sectors and regional organisations.

Key Messages: The Grand Challenge of Water Security in Africa Policymakers' Booklet (Prof Cheikh Bécaye Gaye, Ministry of Higher Education and Research, Senegal)

In 2010, 344 million people in Africa did not have access to an improved drinking water source and 222 million people practised open defecation.

African leaders have committed themselves to ensure sustainable access to safe and adequate clean water supply and sanitation especially for the poor, and to plan and manage water resources to become a basis for national and regional cooperation and development.

The challenges facing African countries include rising populations and the growing demand for water, the rise in living standards and expectations, and rapid urbanisation. Insufficiently treated domestic and industrial effluents and agricultural run-offs have resulted in the rapid deterioration of water quality. Water is pumped into the sea, which has resulted in the continent losing not only water but also energy. Climate change has been identified as a leading human and environmental crisis of the 21st century. Scientists have predicted that Africa is likely to experience higher temperatures, rising sea levels, changing rainfall patterns and increased climate variability, all of which would affect much of its population. The impacts of climate change in Africa are predicted to have negative impacts on agricultural production and food security in large parts of sub-Saharan Africa.

The nine key messages of the *Grand Challenge of Water Security in Africa Policymakers' Booklet* are as follows:

- 1 **The importance of water:** With a growing population, Africa needs more food and must secure the water and energy needed to ensure its production at the same time as good-quality water resources are becoming scarcer.
- 2 **Water-food-energy nexus:** African governments should build efficiency into food production and delivery, as well as resource use, through investment in education and innovation, green technologies, multiple uses of recycled products, and in abundant renewable energy resources. This includes biogas production from organic waste, reuse of nutrients in agricultural production and recycling of process water.
- 3 **Education, knowledge and capacity building:** African governments must strengthen capacity enhancement programmes at community, academic and institutional levels; and support knowledge-based strategies for water management amongst policymakers and decision-makers across the science/management divide.
- 4 **Access to safe water and sanitation:** There is a need for further development of water resources in order to improve access to safe water and sanitation. Whilst progress has been made, serious efforts

are necessary to maintain infrastructure and services and to implement wastewater treatment and recycling. Governments and the private sector should develop nationally and locally appropriate and effective water quality treatment technologies and low-cost sanitation solutions.

- 5 **Water resources and infrastructure for economic growth:** Governments should focus on the management of supply and demand by investing in water infrastructure operations and maintenance, and by promoting the effective use of water.
- 6 **Managing transboundary systems:** To avoid potentially conflicting uses, the African Union should strengthen cooperation among regional economic communities and stakeholders to assure just and equitable distribution of water resources at regional and national levels.
- 7 **Global change and risk management:** African governments should put in place new strategies, or review existing strategies and policies, to counteract the impact of climate change on water resources and incorporate climate change adaptation strategies in their development plans and programmes, such as early-warning systems.
- 8 **Water governance and management:** African countries need to streamline their efforts to promote good water governance, secure the promised financing for development and invest in water infrastructure, human resources and institutions for proper management of the water resources.
- 9 **Financing:** There is a clear need in Africa to increase funding to build human and institutional capacities to effectively develop and utilise water resources. Investment in the water sector should come from both government and the private sectors; initiatives should be encouraged and public-private partnerships strengthened. Governments should be at the heart of harnessing water.

In order to adequately address the issue of water scarcity in Africa, the need to invest in the development of Africa's potential water resources to reduce unnecessary suffering, ensure food security, and protect economic gains must be urgently addressed and appropriate action taken.

Small Island Developing States' (SIDS) Response on Water Advisories (Dr Manta Devi Nowbuth, Faculty of Ocean Studies, University of Mauritius)

Ancient mariners are reported to have said "water, water everywhere but not a drop to drink". Many small island developing states (SIDS) have failed to make acceptable levels of progress towards the achievement of the water-related SDGs and the reduction of water-related risks. SIDS are particularly vulnerable to climate change, climate variability and sea-level rise. Many health hazards in SIDS are caused by poor water quality, limited water quantity and restricted access to clean water. Mauritius has laws to protect water quantity and quality over the long term.

Mauritius has implemented advisory councils to forewarn the public of a particular risk or danger. Water advisories are issued that relate to water quality such as pollution, water quantity such as drought, and water safety, such as floods.

SIDS have their own challenges. Whilst they are subjected to cyclones which result in contamination in water pipelines, and torrential rains which cause flash floods, there are also long dry periods. Mauritius has recognised the need to reduce losses and wastages.

During dry periods, advisories team up with radio, television, social media, billboards and private companies to create awareness with regard to saving and using water optimally. Legal implications are imposed against those that do not adhere to regulations, especially companies. With regard to water safety and torrential rain, warnings and updates are announced from the prime minister's office such as advising the public not to venture near river banks and other water courses, to keep away from flooded areas or to leave their workplaces earlier. Examples of advisories include instructions to consumers on the cleaning of household water tanks and actions to be taken when a leak has been detected in the reticulation system. There is furthermore a website that deals with such matters. Pamphlets are distributed on occasions such as Water Day. The pamphlets also provide useful information for educational purposes.

Active ownership by community members in the operation, maintenance and management of their water supplies is crucial in small island communities. Small islands cannot afford to buy water from neighbouring countries, and therefore investment in storage capacity is critical. The citizens of Mauritius have commenced rainwater harvesting practices in their homes, schools, industries and farms. Recently, the Mauritian government has embarked on an incentive programme to encourage people to include rainwater harvesting mechanisms in the initial design of buildings, especially in residential areas. Dual water cisterns and water efficient taps are freely available on the market. The Mauritian government also gives incentives for people to purchase water tanks and to take precautions during cyclones and torrential rains. The biggest challenge facing the water advisories is that people become complacent and it is only during times of crisis that they adhere to recommendations and policies.

Water advisories are a necessity; they engage with the community, identify hazards and risks, and advise on actions to be taken. Water advisories monitor control measures and easily catch the attention of the general public, particularly in the case of early warnings. Water advisories bring out key issues timeously, especially if legislation is associated with announcements.

Discussion

Prof Chumbow (Cameroon Academy of Sciences) observed that water and energy problems are not insurmountable; they can be solved through careful and effective planning and management to ensure safe clean water and energy for all communities.

Dr Rambau (Auditor-General's Office of South Africa) referred to the key messages noted in NASAC's policymakers' booklet and commented that whilst recommendations had been given to governments, tracking the progress of these recommendations would need to be monitored. He enquired whether any of the speakers' affiliations were assisting governments in addressing the problems.

Mr Ndlovu responded that his presentation was not about government but was directed to the scientists' roles in academies.

Dr Elliott (InterAcademy Partnership) commented that whilst the booklet was very praiseworthy she queried what the outreach plan was to disseminate the knowledge contained therein.

Prof Maudarbocus (NASAC) responded that there were many booklets covering other topics. Booklets such as *Harnessing Modern Agricultural Biotechnology for Africa's Economic Development and the Climate Change Adaptation and Resilience in Africa* booklet launched in Mauritius are just a few of many that have been distributed at conferences and events. With regard to assisting policymakers to address the key messages, he commented that government decision-makers believe they know everything and do not rely much on scientific advice from academies. It is an ongoing struggle to get policymakers to listen to scientists or other knowledgeable forums.

Prof May (University of the Western Cape) remarked that poverty was not natural and was the result of other factors. He expressed interest to know what constituted the politics of water in the preparation of the booklet and whether both governments and private sectors were involved.

Prof Chumbow (Cameroon Academy of Sciences) responded that the role of NASAC and the other academies was to give evidence-based advice to policymakers both in government and the private sector. The challenge was how to reach the private sector.

Prof Modisi (Botswana Academy of Sciences) asked about transboundary agreements and how NASAC could assist with regard to shared waters and shared river basins.

Mr Ndlovu responded that USAID had launched the Resilient Programme involving Botswana, Mozambique and South Africa. The programme addressed transboundary water management, biodiversity management and good governance.

Ms Olang (NASAC) responded that policymaking decisions involve dialogue between all spheres of government, stakeholders and scientists. Whether they take NASAC's advice or not is an ongoing challenge. One should remember that there are other advisory councils that also provide advice to government, and governments are therefore at liberty to choose which advice should be taken. The process of dissemination and outreach is through communication events via the various academies. In relation to the politics of water, the private sector had participated in the preparation of the water booklet and had introduced a positive mindset change around water issues. Whilst NASAC relied on inter-governmental projects to remedy the water issues, it could lend its voice in publicising the recommendations.

Dr Nowbuth (University of Mauritius) commented that although the Mauritian government had commenced with many policy actions and recommendations brought about by climate change, there was a need to bridge the gap between science and policymakers. The *Grand Challenge of Water Security in Africa Policymakers Booklet* was a step in the right direction.

A comment was made that the topic of transboundary agreements was always a topic of discussion at conferences attended by the majority of the academies of science. Some African countries such as Senegal already had programmes in place. It was suggested that a conference should be held with the theme of transboundary agreements and that countries should be given the opportunity of highlighting their achievements.

Prof Farombi (African Academy of Sciences) commented that 1.8 billion people use contaminated sources of drinking water which was an enormous cause for concern. Whilst there was sufficient water available, the quality was poor and therefore the sources of pollution would need to be addressed. Organisations should be taken to task in terms of their indiscriminate disposal of waste and industrial effluent, which affects the quality and value of the food chain. Certain pesticides no longer in use in developed countries were still being used in Africa, for example, atrazine which is used to combat weeds in crops such as maize. Atrazine was banned in the European Union in 2004 because of its persistent contamination of groundwater. Scientific studies around the world have suggested that the herbicide is associated with birth defects in humans as well as in animals. Academia in Africa needs to include toxicology in their studies and to carry out assessments and provide clinical data and make recommendations for other user-friendly pesticides.

Ms Olang responded that it was crucial for academies to make authorities aware of any water contamination issues and that academies should find mechanisms of ensuring that the problems are dealt with timeously and adequately. Educating policymakers about the problem increases their capacity to advocate for policies to address identified needs. In terms of pesticides in water, Kenya had a relatively developed pesticide regulatory system, however the challenge was to exercise proper controls over the sale and use of banned and severely restricted pesticides. The Ministry of Agriculture had made attempts to address this issue and talks are underway for subsidies to be paid to farmers to use bio-pesticides. Academies should engage with authorities and legal institutions to advocate for enforcement in the use of pesticides and for the common good.

Prof Aduda (NASAC) commented that water should be a service and run as a business, particularly in the rural areas of Africa.

Dr Nowbuth (University of Mauritius) responded that water was the source of many businesses and their services. Water must be provided as a basic necessity, as development was not possible without water. Payment for water was a challenge. Many countries have a payment scheme whereby basic needs are addressed, followed by *pro rata* scales of payment, depending on whether the water is used for business or residential purposes.

Ms Olang responded that it was important for governments or states to provide water to its citizenry at reasonable costs. In certain parts of the African landscape, the transport of water could be cheaper due to the downstream gravitation pull. Whilst the suggestion of a commitment of 10% of GDP to water investment was a tall order, it was feasible when looking at the cross-cutting nature of water especially across the health, agriculture and education sectors.

Prof Gaye (Ministry of Higher Education and Research, Senegal) commented that there is enough water in Africa for all populations, but water storage is a problem. This should be addressed not only in cities but also in rural areas.

Another participant suggested that Africa should also establish a continental water advisory council. Populations are growing, and the environment is changing. Projections of future water resources are crucial to the future of Africa as a whole in order to ensure that future generations have water. Financing remains a challenge, and it is extremely important for stakeholders to invest in Africa's water resources in order to realise water security for all. Through the Maputo Declaration on Agriculture and Food Security, African heads of state and governments had committed to the allocation of at least 10% of their national budgetary resources to agriculture and rural development. The suggestion was made that at least 10% of GDP should also be invested in water.

Dr Nowbuth responded that the water advisories in Mauritius are generated from identified situations such as drought or floods. A water advisory at continental level would create much awareness with regard to water issues.

Ms Olang responded that NASAC could compile a water advisory, but usability would need to be addressed by individual national governments.

Ms Sadan (Department of Planning, Monitoring and Evaluation, South Africa) commented that governments have access to the information emanating from scientific knowledge. South Africa had been very aware of the drought, but planning for the consequences of drought had been inefficiently managed and ecological infrastructure had lacked investment. Government should invest in water resources and not just in the building of dams.

Prof Sulaiman (Sudanese National Academy of Sciences) commented that artisanal gold mining presents a serious threat to Africa's fresh water resources. Mercury is used in water during the separation process of gold from silt. Furthermore, factories dispose wastewater that contains heavy metals into the water systems. Governments should have clear restrictions on the dumping of wastewater into water resources.

Dr Nowbuth advised that in terms of water pollution, legislative controls should be in place to secure the health of the population.

Prof Maudarbocus responded that whilst most countries had legislation in place, the private sector would also need to take responsibility for their respective industries.

Mr Ndlovu remarked that reports produced by academia were often long and written in scientific language that the public would not understand. Very often government officials did not read reports, as the documents were too cumbersome. He requested academia to write reports using simple language and to package them so that people could easily understand the message. Furthermore, proposals needed to be clear and concise in order for financiers to see value in the investment of projects.

Prof Chumbow responded that the *Grand Challenge of Water Security in Africa Policymakers' Booklet* had been backed by research. It was very precise and contained all the elements that needed attention. NASAC would make the research documentation available if requested. Prof Chumbow further advised that all academies of science should become agents of change in order to solve the water problem in Africa.

THEME 5: LAUNCH OF SOCIAL PROTECTION POLICYMAKERS' BOOKLET

(FACILITATOR: PROF RAPHAEL MUNAVU, KENYA NATIONAL ACADEMY OF SCIENCES)

Prof Munavu reported that poverty reduction is defined as a set of measures, both economic and humanitarian, that are intended to permanently lift people out of poverty. Poverty is measured by the population's access to basic needs in its environment. Forty-five per cent of the African population live below the poverty line. Investment in social security to uplift the poor above the poverty line was not an easy task. It was therefore imperative to know how poor, people were in order to address the poverty gap. African countries had committed to uplifting poor people to reach a level where they could access services such as education, health, transport, as well as goods such as clothing and shelter. These are declarations of intent; however, poor people need to be enabled and empowered with confidence and dignity to uplift their own well-being. This becomes an issue of social protection. The South African constitution specifies that every citizen has basic rights whether they are poor or wealthy. Social protection is being able to provide goods or services; however, people need to be provided with cash to be able to access the goods and services they need. Kenya is at the forefront in the African region in providing social protection for its citizens, particularly the elderly and marginalised. The effective practice of social protection cohesion allows governance to become easier.

Presentation on the Social Protection in Africa Policymakers' Booklet (Dr Sophie Plagerson, University of Johannesburg)

Social protection comprises a range of public and private initiatives to protect people against social and economic issues. The overall aim is a reduction of the experience of poverty and vulnerability faced by many people across the continent. Social assistance includes cash transfers for social pensions and child and disability grants amongst others. Social insurance is normally accessed on the basis of employment status such as contributory pensions, unemployment benefits and health insurance. Social services include health care, water and sanitation, housing, education, as well as labour-market policies.

The ten key messages of the booklet include:

1 **The mandate for social protection in Africa is endorsed by the African Union**

Globally the social protection mandate is supported by international commitments such as the UN's Sustainable Development Goals. As a continent, the AU has endorsed the promotion of social protection in line

with Agenda 2063 and UN Agenda 2030, which aspire to a prosperous Africa based on inclusive and sustainable development. Social protection has been recognised as an effective instrument to combat poverty, provide food security, cut inequality, promote gender equity, build human capital and integrate marginalised groups. More than 50 countries in Africa have social assistance programmes, yet more than 70% of Africans still lack access to any form of social protection.

2 **Implementing a social protection agenda is feasible and affordable in low and middle-income countries**

Affordability is a political issue, and social protection needs to be viewed as an investment rather than a drain on public resources. This is a key component of both economic and social policy. Evidence has shown that well-designed and well-delivered social protection programmes can be affordable. Social pensions are affordable for almost all African countries, costing approximately 2% of GDP. Financing is available through national government revenues including direct and indirect taxes, international aid and beneficiary contributions. In countries such as Mozambique, governments have funds allocated from other areas that receive high levels of funding, such as military budgets and energy subsidies.

3 **Social protection programmes require clear policies and strong institutions**

The predictability of social protection enhances domestic benefits and therefore, most countries are adopting a rights-based approach to social protection. South Africa and Kenya have both included the right to social security in their constitutions. Many African countries have made progress towards comprehensive social protection systems through legislation and the establishment of delivery institutions. Burkina Faso, Ghana, Kenya, Mozambique, Rwanda, Sierra Leone, Tunisia and Uganda, among others, have adopted, or are in the process of adopting social protection strategies as part of their national development agendas.

4 **Key design features**

In all countries, priorities need to be considered. These may include the needs of children, women, internally displaced people and refugees. Ghana has introduced the Livelihood Empowerment Against Poverty (LEAP) programme, which allows exemption from payment of a health insurance premium for eligible beneficiaries and access to health care benefits that would normally be contributory. Some countries are integrating multiple components within a single programme in order to meet the needs of different vulnerable groups simultaneously. Appropriate targeting and delivery mechanisms have been supported by innovative technologies such as smart phones, smart codes and cell phones. Biometric smartcards have been used in Namibia to overcome difficulties in identifying beneficiaries without appropriate

documentation and allowing beneficiaries to withdraw their pension from either fixed or mobile payment units using their smartcard and fingerprints. Mobile phones have been used in Kenya to transfer cash to nomadic or hard-to-reach beneficiaries. Monitoring and evaluation methods are crucial in the expansion of social protection systems. Social audits and public accountability mechanisms are gaining ground in some cases, for example, community score cards in Malawi. This gives communities an essential role in assessing the performance of services.

5 **Implementation can be phased in ways that build on existing programmes and processes**

Dr Plagerson drew on the example of the child support grant in South Africa. The programme has been gradually extended and coverage has increased from 150 000 grants in 2000 to over 12 million in 2016. The programme was designed to remain within budgetary constraints and assisted by Parliament's approval. Subsequently, the administrative requirements have been relaxed and the South African Social Security Agency was established to centralise and improve the implementation of the grant system. The grant has now been extended to all children up to the age of 18 years and the amount per recipient has been increased to R350. The grant has also been extended to permanent residents and refugees.

6 **Social protection can promote gender equality, empower women and reduce social exclusion**

Social protection can promote gender equality and empower women. Social protection needs differ by gender. Women are poorer, they live longer, work for fewer years and earn lower wages. Women often carry a disproportionate reproductive and care burden. Social protection measures can either be aimed at women or could be discriminatory against women. An example of a gender-sensitive programme is the Ethiopian Productive Safety Net Programme, which provides child care at work sites. The application of a gender base is important, particularly to understand the impacts for women and men in their care roles within and beyond the home. Evidence shows that a reduced gender poverty gap can lead to improved health and education outcomes for girls and women; however, it is possible for programmes to reinforce women's traditional roles and responsibilities, thereby exacerbating existing inequalities.

7 **Government commitment and strategic coordination are essential**

Government commitment and strategic coordination are essential for the success of social protection programmes such as the commitment made by Bishop Kameeta of Namibia to eradicate poverty and to provide integrated social security benefits and services. The Single Registry is a software platform in Kenya that was designed to provide increased harmonisation and consolidation of fragmented schemes and to enhance the responsiveness of social protection initiatives to increase

their capacity to quickly scale up in response to rapid-onset crises. These developments indicate a commitment to building institutional capacity and providing information through accessible and transparent databases.

8 **Social protection is part of an overall development strategy**

Social protection policy must not be viewed in isolation but needs to be considered as part of an overall development strategy. The Purchase from Africans for Africa (PAA) which was inspired by the *Brazilian Programa de Aquisição de Alimentos* provides linkages between school-feeding programmes and local supply chains across several African countries. Schemes are in place to support local farmers to produce more than their needs in order to supply school-feeding programmes.

9 **The synergies between formal and informal social protection need to facilitate the involvement of communities in social development**

Traditional or indigenous informal systems of protection continue to exist in many African countries where extended families, households and communities are the main sources of social support. Different types of informal social protection systems such as cooperative schemes and communal societies help to manage risk and to support people in times of hardship.

10 **Social protection policies are most effective when they are combined with other social and economic policies to sustainably address poverty and inequality**

Social protection can and does have a major impact on poverty redistribution and inequality, particularly when looking at high levels of inequality in southern African countries. In South Africa, the impact of fiscal policy through social grants has significantly reduced inequality. Yet social protection alone is not enough. Social protection policies are most effective when they form part of integrated national development strategies to promote social protection and ensure inclusive human development and pro-poor economic growth. Social protection policies are not stand-alone policies, but should be integrated with other overarching social and economic policies.

Polymakers' Round Table and Response

Ms Adelaide Asante (Ministry of Environment, Science Technology and Innovation, Ghana)

The document has been well prepared and covers many of the key issues in terms of social protection policies and strategies. The issue of sustainability was mentioned throughout the booklet. The national health insurance scheme in Ghana has suffered due to a lack of funding and almost collapsed due to huge debts owed to hospitals and pharmacies and the government was

forced to resolve this issue. This raises the question of how such a programme can be sustained when initiated by global partners and not by the countries themselves. The country is currently undertaking the LEAP programme, which is funded by the World Bank. Further funding would be needed to ensure the success of the programme. International donors and organisations have influenced social protection approaches; however, social protection programmes are expensive and difficult to manage. It is therefore strongly recommended that programmes should be institutionalised to ensure sustainability.

Africa tends to politicise social interventions. In Ghana, allegations have been made that social interventions, such as the school-feeding programme and the national health insurance scheme, have suffered as a result of the politics involved. Countries need to ensure that social interventions are sustained and not politicised. Furthermore, social protection programmes should not stand alone; there are other interventions in other sectors such as education. The Ministry of Science and Technology in Ghana, for example, provides scholarships for science students and in particular for those who fall within the poorer communities. Ghana also has micro-loan centres that finance needy families wishing to start up a small business. This results in capacity building.

Ms Asante concluded that the report was of excellent quality and called on all countries to address the key issues highlighted.

Ms Mastoera Sadan (Department of Planning, Monitoring and Evaluation, South Africa)

Ms Sadan stated that the booklet was a very useful contribution to the policy debate around social protection and raised many pertinent issues. Whilst the impact of the South African child support grant has been positive, dependency remains an issue of discourse in South Africa. The role of the state and social security is fundamental to the development of any country. South Africa as an upper-middle class country has the resources to ensure social security and the welfare of its citizens. South Africa with its high levels of unemployment, poverty and inequality places emphasis on the importance of redistribution.

The South African constitution talks about dignity and citizenship. The Bill of Rights talks about access for all to social security. The constitution contains the promise of access to socio-economic rights for all; however, actual enjoyment of a right, rather than entitlement to it, is what really matters. The caveat that introduced the progressive realisation of rights and the policy reform that the country has seen, particularly in terms of social grants over the last 20 years, speaks to that issue.

In 1994, the new South Africa inherited a relatively well-developed social security system; however, many grants were race targeted. The child support grant therefore should be seen as part of a policy-reform process rather than a new intervention. A narrative commonly used in South Africa is that whilst the country has the best policies, implementation is poor. Although this is true for a number of policies, this does not apply to all policies, especially the child support grant. After 1994, the institutional infrastructure had to learn to give grants to all and not to a selected few, and it was during this time that the child support grant for all was phased in. At the same time, the National Treasury introduced the conditional grant and increased its institutional infrastructure to strengthen its implementation and delivery to poor people. The success of implementation and policy reform can largely be attributed to the relationships between NGOs, government and civil society, which were evident from the exponential growth in child grants in South Africa. Grants now also include foster care and care dependency, resulting in a reduction in child poverty.

Policy success is attributable to context, capacity and commitment to deliver a well-targeted, well-planned and demand-led initiative. Management structures within government must have the capacity to implement the programmes. Adequate technical competencies to design and implement programmes that will appropriately respond to national realities, and monitor and evaluate these programmes, must be addressed.

Mr Francis Kintu (Parliament of Uganda)

It is a common complaint that scientific knowledge is not used efficiently in policymaking. The question should be the extent to which science academies have gone in cementing relationships with policymakers and formulating legislation. Africa has seen a positive growth in GDP over the last decade; however, the level of social protection commitment remains very low at 2.5%. There is a fundamental lack of appreciation of the importance of social protection and poverty eradication, which could be enhanced by the scientific community.

In ten sub-Saharan countries, people are living below the poverty line. African governments must play an important role in social protection. In Uganda, more than one million people are hungry due to droughts and crop failure. Policies are not grounded in scientific knowledge but on the interests of civil society and lobbyists. Whilst parliaments have specialised working committees, they lack the appropriate capacity to formulate and implement policies. Whilst social protection in Africa is very low, it is achievable, but governments do not cater for it correctly. The scientific community has not sensitised governments on the critical role of social protection and needs to form linkages with government policymakers throughout Africa.

Science advice based on evidence is vital for informed decision-making on issues relevant to social protection. The Uganda National Academy of Sciences works to achieve improved prosperity and welfare for the people of Uganda by generating, promoting and sharing evidence-based scientific knowledge and advice to government and civil society. The academy is also working towards training members of parliament to build a greater appreciation and understanding of the social dynamics in that country. It is therefore extremely important for African science academies to have agreements in place with their national parliaments.

Africa is committed to end poverty in all its forms everywhere. Science academies need to engage with governments in order to realise the SDGs in Africa. Nations need to conserve, preserve and harvest water. African governments should focus on management of supply and demand by investing in water infrastructure operations and maintenance, and by promoting the effective use of water such as enhancing water storage by water harvesting, adopting conjunctive water uses, promoting wastewater treatment and recycling, and reducing losses in the supply chain. Social protection must be recognised as part of each country's national development planning.

Discussion

Prof Munavu (Kenya National Academy of Sciences) stated that lobbyists should not outdo scientists in the endeavours to implement social protection programmes.

Dr Nanyaro (Tanzania Academy of Sciences) asked whether the 10% increase in child grants in South Africa was a monthly or annual figure and how it related to inflation.

Dr Plagerson (University of Johannesburg) responded that she was not able to answer the question, but that the full report was available on request. The presentation had shown the overall impact of the grants. The increase of 10% at the upper level amounted to R141 075 per year, whilst the increase of 10% at the bottom level amounted to R2 131 per year.

Prof Munavu asked whether Mauritius had a social protection plan.

Prof Maudarbocus (NASAC) responded that Mauritius had a social protection programme for the elderly in the form of a pension grant. Mauritius' old-age pension was worth approximately 20% of the average wage in the country in 2008. There was also a programme for the unemployed and handicapped, and government was pursuing an insurance programme for the poor. The country would also need to look at issues of free health care and free education.

Mr Ndlovu (South Africa Low Emissions Development Programme (SA-LED)) stated that there are currently 278 municipalities in South Africa. Ninety per cent of households were in urban areas, and the cost to municipalities to keep these households connected to the grid amounted to approximately R900 per household per month. However there were households that consumed less than R60 per month. This underscores the importance of protecting municipal revenues. Social protection funds were not solely generated from national sources but from sub-national entities such as municipalities as well.

Prof Chumbow (Cameroon Academy of Sciences) commented that there was a thin dividing line between social protection and dependence. At township level in particular, unemployed young people sit at corners taking illicit substances whilst still benefitting from social protection funds granted to their parents and grandparents.

Ms Sadan (Department of Planning, Monitoring and Evaluation, South Africa) responded in relation to the comment on unemployed young people who were abusing substances that social security could not solve every problem in society. It is a very particular intervention, which is largely about cash income. People have to be trusted to use the grants in the best possible way for themselves. Government cannot intervene in every household and dictate how the grant should be spent. Evidence shows that the majority of people use the money in a way that actually improves the lives of their children. In terms of dependency, it is a misconception that poor people should work for their money and do not deserve to be given money. The general consensus is that those who work pay taxes, and the poor use those taxes. Whilst the issue of corruption in government is acknowledged in South Africa, taxes are largely channelled to interventions that government has undertaken.

Ms Asante (Ministry of Environment, Science Technology and Innovation, Ghana) commented that effective mechanisms should be put in place to inhibit the potential for abuse of social protection programmes. Dependency was a social problem and should be linked into other social protection programmes. Psychologists for instance could assist with the issue of dependency. Statistics need to be carefully collated and monitored to ensure that grants are channelled in the right direction. Tracking of programmes is essential to ensure that the profiles of recipients are correct and current.

Dr Plagerson responded that it is crucial to develop social protection as an investment and not as a drain on societies and governments. Social protection plans have long and short-term productive impacts. Employment, whilst being a separate issue, was still connected to social protection. Evidence had shown that young people wanted to work and social protection programmes could be seen as a complementary intervention. Evidence had shown that the predictability and regulation of cash transfers had been seen as a bridge

into employment, i.e. funds could be used by rural communities for transport to seek work in urban areas.

Prof Gudyanga (Zimbabwe Academy of Sciences) commented that Zimbabwe has four areas of social protection:

- Grants to pupils whose parents cannot afford to pay for education.
- The National Security Authority, which provides pensions on retirement, and all Zimbabweans contribute towards this fund.
- HIV/AIDS levy which all Zimbabwean employees are charged 3% of their salaries to provide programmes for AIDS prevention and cure.
- The Rural Electrification Authority where each electricity consumer pays 1% to provide electrification to rural areas.

Prof Patel (University of Johannesburg) stated that universities collaborated with government or agencies on scientific issues. South Africa had learned how to use academic resources to formulate evidence-based policies and an example of this was the work that ASSAf and the DST had undertaken.

Mr Kintu (Parliament of Uganda) advised that Uganda has two social protection programmes, namely cash grants to the elderly and grants to vulnerable families. The latter was being redesigned as it had been subjected to abuse.

Prof Munavu advised that the Kenyan constitution provides for basic rights including access to water, education, food and shelter in a conducive environment. The national government is obligated to ensure that the basic rights are met. In Kenya, 0.5% of the GDP is allocated to assisting individuals in poor or disadvantaged communities. Whilst the figure may appear to be small, the quantum is sufficiently high. In South Africa national resources need to be shared formally between the 178 disadvantaged municipalities.

Mr Ndlovu (SA-LED) responded that the fiscal framework for municipalities was different in terms of revenue. Municipalities relied predominantly on revenue from electricity and grants from government.

Prof Munavu enquired how participants saw social protection in Africa in 2025.

Mr Kintu responded that the result would be dependent upon two aspects: social protection would need to be mainstreamed to alleviate some of the problems and it would need strong advocacy. Social protection was a commitment to eradicate poverty. More countries were starting to streamline social protection programmes and science academies could be of great value in this process.

Ms Sadan responded that social interventions must be delivered at scale in order to have impact at scale. In South Africa where the country is delivering at scale, the child support grant of R350 is low and therefore, an impact on poverty reduction is seen but not on inequality.

Ms Asante responded that most of the sub-Saharan countries' social intervention programmes had been initiated by developmental partners, and when they reached the point of mainstreaming, the issue of sustainability remained a key challenge.

Prof Patel argued that social protection is crucial for economic growth in a country. African countries have failed to do this and therefore will not grow.

Prof Munavu responded that Africa needs to empower the poor by 2030. Social protection should include a social empowerment component, as well as an affirmative action framework. A preferred procurement process system had been implemented which stated that 20% must be channelled to the disadvantaged, marginalised, disabled, women, etc.

Prof Diab stated that the booklet *Social Protection in Africa* was pertinent to every member of the audience. The onus was on individuals to disseminate the booklet in their various countries so as to have a positive impact. ASSAf would meet with its Standing Committee on Science for the Reduction of Poverty and Inequality and discuss the steps to be taken. This would be followed by a press release, and the booklet would be made available to all government departments. Presentations would also be made to government and other stakeholders.

Prof Diab thanked the panellists for their contributions. A special word of thanks was extended to Dr Sophie Plagerson and Prof Leila Patel for compiling the booklet for utilisation across Africa.

WAY FORWARD TO AMASA 13 BY NASAC (DR OLADOYIN ODUBANJO, NIGERIAN ACADEMY OF SCIENCE)

AMASA 13 would be held in Nigeria in November 2017 with the theme Science, Technology and Education.

VOTE OF THANKS AND CLOSING REMARKS

(PROF ROSEANNE DIAB, EXECUTIVE OFFICER, ASSAf)

Prof Diab expressed her gratitude for the opportunity to network with representatives from the various science academies and institutions. She stated that this was the 12th meeting of the African science academies and empha-

sised the importance in sustaining this meeting in the years ahead. In spite of a budget shortfall, ASSAf knew that it had to host AMASA 12 and had a reputation to uphold. ASSAf also knew that it would have to raise the funds. In raising the funds, Prof Diab paid tribute and thanked the staff of ASSAf. It was not only senior personnel who raised the funding but the collective effort of many staff including junior staff who went out as individuals and ultimately gathered R2.6 million to host this meeting.

Prof Diab also paid tribute to the many sponsors of the meeting including the Department of Science and Technology, the IAP, the New Zealand High Commission in Pretoria, , GenderInSITE which is sponsored by UNESCO, USAID, the Centre of Excellence in Food Security of the University of the Western Cape, the German National Academy of Sciences Leopoldina and NASAC.

African science academies need to take funding very seriously. The annual meetings have a very important function, as it is the only meeting in the calendar year where the leadership of the academies meet to discuss matters that are of importance to them and to hold the scientific conference. The question is how to sustain these meetings. The meetings cost about US\$200 000 to host, which is a challenging amount for any science academy to raise in the current economic climate. A fundraising strategy for these meetings in the medium to longer term will need to be implemented as it is going to become increasingly difficult to host these meetings, especially for smaller academies.

Prof Diab stated that it had been a privilege to host the conference and thanked all the speakers and participants who enriched the meeting. A proceedings report will be produced and distributed electronically. She also thanked the facilitators of the various sessions and all the participants for their attendance.

APPENDIX 1

LIST OF ATTENDEES

Prof Oumar Sock	Académie des Sciences et Techniques du Sénégal
Ms Nadia Algera	Academy of Science of South Africa
Prof Roseanne Diab	Academy of Science of South Africa
Ms Nozuko Hlwatika	Academy of Science of South Africa
Ms Phyllis Kalele	Academy of Science of South Africa
Mr Tsepo Majake	Academy of Science of South Africa
Ms Marvin Mandiwana	Academy of Science of South Africa
Ms Constance Manyeli	Academy of Science of South Africa
Mr Stanley Maphosa	Academy of Science of South Africa
Mr Kholani Mbhiza	Academy of Science of South Africa
Ms Zuki Mpiyakhe	Academy of Science of South Africa
Prof Daya Reddy	Academy of Science of South Africa
Mr Ian Shendelana	Academy of Science of South Africa
Ms Edith Shikumo	Academy of Science of South Africa
Prof Himla Soodyall	Academy of Science of South Africa
Ms Renate Venier	Academy of Science of South Africa
Ms Henriette Wagener	Academy of Science of South Africa
Prof Ebenezer Farombi	African Academy of Sciences
Prof Georges Ekosse	African Academy of Sciences
Mr Joseph Coopson	African Development Bank
Dr Patrick Caron	Agricultural Research and Development
Mr Martin Matlebyane	American Embassy Pretoria

Dr Takalani Rambau	Auditor-General of South Africa
Prof Mahouton Hounkonnou	Benin National Academy of Sciences, Art and Letters
Prof Mansourou Moudachirou	Benin National Academy of Sciences, Art and Letters
Prof Motsoptse Modisi	Botswana Academy of Sciences
Prof Alexander Proyer	Botswana Academy of Sciences
Dr Vincent Tanya	Cameroon Academy of Sciences
Prof Sammy Chumbow	Cameroon Academy of Sciences
Sir Arthur Guischet	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
Dr Jean Albergel	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
Prof Johan Kruger	Department of Planning, Monitoring and Evaluation
Ms Mukondi Masithi	Department of Planning, Monitoring and Evaluation
Ms Mastoera Sadan	Department of Planning, Monitoring and Evaluation
Mr Mthokousi Tshima	Department of Planning, Monitoring and Evaluation
Ms Mmampeï Chaba	Department of Science and Technology
Dr George Lindeque	Eskom
Prof Bahru Woldehana	Ethiopian Academy of Sciences
Prof Masresha Workneh	Ethiopian Academy of Sciences
Dr Mariamawit Yeshak	Ethiopian Young Academy of Sciences
Ms Melanie Villar	French Embassy
Dr Jan Nissen	German National Academy of Sciences Leopoldina
Prof Akilagpa Sawyerr	Ghana Academy of Arts and Sciences

Dr Christopher Akinbile	Global Young Academy
Prof Refilwe Phaswana-Mafuya	Human Sciences Research Council
Dr Tom Arrison	InterAcademy Partnership
Dr Tracey Elliott	InterAcademy Partnership
Dr Richard Glover	International Council for Science
Mrs Noel Abuodha	Kenya National Academy of Sciences
Prof Raphael Munavu	Kenya National Academy of Sciences
Dr Michieka Okiago	Kenya National Young Academy of Sciences
Prof Yashwantrao Ramma	Mauritius Academy of Science and Technology
Ms Adelaide Asante	Ministry of Environment, Science Technology and Innovation, Ghana
Prof Cheikh Gaye	Ministry of Higher Education and Research, Senegal
Prof Inocente Mutimucuo	Mozambique Academy of Sciences
Prof Orlando Quilambo	Mozambique Academy of Sciences
Prof Arouna Ouedraogo	National Academy of Sciences, Arts and Humanities of Burkina Faso
Prof Hamidou Toure	National Academy of Sciences, Arts and Humanities of Burkina Faso
Dr Papa Diop	National Academy of Young Scientists of Senegal
Ms Dorothy Ngila	National Research Foundation
Dr Mamphela Ramphele	Nelson Mandela Foundation
Prof Bernard Aduda	Network of African Science Academies
Prof Mostapha Bousmina	Network of African Science Academies
Prof Robin Crewe	Network of African Science Academies
Ms Rahab Gitahi	Network of African Science Academies
Prof Yousuf Maudarbocus	Network of African Science Academies
Mr Philbert Okello	Network of African Science Academies

Ms Jackie Olang	Network of African Science Academies
Prof Barney Pityana	Network of African Science Academies
Mr Adam Linnell	New Zealand High Commission, Pretoria
Dr Olufunke Fayehun	Nigeria Young Academy of Science
Dr Oladoyin Odubanjo	Nigerian Academy of Science
Mr Francis Kintu	Parliament of Uganda
Prof Karl Klingsheim	Royal Norwegian Embassy, Pretoria
Mr Melusile Ndlovu	South Africa Low Emissions Development Programme
Dr Tolu Oni	South African Young Academy of Science
Prof Jo Vearey	South African Young Academy of Science
Dr Sahal Yacoob	South African Young Academy of Science
Prof Suad Sulaiman	Sudanese National Academy of Sciences
Prof Esther Mwaikambo	Tanzania Academy of Sciences
Dr Asifa Nanyaro	Tanzania Academy of Sciences
Ms Pfungwa Nyamukachi	The Conversation
Mr Christian Acemah	Uganda National Academy of Sciences
Prof Frederick Kayanja	Uganda National Academy of Sciences
Mr Sydney Sproul	Uganda National Academy of Sciences
Ms Belinda Nabukalu	Uganda National Young Academy
Ms Eunice Namirembe	Uganda National Young Academy
Dr Omilola Babatunde	United Nations Development Programme
Mr Graham Paul	United States Agency for International Development
Prof Joyce Endeley	University of Buea, Cameroon
Prof Hazel Chapman	University of Canterbury, New Zealand
Prof Murray Leibbrandt	University of Cape Town

Prof Jennifer Thomson	University of Cape Town
Prof Vorster Muchenje	University of Fort Hare
Prof Leila Patel	University of Johannesburg
Dr Sophie Plagerson	University of Johannesburg
Dr Manta Nowbuth	University of Mauritius
Prof Jimi Adesina	University of South Africa
Prof Julian May	University of the Western Cape
Mr Tackson Makandwa	University of the Witwatersrand
Ms Janine White	University of the Witwatersrand
Mr James Phiri	Zambia Academy of Sciences
Prof Kavwanga Yambayamba	Zambia Academy of Sciences
Prof Francis Gudyanga	Zimbabwe Academy of Sciences
Prof Michael Tumbare	Zimbabwe Academy of Sciences
Dr Fadzai Mutseyekwa	Zimbabwe Young Academy of Science

APPENDIX 2

LIST OF ACRONYMS

AFAWA	Affirmative Financing Action for Women in Africa
AfDB	African Development Bank
AIDS	Acquired Immune Deficiency Syndrome
ARV	Antiretroviral
ASSAf	Academy of Science of South Africa
ASADI	African Science Academies Development Initiative
AGM	Annual General Meeting
AMASA	Annual Meeting of African Science Academies
AU	African Union
CAADP	Comprehensive Africa Agriculture Development Programme
CGIAR	Consultative Group for International Agricultural Research
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
DST	Department of Science and Technology
EU	European Union
FSN	Food security and nutrition
GDP	Gross domestic product
GenderInSite	Gender in Science, Innovation, Technology and Engineering
HIV	Human Immuno Virus
IANAS	Inter-American Network of Academies of Sciences
IAP	InterAcademy Partnership
ICT	Information and communication technology
LEAP	Livelihood Empowerment Against Poverty
MPI	Multidimensional Poverty Index
NASAC	Network of African Science Academies
NGO	Non-governmental organisation
NRF	National Research Foundation
OWSD	Organisation for Women in Science for the Developing World
PAA	Purchase from Africans for Africa
SA-LED	South Africa Low Emissions Development Programme
SAMSET	Supporting African Municipalities in Sustainable Energy Transition
SDG	Sustainable Development Goals
SIDS	Small island developing states

SMEs	Small and medium enterprises
SMS	Short message service
STI	Science, technology and innovation
UCL	University College London
UN	United Nations
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USAID	United States Agency for International Development
USA	United States of America
US NAS	United States National Academies of Science



