



INNOVATION Symposium
february 24-26, 2010

frontiers of
research,
policy and
practice

ORGANISED & HOSTED BY **WITS UNIVERSITY**

**INTERNATIONAL
SYMPOSIUM**

UNIVERSITY OF THE WITWATERLAND
JOHANNESBURG

Innovation is an imperative

Professor Loyiso Nongxa



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practice

Wits University is a research-intensive university committed to teaching, learning and research for the benefit of Africa's development. A publicly-engaged institution, Wits is critically responsive to society's needs and expectations in the South African and African context.

As an African university, we are in the fortunate position of being able to resort to our African base as a competitive advantage to reach this goal. This implies that we must strive to operate at the leading edge of all disciplines, and wherever feasible address and contextualise African realities in our research endeavours. Such an approach will enable us to explore new, exciting and innovative dimensions in the search for knowledge and truth and thereby elevate global scientific and intellectual debates to new levels. Simultaneously it will mobilise knowledge for innovation and technological advancement which is essential for economic growth and wealth creation, to face the pressures of globalisation, and to cope with the burdens of disease, urbanisation and climate change.

Innovation is at the heart of the process of finding solutions to such urgent global problems as sustaining future livelihoods in the face of the increasing polarisation of wealth and destitution, the growing scarcity of vital resources like food and water, and the disruption of human populations by changing climatic pattern. Countries around the world are experimenting with models that place science and innovation at the heart of government's thinking and strategies and encourage multi-stakeholder collaboration. In a similar spirit, we must find the means to harness our local multi-sectoral capacities in ways that overcome the often inadvertently fragmented deployment of our collective intellectual capital.

Universities, pre-eminent knowledge organisations, have the capability to produce practical, theoretical and strategic knowledge across a wide range of fields – both established and emerging. Indeed, it is from the emerging fields that we are seeing some of the most exciting prospects for engaging the complex challenges of society. The capacity of higher education to supply leading-edge knowledge long into the future depends on its ability to invest in both esoteric and applied disciplines.

To explore these issues, Wits University has undertaken to host an international symposium on innovation and development. The symposium brings together scholars, the private sector, development partners and the public sector. The rich engagement is expected to extend our shared understanding of these issues.

Professor Loyiso Nongxa is the Vice-Chancellor and Principal of Wits University, and is Chairperson of the Higher Education South Africa Research Strategy Group.

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Innovation for Development: Frontiers of Research, Policy and Practice

International symposium organised and hosted by Wits University

Background

Innovation is an imperative for developing countries that seek to balance economic growth with the redistribution of wealth and effective provision of essential public goods, such as education, housing and health. Innovation can be defined as the production, diffusion and use of new and economically useful knowledge; this requires intentional effort and investment and is not restricted to radical innovation or activities at the technological frontier. The strategies used in the developing world involve capability building and technological upgrading, for which learning processes are critical inputs.

Innovation strategies matter for development. Countries as diverse as Korea, Singapore and Ireland have demonstrated that paying attention to these policies can make a difference. Innovation strategies help countries to deal with structural changes in their economies, and enable them to respond better to external challenges, especially in the nature of international markets and trade regimes. The success of a country's response can be shown to rely on its ability to acquire and use new technology and to master new knowledge. This ability does not rely upon basic science so much, but depends on the efficient unfolding of various learning processes. Innovation itself is not a smooth process, but is full of uncertainty and must be managed. Effective innovation systems consist of a web of interacting and interconnected agents and institutions, including private sector firms, universities, research centres and policy institutions. There is an imperative to manage the technological and institutional change inherent in innovation in a way that promotes development. Africa presents specific challenges and opportunities, many of which differ from other developing country regions.

Focus

There is an urgent need to increase focus on innovation and to realign strategies so that science, technology and innovation align with a human development agenda. The contribution that this symposium will make is to connect the innovation studies agenda

explicitly to development debates, and to offer the specific context of Africa and South Africa as an empirical laboratory for investigating aspects of innovation studies practice at national and regional levels.

Approach

Wits University has undertaken to organise, host and manage an international symposium as a contribution to the innovation and development community. The symposium provides a platform for knowledge exchange among academics, policy makers and the business community on the interaction among:

1. science, technology and innovation activities ('practice')
2. public policies to support and enhance innovation activities ('policy')
3. the efforts of the academic innovation studies community to study research and innovation practice and policy, and to mediate between them ('research') and as a cross-cutting theme
4. the relevance and impact of innovation on development ('development').

The organisers have designed the symposium in collaboration with universities, thinktanks and institutes active in science, technology and innovation policy and research, with a focus on developing countries, and Africa in particular. There is an explicit effort to involve private sector firms, institutions, individuals and agencies that may otherwise not be defined as part of the innovation community.

The insights produced are likely to be relevant for promoting innovation, shaping policy and corporate strategies. The university intends to build on the outcomes of this symposium as the basis of an ongoing research programme, as well as for teaching and engagement with its community and stakeholders.

Academic governance for the conference is provided by an international Scientific Committee drawn from specialists in the field, chaired by Professor Belinda Bozzoli, Wits University Deputy Vice Chancellor (Research).

SYMPOSIUM OUTLINE

Planning and design of the symposium are being coordinated by Gillian Marcelle, Associate Professor of Strategy and Innovation at Wits Business School, in consultation with the academic, policy and business community.

Structure of the Symposium

The symposium will consist of keynote presentations by leading scholars, thematic panels, roundtables with policy makers and private sector leaders, and individual paper sessions. There will also be a separate pre-symposium workshop, which will address issues related to developing interdisciplinary approaches to teaching and research on science, technology and innovation for development and mechanisms for strengthening networks on science, technology and innovation for development.

Confirmed Keynote Presentations

Professor Calestous Juma, Harvard; Professor Anil Gupta, Indian Institute of Management; Professor Raphael Kaplinsky, Open University; Professor Judith Sutz, Universidad de la República, Uruguay; Professor Derek Keats, Wits University and Carlota Perez, renowned economic and technological historian and analyst. Dr Mamphela Ramphele, Chair of the Technology Innovation Agency will provide the opening keynote address.

Themes

Individual papers or panels will cover the following themes:

Innovation and Development: Setting the Agenda

- Impact of innovation for development
- Connection and disconnection – bridging development and innovation studies
- Politics of knowledge production
- Rethinking the development project by integrating innovation
- Theorising and measuring contribution of innovation to development
- Strengthening advocacy for the roof innovation in development
- Role of innovation as a catalyst for clean technologies and sustainability

Dynamics of Innovation in Developing Countries: Innovation Outcomes

- Uncovering invisible innovation activities and systems
- Alternative measurement of innovation
- Improved understanding of learning processes for capability building and innovation at the firm level, including sectoral specificities (biotechnology, energy, agriculture, forestry, livestock, natural resources, mining, telecoms, IT, infrastructure, leisure, culture and entertainment)
- Knowledge and technology acquisition by developing country firms, what core competencies are needed?
- Open innovation systems and models
- Innovation in rural and informal settings
- Innovation and protection of indigenous knowledge systems

Generate, Promote and Support Innovation in Developing Countries: Practice and Policy

- Building capacity to promote and manage innovation in developing countries
- Case studies of innovation management and policy formulation
- Review of the approaches used by multilateral agencies and bilateral donors
- Updates on donor strategies in funding technological capability building
- Comparative analysis of various models of funding innovation
- Private sector firms as funders of innovation in developing countries
- Likely impact of global recessions on private and public sector funding of innovation
- Managing and promoting innovation at the city and regional level

Summary of Programme

We are pleased to advise that we attracted a number of high-quality presentations and papers from across the globe. There are a total of 34 papers and presentations, made up of: 27 academic papers and seven keynote presentations, including by Professor Calestous Juma, Harvard; Professor Anil Gupta, Indian Institute of Management; Professor Raphael Kaplinsky, Open University; Professor Judith Sutz, Universidad de la República, Uruguay; Professor Derek Keats, Wits University and Carlota Perez, renowned economic and technological historian and analyst. Dr Mamphela Ramphele, Chair of the Technology Innovation Agency, has accepted our invitation to provide the opening keynote address. The academic paper presentations will be complemented by a development partners roundtable, private sector panel, policy roundtable and several activities open to the general public, including a public lecture by Professor Anil Gupta and a public debate on creating an innovation culture in SA.

Thematic Representation

There is a good spread of papers across the three themes. The Innovation and Development: Setting the Agenda theme attracted five papers from established scholars and one from an emerging scholar; while the Dynamics of Innovation in Developing Countries: Innovation Outcomes theme attracted seven papers from established scholars and seven papers from emerging scholars. Similarly, the theme on Generate, Promote and Support Innovation in Developing Countries: Practice and Policy attracted six papers from established scholars. In addition to these papers in the three themes discussed above, there will also be a pre-symposium workshop dealing with teaching innovation studies in a developmental context. A lead paper by Professor Mario Scerri, Institute for Economic Research on Innovation (IERI), Tshwane University of Technology (TUT), has been accepted for that workshop.

Institutional Representation

The scholars who have submitted papers and the keynote presentations are drawn from over 20 institutions across the world. These include universities, national research bodies, government departments and global institutions.

Geographic Representation

The papers and keynote presentations are drawn from institutions in 12 different countries, including Brazil, Denmark, India, Kenya, Mexico, The Netherlands, Nigeria, Sri Lanka, South Africa, Uruguay, the United Kingdom and the United States. The continental representation for papers and presentations is as follows: 21 from Africa, three from Asia, five from Europe, two from South America and two from North America.

Emerging Scholars

It is heartening to know that the geographic representation above includes eight papers from emerging scholars in the innovation field. They span the continents of Africa and Europe and represent countries such as The Netherlands, South Africa and United States.

Schedule

| | |
|---------------------|---|
| July 2009 | Call for invited papers |
| October 2009 | Confirmations |
| November 2009 | Launch of symposium |
| 19 February 2010 | Lecture by Professor Calestous Juma |
| 23 February 2010 | Workshop on teaching innovation studies |
| 24-26 February 2010 | Main symposium |

Papers

The call for invited papers closed on 30 September 2009. Abstracts of the accepted papers are available on the symposium website, and papers will be posted on a rolling schedule.

Publication Plans

All papers and presentations will be posted online as part of the Wits Business School Working Paper Series on Strategic Management of Innovation, as well as on the symposium website. Wits has secured a partnership with the *Financial Times* for the production of specific materials on the symposium themes. The best papers from the symposium will be published in a Special Issue of an influential peer-reviewed journal – *International Journal of Technological Learning, Innovation and Development (IJTLID)*, with the publication date scheduled for Q4 2010.

SCIENTIFIC & TECHNICAL COMMITTEE

Scientific Committee

| | |
|--------------------------------|---|
| Paulo N. de Figueiredo | (EBAPE/Getulio Vargas Foundation, Brazil) |
| Martin Bell | (SPRU, University of Sussex, UK) |
| Jo Chataway | (Open University, UK) |
| Mammo Muchie | (University of Alborg, Denmark/South Africa) |
| Gillian Marcelle | (Wits Business School, South Africa) |
| Alexandre O. Vera-Cruz | (UAM-X, Mexico) |
| Belinda Bozzoli | (Chair, Deputy Vice Chancellor Research, Wits University, South Africa) |
| Banji Oyelaran-Oyeyinka | (UN Habitat, Kenya) |
| Sunil Mani | (Centre for Development Studies, India) |
| Thomas Pogue | (IERI, Tshwane University of Technology, South Africa) |

Technical Committee

| | |
|-----------------------------|-------------------------------|
| Thomas Pogue | (TUT, South Africa) |
| Gillian Marcelle | (Chair, WITS Business School) |
| Manola Sanchez Aragu | (WITS Business School) |
| Mmabatho Leeuw | (WITS Business School) |
| Pamela Andanda | (WITS Law School) |
| Nhlanhla Mabaso | (WITS University) |
| Nepeti Nicanor | (WITS Business School) |
| Yewande Benza | (WITS Business School) |

FOR FURTHER DETAILS, CONTACT

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PROGRAMME

| Time | DAY ONE Wed 24/02/2010 | DAY TWO Thursday 25/02/2010 | DAY THREE Friday 26/02/2010 | | |
|-----------------------------|--|---|---|---|---|
| | Chalsty Auditorium West Campus | Chalsty Auditorium West Campus | Chalsty Auditorium West Campus | | |
| 8:00 - 9:00 9:00 - 11:00 | Registration Welcome Remarks Opening Keynote by Dr. Mamphele Ramphele Chair, Technology Innovation Agency Keynote Address Professor Judith Sutz | Roundtable discussion with private sector PRESS CONFERENCE & MEDIA BRIEFING | Keynote address Professor Raphael Kaplinsky Roundtable discussion with policy makers | | |
| 11:00 - 11:30 | Refreshments | Refreshments | Refreshments | | |
| 11:30 - 1:00 | Development Partners Roundtable Discussion | Keynote Addresses Professor Derek Keats Professor Anil Gupta Discussion | Emerging scholar presentations Track one Nhlanhla Mabaso Solomon Habtey Alexis Habiyaemye Khafra Crooks Track two Nepeti Nicanor Chris Charalambous Ezekiel Maphisa Geci Karuri-Sebina Discussion | | |
| 1:00 - 2:00 | LUNCH | LUNCH | LUNCH | | |
| 2:00 - 3:00 | Theme 1 Michael Kahn Mammo Muchie Thomas Pogue & Lucy Abrahams | Theme 2 Paulo N.De Figueiredo Boladale Abiola Alex Vera Cruz | Theme 2 Suni Mani Sujata Gamage Michael Gastrow Pamela Andanda | Theme 3 Nal Abdelrasaq Glenda Kruss David Walywn & Phila Sithole | Great Hall Auditorium East Campus PUBLIC DEBATE: CREATING AN INNOVATION CULTURE IN SOUTH AFRICA |
| 3:30 - 4:00 | Refreshments | Refreshments | | | |
| 4:00 - 5:30 | Theme 3 Jo Chataway & Dinar Kale Rasigan Maharajh Banji Oyelaran-Oyeyinka | Theme 1 Jo Lorentzen Gillian Marcelle | | | |
| 4:30 - 5:00 | | | CLOSING SESSION | | |
| 5:00 - 5:30 | | | RECEPTION | | |
| 6:00 - 7:30 | Donald Gordon Auditorium Parktown Campus FORMAL OPENING Director General Dept. of Science & Technology Dr Phil Mjwara PUBLIC LECTURE Opening Remarks Consul-General of India The honorable Mr Vikram Doraiswami PUBLIC LECTURE Professor Anil Gupta | | | | |
| 7:30 - 10:00 | | Conference Dinner | | | |

BIOGRAPHIES

PROFESSOR **CALESTOUS JUMA**

Calestous Juma is an internationally recognised authority in the application of science and technology to sustainable development worldwide. He is professor of the Practice of International Development and director of the Science, Technology and

Globalization Project at the Harvard Kennedy School of Government. He also directs the Agricultural Innovation in Africa Project, funded by the Bill and Melinda Gates Foundation. He is a former executive secretary of the United Nations Convention on Biological Diversity and founding director of the African Centre for Technology Studies in Nairobi, and he also served as chancellor of the University of Guyana.

Professor Juma has been elected to several scientific academies, including the Royal Society of London, the US National Academy of Sciences, the Academy of Sciences for the Developing World, and the UK Royal Academy of Engineering. He has won several international awards for his work on sustainable development. He holds a PhD in science and technology policy studies and has written widely on science, technology and environment. He teaches courses in developmental policy as part of the MPA/ID Program. He is lead author of *Innovation: Applying Knowledge in Development*. He is editor of the *International Journal of Technology and Globalisation* and *International Journal of Biotechnology*.

PROFESSOR **CARLOTA PEREZ**

Carlota Perez is a researcher, lecturer and international consultant, specialising in the social and economic impact of technical change in the historically changing conditions for growth, development and competitiveness. She is visiting senior

research fellow at Centre for Financial Analysis and Policy (CFAP), Judge Business School, Cambridge University, UK; professor of Technology and Socio-economic Development at the Technological University of Tallinn, Estonia; and honorary research fellow at SPRU, Science and Technology Policy Research, University of Sussex, UK.

Her articles from the early 1980s and her book, *Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages* [Elgar 2002], have contributed to the present understanding of the relationship between technical and institutional change, between finance and technological diffusion and between technology and economic development.

Some of her papers and books are used as study material in postgraduate courses in universities in many countries. As consultant and lecturer, she has worked for various public and private organisations, for major corporations and governments in Latin America, North America and Europe as well as for the EU, the OECD, the UN and several multilateral agencies.

She is frequently invited to participate as international keynote speaker in academic, public policy and business events.

DR MAMPHELA RAMPHELE

Dr Mamphela Ramphele is the chairperson of the TIA Board. She spent four years as a managing director at the World Bank. Prior to her time at the World Bank, she was the vice chancellor of the University of Cape Town. She served as a director at the Institute for Democracy in South Africa and Equal Opportunities Research Project. She is also the chairperson of Circle Capital Ventures and a former co-chair of the Global Commission on International Migration.

She holds a PhD in social anthropology from the University of Cape Town, a BCom in administration from UNISA, a diploma in public health from the University of Witwatersrand, a diploma in tropical health and hygiene from the University of Witwatersrand and MBChB from the University of Natal.

Her repertoire of awards include the NRF Lifetime Achiever Award (2007), the Global Health Sciences Award (2007), the Kilby Awards Foundation (2003) and Shoprite Checkers Woman of the Year Award (1996).

Some of her published work include *Laying Ghosts to Rest – Dilemmas of the Transformation in South Africa* (2008), *Steering by the Stars* (2002), *A Life* (1995), *The Affirmative Action Book: Toward an Equity Environment* (1995) and *A Bed Called Home – Life in the Migrant Labour Hostels of Cape Town* (1995). Her fields of expertise are anthropology, academic governance structures, education and health policies, and monitoring and evaluation.

**PROFESSOR JUDITH SUTZ**

Judith Sutz is the academic coordinator of the University Research Council of the University of the Republic, Uruguay, and professor of Science, Technology and Society in the Faculty of Social Sciences. Her research work is related with the specific conditions

for innovation in developing countries, and with problems associated with the production and social use of knowledge in such countries. She was the secretary of Science, Technology and Development of the Latin American Commission of Social Sciences and a member of the task force on Science, Technology and Innovation of the UN Millennium Development Project. She is advisory editor of *Research Policy* and a fellow of the World Academy of Arts and Sciences.

PROFESSOR ANIL K GUPTA

BSc (Agri), MSc (Genetics, HAU), PhD (Kurukshetra)

Indian Institute of Management, Fellow, National Academy Arts and Science, India; Fellow, The World Academy of Art and Science; Executive Vice Chair, National Innovation Foundation; Founder, Honey Bee Network; Member, National Innovation Council; Chaired by adviser to Prime Minister of India.

His mission is to expand global as well as local space for grassroots innovators to ensure recognition, respect and reward for them; blending excellence in formal and informal science; protection of intellectual property rights of the innovators but also expanding open source as a part of 'technology commons'. He is keen to link grassroots innovators in developing countries and has pioneered a grassroots to Global (g2G) strategy for knowledge-based approaches to poverty alleviation and employment generation.

His interests include ethical issues in conservation and prospecting of biodiversity; linking innovations, investments and enterprise; creating knowledge networks at different levels for augmenting grassroots green innovations and inventions in the informal and formal sector. He has worked tirelessly to help organizations become more creative and innovative from bottom up and by learning from grassroots innovations. He was chosen by leading weekly *India Today*, as one amongst 50 Pioneers of Change in the country (along with seven other grassroots innovators).

Professor Gupta established the Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI, 1993,) and the Grassroots Innovation Augmentation Network (GIAN, 1997,), two voluntary organizations to support the Honey Bee Network and to scale up and convert grassroots innovations into viable products respectively. He helped set up the National Innovation Foundation (NIF, 2000,), assisted by the Department of Science and Technology, Government of India to make India an innovative and creative society and a global leader in sustainable technologies. The NIF has mobilized more than 140 000 innovations and traditional knowledge practices from over 545 districts of India, the largest database of its kind anywhere. Recently, through student volunteers and without much external support, he established a portal of 104 000 tech student projects at or to link the needs of the informal sector and small and cottage industry with young technology students This project has increased the Innovation Quotient of the country of India by providing a clearing house. He has been involved in setting up Culturally Alive! India and an open source portal which provides educational software for children.

KEYNOTE PRESENTERS



PROFESSOR DEREK W KEATS

Professor Derek W. Keats is Deputy Vice Chancellor, Knowledge and Information Management at the University of the Witwatersrand, Johannesburg. Derek is a marine biologist with a strong interest in the innovation power of technology in higher education. He has developed a number of initiatives in the fields of educational and environmental informatics, and founded African Virtual Open Initiatives and Resources (AVOIR) to stimulate development through fostering software engineering of Free Software. Despite his strong technology focus, with the help of collaborators, he still manages to publish in the area of his first love – biology. For more information, visit [or](#) for his regular blogs.

RAPHAEL KAPLINSKY

Raphael Kaplinsky is a professor of International Development at the Open University. He is the author of numerous books on technology, industrialisation and globalisation. These include studies on globalisation, industrial policy, industrial organisation, global value chains, the international automobile sector, computer-integrated automation, computer aided design, the impact of microelectronics on employment and on appropriate technology. During the early 1990s, he pioneered research on the changing patterns of organisation in manufacturing in developing countries. In 2005, he published a book on globalisation, utilising micro-, meso- and macro-data to examine the generalised consequence of upgrading in the global economy (*Globalization, Poverty and Inequality*). During the course of this research, he has over the years worked with enterprises, government departments and other organisations in Japan, the USA, Western and Eastern Europe, Central America, Brazil, sub-Saharan Africa, and South and Central Asia.



Professor Kaplinsky has participated in numerous UN and EU Missions, providing advice to a large range of countries, particularly on industrial and technology policies. He has led teams of advisers in Central America, Cyprus, South Africa and Kazakhstan, and has participated as an adviser in a number of other countries. Between 1991 and 2003, he worked intensively with the South African government on industrial policy, and has been deeply involved in the development of industrial strategy in the post-apartheid era. He has also provided advice on strategic focus and on manufacturing organisations to transnational firms, and to firms in the UK, Africa, Brazil, Central Asia, Central America and India. In the mid-1990s, he worked with the European Commission on a programme of assistance to encourage organisational restructuring in European manufacturing and services. More recently, he coordinated economic support to the Brighton and Hove Economic Regeneration Council and advised the United Nations Conference on Trade and Development (UNCTAD) on policies towards agricultural commodities.

Professor Kaplinsky has engaged with African policy makers. In 2008, he presented the opening plenary and closing address to the AfrIPANet IV conference held at the 4th Conference of African Ministers of Industry meeting in Durban, South Africa on 24 and 25 October. On 27 October, he addressed the African Chief Executives Forum on the role that benchmarking can play in supply chain development. On 28 October, he participated in the workshop of the African Clothing and Leather Research Network. On 29 October, he and Esko Aho (former prime minister of Finland, now CEO of Nokia) were the keynote speakers at the opening of the 11th Annual Conference of the Global Competitiveness Institute in Cape Town, South Africa.

On 31 October, he participated in the annual conference of the South African Trade and Industry Policy Secretariat, addressing new directions in innovation strategy.



Technological Change and Innovation Lead the Way to a Global Golden Age

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practice

Carlota Perez is a leading scholar of the relationship between technical change, finance and development. She has studied the historical diffusion patterns of technological revolutions, their regularities and how they change the opportunity spaces for growth, innovation and development. According to her analysis, these changes occur in periodic surges of half a century or more and follow recurring patterns of diffusion. The dominant new technologies of each surge bring a paradigm shift that transforms the logic of innovation organisation and competition across the board. The current shift is from petroleum-based mass production to ICT-based flexible production in a globalised world. She holds that financial booms accelerate the changes, helping displace or modernise the old sectors and installing the new ones. Major collapses, midway along each surge, mark the passage from a turbulent and frenzied period of uneven growth and polarised incomes to a 'Golden Age', when the economic and social benefits of the new potential can fully fructify. In 2005, she opined: "The Nasdaq collapse of 2000 was not big enough to force the changes necessary to get there.... [T]he collapse has to be disastrous enough to make it clear to everyone that the time when the stock market drives the growth of the economy is finished." Art Kleiner (2005) Carlota Perez Thought Leader Interview Strategy + Business / November 29, We pick up that conversation with her in 2010 as part of the International Symposium on Innovation for Development, hosted by Wits University.

In your view, was the 2008 financial collapse big enough this time to unleash the global Golden Age of this technological revolution?

Yes, historically, Golden Ages have occurred after major bubble collapses and this is certainly a major one. The Victorian boom followed the railway mania and panic; the post-WWII boom came after the roaring twenties and the crash of 1929. In that case, there was the long interval of the great depression and a devastating war.

This time, after the NASDAQ collapse, we had another boom, more like a Gilded Age than a Golden Age, driven by financial innovations based on ICT. This second bust certainly seems to have been big enough to unleash the social and political pressures that lead to regulating finance and favouring investment in the production economy rather than in the casino.

Such pendular swings –from the control of finance to that of production and from unfettered markets to regulated ones– are typical of the way the market system works. Each technological revolution takes over as the main growth and innovation driver, but it has to wage a battle against the mature but powerful incumbents. Human resistance to change and the deadweight of organisational inertia have to be overcome, and that's the role of unrestrained free markets and deregulated finance. Once that job is done, which it clearly is now, the pendulum should swing in favour of the 'real' economy, with a reactivation of the role of the State in shaping market conditions. But we may still live through further bubble collapses before the political will is there to make the switch.

Where would innovation for such a Golden Age come from?

The potential for a global sustainable Golden Age is certainly available. Driven by the financial booms, information technology has radically transformed the infrastructure networks for communication, and this has opened a vast range of opportunities for innovation across all sectors of the economy. The paths have also been created for globalisation and the possibility of raising all boats across the world. The new techno-economic paradigm (the common sense logic for most profitable practice with ICT) is available for innovating in new and old firms, in advanced and in developing countries. In addition, the environmental challenges are signalling an obvious direction for innovation that could be unleashed by strong and stable regulation. A virtuous cycle of mutual market growth can be set up through full globalisation and regional specialisation among developed, emerging and developing countries. But not all growth and development potentials come to fruition.

Will the automobile petroleum-based engine of growth still dominate in the Golden Age?

It is clear that the use of electric batteries, fuel cells or other replacements or radical improvements for the internal combustion engine are already happening slowly, and the trend is likely to accelerate and thus reduce the proportion of petroleum-based engines. There are two environmental forces that are pushing in that direction. One is the question of availability of oil and the higher costs of getting to more difficult reserves. That will raise the price of oil and stimulate the switch. The other is global warming and the types of regulation or discouraging mechanisms that governments may put in place to reduce carbon emissions. Those forces will play out in the course of the next couple of decades. The profitability of alternative sources of energy and mobility options and the cultural changes that would be needed will crucially depend upon the price people have to pay for oil.

But your question begs another one. Why has the wasteful energy-intensive lifestyle of the mass production era continued in the developed world and been copied in emerging countries? We have certainly not seen the full use of the materials and energy-saving potential of ICT. This is probably due to having had cheap oil and cheap labour just as the ICT paradigm was taking full shape in the 1990s.

After OPEC raised oil prices in the mid-seventies, a vast movement towards energy-saving and alternative sources got underway in the advanced countries. New practices were established, such as labels about energy consumption in appliances, and smaller, energy-efficient cars became the fashion. Numerous start-up companies began innovating in wind, solar and other alternative energy sources. But, when prices dropped to the old levels in the mid-1990s, all those companies went bust and the next profitable thing was the gas-guzzling SUV. The whole change process was thwarted before it had taken root.

Something similar happened with the cheap labour from China and the ex-Soviet bloc countries. All the new practices to get creativity value from the expensive labour force in the advanced world were made less relevant when masses of extremely low-cost assembly workers could be used to continue the policy of great volumes of quickly replaceable products. And cheap fuel and high volumes made it possible to transport masses of raw materials and finished products all the way across the globe with minimum effect on prices. ICT technologies are cheap and powerful; they have the potential to transform consumption, production and transportation patterns in ways that will protect the environment for future generations and will contribute to healthier lifestyles. But that potential can go to waste, depending on the price of oil and derivatives. If prices are not high enough, either by market forces or by taxes or regulation, the change will not happen (whatever form it will eventually take).

How important are the emerging BRIC economies to this shift?

The existence of dynamic markets is one of the most important factors in bringing about a true recovery and a successful deployment of the new possibilities. The Golden Age of mass production after WWII benefited from the markets created by the need for reconstruction in Europe, from the consumption patterns associated with the move to suburbanization and the income redistribution achieved through the Welfare State.

A global Golden Age of ICT would count on the BRIC economies to gradually become the most important source of market growth for the world economy. This means that the choices they make will have enormous bearing on the shape of the future. It is clear that it will not be possible to incorporate so many millions of new consumers to the so-called 'American way of life'. We only have one planet! Our only hope for truly full globalisation is to redesign the 'good life' in ways that are environmentally friendly. But the new consumption patterns have to be desirable, and not a sacrifice. It is aspiration that moves people, not guilt or fear of an uncertain future.

These countries have three major innovation challenges: lifting the bottom of the pyramid, environmentally friendly growth and catering to diversity. I guess that the only one needing an explanation is the latter. The innovation and profit-making potential of the ICT paradigm thrives in variety, in contrast with mass production that required identical products for economies of scale. Information technology can help achieve very high productivity with a very diverse and changing product mix, through economies of scope. There are also profitable advantages in narrow specialisation. Therefore, it is not necessary to ignore cultural diversity or other identities for sustained growth. Increasing the quality of life no longer implies adopting the exact same lifestyle as the more advanced countries. There can be many different consumption pathways providing equivalent satisfaction. And many of these can flourish in the BRICs and then be exported to groups with similar desires and characteristics. It is a bit like cable TV. People complain that there are hundreds of channels and they only watch six or seven. The problem is that each person watches a different set of six or seven. That is the difference between narrow-casting and the old rigid broadcasting. We might think of it as 'cultural customisation'.

Are financial crises necessary to force entry into the new phases of the cycle? If so, should regulatory rules be tightened, or will this slow movement towards the Golden Age?

Unfortunately, financial crises are indeed necessary, just as financial booms are necessary for the installation of a technological revolution, its common sense paradigm and its infrastructures. Without the 1990s boom, we would not have a transcontinental fibre optic network for the World Wide Web to be truly global. The same rapid coverage with enthusiastic asset inflation happened with canal mania in the Industrial Revolution and with railway mania in the mid-19th century.

And after the financial booms have done the job, the financial panic and the recessionary consequences create the climate for establishing the regulation, the financial architecture and the fiscal and other policies that will facilitate the full deployment of the installed growth and innovation potential.

So regulation not only does not make obstacles to the Golden Age, it is a precondition for it to happen.

How will social values change in the Golden Age? Will the Golden Age be associated with greater economic justice, increased equity and less structural imbalance among regions?

The definition of a Golden Age (as opposed to the Gilded Age prosperities, like in the 1990s and 2000s) is precisely that it spreads the benefits of growth widely across society, rather than concentrating them at the top of the pyramid. The 1950s and 1960s were such a time and, in a different way, so was the Victorian boom in the 1850s and 1860s in the UK. So once we can call it a Golden Age, it is because it is fulfilling those criteria. But if the necessary political changes are not made, the potential can be dwarfed and deployment can be also a Gilded Age. That is what happened during the Belle Époque around 1900. And that is the risk we are running now.

Without being cynical about it, the policies of income redistribution and development are both for the benefit of peoples and regions and for the widening of markets. It is a positive-sum game that is often misunderstood by both sides of the equation. The Welfare State in the advanced countries not only guaranteed the well-being of the majorities but also guaranteed growing markets for suburban housing, automobiles, processed food, electrical appliances and so on. It also made sure, through unemployment insurance, that the mortgage and instalment payments would continue during recessions, and we would neither see countless repossessions nor a flood of cars, refrigerators and TV sets being returned.

This time, we need to extend both social justice and market power across the globe. The productivity potential of this paradigm is several times greater than that of the previous, and the markets will have to be that much greater. The question is how much wisdom we can expect from our political and business leaders this time. Remember that the resistance to the New Deal in the US was ferocious until the cooperation between government and business during the war served as a forced dress rehearsal of what concerted growth policies could offer.

Any recommendations for Africa, and South Africa in particular?

The process of globalization is far from finished, but it is already clear that Asia has become the assembly factory of the world. However, there is a whole range of processing industries connected with natural resources that is far from being globalised. Africa, Latin America and Central Asia could become the world suppliers of specialised and processed food, materials and energy.

The changes that the ICT revolution has brought about in production patterns and market segmentation have modified opportunities radically. No longer is it obvious that 'manufacturing' is the more advanced sector technologically. It is obvious that services have become increasingly sophisticated, thanks to information technologies and Internet, but it is becoming clearer that the more important differences between products in terms of technology and profitability relate to the continuum that goes from the standard basic product to the very specialized niches, whatever the product. It is the technological distance from a desktop computer to the iPad or from basic steel to so-called 'boutique' steels, from aspirin to retroviral drugs, from additives for soap to additives to make oil flow smoothly, from blue jeans material to special cloth for modern sail boats, and even from mass-grown vegetables to certified organic ones. The new kaleidoscopic nature of markets has opened a universe of opportunities for multiplying the customised niches, adding technology and achieving differentiation of the product or of the business model (like Starbucks for coffee).

And once you innovate in these areas, you are bound to require innovation in equipment, software and multiple specialised services, which will strengthen the general competitiveness of the country. Of course, the idea is not to abandon the commodity part of natural resources. That will be the volume and the 'bread and butter' portion of exports. The idea is to innovate on the basis of the resources the country has and knows how to handle. By identifying and targeting niche markets, there can be a gradual improvement in the export mix, both in value and in non-price competition.

In addition, the life sciences and the materials sciences, which would be behind specialised innovation in natural resources, happen to be the key to biotechnology and nanotechnology that are the most likely candidates for the next technological revolution.

The combination of this with the three innovation challenges mentioned above (the poor, the environment and diversity) could lead to a very powerful strategy in South Africa and similarly endowed countries.

PROFESSOR ANIL GUPTA



Poor as Providers of Green Innovative Solutions

New Pedagogies, Processes and Purposes

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Economically disadvantaged people can trigger frugal, creative and recombinable innovations that can stimulate creation of new pedagogies, products and processes. Therefore, the model that I talk about is 'sink' to 'source'. Such people are not 'sink', passive recipients of our advice, or clients of corporate social responsibility (CSR), but given a chance, they can be a provider of solutions that may need further value addition in some cases. Why is it that the designers of pedagogies and curricula world over neglect the need for learning from knowledge rich-economically poor people? Why are there so few papers on innovations by workers in the organised and unorganised sector compared to managerial innovations? Even those countries that have suffered at the hands of colonial rulers show disdain towards knowledge from below; I feel sad and a bit alarmed at the purpose of this persistent neglect. Is it that if we acknowledge the potential of such common people to solve local problems through their own genius in some cases, our policies and programs will have to be redesigned in a fundamentally different manner? In India, the government will not be able to continue with its massive rural employment guarantee programme neglecting *menial* work, stressing only on *menial* work. In Africa too, such neglect is rampant. Are not we the intellectuals and teachers mainly responsible for such biases in developmental thinking? After all, we create the legitimacy for such thinking.

Inclusive Development:

If we use the transaction costs framework, we can recognise at least two kinds of costs, ex-ante and ex-post. The ex-ante transaction costs include the cost of searching information, finding suppliers, negotiating contracts and drawing up contracts. The ex-post transaction costs include monitoring and enforcement; in other words, compliance of the contract, side payments, costs of conflict resolution and, if it does not work out, the cost of redrawing the contract. In the context of the inclusive innovation model, we have to find out ways by which both these costs can be reduced so that barriers to entry and exit can go down and innovation partnerships can emerge between formal and informal sectors. In the absence of local language databases, the search cost of affordable solutions goes up for small farmers and pastoralists.

If there is no database of engineering projects done by students, then small-scale entrepreneurs cannot find the potential applications they could use. Without distributed knowledge management platforms like Techpedia.in, originality can not be promoted, collaboration can not be forged. That is why the Honey Bee database came up 20 years ago. It has helped the National Innovation Foundation pool 140 000 ideas, innovations and traditional knowledge examples from 545 districts of India in the last decade beginning with 10 000 such ideas. The Honourable President of India honours the outstanding innovators every two years. In fact, President Patil has invited HBN to have an exhibition of grassroots innovations at the President's Place during March 11-14 2010, the first-ever such invitation to creative common people by any head of the state. And this is not all. The site www.techpedia.in has created - thanks to the voluntary contribution by young students like Hiranmay during the last six months - a pool of 100 000 projects of 350 000 technology students from 500 engineering colleges in India.

Honey Bee Network provides not only a justification but also an operational framework for such partnerships among young students, creative farmers, formal and informal sector to emerge.

Conditions for inclusion:

Inclusive or harmonious development is recognised as one of the most important goals of socio-economic development in most of the developing countries, in particular India, China, Brazil and South Africa. Inclusion can take place by treating economically poor and disadvantaged people as (a) consumers of public policy of assistance and aid for basic needs, or (b) consumers of products at low cost made by large corporations (à la Prahalad) or state or other enterprises. Inclusion can also take place by building their capacity to produce what they already know and do; or enable them to convert their innovations and outstanding traditional knowledge, either as such or by blending/bundling it with knowledge of others, into products marked by them or other enterprises.

In addition, linkage with modern institutions of R&D to receive technologies or products developed by the institutions or to add value to their knowledge, innovation or practices for developing value-added products for eventual diffusion through commercial or non-commercial channels can also help inclusion.

The Honey Bee Network has mobilised thousands of grassroots green innovations and traditional knowledge examples from all over India and different parts of the world. Some of them provide useful heuristics for innovations in totally unrelated sectors. Let me illustrate....

Yusuf developed a groundnut digger in Rajasthan. This farm machinery works on the principle of lifting the pods mixed with the soil, stirring a sieve or a wire mesh and collecting the pods and leaving the soil on the ground. Another entrepreneur from down south read about it and thought of a creative application. He wanted to use the groundnut digger for sea beach cleaning. The problems were similar but a creative leap of imagination took place when a potential user transformed the context of the solution from one sector to another. *The farther the domain of application from the domain of origin, the higher the value one could get from an innovation.*

Summing up:

The time has come to go beyond the boundaries of the conventional organisations, disciplines, sectors and pedagogies. We have to look for platforms that link creative but economically disadvantaged people to learn from their sustainable solutions. The 'sink' has to become 'source' and the *poor* have to become *providers*.

Professor Anil Gupta

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PROFESSOR **DEREK KEATS**



Open Innovation – an alternative to patent minefields

New Pedagogies, Processes and Purposes

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There is a disturbing trend afoot in the world today, one that equates the output of thinking – always cultivated and nurtured in the soil, formed by the ideas of those who have thought before – with the notion of property. Absurd as it may seem that the expression of an idea can be considered equivalent to a plot of land or a building, that is the kind of world that we are creating for ourselves. Laws regarding patents, which were originally created to foster disclosure, are being subverted to limit the very reason for their existence.

New systems to protect this ‘intellectual property’ (sic) are being devised by nations such as South Africa to ‘foster innovation’, without so much as a single shred of evidence that this in any way benefits society or creates economic wealth. While it is true that the wealthiest nations are the ones most gone mad with the protection of intellectual *pseudoproperty*, correlation, Johnny, is not the same as cause. It seems more likely to me that many of the ideas, laws and practices of the wealthiest nations are mere collateral damage caused to its citizens by the activities of wealthy corporations, rather than something that is beneficial or necessary for wealth generation and economic prosperity.

Last year, the South African Government, through the Department of Science and Technology, published its regulations based on the 2008 Intellectual Property Rights from Publicly Financed Research Act. The Act and its regulations are based on the assumption that the only way to create innovation is to protect intellectual *pseudoproperty* by engaging in activities such as laying patent mines into the mine-infested waters of a world that is already gone mad with patent wars and vicious predatory attacks by patent trolls. Despite existing to promote science and technology innovation, these regulations are as firmly based on scientific evidence as were the ideas of the cargo cults of Papua New Guinea, and are about as likely to produce the desired results.

The last version of the regulations that I saw make a passing notice of alternative business models, but confuse them with the notion of public domain, and miss the wealth-creation potential of abundance-based business models completely. Within the regulations and the milieu in which they were created, patents and their ilk are

seen as wealth-creating, while (free and) open source software (FOSS) and its derivative business approaches are seen as giving things away, something to be humoured, but not something that can create wealth for the nation.

Yet, FOSS can indeed be an alternative means to drive innovation, create wealth and drive economic growth. South African Mark Shuttleworth discovered this in the 1990s, when he built a billion-dollar company in Cape Town based entirely on FOSS technologies. He started Thawte in his parents’ garage in Durbanville in 1995, while he was still a student at university. VeriSign acquired Thawte for US\$575 million in 1999, and Mark has since gone on to create Canonical and Ubuntu GNU/Linux, which has probably done more to make alternative software available to consumers around the world than any other single initiative.

Google is one of the most innovative companies of the past 15 years. The company was initiated entirely on FOSS technologies, and Google remains one of the largest single contributors to FOSS in the world today. The company was founded by Larry Page and Sergey Brin while they were students at Stanford University, after they maxed out their credit cards to buy hardware. Without FOSS, it is doubtful if Google could have gotten off the ground, and become the global player that it is today. Google became a private company on September 4, 1998, and Larry and Sergey were #5 on the Forbes list in 1997, with a net worth of US\$18.5 billion each. Free and open can produce innovation and generate wealth.

Mark Zuckerberg launched Facebook from his Harvard University dorm room on February 4, 2004 on a complete stack of FOSS technologies. It has since become one of the largest web-based companies in the world, with over 400 billion page views every month on the main Facebook application. *Time Magazine* named Zuckerberg as one of The World's Most Influential People of 2008. Facebook was estimated to have a market value of US\$15 billion in 2007. Facebook is still running on a stack of FOSS technologies, and the company's developers contribute to a number of initiatives, including PHP, in which the code for Facebook is written.

Many of the small, medium and very large innovations of the 21st century were created by companies that have innovated atop a stack of Free and Open Source Software. Patents and their ilk are the enemy of this kind of innovation, yet it is a type of innovation that can clearly lead to wealth creation, including the establishment of some very large companies. The spin-offs of these large companies can also provide for the creation of smaller companies, some of which simply exploit niches that the larger company is not interested in, or that is out of the scope of the larger company's business.

Twitter (used with some reservations because it is probably not yet profitable) is a good example of how an ecosystem grows up around companies that are built on FOSS technologies and with a FOSS ethos. There are so many companies that have sprung up offering enhancements to Twitter, tools for interacting with Twitter, and most of them are built on FOSS. African higher education's own Chisimba development framework has built-in support for Twitter and makes use of Twitter in a variety of ways, including for education. The Twitter ecosystem is growing daily, creating new, independent spin-offs that are employing software engineers and others and contributing to local economies.

In a video that he made for us for a conference that we held in Cape Town in 2004, Vint Cerf, co-inventor of TCP/IP and often called the 'Father of the Internet', noted that when core things are free and open, there are no barriers to innovation.

"When Bob Khan and I created TCP/IP and a bunch of us built a platform for internetworking, we did not patent the technologies used. We set TCP/IP free. Had we not done so, it is doubtful if the Internet as we know it today would have come into being," said Cerf.

We know that patents and other methods of keeping secrets are harmful to software. We often assume that they are good in other fields, but we do not know this to be true. We only believe it.

We don't know the probability of social good and economic growth coming out of publicly funded research if the results were made free and open, or at least if free and open business models and ecosystems were given as much a chance to flourish as the ecosystems based on secret science and non-disclosure of ideas? We don't know with certainty, but in managing science, should we not also apply principles of science? Maybe it is time to move beyond the cargo cult in looking at innovation at national level, and to seek *innovative ways to drive innovation* and create a better and more prosperous society. There may be more to innovation than secret science.

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PROFESSOR RAPHAEL KAPLINSKY



Schumacher meets Schumpeter: Appropriate Technology below the Radar

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Meeting the MDG US\$1 per day objective has important growth implications. It is now widely recognised that growth is a necessary condition for sustainably addressing the needs of the poor. At the same time, growth which is inequitable in nature may mean that the needs of the poor are unlikely to be met. Recent experience of growth through deepening globalisation suggests that the resultant inequities condemn a sizeable proportion of the global population to enduring absolute poverty. At the same time, there is increasing evidence that inequality undermines developmental objectives at all levels of per capita incomes.

The issue is thus how to ensure a more equitable outcome to growth. One possibility is to encourage processes of innovation which in some senses contribute to more equitable growth paths. Historically, this issue has been addressed largely through the activities of the Appropriate Technology (AT) movement, following the principles laid out in Schumacher's classic text *Small is Beautiful*. Two problems have beset the AT movement. First, historically, the overwhelming share of global innovative effort has been centred in high-income economies, designed to meet the needs of the rich, and to operate in environments with high labour costs and reliable and diffused infrastructure. Second, the poor have lacked the incomes that provide the effective demand which has spurred appropriate forms of innovation. As a consequence, the development of AT has been driven by the not-for-profit sector located predominantly in high-income economies.

The rise of the Asian Driver economies (China and India) challenges both of these limitations. Their large size and increasing investments in capability-building and R&D have led to the global diffusion of innovative capabilities to low-income economies. At the same time, their very rapid growth, in the context of large populations, has provided considerable purchasing power at relatively low levels of per capita incomes. Moreover, both countries possess a dynamic entrepreneurial class. The consequence of these factors has been the growth of profit-seeking innovation to meet the needs of the poor, and able to operate effectively in economies with weak infrastructure. The innovation flag has thus been passed from Schumacher to Schumpeter.

In this paper, we draw on a number of theoretical frameworks to inform our understanding of these events. These include innovation systems, firm-centred innovation, user-driven innovation and the transition from Mode 1 to Mode 2 innovation archetypes. Informed by these frameworks, we draw on the theory of induced innovation to explain the nature and significance of this new family of innovation targeting the needs of the poor and offering greater scope for the poor to participate in production. This theory of induced innovation focuses on three innovation drivers. The first is demand, and here we highlight the nature and extent of the growth of consumption power by relatively poor people in the global economy. The second are the factor prices that help to determine biases in technical change. The growth of innovation within low-income economies reflects their labour abundance and weak infrastructure. The third is the trajectory and path dependency of innovation systems, and here we challenge the assumption by Prahalad, the CEO of General Electric, and others, that the market at the bottom of the pyramid will be captured by the same TNCs that have historically dominated global innovation processes.

The rise of innovation designed to meet the needs of the poor and to incorporate the poor more centrally in profitable productive enterprises is still in its infancy, and much of what has occurred has been poorly documented. This paper sets out the intellectual terrain that might inform our recognition and documentation of the nature and significance of new generations of innovation, which enhance the prospects of developing a more equitable growth path in low-income countries. Policy conclusions follow from this process of research enquiry.

Towards a knowledge society for all: **the role of innovation and leadership**

Balancing market forces with pro-development goals will pave the way for a knowledge society for all.



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Creation of a knowledge society for all citizens is an ambitious and worthwhile objective. This knowledge society with a digital nervous system will be shaped by social and political forces. It is incumbent on leaders, including those assembled in this room, to ensure that the knowledge society we create will provide significant benefits for, or have a major impact on, the central developmental goals of poor countries. This will not come about automatically, but will require leadership from developing countries and our partners.

Why be concerned about knowledge at all?

Access to and control of knowledge – including through the use of information and communications technologies (ICTs) – can provide people with many developmental benefits. These include increased access to markets, information about market opportunities and increased access to employment and incomes. In the social sphere, the use of ICTs can reduce social isolation, increased confidence and facilitate self-empowerment. In particular, ICTs have been used to provide increased and easier access to information about legal protection and human rights, and have served as an effective mechanism for political organisation across social and national boundaries. Governments around the world – including in developing countries – have been using ICTs to improve access to government services and information, including social welfare grants.

The challenge

However, evidence from around the world convincingly shows that there remains a problem in ensuring that the poor are provided with equitable access to knowledge and ICTs, and that the development needs of people are prioritised. The fundamental organising principles in the ICT sector are not pro-poor and pro-development. This has resulted in the diffusion of ICT facilities and applications being over-reliant on market forces which, in turn, leads to significant disparities across countries and within social groups. In particular, rural people and the urban poor are not well served, and patterns of gender inequality often exist in ICT markets.

In addition, the patterns of inequity in the distribution of wealth, knowledge and power, which are found in wider society, are mirrored in the ICT sector. This has resulted in the increasing concentration of research and development in large, international firms, and an intellectual property regime that limits the public flow of knowledge and information.

These characteristics pose the major challenge in ensuring that ICTs serve development.

The ICT sector in developing countries is defined by classic market failure – a situation wherein social benefits exceed private benefits. The opportunity costs associated with this market failure and the absence of creative public sector leadership are tremendous. It means that Africa and developing countries in Asia do not benefit from the cost savings that would result from intensive use of ICTs in the delivery of education and health services. It also means that the direction of ICT policy is narrowly focused, and does not attempt to increase the multiplier effects of lower prices and improved quality for the enterprise sector. It also means that the opportunities to use ICTs to stimulate participatory government at all levels, including within local communities, have not been seized.

An appropriate response

It is possible to transform and move towards a knowledge society that facilitates development, with a pro-poor and pro-development agenda. To make progress on this path, it will be necessary to avoid the latest fads that originate from well-meaning or self-interested outsiders. It will be necessary for Africa and Asia to develop home-grown strategies, and to build the necessary intellectual, policy-making and diplomatic capabilities needed to implement these strategies. Our regions should avoid strategies that either focus on creating ICT enclaves (free trade zones by another name) or on programmes that cater only for the elite. We will also need to be mindful of the political climate in which all development efforts take place. To succeed, we will need to use creative leadership, entrepreneurship and innovation.

Leadership

I regard leadership as being a process by which visions, dreams and aspirations are transformed into manifest realities. Within this context, then, leadership requires collective engagement, sustained disciplined effort and the application of mental, emotional and spiritual faculties.

Creating a knowledge society that promotes development is a complex process that will require the interaction and engagement of a number of different social actors. This project is too important to be left to a single stakeholder. Particularly because of the need to remedy market failure, transformation of the ICT sector requires public leadership, to ensure that the broadest public interests are served. Governments must be involved. However, our governments should be accountable to and work with the private sector, NGOs, academic and research institutions and international agencies.

To be effective in this leadership process, our leaders will need to adopt a transformative leadership style that is non-authoritarian, and is based on solidarity and service. We need leaders who empower others and serve as champions. At a personal level, leaders must express integrity, commitment and take personal responsibility. Leaders will also need to build their capability to work collaboratively in multi-stakeholder networks. This is particularly important to sustain and renew the vision, and to evaluate and fine-tune strategies and tactics.

Since the possibility of creating knowledge societies is intensively influenced by global forces and patterns, our leaders will need the capacity to engage confidently with the world in the service of the region.

Innovation

Innovation is an imperative for developing countries in Africa and Asia, as we seek to balance economic growth with the redistribution of wealth and the effective provision of essential public goods, such as education, housing and health. Finding ways to compete in international markets, to improve diversification and foster industrial development are crucial if these problems are to be solved. Innovation strategies matter for development; several countries as diverse as Korea, Singapore and Ireland have demonstrated that paying attention to these policies can make a difference.

Innovation strategies help countries to deal with structural changes in their economies, and to respond better to external challenges, especially in the nature of international markets and trade regimes. The success of these countries' industries greatly depends on their ability to acquire and use new technology and master new knowledge. This ability does not so much rely upon basic science but depends on the efficient unfolding of various learning processes. Innovation itself is not a smooth process but is full of uncertainty, and must be managed.

Knowledge societies also are creativity intensive and will require access to higher-order thinking and analysis, as well as reflection. The education and training systems that support these processes will look and feel very different from traditional systems in existence today.

Familiar daily processes of entertainment, household management and communication are in turmoil and change. Our societies face the challenge of managing these processes and capturing benefits for society without losing cultural integrity, stifling talent or promoting intrusions into privacy.

Innovation to manage technology and organisational change must be at the centre of our efforts. In most settings, entrepreneurial private-sector companies will lead the way in the creation of a knowledge society, particularly because they sense and are proactive to change in the socio-economic environment and context. Entrepreneurs are agents of change and part of the productive fabric. Their activities are often so transformative that it can be destabilising; as such, Schumpeter described entrepreneurs as catalysts of creative destruction.

The mobile communications sector perhaps provides the best examples of African entrepreneurship that is world-class, dynamic and path-breaking. In recent years, there is considerable evidence of the increasing globalisation of the strategies of Africa-born companies such as MTN and Celtel (now Zain Group).

Conclusion

Developing countries have not had a long track record with being innovative. Innovation policy has traditionally been concerned with objectives such as the generation of new knowledge, making government investment in innovation more effective, enhancing the diffusion of knowledge and technology, and establishing the right incentives to stimulate private-sector innovation to transform knowledge into commercial success. Scholars have suggested a number of policy interventions that are required by the state, private sector and other stakeholders that go well beyond investment in research and development (R&D) to include encouraging entrepreneurs, supporting active technology acquisition, facilitating university-industry collaboration, developing clusters and science/technology parks.

To these we can add awareness-raising, the execution of flagship projects that can demonstrate the importance and relevance of knowledge societies, and alignment with development objectives. The innovation for development conference provides an opportunity for timely demonstration of developing country leadership.

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THEME ONE

INNOVATION AND DEVELOPMENT: **SETTING THE AGENDA**

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TITLE OF PAPER: *Measuring Innovation and Development: A Case for Treatment*

This paper addresses the key topic of theorizing and measuring the contribution of innovation to development, and necessarily considers innovation impacts and the gulf between development and innovation studies.

The argument commences with consideration of the problems of measuring socio-economic development. It then drills down to the level of the innovation system and its measurement, especially the work of the OECD Working Party of National Experts on Science and Technology Indicators (NESTI). The NESTI measurement toolbox is best suited to industrialized countries, though it can be used in adapted form in developing countries (Fernandez-Polcuch, 2008). As yet, it does not speak to the matters of public sector or social innovation. Bibliometrics and other indicators complement the NESTI family of manuals of good practice.

The paper then turns to the programme and project micro level, where the measurement and evaluation practices of parties active in development, governments, the major donors, donor networks and philanthropic organizations are considered.

Consideration is then given to the measurement gaps and the alternative metrics marketplace, especially the work of what might be termed the 'new kids on the block' – the mainly US-based foundations established in the last one to two decades in the wake of the ICT revolution.

The review of Jones and Young (2007) for DFID found a broad diversity of definitions of research, research themes and research processes, and no evidence of common measurement approaches. Qualitative evaluation methodology remains the method of choice to assess government and donor interventions, making the population of metrics difficult. Among the established bilateral and multilateral donors, the use of metrics as a scoreboard for impact assessment is largely notable by its absence. Despite the general recognition of the value of evaluation, and the willingness of grantees to do it, funding and infrastructure are inadequate.

It is shown that the methodological frontier of impact assessment of social innovation and the management of the associated information is being defined by the Google Foundation, Bill and Melinda Gates Foundation, Skoll Foundation and the social venture capital Acumen Fund (2007). Their work on alternative metrics, visualization and portfolio management tools is path-breaking.

Following the 2006 Blue Sky II Conference (OECD, 2007), which set out to scope the frontier of indicators for the 21st century, the NESTI community of practice is driving projects on the measurement of public sector innovation as well as examining more effective use of existing data and seeking ways to track open and user-driven innovation.

Donors, grantmakers and foundations operate according to their own theory of change, but there is little evidence of common practice in the use of evaluation methods, let alone metrics. Within agencies such as DFID, NSF and the European Union, pressure appears to be growing for greater attention to be given to the quantitative, since such variables are essential inputs for performance modeling of impact assessment. The EU demand for regulatory impact assessment has had a spillover into impact assessment. What is critically important is the beneficiary impact (Bonbright, 2007).

Pressure is growing for quantitative assessment and modeling. In the US, this is found in the call for a Science of Science and Innovation Policy (Marburger, 2005) and, in Europe, for *ex ante* impact assessment of Framework Program 7 (Delanghe and Muldur, 2007). The various approaches to metrics of research for development – as research, as development, as social change – are potentially incommensurable and suggest a need for a pluralistic approach (Donovan, 2007). A dialogue across the divide of communities of practice is overdue.

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TITLE OF PAPER: *Innovation in Low-income Countries and Regions: Capabilities, Issues and Future Research*

From Afghanistan to Zimbabwe, roughly 800 million people live in low-income countries (LICs). They are among the world's poorest. If we add in the share of the population in middle-income countries such as Brazil or India that are also very poor, that number rises dramatically. Innovation matters to their predicament insofar as an improvement of their condition depends on the power of science and technology to address constraints on both livelihoods and productive activity.

Yet, somewhat paradoxically, the literature on innovation in development generates the least insights about those countries whose people need them most. In fact, we know a lot more about middle-income economies, such as the BRICs countries, than about pretty much any country in South Asia or sub-Saharan Africa. This is our first bias. Even just a cursory assessment of the major empirical focus in journals such as *Research Policy*, *Industry and Innovation*, *Corporate and Industrial Change*, *Technovation* and *R&D Management* reveals a high-technology bent, which is obviously not appropriate for LICs, where most economic activities are resource-based or rooted in relatively simple manufacturing. This is our second bias. In other words, the very poor are not really on the global innovation research community's radar.

One reason for this is that the innovation system approach, in particular, has little tradition in analysing learning and upgrading in so-called low-tech activities, let alone in those that are not being pursued by proper 'firms' but by communities; for example, in the area of traditional medicine. Another reason is 'home bias', in conjunction with the fact that the researcher base in these countries is typically much smaller.

This is obviously a problem. Successful innovation requires a system of networks and linkages, which develop over time. The understanding of such a system and its evolution provides governments with a framework within which innovation policies can be formulated and implemented. Given that innovation is a complex phenomenon resulting from a co-evolution of technologies, industrial structures and supporting institutions, it is important that it is contextually analysed. In the absence of such understanding, there is danger that policy borrowing will substitute for policy learning, resulting in the adoption of partly inappropriate policies. In other words, it is not possible to simply transfer findings from middle- to low-income countries. The context in LICs – and in poor regions and communities in middle-income countries – in terms of human capital, firm capabilities, governance and so on, is indeed very different. Hence, lack of innovation literature in LICs is problematic, as it undermines efforts by policymakers to come up with policies that are context-specific; an important issue that is explicitly recognised in innovation systems literature.

This paper, therefore, draws on a systematic overview of innovation literature concerned with LICs published in academic journals from January 1997 to the present. It discusses this literature – most of which was not produced by academics concerned with innovation per se, but experts in health and agriculture – in the context of the capability approach, looking at both the private (i.e. firms and agents of non-formal productive activities) and the public sector. It identifies the main issues as perceived by academic observers, and suggests how innovation scholars can address a number of shortcomings, especially with regard to the evolutionary framework of economic activities and policy intervention.

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TITLE OF PAPER: *Innovation for Development: Towards an Agenda*

Innovation strategies matter for development. At the country level, countries as diverse as Korea, Singapore and Ireland have demonstrated that paying attention to these policies can make a difference. Innovation has been shown to be the foundation for enhanced competitiveness, industrial and technological upgrading and a factor stimulating structural change. The strategies used in the developing world involve capability building and technological upgrading, for which learning processes are critical inputs. Innovation strategies help countries to deal with structural changes in their economies, and enable them to respond better to external challenges, such as the changing nature of international markets and trade regimes. The success of a country's response has been shown to rely on its ability to acquire and use new technology and to master new knowledge. This understanding of the critical role that innovation plays in development is, however, likely to be affected by the global economic downturn, which has impacted wealthy countries and the developing world. As countries grapple with efforts to manage recovery, it is important to investigate how they will understand the potential role of innovation in stimulating recovery and supporting structural change.

The changes in economic climate and structure come at a time when the innovation studies community itself is undergoing reflective review of its contribution to knowledge and impact.

Theoretical underpinnings for innovation strategy include the National Innovation Systems approach, which argues that countries improve their effectiveness at promoting and stimulating innovation by building and reinvigorating a system constituted by a web of interacting and interconnected agents and institutions, including private sector firms, universities, research centres and policy institutions. From a policy perspective, there are increasing calls to 'mainstream' innovation in economic policy making. As the field of innovation studies has grown and matured and established some legitimacy as a discipline, there has been divergence within the field. Some researchers have begun to focus increasingly on processes of learning and capability building and to identify the firm as the centre of analysis, whilst others have taken up quantitative representations and analyses of innovation phenomena, including ever more sophisticated measurement systems. There is also a management tradition within innovation studies that has never sat comfortably within the innovation for development agenda. Innovation studies, therefore, continues to be a heterogeneous field, particularly as recent work stresses the importance of the need to specify the conditions under which innovation takes place, so that a variety of contexts is taken into account and policy recommendations are relevant for the wealthy world and developing countries, as well as at sub-national level within countries.

This paper explores these tracks in the development of the innovation studies field, and asks questions about the implications for innovation being increasingly connected to broader development debates. It asks questions about the extent to which innovation studies scholars perform as development advocates, and investigates the limits to this role and the impact on the politics of knowledge production in scholarly and policy domains. With regard to these questions, Africa presents specific challenges and opportunities, many of which differ from other developing country regions.

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TITLE OF PAPER: *Exploring 'Out of the Box': Trajectories from Linear Growth and Catch-up to Co-evolutionary Dynamic Change for African Development*

This paper will explore how economies that are predominantly agrarian and peripheral may have to undergo different patterns of transformation from those experienced in the semi-peripheries such as China, Brazil, India and South Africa. The constraints of poverty and environmental degradation make it necessary to think how knowledge intensity and systems of innovation for agriculture should be explored without necessarily undergoing the costly process of industrial disruption. If the purpose is to bring about livelihood well-being and ecological sustainability at the same time, there is a need for an intelligent rethinking of how currently low-income economies may find new patterns of co-evolving agriculture with manufacture and services. Broad-based innovation can be drawn from the varieties of locally rooted knowledge communities by drawing in top-end high-tech knowledge to supplement and support their excavation, use and wide diffusion to change the communities.

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TITLE OF PAPER: *The South African Innovation System and Inequality: A Review of the Post-1994 Experience*

Inequality has defined South Africa's political economy historically and continues to be an intractable reality, with race, class, gender and geographic dimensions. This paper traces trends in interpersonal and inter-regional inequality within South Africa since the establishment of a democratic state in 1994. It further reviews key aspects of the co-evolution of the innovation system, side-by-side with current and historical inequality in the science, engineering and technology (SET) workforce and inequality in the benefits of innovation output. Poverty and inequality can be examined from at least five perspectives – namely income, assets, services, infrastructure and knowledge. The examination will touch on a few of these perspectives, including patterns of inequality in income, in housing assets, in health and education services and in knowledge infrastructure.



THEMETWO

DYNAMICS OF INNOVATION IN DEVELOPING COUNTRIES:
INNOVATION OUTCOMES

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TITLE OF PAPER: *Status of Biotechnology Policies in South Africa*

Current progress with regard to the adoption, diffusion and regulation of biotechnology in Africa has mainly been in the area of agricultural biotechnology. Industrial and pharmaceutical sectors are still in their infancy. Most African countries rely on agriculture for economic growth as well as food security. Appropriate policies are necessary for progress in biotechnology, and the development of such policies has been a great challenge for most African countries. To date, only a handful of African countries have policies and guidelines in place. In this paper, the policies that South Africa has developed for dealing with the issues related to adoption, diffusion and regulation of agricultural biotechnology are discussed for the purposes of comparing the South African position with other African countries that have adopted biotechnology.

NAME OF AUTHOR: Professor Paulo N Figueiredo

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TITLE OF PAPER: *Discontinuous Innovation Capability Accumulation in Latecomer Natural Resource-Processing Firms: Evidence from Brazil*

Most of the studies that describe the building of innovation capability in emerging and developing economies have focused on the ways in which latecomer firms develop *continuously* towards advanced capability levels along existing technological trajectories, particularly for the assembled products industries, especially in Asia. A slightly different approach is adopted herein by focusing on pathways of *discontinuous* capability building of firms in natural resource-processing industries. By drawing on evidence from a variety of case studies taken from 13 forestry, pulp and paper firms in Brazil in the period 1950-2007, it was found that: (1) in contrast with the majority of case studies reported in the literature, the pathways followed by firms in their accumulation of innovation capability involved a *qualitative departure* from the established technological trajectory at an *early stage* in the development of their capability; (2) the pathways of firms along the new technological trajectories were nevertheless characterised by a high degree of variability (from intermediate to world leading innovators) in terms of the levels and speeds of the accumulation of innovation capability; and (3) firms that have attained progressively higher levels of innovative performance have more rapidly developed a combination of internal and external research-based arrangements in order to undertake increasingly complex, but firm-centred innovation efforts. This paper sheds some light on some of the discussions that relate to the role of natural resources in the patterns of industrial progress and growth in those countries endowed with particular natural resource-based industries. It also provides a methodological contribution to the study of the long-term innovation strategies that make use of the dynamics of capability building, especially within natural resource-processing industries.

NAME OF AUTHOR: Mr Michael Gastrow

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TITLE OF PAPER: *A Comparative Review of Innovation in the Automotive Manufacturing Sectors in Africa and Argentina*

In the literature on innovation and development, South Africa is commonly compared to Brazil, its fellow BRICs country and also a regional geopolitical powerhouse. This includes literature relating to the innovation in the respective automotive manufacturing sectors. But there are several reasons why Argentina makes a more appropriate 'South-South' comparator, particularly when looking at the automotive sector. Both sectors are of a similar overall size and production output, and both sectors are core platforms for national industrialisation efforts. More importantly, their economic histories reveal remarkable similarities: isolation from the lean manufacturing revolution from the 1970s to the 1990s (in South Africa due to sanctions, in Argentina due to Import Substitution Industrialisation), followed in each country by a period of liberalization, which in both cases left uncompetitive local manufacturers exposed to more competitive global markets. Each country formulated a policy response to this situation: in South Africa, a suite of financial support measures, spearheaded by an import-export complementation scheme. In Argentina, regional integration was pursued, and free trade agreements with Mercusor and other Latin American countries created incentives to manufacture for export. These policies provided strategic incentives for multinationals to increase investment and production in both countries, and in both cases there was rapid growth in investment, multinational-driven technological upgrading, and international knowledge flows, as well as increased production from the late 1990s to 2008.

There has been no previous comparative analysis of innovation in the two sectors. However, funding made available by the Department of Science and Technology has made possible a project comparing the two national systems of innovation in the respective countries, in which the automotive sector is the primary case study. This paper will report on the findings of this case study, which we hope will open up possibilities for future learning and policy lessons.

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TITLE OF PAPER: *Markets, Regulation and Bridging the Digital Divide: The Indian Experience in Increasing the Access to Telecommunication Services*

India has one of the fastest growing telecom services industries in the world. Teledensity in the country – which was less than one telephone per 100 people in 1991, when the country unleashed a wave of market reforms – has now increased to about 47 per 1 000 people in 2009. There are, of course, considerable variations in rural-urban teledensities, although this has been narrowed down in an impressive and sometimes unbelievable fashion. This is especially impressive when you take into account two factors: first, the industry is dominated by private sector enterprises, accounting for about 80% of the services market, and second, administrative and financial mechanisms that the government has put in place to increase access to telecom services in rural areas and thereby bridging the digital divide have not met with much success. In the context, the purpose of the present paper is to provide some explanation as to how these reductions in teledensities have been accomplished. My explanation is in terms of increased competition between services providers, coupled with some reasonable regulation of their market conduct by an independent regulator. Consequently, India has one of the cheapest telecom tariffs in the world, making telecom services eminently reachable at the village level. Added to this, a fast-growing domestic market has encouraged handset manufacturers, all of them affiliates of leading MNCs, to invest in R&D to develop cheaper handsets. The success of India's telecom services industry thus reinforces the idea that competition is the key to driving innovations that ultimately lead to optimum outcomes, from the development point of view.

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TITLE OF PAPER: *Intermediary Institution to Foster the Agricultural System of Innovation: The Mexican Produce Foundations*

Since the 1980s, developing countries' agriculture has become more complex and diversified. In general, the public research and extension institutions in these countries were criticized for not participating in the emergence of the most dynamic agricultural markets. In recent years, many of these institutions have struggled to adapt to the new environment, but they could not overcome the hurdles posed by organizational rigidities, strict public regulations, deteriorating human capital, shrinking budgets and a model of science that hampered their integration into dynamic innovation processes.

In general, developing countries applied similar agricultural research policies: separation of financing and implementation of research, reductions in direct budgetary allocations to research and extension institutions, elimination or major reduction of public extension, and introduction of competitive grants programs to induce a transformation of research organizations. Strong anecdotal information suggests that these policies had limited impact.

Using a different set of instruments, the Mexican Produce Foundations (PF), led by innovative farmers, had major and diverse impacts on the agricultural innovation and research systems. These impacts resulted mostly from activities the PF introduced as they learned to manage competitive funds for research and extension. The PF were able to introduce these activities because they developed strong abilities to learn, including identifying knowledge gaps and defining strategies to fill them.

This paper will focus on how an organization that manages public funds for research and extension could sustain organizational innovations over extended periods, and how it could learn and adapt to maximize its impact on the agricultural innovation system. Previous studies found that human resources, organizational cultures and governance structures are three of the most important factors influencing institutional change and innovative capabilities. Despite their importance, these factors have been largely neglected in the literature on agricultural research and extension policies. This document analyzes what role these factors played in the Mexican experience.

NAME OF AUTHOR: Dr Sujata Gamage

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TITLE OF PAPER: *Lessons in Knowledge Management for Policy Makers in Developing Countries: The Case of Solid Waste Services in Sri Lanka*

Conventional policy approaches to innovation are centered round the notion that knowledge is transferred from the university to industry with facilitation by government agencies. In most developing countries, where governance is poor in general or only 'good in parts' and universities and research institutes, too, are often weak, we need a systems approach to innovation that addresses those realities.

More recent research on innovation systems has revealed that actors other than universities and formal research institutes or government agencies are important in actual innovation processes in manufacturing or services (HSRC, 2009; literature on KIBS or knowledge to innovation in business services). In a report titled 'Enhancing agricultural innovation: how to go beyond the strengthening of research systems', the World Bank provides a framework that allows room for multiple actors and institutions, with the saliency of each determined by each situation in each sector.

The WB 2006 framework enables experimentation with innovation systems. Our own work concerns waste management in the local government sector. Here, the enterprise domain consists of local government service providers and their subcontractors and the few private service providers. There are 300+ local government units in the country, allowing us to treat this group as any industry group. The objective of the research project is to test several tools as instruments that facilitate interactions that lead to innovations.

There are about 30-40 local government authorities (LGAs) or 10% of LGAs that manage their waste successfully, success being defined as the ability to save at least 50% of the waste from being dumped. Almost all of these successes are due to the leadership of exceptional individuals. What is preventing other LGAs from adopting the good practices of these successful ones? Do we simply have to wait for the random occurrence of a committed political leader, the chance of which seems to be 10% or so?

We believe otherwise. We believe that it is possible to change the status quo by viewing the solid waste sector as an innovation system, where the interactions between the actors and institutions in the system and between the actors and the enabling environment can be 'orchestrated' to yield the desired results.

Ideally, orchestration should be done at the national level, paying due regard to the fact that waste management is devolved to local government level and that the coordination of LGAs is the responsibility of respective provincial councils. Currently, there is multiplicity of agencies at the national level, making it difficult for any one agency to take ownership of 'orchestration'. Therefore, we work with the provincial authorities, helping them to take the systems view of solid waste management in their province.

In the proposed paper, the author will be using interaction data for two out of the nine provinces in Sri Lanka. The network of interactions between stakeholders in solid waste management in each province will be analyzed, to examine the extent to which network properties can be related to performance.

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TITLE OF PAPER: *Innovation Policies, Institutions and Performance: Why Malaysia Overtook Nigeria in the Oil Palm Industry*

Forty years ago, Nigeria and Malaysia had comparative GDP per capita; Nigeria was the leading oil palm producer and exporter in the world. Within a decade, Malaysia overtook Nigeria, both as producer and exporter. This paper provides a comparative perspective of the evolution of institutions and policies, contrasting Nigeria and Malaysia over a relatively long period. The aim is to understand – based on the evidence – how and why Malaysia performed so well and Nigeria did not, thereby exploring the systemic, remote and immediate causes of the different evolutionary trajectories of the two countries with very similar geographical characteristics.

We examine policies and institutions and the ways they strengthen learning, investment and systemic linkages, because they profoundly affect dynamic innovative changes, particularly in developing countries. There are a variety of policies, including policies affecting size and shape (demand characteristics) of the domestic market e.g. taxation, wages; policies that affect input costs or outputs for entrepreneurs, for example, land prices and use; policies that change the nature of competition, foreign investment, and those that promote local upgrading and linkages between foreign and local agents; policies that change or make possible access to training for vendors and manufacturers; and international rules that affect learning and innovation.

The data used for this paper relied on three different methods. The primary survey was carried out with questionnaire administration, face-to-face interviews with structured interview guides and secondary information from reports. The paper concludes that differential institutions, policies and investment efforts explain much of the catch-up story of the oil palm sectors in the two countries.



THEMETHREE

GENERATE, PROMOTE AND SUPPORT INNOVATION
IN DEVELOPING COUNTRIES: **PRACTICE AND POLICY**

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TITLE OF PAPER: *National System of Innovation and Export Supply Responses to Preferential Trade Incentives*

Trade performances of sub-Saharan African economies under the African Growth and Opportunity Act (AGOA) preferential trade initiatives have understandably been characterised by differential country-level manufactured export responses. What is seemingly not understandable, however, is that certain countries, which by virtue of conventional criteria would be classified as 'disadvantaged' in terms of trade performance potentials, have achieved relatively higher levels of export successes than their 'more advantaged' counterparts. For instance, in the area of apparel export under the scheme, Lesotho recorded a total value of \$1 136.761 million for the years 2002, 2003 and 2004 collectively. This surpasses export values recorded during the same period for South Africa (\$362.354 million), Kenya (\$568.995 million), Ethiopia (\$6.311 million), Madagascar (\$575.853 million), Botswana (\$30.169 million), Namibia (\$109.568 million) or any other sub-Saharan African country that qualified for apparel benefits as at December 2001 (Tralac, 2006). Yet economic logic would suggest that Lesotho, with revealed disadvantaged attributes in terms of relatively small economic size and landlocked geography, would make her trail in performance behind many of these comparator economies. How this seeming contradiction is explained and what it implies for the role of National System of Innovation (NSI) in development constitutes the central objective of this research.

Current efforts at understanding the relationship between preferential market access initiatives and trade performances of beneficiaries have typically been concerned with the question of whether or not these schemes are effective in stimulating exports of targeted products. There have been very few attempts at investigating what determines the export-stimulating effectiveness of the schemes. Our paper hopes to contribute to research in this area by showing how export performances of nations under preferential market access initiatives can be explained by the role of beneficiaries' NSI.

Insights from three strands of analytical literature, which include institutional economics, national systems of innovation and trade, will be combined to develop an appropriate framework for the proposed study. Empirically, the research will focus on the experience of 12 sub-Saharan African countries that qualified for AGOA apparel benefits as at December 2001. These countries are Botswana, Ethiopia, Kenya, Lesotho, Madagascar, Malawi, Mauritius, Namibia, South Africa, Swaziland, Uganda and Zambia. Data will come from both primary and secondary sources. It is expected that the outcome from this investigation would, among others, help shed further light on the impact of NSI on development.

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TITLE OF PAPER: *New Drugs and Health Technologies for Low-income Populations: Emerging Role of Social Technologies*

Over the decades, evidence suggests that large pharmaceutical firms and firms from emerging economies have limited success in meeting the needs of poor people in developing countries. Path dependencies and business trajectories guide technological development in these firms towards markets in advanced countries. In this context, this paper argues that the development of appropriate technologies for poor people will require a new mix of technology, organisations and institutions. These new social technologies may constitute the basis of new production and innovation system, which could serve the requirement of low-income populations. This paper, using a technology-market matrix, explores 'social technologies' associated with developing country firms and not-for-profit Product Development Partnerships (PDPs). It shows that such arrangements are most likely to generate and deliver the new physical technologies and innovations processes required by low-income users.

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TITLE OF PAPER: *Universities and Knowledge-based Development in Sub-Saharan Africa:
Comparing University-Firm Interaction in Nigeria and South Africa*

In developed economies, as one of the key organizations of science and technology systems, public universities are assumed to be critical sources for learning and innovation for firms and for national economic development (Lundvall, 1999; Mowery and Sampat, 2005). Increasingly, in developing economies universities are expected to become more responsive and play a direct role in knowledge-based economic and social development. Government and higher education institutions are debating and developing policy to promote interaction between university and industry, and a literature on university-industry linkages is emerging (Hershberg et al, 2007; Eun et al, 2006; Liefner and Schiller, 2008; Mathews and Hu, 2007; Wu, 2007; Wong et al, 2007).

These trends are increasingly pervasive in sub-Saharan Africa too, but there is evidence to suggest that policies appropriate to developed economies are being adopted in an imitative manner, without understanding the specificities of the very different contexts of developing countries within sub-Saharan Africa. Scientific, technological and interactive capabilities of universities and firms differ vastly, and it is impossible to ignore issues of human development, of poverty reduction and equitable distribution. New models that take into account global changes in knowledge generation, diffusion and adaptation in relation to local African contexts are thus required.

As yet, however, there is not a great deal of research on universities that could inform contextually appropriate policy in sub-Saharan Africa. What does exist often engages with the challenges in aspirational and normative ways (Etkowitz and Dsizah, 2007; Adeoti, 2002; Myamila and Diyamett, 2006; Mwantimwa, 2008). Research on the changing role of universities in firm learning, innovation and national economic development has not extended systematically to low-income countries of sub-Saharan Africa.

The paper draws on an empirical study that investigated the extent of, incentives for and constraints on interaction between universities and firms in three countries that differ in terms of their level of economic development and their degree of technological sophistication – Uganda, Nigeria and South Africa. Evidence from two main data sources is presented. First, a survey of firms in key regions and sectors in each country, in order to establish their levels of innovation and R&D activity, the channels and modes of interaction with universities, and firms' perceptions of benefits and constraints on interaction. The survey instrument was adapted from a Carnegie Mellon survey (Cohen et al, 2002) for use in Brazil (Rapini et al, 2009) and then for this study, in 12 countries in Asia, Latin America and Africa. Second, case studies were conducted of selected universities' interaction with firms in a biotechnology-related sector in which there was comparative national specialisation, in order to establish the knowledge intensity, outcomes and academic perspectives of the benefits and constraints of interaction.

The paper thus examines conditions of universities, firms and their potential for interaction across a national system of innovation in the three countries, and in so doing, attempts to open up a research agenda in terms of the specific challenges that African countries face.

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TITLE OF PAPER: *The System of Innovation Policy in South Africa: Growth and Development-Potentials and Realities*

The year 2010 and South Africa enjoy a mutually codetermined present and heavily co-influenced future. This year will witness the country celebrate a range of anniversaries whilst simultaneously playing host to the globe's largest spectacle of sport: the FIFA World Cup. It is now a century since the formal creation of the 'white' enclave of the Union of South Africa was proclaimed, and two decades since the processes of normalising the crisis of apartheid capitalism began. Whilst much has been achieved in terms of the more formal and institutional aspects of democracy, freedom from abject poverty and general improvements in the material conditions of South Africans remain universal challenges. This brief paper provides an overview of the post-apartheid reconstruction and development of South Africa, with specific focus on efforts to transform the country's system of innovation, from one which served the needs and interests of a minority of the population towards one which sought the achievement of a better life for all.

The paper is divided into four parts. The first section provides a periodisation of the post-apartheid efforts at enabling an innovation system within South Africa. This surfaces some of the contradictions embedded within a reformist policy agenda of change. The second section briefly reviews the empirical data generated nationally through the use of household, firm-level, innovation, research and development surveys. A preliminary assembly of relevant indicators of innovation will consider their coherence and completeness. Section three provides an assessment of whether co-evolution of policy, agency and institutions associated with the literature on innovation systems have contributed to the achievement of the goals of a better life for all South Africans. The conclusion raises matters arising from the assessment and is aimed at suggesting significant differences between various conceptualisations of innovation systems approaches. It will end on suggesting an agenda for further research which embraces an explicit 'southern' developmental perspective.

South Africa is one of the last countries in the world to achieve national liberation. The Republic of South Africa endured 342 years of colonialism, with the last half-century characterised variously as a period of 'racial capitalism', 'apartheid' or 'colonialism of a special type'. Apartheid, besides the obvious or 'petty' forms of discrimination, was a systematic and organised form of segregation wherein the vast majority of a population was forced to forfeit property rights through 'legal' expropriation and consigned to non-citizen status whilst simultaneously acting as a cheap source of unskilled labour for the exploitation of mineral reserves, the development of secondary industries and building an infrastructural complex which would generate enormous wealth for the minority regime and its collaborators. The year 2010 represents 16 years of post-apartheid experience in redefining the country's developmental path, state formation and delivery on redressing the inequalities inherited. The preceding 15 years provide a sufficient platform to measure progress achieved, recognise contradictions and suggest remedial action.

The process of policy formulation, both directly by government and indirectly by the former national liberation movement, now the ruling party, will also be considered. Here, specific attention will be devoted to the evolution of policies through its consultative, policy and national conferences held respectively in Johannesburg, Durban, Bloemfontein, Mafikeng, Stellenbosch, Midrand and Polokwane. Because of the formal alliance through which the national liberation movement contests elections, attention will also be paid to the formulations and contributions of the other constituent elements, the Congress of South African Trade Unions and the South African Communist Party.

A periodisation will be established, defining phases of policy formulation. This will then be tested with respect to its alignment with formal government policy stances. This will include some references to the Reconstruction and Development Programme (1994), the Growth, Employment and Redistribution Strategy (1996), the Microeconomic Reform Strategy (2001) and the Accelerated and Shared Growth Initiative of South Africa (2006).

South Africa adopted an innovation systems approach to reforming the country's public resources in research, development, science and technology. This position was adopted through the White Paper on Science and Technology in 1996. Subsequent to the establishment of this framework as the key organising tool for managing the transition, a number of institutional and sectoral interventions were generated, including the establishment of a single executing agency for the Government of South Africa: the Department of Science and Technology. The vast array of new instruments are manifested through strategies, programmes and projects which collectively seek to improve the quality of life of all South Africans through improving the competitive performance of business enterprises (both public and private). This array includes the: National Research and Technology Audit (1997), Review of the Science and Technology Institutions in SA (1998), National Research and Technology Foresight (1999), NACI/ NSTF report: Growth and Innovation (2000), National Biotechnology Strategy (2001), National Research and Technology Development Strategy (2002), Advanced Manufacturing Technology Strategy (2003), Indigenous Knowledge Strategy (2005), R&D Tax Incentives (2006) and the recently released 10 Year Plan: Innovation Towards a Knowledge-based Economy (2007).

The Department of Science and Technology has built a capability in the Centre for Science, Technology and Innovation Indicators, located in the Human Sciences Research Council, to measure the system of innovation utilising methodologies of the Organisation for Economic Cooperation and Development (OECD). To date, this centre has generated results using the Survey of Inputs into Research and Experimental Development in the following time series: 2001/02, 2003/04, 2004/05 and 2005/06. They have also deployed an Innovation Survey in 2005. Most of their results are now in the public domain. A further resource exists through the OECD Review of South Africa's system of innovation, conducted in 2006 and published in 2007. The country's statistical agency has also generated massive amounts of data at various levels of aggregation about the living conditions of the population. All of this information will be collated into a form which shows how the country has performed over the preceding decade and a half of its existence.

Based on these sections, the paper will then turn towards providing an assessment of the extent to which the innovation system has contributed to reducing the inequalities of apartheid. In this section, tentative proposals will be made about redressing persistent contradictions and preparing for new challenges.

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TITLE OF PAPER: *Balancing Funding Priorities for Innovation Projects:
Government Address the Issue of Portfolio Management?*

Methodologies and techniques for the assessment and ranking of funding priorities within companies are well developed and widely applied. However, such techniques are not routinely applied within South African Government departments in evaluating various competing options for funding, and hence informing key decisions within National Treasury and Cabinet. These decisions are influenced to some extent by cost/benefit analysis, especially in the evaluation of decisions on healthcare and infrastructure development. In this paper, an overview of portfolio management techniques used for making resource allocation decisions is presented, followed by a more detailed description of some of the techniques which are used by the Department of Science and Technology and other government agencies. The shortcomings of these approaches are described, and alternative methods are proposed. The existing and alternative methods are then compared, using the examples of the development of the Pebble Bed Modular Reactor, the Square Kilometre Array and HIV/AIDS research. It is concluded that there is room for improvement in the way in which funding decisions are taken, and hence in the possible impact of public-funded innovation activities within national systems of innovation.

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TITLE OF PAPER: *Innovation and Policy Capacity in Latecomer Countries*

The literature on development tells us that market imperfections are pervasive and widespread, particularly in developing environments (Rodrik, 2007). To address market imperfections, states in East Asia and Latin America employ industrial policies extensively in the catching-up process, as means to remove obstacles to structural transformation. The role of governments is therefore critical, inasmuch as they are the custodian of policies and institutions. More serious for the latecomer, however, is the evident reality that 'backwardness has been relatively greater', requiring an even greater dose not just of state action, but also specific policy capacities. This backwardness manifests in a number of ways: the absence of strong and competent state institutions, weak entrepreneurial business firms, relatively low levels of skilled engineers and managers and well-educated and abundant low-cost managers (Amsden, 1989; Amsden and Chu, 2003).

The role of governments is therefore critical, inasmuch as they are the custodian of policies and institutions as well as possessing the means of enforcement. State actions manifest in the strategic choices that are made in the form of policies and the apparatus put in place to implement such policies. This paper focuses on the importance of policies and the capacity of governments to formulate and back innovation policy choices made by the respective agents in the process of development in latecomer countries.



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TITLE OF PAPER: *Multiple Approaches for Introducing a Potentially Disruptive Business Model Innovation*

Theme 2: Dynamics of Innovation in Developing Countries: Innovation Outcomes

Over the last two decades, extensive research has been carried out to comprehend business organizations' adaptation behaviors to disruptive innovation. A relatively consistent hypothesis, recurring throughout the literature on this topic, is that almost all established organizations across a wide range of industries succeed in managing continuous innovation, but fail to adapt their organization effectively when faced with disruptive innovation. This phenomenon, which is referred to as 'the tyranny of success' or 'the incumbent curse', has always been considered a technology problem (Henderson, 2006; O'Reilly and Tushman, 2004; Tushman and Anderson, 1986).

Recently, there is an emerging body of knowledge that views disruptive innovation as a business model problem, not just a technology problem. Disruptive innovation is now understood primarily to be a function of conflict between an incumbent's traditional and an insurgent's new (potentially disruptive) business models. A range of research provides important insights into how organizations should manage disruptive innovation (Christensen, 2006; Markides, 2006; Christensen and Overdorf, 2000).

However, the review of the literature suggests that little is known about how firms introduce a potentially disruptive business model. This study explores five case studies, comprising two *technological* innovations and three *non-technological business model* innovations in five South African services industries. The qualitative analysis of the case studies reveals eight approaches for introducing a potentially disruptive business model innovation.

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TITLE OF PAPER: *Technological Capability Development in FIFA 2010*

Theme 2: Dynamics of Innovation in Developing Countries : Innovation Outcomes

The 2010 Federations Internationale de Football Association (FIFA) World Cup will be hosted in South Africa. There are many activities being undertaken in the country and the region in preparation for this. Mozambique is spending on road and rail network construction as part of infrastructure improvement in time for the anticipated tourism boost in 2010 (Sabinetlaw, 2009). South Africa has given 17 guarantees in line with FIFA's requirements and has even passed legislation in support of these (South Africa, 2009). These guarantees include the provision of technological infrastructure. In order for these technology programmes to succeed, the quality of interaction between firms and knowledge institutions is important (Lundvall, Muchie and Gammeltoft, 2003). This paper looks at how technological capability-building processes can form a part of this process. The exploration addresses practical challenges in light of theoretical frameworks on learning and technological capability building. In particular, the analysis makes use of the Information Technology Infrastructure Library (ITIL) model.

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TITLE OF PAPER: *Bio-based Economy in South Africa*

Theme 2: Dynamics of Innovation in Developing Countries: Innovation Outcomes

The bio-based economy (BBE) is increasingly becoming an issue of broad socio-economic impact. It is widely agreed that biomass is the only foreseeable resource for a sustainable production of fuels, commodities and chemicals. Using these materials provides the underlying basis for a bio-based economy, which is one that focuses on renewable resources for meeting environmental, consumer and industrial needs. The bio-based economy can and should be to the 21st century what the fossil-based economy was to the 20th century. The public-good benefits that will accrue from the bio-based economy are compelling. These include national and homeland security, economic advantages to farmers, industry, rural communities and society, environmental benefits at the global, regional and local levels – including sustainability and climate change – in addition to other benefits to society in terms of human health and safety. The Department of Science and Technology (DST) has developed its Ten-year Innovation Plan, which aims to establish South Africa as a world leader in biotechnology and pharmaceuticals, based on the nation's indigenous resources and an expanding knowledge base.

The bio-based economy is a major new opportunity for agriculture – providing the opportunity to take it from its recurring overproduction for limited food, feed and fiber markets to a more sustainable and profitable balance of production and markets. But the benefits of this bio-based economy will extend beyond agriculture to society as a whole, necessitating broad-based support in terms of public policy and investment. Although many stakeholders are getting involved in the business that surrounds the BBE, however, many lack an overview of the value chains as well as the processes that link the various resources with intermediate and the finished bio-product.

Therefore, the goal of this study is to understand and assess the impact of the BBE on the 'present and real economy' of South African BBE value chains by mapping the main BBE value chains; identifying and characterising the key industrial stakeholders within these value chains; assessing the extent to which the individual companies are aware of their relative position in the value chains and estimating the market potential of the BBE.

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TITLE OF PAPER: *The Co-evolution of the Technological Capabilities of a State-owned Enterprise and the National System of Innovation: Lessons from the Past? The Case of Eskom in South Africa 1923-1989*

Theme 2: Dynamics of Innovation in Developing Countries: Innovation Outcomes

This paper explores the possibility of identifying and extracting good practices on innovation and capability building from the apartheid era, which might still be relevant today to meet the current development goals as set out in the Accelerated Shared Growth Initiative of South Africa (Asgisa). Asgisa's goals are to grow the economy by six percent annually, while increasing employment and reducing poverty by half and reducing inequalities by 2014.

The paper examines the historical capability-building process of Eskom, the state-owned enterprise that was responsible for providing electricity to all users on a large scale in the country since 1923. In particular, it examines the role that interactive relationships between various stakeholders played within this process. It also studies the co-evolution of Eskom as a firm, starting and developing its capabilities to deliver large-scale electricity supply from the ground up on the one hand; and the growth of large-scale mining, manufacturing, farming, municipalities and electric railways on the other.

The objective of the paper is to use the Eskom case study to understand the national system of innovation of South Africa that prevailed before the end of the apartheid system (1923-1989). Most specifically, the paper will try and outline the relationships between the key elements of the innovation system and how they were used to meet the national development objectives and the objectives of the various stakeholders. Furthermore, the paper will look at the strategies used to build the capabilities of Eskom as a firm and how its challenges such as war, lack of skills and access to financing, technology and knowledge were mitigated. It will also analyse some of the specific policies that gave Eskom a competitive advantage in meeting its objective of providing cheap electricity for industrial development.

South Africa and many other developing and emerging countries are investing in large infrastructure projects currently from oil, mining, transportation, water and waste management, manufacturing and agriculture. The paper hopes to explore and identify lessons that could be learnt in promoting innovation, capability building and development, based on or linked to these complex large-scale projects.

The analytical and theoretical framework of the paper is the theory of the national system of innovation and the concepts of technological capabilities, learning, interactive networks, absorptive capacity, organisational structure and technological change and the management of large and complex projects.

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TITLE OF PAPER: *The Financial Crisis and Africa's 'Immiserizing Wealth'*

Theme 1: Innovation and Development: Setting the Agenda

Before the onset of the current financial crisis, some African countries richly endowed with natural resources were recording unprecedented rates of economic growth, as a result of a price boom generated by the growing demand for raw materials and fossil energy by China and India. This price boom had reinforced in the minds of many Africans the belief that the raw materials were a source of sustainable prosperity. Although most observers would still affirm today that, with its considerable mineral wealth, Africa is a rich continent, numerous communities in mineral- or oil-rich regions remain mired in misery and see little prospects of improving their livelihoods in the foreseeable future. In fact, available evidence on the way that mineral and fossil resources have been exploited so far raises the question whether natural resources are not the very root of the misery that African populations continue to experience. If such proved to be the case, Africa's endowment in natural resources might be termed 'immiserizing wealth', by analogy to the well-known phenomenon of 'immiserizing growth' in the theory of international trade.

Our paper analyses the impact of the natural resources on the innovation capacity of African countries in the light of the 'Dutch disease' hypothesis and the financial crisis that followed the boom. We find that, for various economic and social motives, the dependence on natural resources in the trade relations of many African countries impedes innovation by delaying the investment in the human and financial capital needed to build the necessary technological infrastructure. Moreover, we show that the abundance of natural resources attracts disruptive and predatory foreign forces that delay the accumulation of innovative capabilities. Our analysis of the collapse of raw materials prices at the onset of the crisis also brings to light the iniquity of relying on natural resources, and shows primacy of the accumulation of productive powers over the rich endowment in mineral wealth.

Since the innovative capability needed to free resource-rich countries from their dependence on the export of natural resources cannot be in place without the creation of domestic technical skills through training, knowledge generation is key to long-term growth, even for mineral-rich countries. Our paper lays the emphasis on the necessity for resource-rich African countries to refocus their educational systems on the development of technical skills and competencies that enable them to innovate, diversify their exports and reduce their dependence on the export of raw materials and other primary commodities. It therefore fits perfectly in the theme of knowledge production and circulation.

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TITLE OF PAPER: *Determinants of PBMR Process Heat Plant Adoption by South African Industry*

Theme 2: Dynamics of Innovation in Developing Countries: Innovation Outcomes

This paper reports findings of a study into factors influencing the adoption of Pebble Bed Modular Reactor (PBMR) Process Heat Plant (PHP) technology by industry in South Africa. The study investigated industrial customers' perception of PBMR PHP technology attributes, their own organizations' characteristics and developers of the PBMR PHP technology's actions leading to the technology's development. PBMR PHP is a nuclear heat-generation plant that produces steam at temperatures above 700oC. The steam is either used directly by industrial processes, or used to generate electricity.

The study reported on here reviewed theoretical material on the factors that influence the adoption of industrial technology, and this was applied to the specific empirical illustration of PBMR PHP technology in South Africa. The theoretical framework includes innovation attributes, adopter organizational characteristics and technology developer actions. Three hypotheses were proposed and tested. A research instrument was designed specifically for the study. A survey was conducted amongst members of the Energy Intensive User Group of South Africa, targeting senior managers who could respond on behalf of their companies.

The research instrument was fairly reliable, but could still be improved. The adoption model was statistically significant and accounted for the bulk of the variance. Results suggest that industry views PBMR PHP technology as a credible technology that can be adopted. However, there are concerns over the public perception of nuclear technology. The study found a strong correlation between PBMR PHP technology attributes, adopter organizational characteristics and technology developer actions.

This study is timely, given the concern in South Africa for efficient energy management and the identification of clean sources of electricity for industrial firms.

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TITLE OF PAPER: *Web 2.0 Tools and their Relevance for Non-governmental Organizations in Developing Countries*

Theme 2: Dynamics of Innovation in Developing Countries: Innovation Outcomes

This paper will examine the use of Web 2.0 tools by non-governmental organizations (NGOs) in Haiti in the aftermath of the January 2010 earthquake and how NGOs, using the example of Haiti, can utilize these new technologies to aggregate information, collaborate on agenda implementation, mobilize their target communities, and at the same time be economically self-sustaining.

Compounding the disaster of the earthquake in Haiti, humanitarian efforts were further challenged by poor infrastructure and a severely devastated telecommunications network. With only 11% of the population having Internet access, and 35% mobile phone penetration, the parties providing humanitarian assistance in addition to the affected populations on the ground used Web 2.0 technologies to respond, track and monitor. This was a collaborative effort where the humanitarian community leveraged social networks and social media to compile as detailed information as possible from individuals within the affected areas. The humanitarian community used Web 2.0 technologies that ran on both Web and SMS (Short Message Service) text messaging platforms, which allowed greater accessibility for individuals without the means for Internet access to contribute to ongoing efforts as well as seek assistance.

Web 2.0 technologies have emerged as highly useful, applicable technologies in crisis management, disaster relief and humanitarian efforts. In Haiti, Twitter facilitated I-reporting, with information in Tweets being aggregated and superimposed onto crisis maps. The crisis maps provided the most detailed maps of the affected areas to the humanitarian community, and online social networks assisted in the aggregation of information for the crisis maps. Online social media, such as CNN and the *New York Times*, helped compile missing person databases. With telecommunications down, Voice over Internet Protocol (VoIP) allowed users to make calls in and out of Haiti over the Internet. GeoChat facilitated information-sharing across a wide variety of parties and organizations. Similarly, All Partners Access Network (APAN) allowed the military, NGOs and other parties to integrate, share and disseminate information and have real-time chats to review, collaborate and execute relief efforts in the shortest amount of time.

The Haitian experience is a cogent example of aggregating Web 2.0 technologies, which NGOs can uptake using social media platforms (SMPs) to achieve their agendas, mobilize populations and remain sustainable – using SMPs for fundraising by leveraging online social networks and social media. Combined with NGOs other strategies, Web 2.0 technologies provide additional social mobilization tools.

While Web 2.0 technologies have proven applicable and highly useful tools for assisting NGOs to implement their agendas and humanitarian efforts, they are not without disadvantages, which include oversaturation of information, unreliable information, misinformation and scams. Suggestions for overcoming the disadvantages of Web 2.0 technologies include using geo-location information segmentation, self-policing by the online community of the information posted online, and online sites that track governmental and organizational spending.

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TITLE OF PAPER: *eKasi and the Neighbourhood Development Partnership Grant: Township Innovation System*

Theme 2: Dynamics of Innovation in Developing Countries: Innovation Outcomes

This paper explores the conceptualisation of the 'township-level innovation system' (TIS) as a general category. The study uses IS theory to interrogate a prevailing local development challenge in South Africa – the 'location' or 'township' – which is characterized by unique historic, geospatial, economic and social peculiarities, but which also fits into a broader system of development interaction and intervention defined by particular contextual realities and dynamics (actors, institutions, legislative and policy environments, political dynamics, etc.). An IS approach is used to map the elements, interactions and boundaries of the 'township system' from two perspectives – that of 'the township' as a specific, constructed spatial category, and that of the 'development strategy' as a programmatic public response to the challenge of townships.

For the latter, the study takes the case of South Africa's Neighborhood Development Partnership Grant (NDPG), a township-focused grant programme administered by the National Treasury and driven through local authorities. The NDPG has its genesis in the notion that various forms of strategic, area-based public sector investments can provide the impetus for sustainable private sector (and other role player) investment and improvement in the collateral value of township properties. Thus, the NDPG focuses specifically on how its R10 billion over 10 years can enable sustained improvement in the investment desirability of townships by 'crowding in' partnerships or development – or innovation system? – activity. Currently, the grant is being applied in over 100 townships in 57 (20%) of South Africa's municipalities.

Taking a sample of these NDPG-funded townships, the paper considers the relationship between the emerging area-based strategies and the indigenous 'township systems' from an innovation systems perspective, concluding with observations about the efficacy and potential contribution of the IS approach in township development study and practice.

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