

IST-Africa 2018

Conference Report

Gaborone, Botswana

09 - 11 May 2018

Photograph Copyright © Botswana Tourism

ISTAfrica

Supported by



Hosted by



Technical Co-Sponsor



Introduction

IST-Africa 2018 Conference took place 9 -11 May 2018 in Gaborone, Botswana, as part of **IST-Africa Week 2018**. An activity of **IST-Africa**, which is supported by the European Commission and African Union Commission and co-funded under the EU Framework Programme, **IST-Africa 2018** was the thirteenth in an Annual Conference Series bringing together senior representatives from leading public, private, education & research organisations, to discuss ICT policy, showcase research results and share knowledge.

European research activities are structured around consecutive multi-annual programmes, or so-called Framework Programmes. Horizon 2020 sets out the Priorities and thematic areas, including ICT, for 2014 - 2020. Horizon 2020 is fully open to international co-operation with the aim to jointly address major challenges where significant added value is expected to be gained from a world-wide R&D cooperation. In this context, the European Commission has co-funded **IST-Africa** since 2006, to promote African - European research cooperation and support Information Society and ICT aspects of the Africa-EU Strategic Partnership.

Hosted by the Government of Botswana through DTPS, Ministry of Transport and Communications and Technically Co-Sponsored by IEEE, **IST-Africa 2018** focused on the the Role of ICT, Research and Innovation in Africa's Development and specifically on Applied ICT research in the areas of eHealth, Technology Enhanced Learning and ICT Skills, eInfrastructures, eAgriculture, Societal Implications of Technology, International Cooperation, ICT4D and eGovernment. **IST-Africa 2018** provided a collegiate setting for presentations and discussions of national & regional developments, issues of concern & good practice models, and networking with peers. **IST-Africa 2018** will also provide an opportunity to identify potential partners for future proposals under Horizon 2020.

IST-Africa directly supports Information Society, Innovation and ICT aspects of the Africa-EU Strategic Partnership and the Science, Technology and Innovation Strategy for Africa (STISA-2024)

The goals of the **IST-Africa** Conference Series are Community Building to facilitate EU-African research cooperation and successful exploitation of research results, to stimulate take-up of RTD results, to promote knowledge sharing between commercial, government and research organisations, to exchange experiences about the current state of eAdoption at a sectoral, national or regional level, and to support International Cooperation and open up the European Research Area (ERA) to Africa.

Participants at IST-Africa 2018

IST-Africa 2018 Conference attracted over 400 delegates from 34 countries representing policy makers, practitioners, and researchers from leading commercial, government and research organisations around the world. Unlike many research conferences, **IST-Africa** provided an opportunity to meet with senior managers, practitioners, project managers, software engineers and researchers from industry, government and research organisations. Delegates and speakers attend to share knowledge, experience and lessons learnt, and network with their peers from around the world.

IST-Africa 2018 Conference also provided the unique opportunity to identify partners and opportunities to co-operate in international ICT research projects co-funded by the European Commission under Horizon 2020. The Programme also facilitated sharing of interim results from ongoing Horizon 2020 projects including projects funded under the ICT-39-2015 Call.

The Venue

IST-Africa 2018 Conference took place in Gaborone International Conference Centre, Botswana.

The Programme

The 3-day programme featured an invigorating mix of business and government case studies, technical and policy papers and interactive workshops. As well as opening and closing plenary sessions, delegates could participate in 37 thematically focused parallel sessions featuring different aspects of International Cooperation, eHealth, Technology Enhanced Learning and ICT Skills, CyberSecurity, Privacy and Trust, Next Generation Computing including Internet-of-things, eGovernment, ICT4D, eAgriculture, Content Technologies and Societal Implications of Technology. Session Chairs ensured active discussion and facilitated delegate participation.

In the context of focusing on the Role of ICT, Research and Innovation in Africa's Development, the Opening Plenary on Wednesday 9 May features a high level Roundtable on the Role of ICT, Research and Innovation in Supporting Entrepreneurship and Socio-Economic Development in Africa.

Horizon 2020

Horizon 2020 commenced in January 2014 as the new Framework Programme to implement the Innovation Union with research and innovation funding of €80 billion available under competitive Calls during the period 2014 - 2020.

Horizon 2020 addresses all research and innovation funding areas previously addressed through the Framework Programmes for Research and Technical Development (e.g. FP7), as well as the Competitiveness and Innovation Programme (CIP) and European Institute of Innovation and Technology.

Three main priorities under Horizon 2020 include:

- Excellence Science – Research Infrastructures, Marie Curie (Mobility Grants), Future and Emerging Technologies
- Leadership in Enabling and Industrial Technologies (LEIT) – Components & Systems, Advanced Computing, Future Internet, Content Technologies and Information Management, Robotics, Micro and Nano-electronics and photonics
- Societal Challenges – Health, Food Security & Agriculture, Energy, Transport, Climate action and Environment, Innovation and Reflective Societies and Secure Societies

The Work Programmes for each thematic area for the period 2018 - 2020 were published on 27 October 2017. ICT is a horizontal activity that is included across a number of Work Programmes within LEIT as well as within Societal Challenges.

The IST-Africa Guide to 2018 Calls for Proposals within Horizon 2020 provides an easy-to-use overview of Open Calls, themes and deadlines within the 2017 – 2018 Work Programmes for Marie Curie, eInfrastructures, Leadership in Enabling and Industrial Technologies (LEIT - Components and Systems, Advanced Computing, Future Internet, Content Technologies and Information Management, Robotics and Key enabling Technologies (Micro-nano-electronics and photonics)) and Societal Challenges (Health, Food Security and Agriculture, Energy, Transport, Environment, Inclusive and Reflective Societies, Secure Societies)

The IST-Africa Introduction to Horizon 2020 is designed to support newcomers to Horizon 2020 to better understand the structure, rules and expectations

Please visit

www.ist-africa.org/home/default.asp?page=horizon2020

to download the individual Work Programmes and the IST-Africa Guide to 2018 Calls for Proposals

Conference Proceedings

The **IST-Africa 2018** conference proceedings was published on a USB Drive and published on an open access basis in the Paper Repository on the Conference Portal. Each delegate received a free copy of the conference proceedings at Registration.

Papers that were physically presented during the event also had the option for their paper to be included in the **IST-Africa 2018** Conference Proceedings submitted for publication in IEEE Xplore. .

IST-Africa Initiative

Supported by the European Commission (EC) and African Union Commission (AUC), and Co-Funded under Horizon 2020 (Contract 723240), **IST-Africa** facilitates and supports:

- Strategic engagement with Africa focused on International Research, Innovation and Policy Cooperation
- Knowledge Sharing, Capacity Building and Skills Transfer between IST-Africa Partner Countries
- Collaborative Open Innovation, ICT4D, Technology & Social Entrepreneurship
- Africa – EU Strategic Partnership (ICT, Information Society, Innovation)

IST-Africa Activities include:

- Annual IST-Africa Week Hosted by IST-Africa Partner Governments and associated Scientific Proceedings
- Monitoring and Analysis of African Technology-related Research & Innovation Priorities
- Analysis of African Research & Innovation Capacity, and Innovation Spaces
- Horizon 2020 Training Workshops to support Research and Innovation
- Capacity Building and promote Africa - EU Cooperation Opportunities
- Help Desk supports African - European Research Collaboration
- Participation in Technology, ICT4D, Policy and Innovation related International Cooperation Events

The IST-Africa Initiative is a strategic collaboration between IST-Africa Institute (Ireland), IIMC (Ireland, Coordinator), Ministry of Transport and Communications (Botswana); Ministère de l'Enseignement Supérieur et de la Recherche Scientifique (Burundi); Agence Nationale des Technologies de l'Information et de la Communication (Cameroon); Information Technology Industry Development Agency (Egypt); Ministry of Communication and Information Technology (Ethiopia); Ministry of Higher Education, Science and Technology (Kenya); Ministry of Communications, Science and Technology (Lesotho); National Commission for Science and Technology (Malawi); National Computer Board (Mauritius); Instituto Nacional de Tecnologias de Informacao e Comunicacao (Mozambique); National Commission on Research, Science and Technology (Namibia); Ministère de l'Enseignement Supérieur de la Recherche (Senegal); Department of Science and Technology (South Africa); Ministry of Information Communication Technology (Swaziland); COSTECH - Tanzania Commission for Science and Technology; Ministère de l'Enseignement Supérieur et de la Recherche Scientifique (Tunisia) and Uganda National Council for Science and Technology.

Plenary Session Speakers

Plenary Speakers & Panelists included:

- **His Excellency Mokgweetsi E.K Masisi**, President of the Republic of Botswana, Botswana
- **Hon. Minister Onkokame Kitso Mokaila**, Ministry of Transport and Communications, Botswana
- **Kabelo Ebineng**, Permanent Secretary, Ministry of Transport and Communications, Botswana
- **Dr Kekgonne Baipoledi**, Deputy Permanent Secretary, Ministry of Tertiary Education, Research Science and Technology
- **Paola Cervo**, DG DEVCO, European Commission
- **Mr Tshoganetso Kapaletswe**, Chief Technology Officer, Botswana Communications Regulatory Authority (BOCRA)
- **Alan Phemelo Boshwaen**, Chief Executive Officer, Botswana Innovation Hub
- **Cathrin Stover**, Chief Collaboration Officer, GEANT, Netherlands
- **Bonny Khunga**, CEO, Zambia Research and Education Network / UbuntuNet Alliance
- **Prof Julius Athlopheng**, Dean, Faculty of Science, University of Botswana
- **Lesego Thamae**, Director, Department of Research Science & Technology
- **Simon Hodson**, Executive Director: CODATA

International Programme Committee

A distinguished Programme Committee has been formed to review and provide feedback on papers and presentations, and chair sessions.

The **IST-Africa 2018** International Programme Committee includes

- **Paul Cunningham** (Conference Chair), IST-Africa Institute / IIMC, Ireland
- **Tiwonge Msulira Banda**, Ubuntunet Alliance, Malawi
- **Dr. Philip A. Catherwood**, NIBEC Research Labs, Ulster University, Northern Ireland
- **Laurens Cloete**, University of Pretoria, South Africa
- **Miriam Cunningham**, IST-Africa Institute / IIMC, Ireland
- **Kim Davis**, Research Council of Norway, Norway
- **Prof. Love Ekenberg**, DSV, University of Stockholm, Sweden
- **Dr. Charmayne Hughes**, Health Equity Institute, San Francisco State University, USA
- **Dr. Mike Joy**, University of Warwick, United Kingdom
- **Dr. Chipo Kanjo**, Department of Computer Science, Chancellor College, University of Malawi, Malawi
- **Vasilis Koulolias**, eGovLab, Stockholm University, Sweden
- **Kristiina Lahde**, 4Front, Finland
- **Gareth MacNaughton**, RMIT University, Spain
- **Tatiana Mariscal**, Health Equity Institute, San Francisco State University, USA
- **Prof. Maurice Mars**, University of KwaZulu-Natal, South Africa
- **Morten Møller**, GRELEN, Denmark
- **Dr Fungai Bhunu Shava**, Computer Science Department, Namibia University of Science and Technology, Namibia
- **Dr Adriana Mihai**, University of Bucharest, Romania
- **Dr Rayne Reid**, EBEIT, Nelson Mandela University, South Africa
- **Dr Marita Turpin**, Department of Informatics, University of Pretoria, South Africa
- **Prof. Darelle Van Greunen**, Nelson Mandela Metropolitan University, South Africa

Organising Committee

- **Miriam Cunningham**, IST-Africa Institute / IIMC, Ireland
- **Paul Cunningham**, IST-Africa Institute / IIMC, Ireland
- **Itumeleng Batsalelwang**, DTPS, Ministry of Transport and Communications, Botswana
- **Phodiso Phole**, DTPS, Ministry of Transport and Communications, Botswana
- **Ronald Keikotlhaile**, DTPS, Ministry of Transport and Communications, Botswana

Conference Secretariat

IIMC Ltd
Docklands Innovation Park, 128 East Wall Road,
Dublin 3, Ireland
Tel: +353 (0) 1 8170607, Fax: +353 (0) 1 8170606
e-mail: secretariat@IST-Africa.org
www.IST-Africa.org/Conference2018





Wednesday,
May 9, 2018

08:00

Registration

09:00 Opening Plenary 1a

Moderator: [Itumeleng Batsalelwang, DTPS, MTC, Botswana](#)**Opening Remarks**

Kabelo Ebineng, PS, Ministry of Transport and Communications, Botswana

EU Africa Research and Innovation Cooperation

Paola Cervo, DG DEVCO, European Commission, Belgium

High-Level Roundtable focused on Role of ICT, Research and Innovation in Supporting Entrepreneurship and Socio-Economic Development in Africa

Moderator: [Paul Cunningham, IIMC, Ireland](#)

Panelists include:

Mr Kabelo Ebineng, Permanent Secretary, Ministry of Transport & Communication

Dr Kekgonne Baipoledi, Deputy Permanent Secretary, Ministry of Tertiary Education, Research Science and Technology

Paola Cervo, DG DEVCO, European Commission

Tshoganetso Kapaletswe, Chief Technology Officer, Botswana Communications Regulatory Authority (BOCRA)

Alan Phemelo Boshwaen, Chief Executive Officer, Botswana Innovation Hub

Cathrin Stover, Chief Collaboration Officer, GEANT, Netherlands

Bonny Khunga, CEO, Zambia Research and Education Network / UbuntuNet Alliance

10:30

Coffee Break & Networking

11:00 Workshop 2a: [IST-Africa - Research Capacities and Priorities I](#)Chair: [Paul Cunningham, IIMC / IST-Africa Institute, Ireland](#)**IST-Africa Initiative & African Engagement in Horizon 2020**

Paul Cunningham, IIMC / IST-Africa Institute, Ireland

ICT Initiatives and Research Capacity in Botswana

Phodiso Potesh Phole, Ministry of Transport and Communications, Botswana

ICT Initiatives and Research Capacity in Namibia

Ebenhezer Kauhonina, National Commission on Research, Science and Technology, Namibia

ICT Initiatives and Research Capacity in Mozambique

Augusto Nunes, INTIC, Mozambique

ICT Initiatives and Research Capacity in Lesotho

Lieketseng Tjokotsi, Department of Science and Technology, Lesotho

ICT Initiatives and Research Capacity in South Africa

Peacemaker Dlamini, Department of Science and Technology, South Africa

11:00 Session 2b: [mHealth - Issues](#)Chair: [Tatiana Mariscal, San Francisco State University, United States](#)**Factors Motivating the Adoption of Self-Healthcare Monitoring Mobile Applications by the South African Youth**

Patrick Ndayizigamiye, University of KwaZulu-Natal, South Africa

Role of Information Literacy in Evidence Based Practice by Nurses at Kenyatta National Hospital, Kenya

Rose Njoroge, Kenyatta University, Kenya

Access Control Model for E-Health in a Cloud-Based Environment for HIV Patients in South Africa

Nureni Azeez, North-West University, South Africa

A Review of Applications of Image Analysis and Machine Learning Techniques in Automated Diagnosis and Classification of Cervical Cancer from Pap-smear Images

William Wasswa, Mbarara University of Science and Technology, Uganda

Gamification in Healthcare: Motivating South Africans to Exercise

Thaverson Devar, University of Pretoria, South Africa

11:00 Session 2c: [Technology-enhanced Learning I](#)Chair: [Morten Møller, GRELEN Consulting, Denmark](#)**A Critical Review of eLearning Research Trends in Tanzania**

Joel Mtebe, University of Dar es Salaam, Tanzania, Tanzania

A Conceptual Integrated Model for Measuring the Success of eLearning in Developing Countries: Literature Review

Lydia Kimani, University of the Western Cape, South Africa

ICT in Education in Mozambique – the example of EquaMat@moz

Antonio Jose Batel Anjo, ISCTEM, Mozambique

Ambient Learning - Knowledge as a Service Model: Towards the Achievement of Sustainable Development Goal Four

Simon Mwenda, KCA University, Kenya

The Impact of School Management Support on Individual Characteristics Towards Knowledge Sharing and Trust as a Motivating Factor: Structural Equation Modeling Approach

Lovemore Motsi, University of South Africa, South Africa

11:00 Session 2d: [CyberSecurity- Issues](#)Chair: [Peter Mokube, National Agency for Information and Communication Technologies, Cameroon](#)**Measuring Cybersecurity Wellness Index of Critical Organisations**

Husin Jazri, Namibia University of Science and Technology, Namibia

Major Security Incidents since 2014: an African Perspective Social Networks Systems using Homomorphic Cryptographic Techniques in Ubiquitous Computing Environment

Kosmas Kapis, University of Dar es Salaam, Tanzania

The Race Towards Quantum Security

Yaseera Ismail, University of KwaZulu-Natal, South Africa

Enhancing Privacy in Social Networks Systems using Homomorphic Cryptographic Techniques in Ubiquitous Computing Environment

Kosmas Kapis, University of Dar es Salaam, Tanzania

11:00 Session 2e: [Next Generation Computing I](#)Chair: [Mohamed Jmaiel, Ministere de l'Enseignement Superieur et de la Recherche Scientifique, Tunisia](#)**Selective Mobile Cloud Offloading Decisions**

Marijke Coetzee, University of Johannesburg, South Africa

Time-Cost Effective Algorithms for Cloud Workflow Scheduling - Extension of An Earlier Work

Lakshmi Narasimhan, University of Botswana, Botswana

ANN-MIND: A Comparative Study on the Training of Neural Networks with Incomplete Datasets

Tshilidzi Mudau, University of Johannesburg, South Africa

Adaptive Algorithm for Parameterization of Feature Extraction Techniques in Remote Sensing Image Processing.

Edmore Chikohora, Namibia University of Science & Technology

12:30

Lunch & Networking

13:30 Workshop 3a: [IST-Africa - Research Capacities & Priorities II](#)Chair: [Paul Cunningham, IIMC / IST-Africa Institute, Ireland](#)**ICT Initiatives and Research Capacity in Malawi**

Gift Kadzamia, National Commission for Science and Technology, Malawi

ICT Initiatives and Research Capacity in Swaziland

Nqoba Msibi, Ministry of Information Communication Technology, Swaziland

ICT Initiatives and Research Capacity in Mauritius

Ashwin Seegolam, National Computer Board, Mauritius

ICT Initiatives and Research Capacity in Kenya

Jacob Njagih, Ministry of Education, Science and Technology, Kenya

ICT Initiatives and Research Capacity in Ethiopia

Leulseged Alemie, Ministry of Communications and Information Technology, Ethiopia

ICT Initiatives and Research Capacity in Burundi

Tatien Masharabu, Ministere de l'Enseignement Superieur et de la Recherche Scientifique, Burundi



Thursday,
May 10, 2018

13:30 Session 3b: [mHealth - Issues & Applications](#)

Chair: [Charmayne Hughes, San Francisco State University, United States](#)

From Sustainable to Continuously Adaptive Information Systems
Flora Asah University of Oslo, Cameroon

Using Patient Information Systems for Primary Health care in Hospitals – Implications for Data Structures and User Interaction
Tiwonge Manda, University of Malawi, Chancellor College, Malawi

mPOWERED System for Comprehensive Health Care Provider Focused Intimate Partner Violence Care
Tatiana Mariscal, Health Equity Institute, San Francisco State University, United States

Leveraging Local Resources in Information Systems Development: MIS for Persons with Disabilities in Malawi
Patrick Albert Chikumba, University of Malawi

13:30 Session 3c: [Technology Enhanced Learning in Universities](#)

Chair: [Lieketseng Tjokotsi, Department of Science and Technology, Lesotho](#)

The Use of Git as Version Control in the South African Software Engineering Classroom
Frans Blauw, University of Johannesburg, South Africa

Developing an Accreditation System to Recognize Competence in Mathematics Education Students in Germany
Melanie Platz, University of Siegen, Germany

Influence of the Leader as a Developer on E-Readiness Accession in Higher Education Institutions in Kenya
Mwirigi Kiula, JKUAT, Kenya

How to Train a Data Scientist for the Global South?
Tomi Westerlund, University of Turku, Finland

Evaluating Machine Learning Techniques for Improved Adaptive Pedagogy
Methembe Dlamini, University of Johannesburg, South Africa

13:30 Session 3d: [Cyber Security - Networks](#)

Chair: [Peacemaker Dlamini, Department of Science and Technology, South Africa](#)

Minimising Black Hole Attacks to Enhance Security in Wireless Mobile Ad Hoc Networks
Gibson Chengetanai, Botswana Accountancy College, Botswana

Preventing Utilization of Shared Network Resources by Detecting IP Spoofing Attacks through Validation of source IP Address
Hussein Lema, University of Dar-Es-Salaam, Tanzania

A Review of New Trends in Cyber Attacks: A Zoom into Distributed Database Systems
Attlee M. Gamundani, Namibia University of Science and Technology

Shared Wireless Access Point Security in a Hybrid Star Topology using Primary Host Authentication: A Case Study of NAITES Wi-Fi
Moses Agana, University of the Free State, South Africa

A Model to Mitigate Session Hijacking Attacks in Wireless Networks
Enos Letsoalo, Tshwane University of Technology, South Africa

13:30 Session 3e: [Next Generation Computing II](#)

Chair: [Haitham Hamza, ITIDA, Egypt](#)

SDN-enabled Infrastructure Sharing in Emerging Markets: CapEx/OpEx Savings Overview and Quantification.
Lusani Mamushiane, CSIR, South Africa

Stochastic Modeling of Internet Service for Profit Optimization in Uganda
Kizito Paul, Kyambogo University, Uganda

Fuzzy Logic Sensor Fusion for Obstacle Avoidance Mobile Robot.
Aggrey Shitsukane, Technical University of Mombasa, Kenya

Choosing an Appropriate Algorithm for Reduction of Night Vision Digital Image Noise: A Comparison of BM3D and KSV
Bulelani Gunu, University of Fort Hare, South Africa

15:00 Plenary Session 4a: [Formal Opening](#)

Moderator: [Itumeleng Batsalelwang, DTPS, MTC, Botswana](#)

Welcome

Hon. Minister Onkokame Kitso Mokaila, Ministry of Transport and Communications, Botswana

Opening Address

His Excellency Mokgweetsi E.K Masisi, President of the Republic of Botswana, Botswana

16:00

Coffee Break & Networking

09:00 Workshop 5a: [IST-Africa - Research Capacities & Priorities III](#)

Chair: [Paul Cunningham, IIMC / IST-Africa Institute, Ireland](#)

ICT Initiatives and Research Capacity in Tanzania
Mauridi Abubakari, COSTECH, Tanzania

ICT Initiatives and Research Capacity in Uganda
Loi Namugenyi, Uganda National Council for Science & Technology

ICT Initiatives and Research Capacity in Cameroon
Peter Mokube, National Agency for Information and Communication Technologies, Cameroon

ICT Initiatives and Research Capacity in Egypt
Haitham Hamza, ITIDA, Egypt

ICT Initiatives and Research Capacity in Senegal
Salif Gaye, Ministère de l'Enseignement Supérieur de la Recherche, Senegal

ICT Initiatives and Research Capacity in Tunisia
Mohamed Jmaiel, Ministère de l'Enseignement Supérieur et de la Recherche Scientifique, Tunisia

09:00 Session 5b: [mHealth - Applications](#)

Chair: [Tatiana Mariscal, Health Equity Institute, San Francisco State University, United States](#)

Porting Bacis Decision Support System for Antenatal Care onto OpenMRS

Vincent Horner, University of South Africa, South Africa

Integrated System for Health Services Management
Mateus Padoca Calado, Universidade Agostinho Neto, Angola

A Mobile Telehealth Application for Rural Namibia
Nomusa Dlodlo, Namibia University of Science and Technology, Namibia

09:00 Session 5c: [Technology Enhanced Learning - Issues](#)

Chair: [Jacob Njagih, Ministry of Education, Science and Technology, Kenya](#)

South Africa's e-Skills Policy. From e-Skills to Media Literacy?
Wouter Grove, University of the Western Cape, South Africa

Knowledge Society for Africa: ICT Development in the Education Sector in Namibia

Aletta Mweneni Hautemo, Namibia University of Science and Technology

IT Governance Steering Committee, IT Competence and IT Governance Performance in Ugandan Public Universities
Sonny Nyeko, Makerere University Business School, Uganda

Facilitating Group Learner Participation using Intelligent Agents in Collaborative M-Learning
Stephen Njenga, Murang'a University of Technology, Kenya

A Metaphor-driven Interactive Multimedia Simulation for teaching and learning of programming concepts
Gina Moape, Tshwane University of Technology, South Africa

09:00 Session 5d: [Cyber Security - Case Studies](#)

Chair: [Ashwin Seegolam, National Computer Board, Mauritius](#)

Investigating the Level of Awareness on Information Security amongst users at Botho University
Kabelo Mberekhi, Botho University, Botswana

Towards Information Security Savvy Students in Institutions of Higher Learning in Africa: A Case of a University in Kenya
Joshua Ndiege, United States International University-Africa, Kenya

Investigating Secure implementation of Government Web based Systems in Tanzania

Aron Kondoro, University of Dar-es-Salaam, Tanzania

Perceptions of Online Banking Custodians on System Development and User Behaviour: An Empirical Study
Mathias Mujinga, University of South Africa, South Africa

09:00 Session 5e: [Next Generation Computing III - IoT](#)

Chair: [Oteng Tabona, BIUST, Botswana](#)

An Analysis of CoAP as Transport in an Internet of Things Environment

Louis Coetzee, Meraka Institute, CSIR, South Africa

CDE for ICT Innovation Through the IoT Based iGrid Project in Tanzania

Diana Severine Rwegasira, University of Dar es Salaam, Tanzania

Internet-of-Things for Air Pollution Monitoring in Smart Cities: A Network Selection Model

Shu Chen, ISAT-UWC, South Africa

An IoT Middleware for Air Pollution Monitoring in Smart Cities: A Situation Recognition Model

Tafadzwa Mandava, ISAT-UWC South Africa

Implementation of a K-means Tweet Clustering Engine

Phumelela Mjoli, University of Fort Hare, South Africa

10:45

Coffee Break

11:15 Workshop 6a: [WS: Strategic Capacity Building for Open Innovation](#)

Chair: [Ville Mikael Taajamaa, University of Turku, Finland](#)

Promote International Research Innovation, and Policy Cooperation and Coordination: "case Africa from a global bird's view"

Hannu Tenhunen, Royal Institute of Technology (KTH), Sweden

Collaborative Open Innovation and ICT-enabled Entrepreneurship (including Social Entrepreneurship): "Global business development platforms as catalysts of local innovation and entrepreneurship"

Antero Järvi, University of Turku, Finland

Showcase African Research and Innovation Capacity: "Building students innovation capacity and educational innovations"

Ville Mikael Taajamaa, University of Turku, Finland

11:15 Session 6b: [mHealth - Disease Management](#)

Chair: [Charmayne Hughes, San Francisco State University, United States](#)

Using Ley's Extended Model as a Framework to Explore Factors that Influence Patient's Adherence to Tuberculosis Medication

Harma Motsi, University of South Africa, South Africa

An Expert System for Malaria Diagnosis using the Fuzzy Cognitive Map Engine

Faith-Michael Uzoka, Mount Royal University, Canada

WikiTropica: Collaborative Knowledge Management in the field of Tropical Medicine and International Health

Jan Kennis, Institute of Tropical Medicine, Belgium

11:15 Session 6c: [Technology Enhanced Learning - Applications](#)

Chair: [Mauridi Abubakari, COSTECH, Tanzania](#)

Pre-Processing and Feature Extraction Technique for Hand-drawn Finite Automata Recognition

Kehinde Aruleba, University of the Witwatersrand, South Africa

Using WhatsApp to Support Communication in Teaching and Learning

Martin Ujakpa, International University of Management, Namibia

Automatic Attendance Capturing Using Histogram of Oriented Gradient on Facial Images

Abejide Ade-Ibijola, University of Johannesburg, South Africa

Sign Language Gesture Recognition through Computer Vision

Ruth Wario, University of the Free State, South Africa

Fighting Unemployment through Java Internships: Creating a Path to Software Development through Test Automation

Laurie Butgereit, Nelson Mandela University, South Africa

11:15 Workshop 6d: [Research Cyber-infrastructure and NRENS](#)

Chair: [Tshiamo Motshegwa, University of Botswana](#)

A Case for NRENS

Cathrin Stöver, GEANT, Netherlands

Progress on the Development of the BotsREN

Seretse Bagopi, BIUST, Botswana

NREN Case Studies - ZamREN

Bonny Khunga, ZAMREN, Zambia

Lessons learnt - Designing, implementing and governing the South African Federated Identities for Research and Education (SAFIRE) platform and Security Incidence Response Team (SIRT) of the South African NREN

Renier Pelser van Heerden, SANReN/CSIR, South Africa

Panel Discussion - Future Services of NRENS & Supporting Open Data and Open Science

Nobubele Shoji, CSIR, South Africa

11:15 Workshop 6e: [WAZIUP](#)

IoT Standards for Africa and Sustainable Development Goals (SDGs)

Congduc Pham, University of Pau, France

Low-Cost IoT Solutions for Fish Farmers in Africa

Sadouanouan Malo, Nazi BONI University, Burkina Faso

13:00

Lunch

14:00 Workshop 7a: [Geospatial Sciences & Land Administration](#)

Chairs: [Joyce Gosata Maphanyane, University of Botswana & Boniface Hungwe, Botswana Institute of Geomatics, Botswana](#)

Opening Remarks

Kekgonne Baipoledi, Ministry of Tertiary Education, Research, Science and Technology, Botswana

Keynote Speech

Motsotse Modisi, University of Botswana

Changing Phases of Land Administration, Laws, Acts and Policies

Bareng Malatsi, Ministry of Land Management, Water and Sanitation Services, Botswana

LAPCAS GIS & LIS Advanced Land Allocation and Registration

Jakoba Kgopolelo, Botswana Institute of Geomatics, Botswana

Developments in Teaching & Research Innovation in Geospatial Science at University of Botswana

Julius Athlopheng, University of Botswana

Towards the Building of a Robust National Database Infrastructure (NSDI) Developing Country Needs: Botswana Case Study

Tshiamiso Oitsile, Department of Surveys and Mapping, Botswana

Reconstruction of Historical Landscapes: An Alternative Approach to Monitor Land Cover Change

Joyce Gosata Maphanyane, University of Botswana

Closing Remarks

Isaac Mazonde, University of Botswana

14:00 Workshop 7b: [mHealth4frika](#)

Chair: [Paul Cunningham, IIMC / IST-Africa Institute, Ireland](#)

mHealth4frika Initiative

Paul Cunningham, IIMC / IST-Africa Institute, Ireland

mHealth4frika Beta Validation Results

Miriam Cunningham, IIMC / IST-Africa Institute, Ireland

mHealth4frika System

Miriam Cunningham, IIMC / IST-Africa Institute, Ireland

14:00 Session 7c: [Technology Enhanced Learning - Case Studies](#)

Chair: [Love Ekenberg, Stockholm University, Sweden](#)

mLearning in Nursing and Midwifery Education: Are Ghana's Students Ready?

Robert Kaba Alhassan, University of Health and Allied Sciences, Ho, Ghana

Case Study: Experiences in the Use of CommCare Technology in Mapping Assistive Technology in Southern Africa

George Kayange, Southern Africa Federation of the Disabled (SAFOD), Botswana

An Open-Source Tool-set for Meaningful Monitoring and Visualisation of Rural ICT Projects

Kim Gush, CSIR, South Africa

Lessons Learned in an Experiments comparing PDF Format and EPUB Format in an Arabic Language Secondary Level Grade 2 Biology Classroom in Khartoum

Muna Mohamed Mahmoud Abu Gosseisa, The National Ribat University, Sudan

Grade Monitoring System: A Prototype for Thulamela Secondary Schools

Pardon Takalani Ramazhamba, CSIR, South Africa

14:00 Session 7d: [eInfrastructure](#)

Chair: [Augusto Nunes, INTIC, Mozambique](#)

Research and Education Networking Across the African Continent - an update on the AfricaConnect2 project and GEANT's global activities

Cathrin Stöver, GEANT, Netherlands

A Proposed Architecture for Distributed Internet eXchange Points in Developing Countries

Diarmuid O'Briain, netLabs!UG Research Centre, Makerere University, Uganda

Challenges Faced by ZAMREN's Affiliates in the Provision of E-Learning: A Cross-Country Analysis

Mbuyu Sumbwanyambe, University Of South Africa, South Africa

14:00 Session 7e: [Mobile Technology](#)

Chair: [Salif Gaye, Ministère de l'Enseignement Supérieur de la Recherche, Senegal](#)

Assisting Tourism in Underserved Areas with TensorFlow: A Proof-of-Concept Mobile App

Laura Martinus, CSIR, South Africa

Evaluating Quality of Service for Short Message Service as a Platform to Transmit Seismic Data in Earthquake Early Warning System

Eva Shayo, University of Dar es Salaam, Tanzania

Assessment of Radio-Frequency Radiation Exposure Levels: A Case of Selected Mobile Base Stations in Dar es Salaam, Tanzania

Zaituni Kaijage, University of Dar es salaam, Tanzania

Mobile Video Comparison to Help Deaf People Make Informed Choices: a South African Case Study with Provincial Data

Andre Henney, University of the Western Cape, South Africa

An Analysis for Convergence and Culture Awareness in Mobile Technology: Towards Convergence Related Culture-Aware Technology Developments

Galamoyo Male, Botswana Accountancy College, Botswana

Battery and Data Drain of Over-The-Top Applications on Low-end Smartphones

Shree Om, University of the Western Cape, South Africa

15:45

Coffee Break

16:15 Workshop 8a: [WS: Open Data Open Science](#)

Chair: [Julius Athlopheng, University of Botswana](#)

Developing a Cyber-infrastructure for Enhancing Regional Collaboration on Education, Research, Science, Technology and Innovation

Tshiamo Motshegwa, University of Botswana

Botswana Open Data Open Science Case Study

Julius Athlopheng, University of Botswana

African Open Science Platform

Ina Smith, Academy of Science of South Africa, South Africa

Emerging Outcomes of Open Data in Tanzania: A Case of the Tanzania Data Lab

Moses Ismail, University of Dar es Salaam, Tanzania

FAIR Data & The International Data Week

Simon Hodson, Committee on Data of the International Council for Science, France

Q&A and Panel Discussion – Making Data Sharing Work

Tshiamo Motshegwa, University of Botswana

16:15 Session 8b: [mHealth - Security](#)

Chair: [Aubrey Pheto Mokotedi, Botswana Institute for Technology Research and Innovation](#)

Blockchain Technology: Is this the Solution to EMR Interoperability and Security Issues in Developing Countries?

Elizaphan Maina, Kenyatta University, Kenya

A Framework for User Awareness and Acceptance of Smart Card and Fingerprint-Based Access Control to Medical Information Systems in South Africa

Elisa Maeko, University of Johannesburg, South Africa

Enhancing Security in Electronic Health Records using AES and PBKDF2: A case study of Zimbabwe e-health system

Macdonald Mukosera, HIT, Zimbabwe

Towards Fog-based Cyber-Healthcare Data Storage Security and Availability

Samson Akintoye, University of the Western Cape, South Africa

16:15 Session 8c: [eGovernment - eVoting & Local Governance](#)

Chair: [Leulseged Alemie, Ministry of Communications and Information Technology, Ethiopia](#)

Online Voting System with Reliable Voter Authentication Protocols

Emily Bagarukayo, Makerere University, Uganda

Electronic Voting System for University Student Elections: The Case of Kabarak University, Kenya

Moses Thiga, Kabarak University, Kenya

The Role of ICT in Electoral Processes: Case of Kenya

Elyjoy Micheni, The Technical University of Kenya, Kenya

Implementing Financial Management Information Systems in Local Governments: A Model of Success Factors

Gilbert Maiga, Makerere University, Uganda

A Framework to Mitigate Water Billing Information Systems Integration Challenges at Municipalities

Duane Boucher, University of Fort Hare, South Africa

16:15 Session 8d: [eInfrastructure -Transport](#)

Chair: [Ebenhezer Kauhonina, National Commission on Research, Science and Technology, Namibia](#)

Real-time Driver Advisory Model: Intelligent Transportation Systems

James Obuhuma, Africa Nazarene University, Kenya

Assessing Scheduled Public Transport Reliability Using MATSim Toolkit

Edmore Chindenga, University of Fort Hare, South Africa

16:15 Session 8e: [Promoting Entrepreneurship](#)

Chair: [Tirelo Ramasedi, Botswana Innovation Hub](#)

Investigating the Impact of Rural Incubation Hubs in Kenya: A Case of Sote Hub

David Ogiga, Sote Hub, Kenya

Promoting Women Ict Start-Ups to Accelerate Women's Economic Empowerment: A Case of Strathmore Univerisity-@Ibizafrica

Tracy Weru, Strathmore University, Kenya

Assessing the Presence of Innovation Elements in Competitions and Awards Events in Tanzania

Angelina Misso, University of Dar es Salaam, Tanzania

Challenges Botswana's Mobile Application Developers Encounter: Funding, Commercial and Technical Support

Admore Tutsirayi Nyamaka, UNISA, Botswana

18:00

End of Parallel Sessions



Friday,
May 11, 2018

09:00 Session 9b: **mHealth - Case Studies**

Chair: **Vasilis Kouloulas, eGovlab, Sweden**

Understanding the Effects of Decentralization on Health Information Systems in Developing Countries: A Case of Devolution in Kenya

Belina Shisia, Ministry of Health, Kenya

Perceived Impact of Devolved Health Services on Implementation of DHIS2 in Kenya: A Qualitative Study

Josephine Karuri, Moi University, Kenya

A Cross-cultural Comparison of Design Feature Preferences Required for a Stroke Tele-rehabilitation System

Charmayne Hughes, San Francisco State University, United States

An Evaluation of Health Information Systems (HIS) for Namibia

Suama Hamunyela, Namibia University of Science and Technology, Namibia

09:00 Session 9c: **eGovernment - eServices**

Chair: **Phodiso Phole, Ministry of Transport and Communications, Botswana**

Unified Cooperative Population Identification Architecture to Enhance the National Identity Ecosystem of Developing Countries

Stefanus Van Staden, Office of Prime Minister, Namibia

Investigation of a Co-Design Approach for a Civic Engagement Mobile Application

Shaun Pather, University of the Western Cape, South Africa

RDSMS – A South African Research and Development Survey Management System

Louis Engelbrecht, CSIR, South Africa

Document Management Systems – Legislative Compliance, Good Governance and Municipal Practice

Silma Koekemoer, Nelson Mandela University, South Africa

09:00 Session 9d: **mAgriculture - Applications**

Chair: **Lakshmi Narasimhan, University of Botswana**

Factors Impacting the Design of a Mobile Application for Soil Management: A Case Study of the Eastern Cape Crops

Stephan Botha, Nelson Mandela University, South Africa

An Integrated Multi-Function Information System Model for Livestock Stakeholders

Gladness Mwanga, Nelson Mandela African Institution of Science and Technology, Tanzania

Condition Monitoring and Reporting Framework for Wireless Sensor Network-based Automatic Weather Stations

Mary Nsabagwa, Makerere University, Uganda

What is the Impact of Digital Financial Service on Agribusiness Market Risk?

Thabo Gopane, Johannesburg Business School, University of Johannesburg, South Africa

09:00 Session 9e: **ICT4D & Content Technologies**

Chair: **Gift Kadzamira, National Commission for Science and Technology, Malawi**

What Theory of Change Can Contribute to Capability Approach: Towards Evaluating ICT-Enabled Interventions

Mathew Egessa, Technical University of Mombasa, Kenya

A Statistical Approach to Error Correction for isiZulu Spellcheckers

C. Maria Keet, University of Cape Town, South Africa

The Impact of Demographic Factors to the Adoption of Social Commerce in Tanzania

Edison Wazoel LUBUA, North-West University, South Africa

Innovation and Intellectual Property Rights: Shaping ICT landscape in Africa

Mhlambululi Mafu, Botswana International University of Science and Technology, Botswana

10:30

Coffee Break

11:00 Workshop 10b: **mHealth in Botswana**

Chair: **Kagiso Ndlovu, University of Botswana**

Botswana's Current eHealth/mHealth Status and Future Prospects

Tony Chebani, Ministry of Health & Wellness, Botswana

Status of eHealth Readiness in Botswana

Kabelo Leonard Mauco, Botho University, Botswana

Implementing School Vision Screening Programme using Smartphone Technology in Southern Botswana

Maipelo Jeremiah, Botswana-UPenn Partnership, Botswana

Scaling Up a Mobile Telemedicine Solution (Kgonafalo) in Botswana

Kagiso Ndlovu, University of Botswana

University-Industry Collaboration Model for Setting up an eHealth Research Unit

Audrey Masizana, University of Botswana

11:00 Session 10c: **eGovernment - Issues & Case Studies**

Chair: **Gladness Pinkie Mosigi, Department of Information Technology, Botswana**

eGovernment in Mozambique: Past, Future and New Prospects

Domingos Luis Rhongo, Catholic University of Mozambique (UCM)-FGTI, Mozambique

Enhancing e-Service Delivery in Rural Communities of South Africa

Lizo Masikisiki, University of Fort Hare, South Africa

Government Facilitated Access to ICTs: Adoption, Use and Impact on the Well-Being of Indigent South Africans

Rashidi F Kassongo, University of Western Cape, South Africa

TAS: Risk Analysis & Clustered Sensors

Alfredo M. Ronchi, Politecnico di Milano, Italy

11:00 Session 10d: **eAgriculture & Environmental Sustainability**

Chair: **Loi Namugenyi, Uganda National Council for Science & Technology**

Analysing the Relationship between the Use of ICTs and Food Insecurity in Smallholder Farmer Households

Ntabeni Jere, University of KwaZulu-Natal, South Africa

Community Climate Services for Small-Scale Farmers in Tanzania

Ville Myllynpää, University of Turku, Finland

Semantic Interoperability Middleware Architecture for Heterogeneous Environmental Data Sources

Adeyinka Akanbi, Central University of Technology, South Africa

Visualisation of Big Data in Agriculture and Rural Development

Karel Jedlička, UWB, Czech Republic

12.30 Closing Plenary 11a

Chair: **Itumeleng Batsalelwang, DTPS, MTC, Botswana**

Prof Julius Athopheng, Dean, Faculty of Science, University of Botswana

Ms Lesego Thamae, Director, Department of Research Science & Technology

Mr Tshoganetso Kapaletswe, Deputy Chief Executive: Botswana Communications Regulatory Authority (BOCRA)

Mr Simon Hodson, Executive Director, CODATA

Best Paper Award

14:00

Lunch

Opening Plenary



The Opening Plenary Session was in three parts, starting with an introduction by the Permanent Secretary of the Ministry of Transport and Communications and presentation by the European Commission.

Mr Itumeleng Batsalelwang, Director, DTPS, Ministry of Transport and Communications introduced Mr Kabelo Ebineng, Permanent Secretary, Ministry of Transport and Communications, Botswana

Opening Remarks, Mr Kabelo Ebineng, Permanent Secretary, Ministry of Transport and Communications, Botswana



Mr Kabelo Ebineng outlined his pleasure to address this important meeting which brings together policy makers, academics, researchers, practitioners, entrepreneurs and innovators. He welcomed discussions in relation to applications that can improve the lives of fellow countrymen in this region. He indicated that the Ministry of Transport and Communications (MTC) is very appreciative of **IST-Africa**, what it has done, and considers dialogue between academia, researchers, practitioners and policy makers to be important. He outlined the need for continued dialogue and synergies that will facilitate the best possible outcome from our collective efforts.

In 2014 Paul Drummond in the working paper for the International Monetary Fund noted that Africa will account for 80% of the increase in the global population by 2021. The increase in the working age population creates a window of opportunity which if properly harnessed can translate into higher growth.

Mr Ebineng outlined that it is appropriate that **IST-Africa 2018** Conference should start by looking at the contemporary challenges and opportunities for Africa as a developing continent, Drummond and others observed the great potential for the continent to tap on its young population for further development. The **IST-Africa 2018** program will share insights into ICT Initiatives and Research Capacity in IST-Africa partner countries and a range of ICT application areas. It is important that outputs and lessons learnt from research can be applied towards addressing socio-economic challenges, through applications that can be beneficial to communities going forward. It is important that ideas being shared have sustainability in an African context. ICT research and innovation are key, as they can provide an opportunity to drive a national economy through the provision of entrepreneurship opportunities creating youth employment. Botswana considers ICT to support the future and MTC is looking for tangible outcomes from the knowledge shared and torch bearers who can lead the way for others to follow. Africa as a continent has a lot of potential. Mr Ebineng highlighted the importance that research outputs can be communicated, are inclusive and can be applied by the wider community. It is important to recognise that development is people driven and it is necessary for national people to take responsibility for driving their country forward and provide the appropriate capacity building to the people of the region.

Mr Ebineng outlined that MTC is looking forward to feedback on how policy makers can help and how researchers and practitioners can apply new knowledge. ICT is a key enabler of socio-economic development. MTC remains optimistic that Africa can benefit from addressing national challenges contextualised to specific environments through creative solutions to identified problems. Through the interactions during this event delegates will know more as a result of knowledge shared during IST-Africa 2018. He indicated the importance that national participants identify how to apply this knowledge to facilitate Botswana to move forward in terms of policy and implementation.

He welcomed all the participants to this important meeting. He appreciated the commitment demonstrated by coming to Botswana to share experiences and knowledge, resources applied and the time allocated to discussions over the coming three days. He invited participants to visit parts of Gaborone and benefit from Botswana hospitality.

Mr Itumeleng Batsalelwang, Director, DTPS, Ministry of Transport and Communications thanked Mr Kabelo Ebineng, Permanent Secretary, Ministry of Transport and Communications for his opening remarks and invited Mrs Paola Cervo, DG DEVCO to present the address on behalf of the European Commission.

EU Research and Innovation: the International Cooperation and Development Dimension, Mrs Paola Cervo, DG DEVCO, European Commission



Mrs Paola Cervo, DG DEVCO, European Commission outlined that she was delighted and honoured to address the **IST-Africa 2018** Conference representing the European Commission on 9th of May (Europe Day), when peace and prosperity is celebrated in Europe. She highlighted that it was her pleasure to participate in the different sessions of **IST-Africa 2018** to hear about priorities, recent developments and trends in ICT, Research and Innovation in the participating countries. She indicated that she planned to outline the overall European Union (EU) framework for research and innovation, focusing on its international dimension to show how it can be of benefit to partner countries in particular in the African continent. She then concentrated on the EU international cooperation and development dimension to show how it contributes to research and innovation,

outlining some of the most relevant initiatives and instruments in support of Science, Technology and Innovation.

Paola highlighted that Agenda 2030 and the associated Addis Ababa Action Agenda fully integrate **Science, Technology and Innovation (STI)** as enablers for socio-economic development and call for an increase in international cooperation in this domain. The global agenda intercepts clear trends which have emerged over the last years. Despite the financial crisis, global expenditure on research and development has grown faster than the global economy, showing confidence that investment in knowledge and science will bring future benefits. The North-South divide in research and innovation is narrowing, as a large number of countries are incorporating STI in their national development agendas. There are ever more scientists in the world and they are becoming more mobile. In particular, the African Union's (AU) Agenda 2063 and Europe 2020 have a strong focus on investment in research and innovation for job creation.

Through its 10-year Science, Innovation and Technology Strategy (STISA 2024), Africa has committed itself on the path to an innovation-led, knowledge-based economy. In 2013 African R&D spending reached 0.45% of GDP, climbing from 0.36% of GDP within 6 years, thus taking a step closer to the 1% of GDP target agreed by AU Member States as the minimum investment in R&D. Commitment to R&D spending in the European Union is set to reach 3% of EU GDP in 2020. It currently is around 2% of GDP.

Paola then focused on **Horizon 2020**, which is the largest EU Research and Innovation programme to date, with nearly 80 billion euro of funding available over 7 years (2014 to 2020). By coupling research and innovation, Horizon 2020 puts emphasis on excellent science, industrial leadership and tackling societal challenges. International cooperation is a cross-cutting priority of H2020, whereby work programmes take into account the priorities that have been identified jointly with the EU's partner countries and regions. Work programmes encourage international participation in consortia and an increasing number of topics offer opportunities for international collaboration or are even specifically designed around international cooperation.

Paola highlighted that the international dimension of Horizon 2020 has been reinforced as part of priorities set for the last part of the programme covering commitments in 2018 to 2020. Over the last year, Joint S&T Cooperation Committee meetings have been successfully organised with a range of countries (including Algeria, Tunisia, Egypt and South Africa). In addition, regional policy dialogues have notably included an EU-African Union high-level policy dialogue. More than 30 flagship initiatives of large scale and scope have been launched under the last Work Programme, on topics dedicated to international cooperation in areas of mutual benefit, comprising a total budget of over 1€ billion. Large Flagship initiatives include, for example, the EU-Africa Partnership on Food & Nutrition Security & Sustainable Agriculture.

The EU-Africa cooperation in Research and Innovation grows stronger as a result of EU R&I Framework Programmes. Under the 7th Framework Programme (2007 to 2013), organisations from the African Union reached 1055 participations in 427 collaborative actions, receiving 153 million euro from the European Commission and contributing with 50.8 million euro. Health, food security, ICT, climate change and energy were among the primary areas of cooperation. 1319 researchers from the African Union participated in Marie-Curie actions, and entities from the African Union participated 10 times in signed European Research Council grants, receiving 1.2 million euro from the EU.

Africa remains a key partner region for the EU in Horizon 2020. So far, organisations from the African Union have reached 191 participations in 79 signed grants, receiving 31.2 million euro from the European Commission and contributing with 2.9 million euro. The areas of cooperation vary from energy and environment to transport, ICT, and research infrastructures. In addition, a total of 182 researchers from the African Union have participated

in Marie Skłodowska Curie Actions, and entities from the African Union have participated 2 times in signed European Research Council grants.

The need to continue investing in research and development for and with developing partners is reaffirmed by the **European Consensus on development**. This is a blueprint for aligning the European Union's development policy with the UN 2030 Agenda for Sustainable Development. It sets the framework for the common EU approach to development cooperation policy in support of Sustainable Development Goals (SDGs). The Consensus commits the EU and its Member States to continue investing in research and development to contribute to better conditions for economic activity in developing countries, unlocking private sector investment and driving socio-economic development through upgraded research and innovation capacity.

Paola highlighted that from a specific Africa-Europe perspective, investing in people – education, science, technology and skills development – is one of the strategic priorities set by the AU and the EU at their last Summit (Abidjan, November 2017). The AU-EU Partnership recognises the importance of deepen collaboration and exchange in these areas to respond effectively to the needs of the economies in African and European countries, and with the aim of increasing the employability of young people.

From a more specific perspective related to the growing role of the digital economy in partner countries, it is important to also mention the **"Digital4Development: Mainstreaming digital technologies and services into EU development policy"** (D4D), which the European Commission issued in 2017. The approach is to support partner countries to address the challenges brought about by digitalisation and technology. Digitalisation should play, and indeed will play, a central role in improving lives – in particular by empowering women and girls, enhancing democratic governance and transparency, and boosting productivity and job creation.

Paola highlighted that four interrelated priorities have been defined for action that align the opportunities for digital technology innovation with the EU development policy:

- Access to open, affordable and secure broadband connectivity and digital infrastructure including the necessary regulatory framework;
- Digital literacy and digital skills;
- Digital for growth, entrepreneurship and job creation; and, last but not least,
- Digital technologies as an enabler in other focal sectors (such as energy, governance, agriculture, health, education etc.).

The immediate focus is on Africa, in view of the digital divide, and in particular in those African countries that are more ready, building on the interests and consensus of the local partners. Since the launch of the policy in May 2017, the D4D policy was recognised as a priority by the EU and African heads of state and governments during the EU-Africa Summit held in Abidjan.

Paola highlighted that another tool to be used to foster digitalisation in Africa is the **European External Investment Plan** (EIP), designed to leverage 44 billion euro of private investment by using public funds to de-risk investments. In particular its European Fund for Sustainable Development (EFSD) includes a "digital window", aiming to create the conditions for the deployment of digital technologies as well as for scaling-up of digital services, streamlining digital in various sectors (agriculture, energy, health, education etc.) including financial services, and promoting the adoption of digital productivity tools by SMEs.

Implementation of the EIP will be through the existing blending mechanisms, involving multilateral European Finance Institutions, bilateral Development Banks from Member States, European Development Finance Institutions, as well as other regional or multilateral development banks (e.g. African Development Bank). Operations envisioned include: support to digitalised public services, intended to increase the performance of public services towards citizens and business; venture capital funds, business angels and other non-institutional investors for the financing of digital innovative solutions; local operators in the field of Digital Payment Systems and Digital Financial Services as well as de-risking last mile connectivity.

Paola concluded by providing some examples of EU development instruments and initiatives in support of ICT, Research and Innovation in Africa.

The **Pan-African programme** implements the Joint Africa-EU Strategy (JAES). It covers Africa as a whole, with a continental and trans-regional approach. The 2014-2017 roadmap funded initiatives for 845 million euro in 5 priority areas, including Science, Technology and Innovation, and Higher education.

The **Africa Connect II programme** provides support to develop a regional education and research communication network and high-capacity internet connectivity. It builds on existing networks in Eastern and Southern Africa and North Africa and will extend connectivity into West and Central Africa. The programme targets research and higher education institutions, with a focus on developing local solutions for local contexts.

The **African Union Research Grant** aims to strengthen collaboration between Africa and the EU in research and innovation, and to provide equitable access to research funding for candidates from Africa and Europe. The 2016 Call for Proposals (9 million euro) focused on STISA-2024 Priority One: Eradicate hunger and ensure food and nutrition security. The 2018 Call for Proposals (8 million euro) focuses on Food & Nutrition Security and Sustainable Agriculture (FNSSA) with particular attention on Agriculture and Food Systems for Nutrition.

The **Intra-Africa Academic Mobility Scheme** aims at funding partnerships between higher education institutions (HEIs) from different African countries and at granting scholarships to students and academics to carry out studies, research or teaching in another African country. It provides financial support to partnerships of African HEIs for the organisation and the implementation of student and staff mobility in high quality master and doctoral programmes within African countries.

Scientific and technological research has long been an important aspect of the cooperation between the EU and the ACP Group of Countries. Since 2006, three consecutive **EU-ACP programmes** have aimed at strengthening science, technology and innovation systems in ACP countries, and at supporting applied research. The three programmes have been implemented by the Secretariat of the ACP Group of States, with the support of the European Commission. The latest EU-ACP programmes focused on improving STI and research capacities particularly in the agriculture, food and energy sectors, and encouraged the creation of synergies between different actors of the R&I system: government, academia, civil society and the private sector.

It is also worth mentioning that the programmes have been developed in complementarity with other initiatives such as EDULINK – the EU-ACP programme aimed at fostering capacity building and regional integration in the field of higher education through institutional networking; and supporting quality higher education – and the intra-ACP contribution to Erasmus+ whereby ACP countries are eligible to take part in several components of the programme.

As part of the cooperation under the 11th European Development Fund, the EU and the ACP have decided to step up their efforts in support of R&I with a forthcoming programme, which they expect to approve by the end of 2018. The programme proposes a strategic approach to building innovation capability in ACP countries by helping structure their innovation eco-systems. It is designed to induce change at interlocking levels: policy development, knowledge transfer, and capacity of research and innovation stakeholders. As for previous initiatives, the programme will be managed by the ACP Secretariat. More information on this will be circulated amongst ACP Ministries and Embassies towards the end of 2018.

Paola thanked the participants for their attention and outlined that she looked forward to engaging in fruitful exchanges during **IST-Africa 2018**.

High Level Roundtable on the Role of ICT, Research and Innovation in Supporting Entrepreneurship and Socio-Economic Development in Africa



Paul Cunningham, IST-Africa Coordinator welcomed the panelists and participants to the High Level Roundtable on the Role of ICT, Research and Innovation in Supporting Entrepreneurship and Socio-Economic Development in Africa. Paul invited the participants to stand and introduce themselves to the person beside them.

Paul provided a brief summary of IST-Africa activities. **IST-Africa** was founded in 2002

and over the last number of years has grown to become a strategic partnership with 18 African Member States supported by the European Commission and African Union Commission. Paul indicated that we are delighted that for the second time the Government of Botswana has hosted **IST-Africa**. As the Permanent Secretary has highlighted the whole purpose of **IST-Africa** is to strengthen capacity and to address societal challenges. While the high level round table is going to look at things from both a policy and a strategic point of view, we never forget that at the end of the day we are trying to transform society. So working together over the past 10 years the **IST-Africa** partners have brought over 165 million euros of research funding into African Institutions to support the building of masters and PhD programmes addressing local societal challenges instead of the most talented people getting headhunted from abroad. It is important to recognise that one of the most important

achievements of the partnership over that period of time with the support of key stakeholders including the EU Commission has been to build that local capacity. While listening to the panelists exchange views, Paul invited the participants to think about "How can I apply this in my context?", "How can I adopt and adapt the ideas that I am hearing to the socio cultural norms, the resource constraint and other issues that affect the society in which I live?" Paul outlined that he hoped that at the end of the 3 days participants will go home and act as multipliers within their organisations and communities to help make their country a better place than it was as a result of being here today.

Paul introduced the panelists including: Mr Kabelo Ebineng, Permanent Secretary, Ministry of Transport & Communication; Dr Kekgonne Baipoledi, Deputy Permanent Secretary, Ministry of Tertiary Education, Research Science and Technology; Mrs Paola Cervo, DG DEVCO, European Commission; Mr Tshoganetso Kapaletswe, Chief Technology Officer, Botswana Communications Regulatory Authority (BOCRA); Alan Phemelo Boshwaen, Chief Executive Officer, Botswana Innovation Hub; Mrs Cathrin Stover, Chief Collaboration Officer, GEANT, Netherlands and Mr Bonny Khunga, CEO, Zambia Research and Education Network / UbuntuNet Alliance.

Paul outlined that the Roundtable will take the format of short interventions around a number of agreed talking points. The Roundtable commenced by discussing innovative and impactful ways in which ICT is being applied across Africa to strengthen socio-economic development and how it can further strengthen entrepreneurial capacity.

What are some of the more innovative and impactful ways in which ICT is being applied across Africa to strengthen socio-economic development? How can ICT be leveraged to further strengthen Entrepreneurial capacity and culture in Botswana as well as in a broader African context?

Paul invited **Mrs Paola Cervo, DG DEVCO, European Commission** to provide the first intervention.

Paola highlighted that digital technologies, including the Internet, are being adopted in the developing world at an unprecedented rate – faster than any other technology in the past. The digital economy has taken an important leap forward in developing countries, surpassing many of the traditional sectors. Mobile penetration has reached 80% in Africa. Local entrepreneurs have started to develop impactful local solutions for local problems while e-Government solutions show the impact on creating efficiency and transparency in the public sector.

Technological trends, such as mobile and social solutions, cloud computing and data analytics, offer a range of new opportunities for new business services in the knowledge economy and facilitate innovative Small Medium Enterprises (SMEs) to enter into the market. Digital solutions can significantly contribute to a more transparent and rules-based business and investment climate, including by facilitating company registration, fiscal and administrative procedures.

Paola outlined that digital entrepreneurship can strongly contribute to reduce poverty and create prosperity and livelihoods in developing countries. Digital entrepreneurs can reap the benefits of the global market. Young people can develop their capacity to build start-ups and innovative community initiatives by using digital technologies as support. Some of the areas to be addressed by digital entrepreneurs include: removing intermediaries (cf. debate on the advantages of blockchains), matching employers with their future employees, providing online education, adapting the educational material, giving people their first physical address and their first bank account.

Nevertheless, Paola highlighted that it is also important to mention that connectivity and affordability remain a problem both across and within regions. There are large variations in connectivity between high and lower income countries and between cities and rural areas. The European Union promotes a vision of access to affordable broadband connectivity, with equally trained men and women accessing and creating relevant content and services that are beneficial for themselves and their societies, and potentially globally competitive, enabled by an open and free Internet. For this reason, the European Union proposed "Digital4Development" as the appropriate framework for mainstreaming digital technologies, contributing to the achievement of the Sustainable Development Goals and ensuring an effective delivery. Fostering digital entrepreneurship (SMEs) and job creation is one of the main priority areas.

Within this context, the EU considers that financial support should not rely exclusively on Official Development Aid. Indeed, investments appear to be the preferred avenue. Blending instruments to leverage financial resources would therefore constitute the main tool working together with International Financial Institutions and the private sector. National resources should also be mobilised through effective and fair taxation policies.

Paul thanked Paola for this insight and invited **Mr Bonny Khunga, CEO, Zambia Research and Education Network / UbuntuNet Alliance** to share his perspective.

Bonny shared a practical example. As a result of increased bandwidth allocated to University of Zambia, access and transfer of huge data was possible for a successful research on "Soils Mapping" in Zambia by Dr Lydia Chabala. The research results are now available on the national database to support cost efficiency in agricultural initiatives undertaken in the country. This has been of great help especially to small-scale and farmers in shifting

from the usual low yield maize farming to other crops that are suitable to the local soils. It has also assisted in interventions for soil improvement.

Paul thanked Bonny for sharing this practical example and invited **Mr Tshoganetso Kapaletswe, Chief Technology Officer, Botswana Communications Regulatory Authority (BOCRA)** to share his experiences.

Tshoganetso highlighted that ICT can facilitate e-commerce. This facilitates African entrepreneurs to become players rather consumers in the e-commerce ecosystem. It will allow agricultural producers to market and sell their goods online. Most of the African Countries including Botswana has passed Electronic Transaction Act which facilitate e-commerce. However, effective implementation is still lacking behind. There is a need to have an e-commerce strategy to promote most businesses to trade online. Mobile money payments will facilitate the unbanked society to participate in e-commerce.

Paul thanked Tshoganetso for sharing this complementary insight.

The panelists were then invited to discuss the role and potential contribution of multi-stakeholder Collaboration in supporting Research, Innovation and technology-enabled Entrepreneurship.

What is the role and potential contribution of multi-stakeholder Collaboration in supporting Research, Innovation and technology-enabled Entrepreneurship focused on addressing African societal challenges and policy priorities at both a national and continental level?

Paul invited **Mrs Paola Cervo, DG DEVCO, European Commission** to share her insight.

Paola commenced by outlining that research and innovation (R&I) systems consist of a complex and dynamic set of cyclical activities performed by different key actors. This can either adapt/create the knowledge or simply use it for different applications: universities and training institutes, local communities and indigenous knowledge holders, SMEs, start-ups and technology-based firms, national governments, public funding agencies, intermediaries (e.g. technology transfer offices, advisory bodies, etc.), non-university research institutes, social organisations such as NGOs and cooperatives.

Paola highlighted that strong innovation performance remains the prerogative of those countries able to mobilise effective interactions amongst all the actors of the innovation value chain, which is a key success factor to promote learning and knowledge accumulation. In fact, investments in R&I capability are likely to pay a high dividend if embedded in an effective innovation eco-system, including opportunities for collaboration between different stakeholders – namely R&I institutions, industry and academia – combined with efforts to constitute a critical mass of skilled people.

For the past years, through its international cooperation and development instruments, the European Union has encouraged multi-stakeholder partnerships; supported the synergies between higher education institutions, academics, practitioners and Small Medium Enterprises; fostered networking and knowledge sharing between the different stakeholders of the research and innovation system. These experiences – within the specific frameworks of the cooperation both with the African Union and the ACP countries – have once more demonstrated the value of multi-stakeholders cooperation to support the application of research and innovation to specific development needs.

Still, in many countries, challenges remain mainly in terms of: lack of interaction among key actors, both from the formal and the informal sector, including grassroots innovators, and local and indigenous knowledge-holders; and, involving the private sector (SMEs in particular), foundations, civil society, and local/regional authorities – so that adequate arrangements for effective collaboration between all the innovation actors facilitate the translation of knowledge into goods, services and technologies.

Paola also highlighted that the experience with Horizon 2020 shows how engaging with international multi-stakeholder partnerships has positive effects. Horizon 2020 data shows that the success rate of proposal increases when the consortium takes on board international partners, and international co-publications are on average more often cited than other publications.

Dr Kekgonne Baipoledi, Deputy Permanent Secretary, Ministry of Tertiary Education, Research Science and Technology and **Mr Alan Phemelo Boshwaen**, Chief Executive Officer, Botswana Innovation Hub agreed that it is important to actively encourage multi-stakeholder collaboration. Alan highlighted that the Government of Botswana is actively encourage technology-enabled entrepreneurship through activities supported by the Botswana Innovation Hub.

Paul thanked Paola, Kekgonne and Alan for sharing their perspectives.

The panelists were then invited to discuss the opportunities as a result of improving eInfrastructure in Africa.

How does the steadily improving eInfrastructure in Africa support the transformation of Education, Research and Innovation? What still needs to be done to further strengthen Research and Innovation related capacity and related infrastructure to achieve even greater societal impact?

Paul invited **Mrs Cathrin Stover, Chief Collaboration Officer, GEANT, Netherlands** to share experiences from AfricaConnect and GÉANT2.

Cathrin briefly introduced herself and GÉANT, which is the pan-European research and education network. There are about 110 national research and education networks in the world, interconnecting universities and research institutions of their country into a global dedicated telecommunications network. This is Internet bandwidth solely dedicated to research and education.

Cathrin has been the project manager of the AfricaConnect project since 2011. AfricaConnect procures data communication networks and interconnects the NRENs in Africa to ensure African universities and research institutions are being connected to the global network. From her perspective it is essential that students and researchers in Africa have the same access to data communications networks and technology as their counterparts around the world. We have challenges in the world today - climate is one example, which only global interconnected and collaborative research collaborations can solve.

Cathrin highlighted that there is no ICT without infrastructure and affordable access to this infrastructure. She provided the example that a car is of little use when there are no roads or the roads end at the border of a city or a country. Data needs roads to travel. But the road needs to also be affordable. GÉANT builds and manages data comms infrastructure for research and education. Cathrin noted that GÉANT and the AfricaConnect project buys data comms capacity to build our network and interconnect. When GÉANT started working in Africa they have seen pricing 1000 times higher than pricing in Europe. There has been a fantastic reduction of costs for connectivity in many parts of Africa over the past few years. In some countries there have been reductions of up to 97% since AfricaConnect started in 2011. This has increased the capillarity of NRENs around Africa, more scientists and students are connected. But still - NRENs are not yet set up everywhere - we still struggle with too high telecoms costs in Africa.

The EC co-funded AfricaConnect project commenced in 2011 with a focus on procuring and operating infrastructure for research and education in South and East Africa. The result is the UbuntuNet network, which today interconnects the existing NRENs in the region, one of them of course being ZAMREN in Zambia. AfricaConnect2 is the current project and consolidates the infrastructure of the UbuntuNet alliance, but also commenced to procure and operate infrastructure for research and education in West and Central Africa, in collaboration with WACREN. So far so good. However, Cathrin highlighted that they see that in some parts of Africa roll-out of this dedicated connectivity to universities and research institutions is still slowed down by exceedingly high costs of connectivity. This is a challenge to the regulatory environment in the countries but also across the African continent, as we are talking regional connectivity.

It is vital for the audience in Botswana to understand that all AfricaConnect projects are self-inclusive – the decision to join the project has to be made by the respective country and the drive towards the creation of a national research and education networks needs a champion within the country. It is also important to understand that the architecture of the backbones that the project builds ensure that traffic aggregation and exchange happens in the African continent.

Paul thanked Cathrin for sharing these experiences from AfricaConnect and GÉANT. Paul invited **Mr Bonny Khunga, CEO, Zambia Research and Education Network / UbuntuNet Alliance** to share experiences from ZAMREN.

Bonny outlined that ZAMREN is a member of the Regional Research and Education Network, UbuntuNet Alliance (UA). It is a consortium of universities, colleges and research institutes. ZAMREN has been a change agent in the pricing of Internet connectivity in Zambia. Prior to ZAMREN in 2012, the cost of bandwidth was between US\$4,500 to US\$5,000 per 1Mbps per month. With this pricing structure universities and colleges in Zambia could only afford very low connectivity capacities. In fact the total capacity for all the learning institutions in the country was about 35Mbps. ZAMREN began providing connectivity services to research and education institutions in July 2012 at rate of US\$900 per 1Mbps per month. This was of course a huge drop. Local commercial ISPs thought they could not survive a year. Well, it now five years since. Not only that, with the Africaconnect Project supporting the building of the Regional Network, and connectivity to the European Network Geant, ZAMREN is continuously pushing connectivity costs down and our tariffs are now at less than US\$100 per 1Mbps per month. There are three international border links through UbuntuNet Alliance, at Nakonde into Tanzania, at Kazungula, into Namibia and at Chirundu into Zimbabwe. ZAMREN are now providing Global Transit connectivity capacity to our member institutions at 2000Mbps. We are planning further capacity increments this year. ZAMREN now has 107 universities, higher education institutions and research institutes connected onto its network.

Bonny highlighted that ZAMREN has engaged with Government through the Ministry of Education, and Ministry of Transport and Communications. They liaise with the ICT Regulatory body, ZICTA, which manages the Universal Access Funds. They have applied part of this fund for financing last-mile connectivity of public universities and colleges to ZAMREN POPs. With internally generated funds ZAMREN finance and support campus wireless networks for deployment of eduroam.

ZAMREN has also engaged with local optic fibre infrastructure owners for transit capacities within the country. A major engagement has been with the power utility company (ZESCO), which, by the way, is quasi-government. ZAMREN has an MoU with ZESCO under which ZESCO carries our international traffic to and from the borders of Zambia gratis. Power utilities companies have fibre infrastructure as part of the Earthing cable for the purpose of running SCADA systems, which are very critical for control and managing power distribution. The system consumes at most 5% of the fibre capacity. The rest of the capacity, the company supplies to bulk carriers. NRENs can negotiate for use of this capacity with power utility companies with the backings of the Ministry of education. These engagements are necessary for setting up and running any upcoming NREN in our region.

Paul thanked Bonny for sharing practical experiences from ZAMREN. Paul invited **Mr Tshoganetso Kapaletswe, Chief Technology Officer, Botswana Communications Regulatory Authority** to share his perspectives.

Tshoganetso highlighted that National Research and Education Networks (NREN) are very important for the country to have to promote research and exchange information. One of the major barriers of creating an NREN has been the high tariff costs. However, international bandwidth costs are gradual coming down due to the competition in the undersea cable (WACS, EASSY, Seacom), even though the tariffs are still relatively high in comparison to other countries, particularly developed countries. The main challenge for developing countries such as Botswana in relation to high tariffs is that the country is sparsely populated therefore to ensure that the ICT services are universally available throughout the country the urban centres are mainly subsidising the rural areas. In addition the IPT tariffs for connecting to the International POPs are still relatively high. Therefore, regardless of how the market is competitive the prices will never be compare to those in developed countries.

In Botswana the Government had also been subsidising the roll-out of the national backbone and international backbone through a wholesale provider, BOFINET. The Internet costs particularly for fixed broadband are still relative high due to the local loop access cost. The regulator is available to facilitate the introduction of an NREN in Botswana, it is up the university and research institute to collaborate and work together.

Paul thanked Tshoganetso for this intervention.

The panelists were then invited to discuss how technology can be leveraged to strengthen quality education.

How can technology be leveraged to further strengthen the availability of quality education across the continent, whether at the primary, secondary/high school, vocational or tertiary level? What are some of the key change management and policy challenges that must be addressed to effectively leverage technology in education?

Dr Kekgonne Baipoledi, Deputy Permanent Secretary, Ministry of Tertiary Education, Research Science and Technology highlighted the value of using technology within education to provide access to remote resources and to share resources within multiple sites.

Mrs Paola Cervo, DG DEVCO, European Commission outlined the importance of equal access to science, technology, engineering, and mathematics (STEM) since primary level of education. Women's participation in STEM is one of the areas where the education gender gap is more evident. Although just as many girls as boys complete high-school level education, and more women graduate from university worldwide than men, women remain a minority in STEM fields. Only one in three researchers is a woman in sub-Saharan Africa. Female participation drops at higher levels of the research system, the proportion of women in decision-making bodies are still very low; women make only 5 per cent of membership in national academies in science and technology disciplines. Women are also less represented in prestigious universities and senior faculty, the very positions where researchers publish the most. Evidence suggests that reasons for this systematic underrepresentation are multiple and complex, but it definitely also depend on an accessible, equal and qualitative education in STEM since the early years

Paul thanked Kekgonne and Paola for these insights.

Paul thanked all the panellists for the insights shared during the Roundtable and invited the delegates to go to lunch.

Formal Opening Ceremony



Mr **Itumeleng Batsalelwang**, Director, **DTPS, Ministry of Transport and Communications**, Botswana welcomed the participants to stand up while H.E. Mr Mokgweetsi Masisi, President of the Republic of Botswana entered the room with Hon. Onkokame Kitso Mokaila, Minister of Transport and Communications with Mr Kabelo Ebineng, Permanent Secretary, Ministry of Transport and Communications. The National anthem was then played.



Mr Itumeleng Batsalelwang called upon **Hon. Onkokame Kitso Mokaila, Minister of Transport and Communications** to present the welcome remarks.

Hon. Onkokame Kitso Mokaila welcome the participants, Paola Cervo, DG DEVCO, European Commission and Miriam Cunningham, IST-Africa Institute, Ireland to the Republic of Botswana. He acknowledged H.E. Mr Mokgweetsi Masisi, President of the Republic of Botswana and Mr Kabelo Ebineng, Permanent Secretary, Ministry of Transport and Communications.

Hon. Mokaila commenced by stating that the **IST-Africa 2018** Conference is very important. It comes at the right time for Botswana because the Government is currently restructuring and reorganising its ICT priorities. He indicated that he wished to talk about why Africa has to adopt ICTs, why the issue of the cost should not be an issue because generally Africa is already lagging behind. If Africa wants to progress and catch up then it is very important that we embrace ICTs because that is the only leverage that we have. From an intellectual capital point of view, we are there with everybody. However, technologically we are not. These systems have been developed and are there for us to exploit and therefore a gathering like this which brings this African intellectual capital together comes to speak to the issue of how do we learn from each other to leverage on the systems that are already there to better our own economies.

Hon. Mokaila outlined that politicians have an agenda to bring developments to our country to improve the livelihoods of our people. Therefore we must come up with systems that help us to design this future for our people. This conference brings these minds together for us to gain from them.

Hon. Mokaila highlighted that in his inauguration speech His Excellency, the President of Botswana spoke about ICT being a priority to create jobs for the youth, and offered the Minister his full support in time to achieve the diversity of Botswana and do what is right because times have changed. Big Data is here, internet is everywhere, so how do we leverage it so that someone sitting in the middle of nowhere gets the same service as someone in Cameroon. This brings up the issue of infrastructure sharing. For the Ministry it is about cost, universal access, and how to reach everyone in Botswana to make sure that they are not left behind as we attempt to become a knowledge based society. People need access to information. As the Government it is necessary to put the necessary infrastructure in place to facilitate citizen access to the knowledge based economy.

Hon. Mokaila highlighted that he wished participants to get the warmth of knowing that we are trying to better the lives of people. Tim O'Reilly said that we are entering a world where data may be more important than software. Hon. Mokaila outlined that he believes that data has become more important than anything else because it creates patterns for us and using technology that we can use to better ourselves.

Hon. Mokaila highlighted that His Excellency, the President of Botswana has been travelling all over Southern Africa meeting other presidents and setting the tone about the direction he wants to take Botswana. He assured the President that as the Minister of Transport and Communications in our reprioritisation we must allow Ministries to become experts in their fields so that they can grow and help us to go into online services or eServices quicker. He highlighted the important to offer online services for Education, Health, Agriculture and Trade so we can move Botswana forward. He outlined the importance of the **IST-Africa 2018** Conference to allow participants to share knowledge and experiences across countries and regions so that participants can go home and leverage this knowledge effectively. In conclusion he thanked the participants for their attention and welcomed them to Botswana.

Mr Itumeleng Batsalelwang invited **Dipako Sesienyane**, to read a poem.



Following the poem, Mr Itumeleng Batsalelwang invited **Mr Kabelo Ebineng, Permanent Secretary, Ministry of Transport and Communications** to introduce H.E. Mr Mokgweetsi Masisi, President of the Republic of Botswana.

Mr Ebineng said that it was an honour to introduce the President and invited **H.E. Mr Mokgweetsi Masisi, President of the Republic of Botswana** to speak.



H.E. Mr Mokgweetsi Masisi, President of the Republic of Botswana confirmed that he was most honoured to have been invited to officiate at **IST-Africa 2018** Conference. He began by extending a warm welcome to participants, particularly those who are from outside Botswana, and wished them a pleasant and enjoyable stay in Botswana. The participation of researchers, policy makers and practitioners from Africa, Europe and other parts of the world at **IST-Africa 2018** Conference is a clear indication of the importance that they attach to the critical role of Information, and Communications Technologies (ICTs) in our economic and social development as Africans.

His Excellency outlined that he had been informed that participants will be discussing and sharing knowledge on research projects, as well as the application of ICTs in the field of research. He has also been informed that the goals of the **IST-Africa** Conference series is to support European and African research cooperation, to promote knowledge sharing between Government, Commercial and Research organisations, as well as to harness ICTs to provide practical and tangible solutions to our people. His Excellency highlighted that this is also a priority for the Government of Botswana. He outlined the hope that the interactions at **IST-Africa 2018** over the next three days will contribute in no small measure to the development of robust ICT policies and programmes, whose implementation will change the lives of our people for the better. He highlighted that he was very happy to note that this conference is taking place at a time when the whole world is moving in the direction of knowledge based economies. He noted that issues of relevance to Africa such as technology enhanced learning, ICT skills, e-government, and cyber security, are on the agenda of **IST-Africa 2018**. This will undoubtedly enrich our insight into the latest technological approaches available for Africa's development.

His Excellency outlined that it is important for Africa to identify locally developed solutions to address African problems. In this connection, policymakers need to institutionalise comprehensive and relevant Research, Science, Technology and Innovation (RSTI) policies that will enable other stakeholders to play their part. Good research is one which will foster sustainable development and thus render future generations better off than the generations of today. Research outputs have milestones that look beyond the horizon, and the technologies should impact positively on all aspects of our lives.

His Excellency assured the participants that the Government of Botswana recognises the key role of **IST-Africa** in bringing researchers together. A gathering such as this one is a good example of South- South and North-South cooperation. As a consortium of 18 African countries, **IST-Africa** fosters relationships among stakeholders from these countries. The Government of Botswana is happy to see countries of the South working together and collaborating with their counterparts from the North in their search for innovation and technological breakthroughs.

His Excellency emphasised the fact that an enabling policy environment entails the active collaboration between government, the private sector and academic research activities. Research organisations and professionals should continuously pursue solutions to contemporary African problems. This should not be research for its own sake, but that which provides Governments and the private sector with possibilities improvements in efficiency, productivity, economic growth and the wellbeing of society. He highlighted that the Government of Botswana has launched the National Research, Science, Technology and Innovation Policy and has set up the Department of Research, Science and Technology, dedicated to formulating research policies. In addition, there is the Botswana Innovation Hub, the Botswana Institute for Technology, Research and Innovation, and the Botswana International University of Science and Technology which are also national research centres.

His Excellency highlighted that the **IST-Africa 2018** Conference is particularly special to him as it is taking place a few weeks after his inauguration as the Fifth President of the Republic of Botswana. Some of the

participants may recall that during his Inauguration Speech, His Excellency spoke about the Government's priorities of transforming Botswana into a knowledge based economy, in order to address challenges of unemployment, particularly amongst the youth. The guiding document in carrying out this task is the National Vision 2036 which identifies Information and Telecommunications Technology as a crucial enabler of efficient delivery of products and services across all sectors, including in the delivery of Government services. The Government has identified digitisation of the economy as a means to achieve employment creation particularly through the extensive utilisation of modern technologies. The hosting of the **IST-Africa 2018** Conference by Botswana is very important as it not only provides a platform for exchange of ideas on best practices in ICTs, but also avails networking opportunities to increase the level and scope of our knowledge of the latest technologies.

The Government of Botswana is in the process of developing a Broadband Strategy, which aims to inform the allocation of resources, to attain workable or minimum speeds for a wide range of users. This will enable those who need higher capacity bandwidth to access information much faster, in real time, and on demand. The Strategy has a broad spectrum, with special focus on the rural populace. These are the people we should pay more attention to, if we are to succeed in bridging the digital divide. In the course of implementing the Rural Telecommunication Strategy, Tele-centres, commonly known as Kitsong Centres were set up in 197 rural villages to facilitate access to the Internet, other wide-range ICT-driven services to benefits of the information age.

Botswana is considering the establishment of an Information Age Council which will be responsible for advising Government on the national direction of ICT. To complete this, Computer Incidence Response Teams (CIRTs) will also be established through the Botswana Communications Regulatory Authority (BOCRA) across various sectors of the economy. This will be done taking into account the need to minimise of cyber-attacks risks in Botswana. The Government plans to commence the establishment of a Public Key Infrastructure (PKI) project whose main purpose will be to oversee and protect our networks. Botswana has embarked on the modernisation of the Government Data Network so as to enable provision of eServices such as e-Health, e-Commerce, e-Education and e-Agriculture, among others which forms part of the transformational agenda of the Ministry of Transport and Communications. It is for this reason that futuristic solutions are needed from researchers such as yourselves.

The value of research and knowledge sharing cannot be overstated. As a country, Botswana is on a journey of economic transformation. It is moving away from an economy that is heavily reliant on primary production to one that develops downstream segments of the economy. Therefore, the role of ICT in achieving this is fundamental. Government is always looking for progressive solutions to national problems. In this respect, we do not only look inside, but embrace input from the private sector and the research community in general.

His Excellency quoted an American Political theorist John H Schaar: "The future is not some place we are going, but one we are creating. The paths are not to be found, but made. And the activity of making them changes both the maker and the destination." These powerful words reflect the ability of the human spirit to shape our circumstances. They also challenge us to engage in deep introspection. With dedication and a purposeful approach, we can solve the problems that we face as a continent. Therefore, the onus is on everyone to change the future, making it better for all.

His Excellency acknowledging the invaluable support of the European Commission and African Union to **IST-Africa**. The seeds that you have sown will be reaped by many generations to come. His Excellency wished the delegates a successful and fruitful **IST-Africa 2018**. He declared the conference officially open. His Excellency, **Mr Mokgweetsi Masisi, President of the Republic of Botswana, Hon. Onkokame Kitso Mokaila, Minister of Transport and Communications**, other officials from MTC and Paola Cervo, DG DEVCO, European Commission joined with IST-Africa partner representatives in a photograph.



Scientific Programme

The Scientific Programme incorporated over 170 presenters from public, private, education and research organisations in 34 countries in 37 thematically focused sessions. Themes addressed include International Cooperation, Innovation, eHealth, eGovernment, Technology-enhanced Learning, Cyber Security, eInfrastructure, Next Generation Computing, eAgriculture and Societal Implications of Technology. Presentations shared insights from projects funded at national, international and European Commission level. The sessions were well attended with a good level of discussion and knowledge sharing.

The IST-Africa Workshop showcased ICT Initiatives and Research Capacities in Botswana, Namibia, Mozambique, Lesotho, South Africa, Malawi, Swaziland, Mauritius, Kenya, Ethiopia, Burundi, Tanzania, Uganda, Cameroon, Egypt, Senegal and Tunisia to raise awareness of ongoing activities and to promote national institutions with capacity to participate in LEIT and Societal Challenges calls under Horizon 2020. This mapping of research expertise to Horizon 2020 areas provides input into the planning for future Work Programmes. Delegates took the opportunity to ask the IST-Africa partners for more details in specific areas of interest.

Paper sessions on Wednesday included eHealth, Technology-enhanced Learning, CyberSecurity and Next Generation Computing.

The Scientific Programme on Thursday incorporated tracks on eHealth, Technology-enhanced Learning, CyberSecurity, Next Generation Computing and eGovernment. Workshops focused on GeoSpatial Sciences, Open Data and Open Science and Botswana's progress to date to set up a NREN.

The mHealth4Afrika, and WAZIUP Horizon 2020 projects, co-funded under the ICT-39-2015 Call, focus on African ICT Research Challenges and shared ongoing results with the conference community.

As part of a full eHealth track, mHealth4Afrika organised a workshop on Thursday 10 May. This workshop provided insights into the mHealth4Afrika objectives, comparative results from the validation of the first beta iteration and ongoing activities. This was complimented by a demonstration of the mHealth4Afrika beta platform, medical sensors being used at the point of care and Android application to capture the sensor readings and transfer using HL7 FHIR to the patient's electronic patient record. This session was very well attended. The presentations and demonstrations raised a lot of positive interaction around the co-design approach, digital literacy training with the healthcare professionals and how the medical sensors were identified and selected.

On Thursday evening there was a Conference Dinner supported by BOCRA to facilitate in-depth networking and partnership building.

The Scientific Programme on Friday incorporated sessions on eGovernment, eHealth, eAgriculture, ICT4D and Content Technologies.

The **IST-Africa 2018 Proceedings** is available on an open access basis to members of the IST-Africa community - simply register on the IST-Africa portal if you do not have an existing account. Please note that each author retains the copyright in relation to their individual paper. Therefore no paper or part thereof may be reproduced without the written permission of the appropriate author(s). IST-Africa Community Members can download and use the blind peer reviewed papers for personal use. IST-Africa papers should not be stored on electronic repositories without permission from the publisher.

Closing Plenary



The Closing Plenary focused on where Botswana is currently at and how it can leverage outputs from **IST-Africa 2018**. Panelists included: Prof Julius Athlopheng, Dean: Faculty of Science, University of Botswana; Ms Lesego Thamae, Director: Department of Research Science & Technology; Mr Tshoganetso Kapaletswe, Deputy Chief Executive: Botswana Communications Regulatory Authority and Mr Simon Hodson, Executive Director: CODATA .

Prof Julius Athlopheng, Dean: Faculty of Science, University of Botswana commenced by summarising the impacts from

IST-Africa 2018 that national stakeholders can leverage after the event. **IST-Africa 2018** aimed to contribute towards supporting an Information Society and Knowledge based Economy, raising awareness of research as a vehicle to ensure impact and to facilitate networking. Prof Athlopheng summarised the impacts as including: Impact 1 – **IST-Africa 2018** provided a practical contribution towards to building a **knowledge based**

economy. Botswana has adopted this, and **IST-Africa 2018** was truly implementing the requisite initiatives in this regard. The national initiatives such as **NDP II** (the current National Development Plan 11), with its clear goals of ICTs as enablers, was realized during **IST-Africa 2018**. The **VISION 2036** – where transformative action is required to move Botswana from middle to high income economy i.e. requiring efforts which are pragmatic to ensure this succeeds – has been achieved. **IST-Africa 2018** developed and shared Innovative Systems, from global sphere, from which the Vision 2036 initiatives may be benchmarked. Many practical innovative products have been demonstrated during the conference.

Impact 2: Policy makers benefited through – content for infrastructure, products and services. In all these areas, they learnt of the what, why and how of effective development and implementation strategies. This helped with implications of Policy coordination – so as to enhance indicators of performance (to whom, i.e. accountability systems), mapping risks/challenges.

Impact 3: Communication, i.e. platform (**IST-Africa 2018**) offered a unique platform for various stakeholders to dialogue, and come up with solutions in a broad and inclusive way. Usually researchers, industry and policy-makers do not have a space to engage – **IST-Africa 2018** offered youth and other stakeholders a voice to engage and make the necessary impact.

Impact 4: Capacity building needs: highlight strategic focus areas according to needs of research, economy and industry (now and into future). The needs were user and or stakeholder centred.

Impact 5: Transformation as enshrined in Vision 2036 – its requirements, i.e. mindsets – that they need to change from outputs to outcomes, from silos to collective and to integration around niche areas (of national importance); need for more strategic/deliberate collaborations/partnerships to ensure success – both locally, regionally and internationally.

Prof. Athlopheng highlighted that there are many examples of local success e.g. the land issues where national spatial data infrastructure, digitization successes, linking up of national systems were apparent examples. Bringing in youth and demonstrating trends in ICT related initiatives e.g. geospatial sciences; e-health or m-health applications where countries shared best practices, which included cost-effectiveness derived through ICT. Open data contributions which included national, SADC member countries and the African Open Science Platform (AOSP) and the CODATA which shared the upcoming International Data Week in 2018. This will be hosted by Botswana. National Research and Education Networks (NRENs) and their critical contribution and how they may be set up – were some of the important highlights.

Prof. Athlopheng summarised data issues discussed to include

- Unravelling IPR (intellectual property rights) vs data access rights. How to protect, benefit from and instill confidence on producers and users. Many natural resources, indigenous systems and ownership challenges, would benefit from more data, to protect all.
- Data literature society (is the new trend); skills/processes – are all data intensive; Africa has poor infrastructure to enable the benefits of data impact.
- Research priorities – these need more/better documentation, translation, dissemination to empower knowledge economy, innovations (social & technical) for more efficient delivery of services/products.
- Data stewardship capacity development is most needed, for the continent to prosper, more.

Prof. Athlopheng highlighted that we need data initiatives i.e. open data initiatives to realise transparency, efficiency and for enhanced monitoring, reporting and evaluation. The past NDP i.e. NDP10 indicated several shortfalls i.e. most targets were not met – and this is due to lack of data, which thus reduced delivery. Botswana needs to move into the Big Data reality, so as to enhance benefits of policy and national initiatives intents.

Prof. Athlopheng noted that after **IST-Africa 2018** conference, participants will be moving from conference rooms to the people to ensure that the results and experiences shared during **IST-Africa 2018** will have impact where it matters i.e. the people. He highlighted the following complimentary events:

- a) The Botswana Telecommunications Commemorative Day (May 2018), which was celebrated in Molembo (one of our rural areas) where ICT issues reach communities, making impact on their lives and livelihoods. There is citizen participation at these annual events organized by the Ministry of Transport and Communications.
- b) The Botswana STI week, billed for August – organized by the Ministry of Tertiary Education, Research Science and Technology. This will ensure that communities, industry, youth, policymakers and various interest groups build a better future, in applying the key areas of the Research Science Technology and Innovation Policy; that needs priorities are fully driven, in a collaborative and not in a disjunctive way.

Ms **Lesego Thamae**, Director: Department of Research Science & Technology summarised some of the innovative ways in which research science and technology can be leveraged in Botswana.

Mr **Tshoganetso Kapaletswe**, Deputy Chief Executive: Botswana Communications Regulatory Authority highlighted that Botswana is working hard to ensure that broadband is universally accessible throughout the country. The regulator has imposed an obligation on operators to roll-out mobile broadband (3G/4G) in all the villages with more than 5,000 inhabitants without subsidy as part of the spectrum licence condition. However, consumers are still complaining that mobile data prices are relatively high in comparison with other countries. The Government is providing some subsidy to fixed broadband, in particular fibre to the business. It is mainly deployed in urban areas.

Another issue facing the ICT industry is cybersecurity and building user confidence to utilise ICT services. Cybersecurity must be considered from four dimensions i.e. legislation/policy/regulations, Technical Measures, Consumer education and awareness and International Cooperation. Cybersecurity requires a multi-stakeholder approach and Government has drafted National Cybersecurity Strategy which clarify the roles and responsibilities of the various players. In addition, Botswana is in the process of establishing a Computer Incidence Response Team to proactively and reactively monitor cyber threats and assist the stakeholders and consumer education and awareness.

A major challenge to the ICT industry, particularly in developing countries, is the issue of the Over the Top (OTT) services. The unregulated OTT services are eroding the revenue of the most of the traditional regulated ICT services such as voice and SMS. The main challenge facing regulators is how to apply the principle of the "Net Neutrality" between a regulated services and unregulated services. The OTT services benefit the consumer and attract consumers to use ICT services. On the other hand, the regulated service providers construct national ICT networks and contribute to the Universal Access Fund, while the Unregulated OTT Service Providers just utilise the network. The issue of network neutrality is a difficult topic for further discussion.

Mr **Simon Hodson**, Executive Director: CODATA proposed that data related intellectual property rights should be "keep as open as possible, as closed as necessary".

Mr **Itumeleng Batsalelwang**, Director, DTPS, Ministry of Transport and Communications, Botswana thanked the panelists for sharing their perspectives.

Awards

The Awards for Best Paper and Runner-up Paper were announced by Paul Cunningham, **IST-Africa** and presented by Mr Itumeleng Batsalelwang, Director, DTPS, Ministry of Transport and Communications during the Closing Plenary Session of **IST-Africa Week 2018**.

All papers submitted to IST-Africa are double-blind peer reviewed by members of the International Programme Committee. As part of this process the reviewers nominate a shortlist of papers to be considered for the Best Paper and Runner-up Paper Awards.



The Best Paper was awarded to "An Expert System for Malaria Diagnosis using the Fuzzy Cognitive Map Engine", authored by Faith-Michael E. Uzoka Department of Mathematics and Computing, Mount Royal University, Canada; Boluwaji Ade Akinnuwesi Department of Computer Science, Lagos State University, Nigeria; Taiwo Amoo, Department of Information Technology, Bells University of Technology, Nigeria; Fikru Debele, School of ICT, Southern Alberta Institute of Technology, Canada; Gbenga Fashoto, Department of Computer Science, University of Swaziland and Chinyere Nwafor-Okoli, Canadian Institute

for Innovation and Development.



The Runner-up Paper was awarded to "A Cross-cultural Comparison of Design Feature Preferences Required for a Stroke Tele-rehabilitation System" authored by Charmayne Hughes, Tatiana Mariscal, Michael Sera, Jonathan Ontiveros, Aaron Encarnacion, Alejandra Padilla, Amy Hintze, Tony Peng, Lok Yi Lo, Sam Warner, Zeus A Cruz, Brian Ling, Health Equity Institute, San Francisco State University, USA; Sven Weidner, Bielefeld University Sportsmedicine, Germany and Kedir Sany, Moges Baye University of Gondar, Ethiopia.

Conclusion

On behalf of **IST-Africa** Paul thanked our IST-Africa partner in Botswana, the DTPS, Ministry of Transport and Communications, H.E. Mr Mokgweetsi Masisi, President of the Republic of Botswana, Hon. Onkokame Kitso Mokaila, Minister of Transport and Communications, Mr Kabelo Ebineng, Permanent Secretary, Ministry of Transport and Communications, panellists, presenters and delegates for making **IST-Africa Week 2018** such a success. Paul wished the delegates a safe travel home and looks forward to seeing them next year.

Participants

IST-Africa 2018 Conference attracted over 400 delegates from 34 countries representing policy makers, practitioners, and researchers from leading commercial, government and research organisations around the world.



European, US and Canadian Organisations

Organisation	Country
DG DEVCO, European Commission	Belgium
Institute of Tropical Medicine	Belgium
UWB	Czech Republic
GRENN Consulting	Denmark
University of Turku	Finland
Committee on Data of the International Council for Science	France
University of Pau	France
German Red Cross	Germany
University of Siegen	Germany
IIMC / IST-Africa Institute	Ireland
Politecnico di Milano	Italy
GEANT	Netherlands
University of Oslo	Norway
British High Commission	Botswana
Embassy of the Federal Republic of Germany	Botswana
Embassy of Turkey	Botswana
eGovlab	Sweden
Royal Institute of Technology (KTH)	Sweden
Stockholm University	Sweden
Mount Royal University	Canada
San Francisco State University	United States

African Organisations

Organisation	Country
Universidade Agostinho Neto	Angola
ABM University College	Botswana
Adams Database	Botswana
Astronomical Society of Botswana	Botswana
Bayon Holdings	Botswana
BDC	Botswana
BDF	Botswana

Organisation	Country
BIDPA	Botswana
Bitbrands	Botswana
BNPC	Botswana
BOCRA	Botswana
Botho University	Botswana
Botswana Accountancy College	Botswana
Botswana Astonomical	Botswana
Botswana Bureau of Standards	Botswana
Botswana Fibre Networks	Botswana
Botswana Geoscience Institute	Botswana
Botswana Innovation Hub	Botswana
Botswana Institute for Technology Research and Innovation	Botswana
Botswana Institute of Geomatics	Botswana
Botswana International University of Science and Technology	Botswana
Botswana National Commission For UNESCO	Botswana
Botswana Police	Botswana
Botswana University of Agriculture and Natural Resources	Botswana
Botswana UPenn Partnership	Botswana
BPC	Botswana
BTC	Botswana
BUAN	Botswana
Business Botswana	Botswana
Department of Information Technology	Botswana
Department of Research Science and Technology	Botswana
Department of Surveys and Mapping	Botswana
Dept of Mineral Affairs	Botswana
Dept of Mines	Botswana
Diamond Hub	Botswana
DTPS, MTC	Botswana
Focus Surveys	Botswana
Forestry	Botswana
Gaborone City Application	Botswana
Gender Affairs Dept	Botswana
GICO	Botswana
GIZ	Botswana
Human Resource Development Council	Botswana
Imperial School of Business and Science	Botswana
Intelligent Transport Management System	Botswana
Joint Mind Consult	Botswana
Lagos State University	Botswana
Limkwonkwing University	Botswana
Meterological Services	Botswana
Ministry of Agricultural Development and Food Security	Botswana
Ministry of Basic Education	Botswana
Ministry of Education Science and Technology	Botswana

Organisation	Country
Ministry of Green Energy	Botswana
Ministry of Health & Wellness	Botswana
Ministry of Land Management, Water and Sanitation Services	Botswana
Ministry of Tertiary Education Research Science and Technology	Botswana
Ministry of Transport and Communications	Botswana
MOBE	Botswana
Mobisoft Tech	Botswana
Nault Innovation (Coll24)	Botswana
NFTRC	Botswana
NSO	Botswana
Nuku Speaks	Botswana
NUST	Botswana
OptimumQ	Botswana
Peek Vision	Botswana
ProAid	Botswana
Radio Botswana	Botswana
SAFOD	Botswana
Service Line Engineering	Botswana
Smart Match Labs	Botswana
SmartCom	Botswana
Spectrum Analytics	Botswana
Statistics Botswana	Botswana
University of Botswana	Botswana
UNAIDS	Botswana
UNESCO	Botswana
UNISA	Botswana
Nazi BONI University	Burkina Faso
Ministere de l'Enseignement Superieur et de la Recherche Scientifique	Burundi
National Agency for Information and Communication Technologies (ANTIC)	Cameroon
ITIDA	Egypt
Ministry of Communications and Information Technology	Ethiopia
University of Health and Allied Sciences	Ghana
Africa Nazarene University	Kenya
JKUAT	Kenya
Kabarak University	Kenya
KCA University	Kenya
Kenyatta University	Kenya
Ministry of Education	Kenya
Ministry of Health	Kenya
Moi University	Kenya
Murang'a University of Technology	Kenya
National Hospital Insurance Fund	Kenya
Strathmore University	Kenya
Technical University of Mombasa	Kenya
The Technical University of Kenya	Kenya

Organisation	Country
United States International University-Africa	Kenya
Department of Science and Technology	Lesotho
Chancellor College - University of Malawi	Malawi
National Commission for Science and Technology	Malawi
National Computer Board	Mauritius
Catholic University of Mozambique	Mozambique
National Institute for ICT	Mozambique
ISCTEM	Mozambique
International University of Management	Namibia
Namibia University of Science & Technology	Namibia
National Commission on Research, Science and Technology	Namibia
Office of Prime Minister	Namibia
Ministère de l'Enseignement Supérieur de la Recherche	Senegal
Academy of Science of South Africa	South Africa
Central University of Technology	South Africa
CSIR	South Africa
ISAT-UWC	South Africa
Meraka Institute, CSIR	South Africa
Nelson Mandela University	South Africa
North-West University	South Africa
SANReN	South Africa
Tshwane University of Technology	South Africa
University of Cape Town	South Africa
University of Fort Hare	South Africa
University of Johannesburg	South Africa
University of KwaZulu-Natal	South Africa
University of Pretoria	South Africa
University of South Africa	South Africa
University of the Free State	South Africa
University of the Western Cape	South Africa
University of the Witwatersrand	South Africa
The National Ribat University	Sudan
Ministry of Information Communication Technology	Swaziland
COSTECH	Tanzania
Nelson Mandela African Institution of Science and Technology	Tanzania
University of Dar es Salaam	Tanzania
Ministere de l'Enseignement Superieur et de la Recherche Scientifique	Tunisia
Kyambogo University	Uganda
Makerere University	Uganda
Mbarara University of Science and Technology	Uganda
netLabs!UG Research Centre, Makerere University	Uganda
Uganda National Council for Science & Technology	Uganda
ZAMREN	Zambia
HIT	Zimbabwe