IST-Africa 2020 Conference Report

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18 - 22 May 2020

Hosted by

MINISTRY OF SCIENCE, TECHNOLOGY AND INNOVATION
REPUBLIC OF UGANDA

IST-Africa

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European Commission

AFRICAN UNION

IEEE Humanitarian Activities Committee

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IEEE SSIT SOCIETY ON SOCIAL IMPLICATIONS OF TECHNOLOGY

Introduction

Due to the unprecedented circumstances during the COVID-19 pandemic, **IST-Africa 2020** took place as a virtual event from 18 - 22 May. An activity of **IST-Africa**, **IST-Africa 2020** was the fifteenth 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 co-funded **IST-Africa** from 2006 - 2018, to promote African - European research cooperation and support Information Society and ICT aspects of the Africa-EU Strategic Partnership.

Hosted by the Government of Uganda through the Ministry of Science, Technology and Innovation, Supported by the European Commission and African Union Commission, IEEE Society on Social Implications of Technology, IEEE Africa Council, IEEE Uganda Section and IEEE Humanitarian Activities Committee, **IST-Africa 2020** 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, eGovernment, eInfrastructures, Technology Enhanced Learning and ICT Skills, Cyber Security, Next Generation Computing, eAgriculture, Societal Implications of Technology, International Cooperation and ICT4D. **IST-Africa 2020** provided a collegiate setting for presentations and discussions of national & regional developments, issues of concern & good practice models, and networking with peers. **IST-Africa 2020** also provided an opportunity to identify potential partners for future proposals under Horizon Europe.

IST-Africa directly supports Information Society, Innovation and ICT aspects of the Africa-EU Strategic Partnership, the Science, Technology and Innovation Strategy for Africa (STISA-2024), the Digital Transformation Strategy for Africa (2020-30) and the UN Sustainable Development Goals.

The goals of the **IST-Africa** Conference Series are Community Building to facilitate EU-African research cooperation and successful exploitation of Research and Innovation 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, to support International Cooperation and open up the European Research Area (ERA) to Africa.

Participants at IST-Africa 2020

IST-Africa 2020 Conference attracted over 400 delegates from 44 countries representing policy makers, practitioners and researchers from leading commercial, government, research and societal organisations around the world. Unlike many research conferences, **IST-Africa** provides an opportunity to meet with senior managers, practitioners, project managers, software engineers and researchers from industry, government and research organisations. Delegates and presenters attend to share knowledge, experience and lessons learnt, and network with their peers from around the world.

IST-Africa 2020 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 as well as projects supported by national and international funding sources.

Virtual Event

Due to the unprecedented circumstances during the COVID-19 pandemic, **IST-Africa 2020** took place as a virtual event from 18 - 22 May.

The Programme

The 5-day programme featured an invigorating mix of business and government case studies, technical and policy papers and interactive workshops. Delegates participated in 31 thematically focused sessions featuring different aspects of eGovernment, eHealth, eInfrastructures, Technology Enhanced Learning and ICT Skills, CyberSecurity, Next Generation Computing, ICT4D, eAgriculture, Content Technologies, Entrepreneurship and Societal Implications of Technology.

Plenary presentations provided insights into how Research, Innovation and Entrepreneurship is being supported in Uganda, the critical role International Cooperation plays in Information Society Technologies; the Digital Transformation Strategy for Africa (2020-30), EU-Africa Cooperation on Research and Innovation for Sustainable Development, AfricaConnect, Support for Innovation and Entrepreneurship in Southern Africa (SAIS2) and how IEEE is supporting Sustainable Development and activities 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.

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 Nanoelectronics 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, with the updated work programmes for 2020 published on 02 July 2019. 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 2020 Calls for Proposals provides an overview of Calls, themes and deadlines during 2020 within the Marie Curie, eInfrastructures, Leadership in Enabling and Industrial Technologies (LEIT) and each of the Societal Challenges (Health, Food Security and Agriculture, Energy, Transport, Environment, Inclusive and Reflective Societies, Secure Societies) Work Programmes.

Please visit

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

Conference Proceedings

The **IST-Africa 2020** conference proceedings was provded to delegates in May and is available on an open access basis in the Paper Repository on the Conference Portal. Please visit

www.ist-africa.org/conference2020/default.asp?page=paper-repository

Papers that are physically presented during the event also had the option after the event for their paper to be included in the **IST-Africa 2020** Conference Proceedings submitted for publication in IEEE Xplore.

IST-Africa YouTube Channel

A selection of plenary and paper video presentations from **IST-Africa 2020** Programme are available on the **IST-Africa Institute** YouTube Channel to facilitate ongoing knowledge sharing. Please visit

https://www.youtube.com/channel/UCJ7ZOQCGJFbHPnzIK81Y24A

IST-Africa Initiative

IST-Africa is a strategic partnership open to participation by all ACP (African, Caribbean, Pacific) Group Countries. 18 African Member States are represented by Ministries and National Councils responsible for Innovation, Science and Technology implementation, research, policy & adoption. Founded in 2002, **IST-Africa** is supported by the European Commission and African Union Commission, co-funded under the European Framework Programme (2005 – 2018). The **IST-Africa Institute** is a Member of the UN Sustainable Development Solutions Network (SDSN).

The objectives of **IST-Africa** are to support:

- 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); Ministere de l'Enseignement Superieur 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 Innovation and Technology (Ethiopia); Ministry of 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 Innovation (South Africa); Ministry of Information Communication Technology (Swaziland); COSTECH - Tanzania Commission for Science and Technology; Ministere de l'Enseignement Superieur et de la Recherche Scientifique (Tunisia) and UNCST - Uganda National Council for Science and Technology / Ministry of Science, Technology and Innovation (Uganda).

Plenary Speakers

Plenary Speakers included:

- **Dr. Elioda Tumwesigye,** Minister for Science, Technology and Innovation, Uganda
- **Paul Cunningham**, IST-Africa Institute, Ireland
- **Moctar Yedaly**, Head, Information Society, African Union Commission
- **Prof. Magdalena Salazar Palma**, Director, IEEE Region 8
- **Daan du Toit,** Deputy Director-General: International Cooperation and Resources, Department of Science and Innovation, South Africa
- **Dr Fadila Boughanemi,** Deputy Head, International Cooperation II (Asia, Africa, Middle East & External Relations), DG Research and Innovation, European Commission
- **Moses Bayingana,** Senior Policy Officer for ICT, African Union Commission
- **Tom Fryer and Leila Dekkar,** GÉANT in cooperation with UbuntuNet Alliance, WACREN and ASREN
- **Ilari Lindy,** SAIS2, Namibia
- **Paul Kostek,** IEEE Humanitarian Activities Committee Events Chair
- **Vincent Kaabunga,** IEEE Africa Council Chair

International Programme Committee

A distinguished Programme Committee reviewed and provided feedback on blind peer reviewed papers.

The **IST-Africa 2020** International Programme Committee includes

- **Paul Cunningham** (Conference Chair), IST-Africa Institute / IIMC, Ireland
- **Tiwonge Banda,** UbuntuNet Alliance, Malawi
- **Dr Donia Smaali Bouhlila**, University of Tunis El Manar, Tunisia
- **Laurens Cloete,** University of Pretoria, South Africa
- **Miriam Cunningham**, IST-Africa Institute / IIMC, Ireland
- **Kim Davis**, Research Council of Norway, Norway
- **Dr Emmanuel Eilu**, Uganda Christian University, Uganda
- **Prof. Jelel Ezzine,** ENIT, Tunisia
- **Prof. Kenneth Foster,** North Carolina State University, USA
- **Dr Charmayne Hughes,** Health Equity Institute, San Francisco State University, USA
- **Prof. Mohamed Jmaiel,** University of Sfax, Tunisia
- **Dr Chipo Kanjo,** Chancellor College, University of Malawi, Malawi
- **Vasilis Koulolias,** eGovLab / DSV, Sweden
- **Kristiina Lahde,** Saliens Ltd, Finland
- **Ilari Lindy,** SAIS II, Namibia
- **Prof. Johann Marquez-Barja,** University of Antwerp - imec Belgium
- **Prof. Maurice Mars,** University of KwaZulu-Natal, South Africa
- **Dr Tendani Mawela,** University of Pretoria, South Africa
- **Morten Møller,** GRENEN, Denmark
- **Dr Tshiamo Motshegwa,** University of Botswana, Botswana
- **Esteban Municio,** University of Antwerp - imec, Belgium
- **Dr Joshua Ndiege,** United States International University - Africa, Kenya
- **Dr David Padi**, DOS, United Nations, USA
- **Dr Fungai Bhunu Shava**, Namibia University of Science and Technology, Namibia
- **Martin Ujakpa**, International University of Management (IUM), Namibia
- **Prof Darelle van Greunen**, Nelson Mandela University, South Africa

Organising Committee

- **Miriam Cunningham,** IST-Africa Institute / IIMC, Ireland
- **Paul Cunningham,** IST-Africa Institute / IIMC, Ireland
- **Emmanuel Freddie Mugunga,** Ministry of Science, Technology and Innovation, Uganda
- **Dr Maxwell Otim**, Ministry of Science, Technology and Innovation, Uganda

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www.IST-Africa.org/Conference2020

MINISTRY OF SCIENCE, TECHNOLOGY AND INNOVATION
REPUBLIC OF UGANDA

1 DAY Monday, 18 May, 2020

09:00 Opening Plenary 1

Welcome Address
Paul Cunningham, IST-Africa Institute, Ireland

Welcome Address
Moctar Yedaly, Head, Information Society, African Union Commission

Welcome Address
Prof. Magdalena Salazar Palma, Director, IEEE Region 8

Welcome Address
Dr. Elioda Tumwesigye, Minister for Science, Technology and Innovation, Uganda

09:30 Session 2: eInfrastructure

Advancing Rural Connectivity in South Africa through Policy and Regulation: A Case for Community Networks
Shaun Pather, University of the Western Cape, South Africa

Telecentre Users as Mediators of Empowerment of Rural Communities in Malawi
Sellina Khumbo Kapondera, Royal Holloway University of London, United Kingdom

Silent Adoption of Bring-Your-Own-Device in Tanzania Higher Learning Institutions - Adoption Policies
Mawazo Magesa, Sokoine University of Agriculture, Tanzania

Electricity and Solar Power in Health Institutes, complexities in rural Zimbabwe
Ronald Manhibi, SolidarMed, Zimbabwe

10:45 Break

10:50 Session 3: Global Development Applications and Case Studies

Unmanned Aerial Vehicles: Opportunities for Developing Countries and Challenges
Sheila Mugala, Makerere University, Uganda

Transforming Paratransit in Africa's congested Cities: An ICT- enabled Integrated Demand Responsive Transport (iDRT) Approach
Innocent Ndibatya, Stellenbosch University, South Africa

Assessment of the Value of an Academic Preparation for Short-Term International Humanitarian Missions
Bernard Cohen, Neurological Monitoring Associates, LLC, United States

12:00 Plenary 4

IST Diplomacy in the Fight against Covid-19 - Perspectives from South Africa
Daan du Toit, Deputy Director-General: International Cooperation and Resources, Department of Science and Innovation, South Africa

12:25 Lunch Break

13:25 Session 5: Societal Implications of Technology - Supporting Financial Transactions

Role of Mobile Applications in Mitigating Challenges Faced by Informal Saving Groups
Patrick Kanyi Wamuyu, USIU-Africa, Kenya

Towards Small-Scale Farmers Fair Credit Scoring Technique
Benjamin Otieno, Kibabii University, Kenya

An Information Technology Controls Evaluation Prototype for Financial Institutions in Kenya
Bernard Shibwabo, Strathmore University, Kenya

Predicting Online Purchase Intentions in Business Administration Graduate Students
Joseph Kizito Bada, Makerere University Business School, Uganda

14:40 Break

14:45 Session 6: Societal Implications of Technology - Supporting ePayments

eReadiness of Namibian SME Retailers to Adopt B2C eCommerce
Kululeko Mthembo, Namibia University of Science and Technology, Namibia

Mose: A Mobile Application for Women Street Vendors in Cape Town
Tavonga Majoni, The University of the Western Cape, South Africa

Using Mobile Biometrics and Management Information Systems to Enhance Quality and Accountability of Cash transfer in a Girls' empowerment Program in Rural and Urban Poor Settings
Eva Muluve, Population Council, Kenya

Towards Creating Transparency in Loyalty Payments in Music Streaming Platforms in Kenya
Mzee Awuor, Kisii University, Kenya

16:10 Break

16:15 Session 7: Societal Implications of Technology 3

Managing the Challenges of the Digital Divide among First Year Students: A Case of UKZN
Temitayo Faloye, University of KwaZulu-Natal, South Africa

Industry 4.0: University Students' Perception, Awareness and Preparedness - A Case of Namibia
Aussie Mutalya, International University of Management, Namibia

Semantic Web and Grid Technology use in Collaborative Researches for Universities in Kenya
Julius Murumba, The Technical University of Kenya, Kenya

17:30 End of Sessions

Tuesday, 19 May, 2020

09:00 Session 8: eGovernment

Evaluating a Citizen-Centric e-Government Solution in Practice
Karin Fröhlich, Aalto University, Finland

Digital Ecosystems for Public Enterprises: Prospects and Challenges
Simon Shikongo, Namibia University of Science and Technology, Namibia

Open Innovation in Government Services: An Empirical View of Citizens' Participation
Collins Oduor Ondiek, United States International University- Africa, Kenya

Smart City Citizens' Service Provision using Participatory Design and Participatory Sensing: Lessons for Developing Cities
Stephen Kyakulumbye, University of the Western Cape, South Africa

Increasing Participation and Security in Student Elections through Online Voting: The Case of Kabarak University
Moses Thiga, Kabarak University, Kenya

10:40 Plenary 9

The Digital Transformation Strategy for Africa (2020-30)
Moses Bayingana, Senior Policy Officer for ICT, African Union Commission

11:00 Break

11:05 Session 10: Content Technology Applications

Towards a Sign Language Hand Gesture Recognition Design Framework
Casam Nyaga, University of the Free State, South Africa

Instagram as a New Marketing Platform for Informal Traders in Tanzania
Nasibu Mramba, College of Business Education, Tanzania

A Framework for Items Recommendation System Using Hybrid Approach
Samuel Wairegi, Jomo Kenyatta University of Agriculture and Technology, Kenya

Question Answering using Automatically Generated Semantic Networks – the case of Swahili Questions
Barack Wanjawa, University of Nairobi, Kenya

12:30 Lunch Break

13:30 Plenary 11

Research and Innovation for Sustainable Development-Future Perspectives
Fadila Boughanemi, Deputy Head, International Cooperation II (Asia, Africa, Middle East & External Relations), DG Research and Innovation, European Commission

13:55 Session 12: eHealth Issues and Applications 1

Prediction of Cancer Basing on Risk Factors using Ensemble Learning
Ruth Wario, University of the Free State, South Africa

A Dictionary Learning Approach for Noise-Robust Image Reconstruction in Low Field Magnetic Resonance Imaging
Emmanuel Ahishakiye, Mbarara University of Science and Technology, Uganda

WIDGET: the Watrilmed knowleDGe Exploration Tool
Borlli Michel Jonas Some, Université Nazi BONI, Burkina Faso

Identification of the Limitations of Healthcare Service/Insurance Industry ERPs on Data Flow using QlikView and MS Excel
Mwirigi Kiula, JKUAT, Kenya

15:15 Break

15:20 Session 13: eHealth Issues and Applications 2

Challenges Affecting the Effective Communication of PHI to Non-Medical Users: A Contextual Inquiry.
Laura Cheptegei, Kabarak University, Kenya

Towards Implementation of an Information Dissemination Tool for Health Publications: Case of a Developing Country
Christine Mulunda, University of Nairobi, Kenya

eSurveillance for Investigating Capacity of Health Systems to Detect and Control Infectious Diseases of Poverty- A Case of Kitui South Sub-County
Elizabeth Muli, Technical University of Kenya, Kenya

16:20 Break

16:25 Session 14: eHealth Issues and Applications 3

Integration of DHIS2 and Climatic Data for Disease Prediction: A Case of Malaria Occurrence in Gulu District, Uganda
Justine Fay Katwesige, School of Public Health, Makerere University, Uganda

Continued mHealth Technology Usage: Pilot Study of e-Tracker Implementation in Ghana
Flora Asah, University of Oslo, Norway

A Web Based Application for National Healthcare System
Mateus Padoca Calado, Universidade Agostinho Neto, Angola

17:30 End of Sessions

Wednesday, 20 May, 2020

09:00 Session 15: Entrepreneurship in Uganda

IEEE Entrepreneurship at a Glance
Janati Nakimera, IEEE Uganda Section, Uganda

Online Digital Payments that Every Startup Should Consider
Kenneth Bintu, Cavendish University Uganda, Uganda

09:45 Plenary 16

SAIS Programme - Supporting Innovation and Entrepreneurship in Southern Africa
Ilari Lindy, SAIS2, Namibia

10:10 Break

10:20 Session 17: Next Generation Computing

Using the Internet-of-Things and Clustering Algorithms to Help Allocate Temporary Work to the Unemployed
Laurie Butgereit, Nelson Mandela University, South Africa

Towards a Strategic Application of IoT and Big Data for African Societal Solutions
Jackson Machii, The Technical University of Kenya, Kenya

Checkpointing as a Counter to Security Issues in Cloud Computing Infrastructures
John Msagha Mbogholi, Maseno University, Kenya

Personal Cloud Computing Adoption: Integrating IT Mindfulness with TAM
John Oredo, University of Nairobi, Kenya

A Prototype of an Android Application Controlled Lawnmower
Valerianus Hashiyana, University of Namibia, Namibia

12:00 Lunch Break

13:15 Plenary 18

IEEE Humanitarian Activities Committee - Supporting Sustainable Development
Paul Kostek, IEEE Humanitarian Activities Committee Events Chair

13:30 Break

13:35 Session 19: Cyber Security Issues - 1

Secure Information Infrastructure Framework Components for a Smart City: A Case Study of Windhoek
Fungai Bhunu Shava, Namibia University of Science and Technology, Namibia

Design and Implementation of an IPSec Virtual Private Network: A Case Study at the University of Namibia
Flavia Kyeyago Ouma, Uganda Bureau of Statistics, Uganda

A Systematic Review: Vulnerability Assessment of Wi-Fi in an Educational Institution
Emily Bagarukayo, Makerere University, Uganda

A Methodology for Evaluating Security in MNO Financial Service Model
Sigsbert Rwiza, University of Dar es Salaam, Tanzania

15:00 Break

15:05 Session 20: Cyber Security Issues - 2

A Two-tier Fragile Audio Watermarking Algorithm Final
Dumisani Mfune, Mzuzu University, Malawi

Social Engineering Based Cyber-Attacks in Kenya
James Obuhuma, Africa Nazarene University, Kenya

Using Apriori Algorithm Technique To Analyze Crime Patterns for Kenyan National Crime Data: A County Perspective
Edigar Adero, Technical University of Kenya (TUK), Kenya

A Real-Time Location Based Prototype for Notification of Crime Hotspots Using Crowdsourcing
Bernard Alaka, Strathmore University, Kenya

Emerging Network Security Issues in Modern Tertiary Institutions
Knowledge Rusere, University of South Africa, Namibia

16:45 End of Sessions

Thursday, 21 May, 2020

09:00 Session 21: Technology-Enhanced Learning 1 - Supporting Skills Development

Starting from Scratch: Introducing Primary School Learners to Programming
Afikile Sikwebu, Nelson Mandela University, South Africa

Learning to program on KaiOS: a Hands-on Coding School for Developing Climate Service Apps
Ville Myllynpää, University of Turku, Finland

Co-designing a European Future Tech Lab in Africa as a Place for Open Innovation
Marko Lahti, University of Turku, Finland

10:15 Plenary 22

AfricaConnect: a Past, Present and Future Success Story for African Research and Education
Tom Fryer, Head of International Relations, GÉANT

10:40 Break

10:45 Session 23: Technology Enhanced Learning in Schools 2

A Mobile Ad-hoc Strategy to Enhance ICT Based Education in Zimbabwean Rural Schools
Beauty Mugoniwa, UNISA, Zimbabwe

eReadiness Assessment Tool for Schools
Alida Veldsman, Nelson Mandela University, South Africa

SESEMAT In-service Pedagogical Strategies and Student Achievement in Science at Ordinary Level in Tororo SESEMAT Region
Deborah Manyiraho, Busitema University, Uganda

12:00 Lunch Break

13:15 Session 24: Technology-Enhanced Learning 3 - Applications

Nigerian Instructors' Acceptance of Learning Management Systems: A structural Modelling Approach
Mohammed Yakubu, American University of Nigeria, Nigeria

An Adaptive Gamification Model for e-Learning
Samuel Muthee Kamunya, SEKU University , Kenya

An Innovative Blended Learning Model for Information Technology Courses for a South African University
Nosipho Mavuso, Walter Sisulu University, South Africa

14:30 Break

14:35 Session 25: Technology-Enhanced Learning 4 - Issues and Applications

Manahij App as a Tool to Enhance Students' Performance Utilizing Data Analytics and Academic Supervision - Case Study: National University Sudan
Muna Mohamed Mahmoud Abu Gosseisa, Ibn Sina University, Sudan

Automated Graduate Training Monitoring: The Case of Gulu University and Strategies for Institutional Adoption
Benedict Oyo, Gulu University, Uganda

Awareness, Accessibility and Usability of eResources: University Students Perspective
Bonnie Obeka Obande, University of Agriculture Makurdi, Nigeria

15:50 Break

15:55 Session 26: Technology-Enhanced Learning 5 - Issues and Applications

An Empirical Approach to Mobile Learning on Mobile Ad Hoc Networks (MANETs)
Ichaba Mutuma, KCA University, Kenya

Development of an Open Source Desktop Application Client Software for Running Internet Enabled Laboratories
Joel Tibabwetiza Muhanguzi, Makerere University, Uganda

Barriers to the Implementation of Big Data Technology in Education: An Empirical Study
Jude Osakwe, Namibia University of Science and Technology, Namibia

E-complaints: A Semi-structured E-forum at University
Maria Ntinda, University of Namibia, Namibia

17:30 End of Sessions

5 DAY Friday, 22 May, 2020

09:00 Session 27: eAgriculture

Blockchain based Milk Delivery Platform for Smallholder Dairy Farmers in Kenya: Enforcing Transparency and Fair Payment
Dorothy Rambim, Masinde Muliro University of Science and Technology, Kenya

Co-design of an Agricultural Management Application for Small-Scale Farmers
Martin Ujakpa, International University of Management, Namibia

Computer Vision for Smart Farming and Sustainable Agriculture
Ronald Tombe, University of Kwazul Natal, South Africa

10:00 Plenary 28

IEEE Africa Council
Vincent Kaabunga, IEEE Africa Council Chair

10:20 Break

10:25 Session 29: Green-energy driven Technology Solutions for Sustainable Small-scale Farming

Introduction of LEAP-AGRI Programme
Darelle van Greunen, Nelson Mandela University, South Africa

Project Africa
Waldir Moreira, Fraunhofer AICOS, Portugal

IoT Sensing Platform for e-Agriculture in Africa
Waldir Moreira, Fraunhofer AICOS, Portugal

Mobile Applications in Support of Small-scale Crop Farming
Darelle van Greunen, Nelson Mandela University, South Africa

Wrap Up

12:00 Lunch Break

13:15 Session 30: eAgriculture & Environmental Sustainability

Use of Participatory Approach to Determine Adoption of ICTs Agricultural Services
Jasper Ondulo, Masinde Muliro University of Science and Technology, Kenya

Usability as Critical Success Factor of Mobile App for Pesticides Authenticity Verification: Reducing Risks for Farmers in Tanzania
Catherine Cleophace Ngirwa, Dar es salaam University College of Education, Tanzania

Development of an Integrated Framework for Knowledge Sharing and Integration on Land use and Land Management in West-Africa
Mahamadou Belem, Université Nazi Boni, Burkina Faso

14:15 Break

14:20 Session 31: Environmental Sustainability

ITIKI Success Story: Classic Application of Design Thinking
Muthoni Masinde, Central University of Technology, South Africa

Evaluation of Requirements for the Design of Water Resource Management ICT Model for Integrated Water Resources Management: The Case of Management of Lake Victoria Basin
Godfrey Odongtoo, Busitema University, Uganda

Incorporating Indigenous Knowledge within Appropriate Technologies for Promoting Awareness of Water Resource Issues
Dumani Kunjuzwa, Nelson Mandela Metropolitan University, South Africa

Understanding the Influence of ICT in Development: A Study of Uganda's Water Sector
Musa Chemisto, Islamic University In Uganda, Uganda

16:00 End of Sessions

Opening Plenary

The Opening Plenary incorporated presentations from: Paul Cunningham, IST-Africa Institute, Ireland; Moctar Yedaly, Head, Information Society, African Union Commission; Prof. Magdalena Salazar Palma, Director, IEEE Region 8 and Dr. Elioda Tumwesigye, Minister for Science, Technology and Innovation, Uganda.

Opening Remarks, Paul Cunningham, IST-Africa Institute

Paul Cunningham welcomed the participants to the **IST-Africa 2020** Conference. This year there are more than 400 participants from 44 countries (Angola; Argentina; Bangladesh; Belgium; Botswana; Burkina Faso; Cameroon; Chad; Congo (DRC); Denmark; Egypt; Ethiopia; Finland; Germany; Ghana; India; Iran; Ireland; Kenya; Lesotho; Liberia; Malawi; Mauritius; Morocco; Mozambique; Namibia; Netherlands; Nigeria; Norway; Portugal; Senegal; Sierra Leone; South Africa; Spain; Sudan; Swaziland; Tanzania; Tunisia; Uganda; United Kingdom; United States; Zambia) representing policy makers, practitioners and researchers from leading commercial, government, research and societal organisations around the world.

Paul briefly provided some insights into the focus of **IST-Africa,** which is a not-for-profit Strategic Partnership between **IST-Africa Institute**, IIMC (Ireland) and African Ministries and National Councils responsible for Innovation, Science and Technology in 18 African Member States. Over the past ten years **IST-Africa** has assisted African Universities to secure >€200 million research and innovation funding from FP7 and Horizon 2020. It has published comprehensive reference reports and mappings of ICT Initiatives, research capacity and Innovation Spaces in IST-Africa Partner countries to support policy development. The outputs of this mapping informed the evidence provided to the European Commission and EU Member States to justify the inclusion of three African-centric calls in the Horizon 2020 LEIT Work Programmes (ICT-39-2015, ICT-39-2017 and ICT-58-2020). It has showcased African research and Innovation capacity and facilitates capacity building, partnerships & knowledge sharing. **IST-Africa** has significantly increased peer reviewed research publications from Africa and about research relevant to Africa, both through the Open Access **IST-Africa** Paper Repository and via IEEE Xplore.

Paul invited the participants to share experiences, ask questions and make new collaborations during **IST-Africa 2020.** Paul introduced **Moctar Yedaly, Head, Information Society, African Union Commission**.

Welcome Remarks, Moctar Yedaly, Head, Information Society, African Union Commission

Moctar Yedaly welcomed the participants and noted that this short presentation will be complemented by a presentation of **The Digital Transformation Strategy for Africa (2020-30)** by his colleague Moses Bayingana, Senior Policy Officer for ICT, African Union Commission.

Moctar thanked Paul Cunningham and Miriam Cunningham for all their good work in the context of IST-Africa. He highlighted that in the context of COVID-19 it has been possible for colleagues to work remotely, children and students to participate in school and college activities online and researchers to collaborate with collleagues from around the world leveraging innovative technologies. ICTs and Next Generation Internet Technologies represent an opportunity for Africa to actively participate in the Fourth Industrial Revolution. We can leverage cutting edge Science, Technology and Innovation to address societal challenges and Digital Transformation.

Moctar concluded by reiterating that the African Union Commission and his department very much support **IST-Africa** activities and **IST-Africa 2020** and invited the participants to leverage this opportunity to share knowledge and experiences and develop new collaborations.

Paul thanked **Moctar** for his address and introduced **Prof. Magdalena Salazar Palma, Director, IEEE Region 8.**

Welcome Remarks, Prof. Magdalena Salazar Palma, Director, IEEE Region 8

Prof. Magdalena Salazar Palma, Director, IEEE Region 8 provided a background introduction to IEEE in terms of membership, geographic reach and technical capacity, highlighting the importance of strategic partnerships, particularly in the context of international conferences, technical standards and publications.

Magdalena explored IEEE activities as they relate to Sustainable Development and advancing technology for the benefit of humanity, and the diversity of IEEE humanitarian and philanthropic programs, providing volunteer opportunities to contribute towards improving the human condition around the world. In this context, she highlighted the importance of the work of the IEEE Humanitarian Activities Committee and the IEEE SIGHT Program.

Magdalena then focused on IEEE Region 8, which includes Africa, Europe and Middle East, and the diversity of conferences organised by and co-sponsored by IEEE. She took the opportunity to acknowledge the success of Africa in the context of Regional awards, including Outstanding Small Section and Outstanding Medium Section Awards won in 2019 by Kenya and South Africa respectively. She also discussed the establishment of the IEEE Africa Council, the appointment of new Executive Committee members from Uganda, Tunisia, Nigeria and Kenya, and facilitating stronger relations between Region 8 and the Africa Council by appointing the Africa Council Chair as

a R8 Appointed Member from 2020

Magdalena acknowledged the strategic importance of **IST-Africa 2020** in an African context, particularly in relation to facilitating networking and collaboration opportunities for participants, thanked the organisers for all their hard work and wished everyone a very successful conference.

Paul thanked **Magdalena** for her address and introduced **Dr. Elioda Tumwesigye, Minister for Science, Technology and Innovation, Uganda.**

Welcome Address, Dr. Elioda Tumwesigye, Minister for Science, Technology and Innovation, Uganda

Honourable Dr Elioda Tumwesigye commenced by stating that he was honored to make opening remarks and formally welcome the participants to the **IST-Africa 2020** Virtual Conference, which was originally scheduled to be hosted by the Ministry of Science, Technology and Innovation, in Kampala from 6 – 8th May 2020. As we are participating in this virtual conference, most countries around the world, including Uganda, are in a state of lockdown, a measure of ensuring social distancing and minimizing the spread of the COVID-19 pandemic which has affected millions and resulted in over 300,000 deaths to date. By putting effective measures in place at the very onset of this disease on the African continent, Uganda, under the wise leadership of President Museveni, has minimized infections and to date, Uganda has recorded no COVID-19 related deaths.

Hon. Dr Elioda Tumwesigye indicated his wish at the very outset to recognize and appreciate the enormous contribution that Prof Paul Cunningham and Ms. Miriam Cunningham of the **IST-Africa Institute** and International Information Management Corporation Limited (IIMC) have made to strengthening Sustainable Development and ICT-enabled Innovation, Science and Technology capacity and multi-stakeholder collaboration across the continent of Africa since **IST-Africa** was founded in 2002.

Hon. Dr Elioda Tumwesigye indicated that he was aware that **IST-Africa** is supported by the European Commission (EC) and African Union Commission (AUC) and co-funded under the European Framework Programme between 2005 and 2018. **Hon. Dr Tumwesigye** saluted these very eminent continental Commissions for the support that has enabled **IST-Africa** through this Strategic Partnership with Ministries and National Councils responsible for Innovation, Science and Technology related Implementation, Adoption, Policy and Research in 18 African Member States to galvanize ICT actors, researchers, innovators and practitioners across the African continent into a very dynamic constituency, and facilitate mutually beneficial collaboration between peers in Africa, Europe and the rest of the world.

In the case of Uganda, IIMC has been collaborating with the **Uganda National Council for Science and Technology (UNCST)** and since its establishment, the **Ministry of Science, Technology and Innovation**, to mobilize key players and innovators into a formidable constituency that that has continued to leverage and harness the power and opportunities that technology-enabled innovation presents to create solutions addressing national Societal challenges and achieving the UN Sustainable Development Goals in Uganda.

Uganda was one of the first countries to develop its National Development Plan in line with the UN SDGs. Through Uganda's strategic partnership with IST-Africa, UNCST has been able to leverage **IST-Africa** activities to:

- Actively galvanize the National Research and Innovation Community in Uganda to focus on leveraging technology-enabled innovation to address national societal challenges
- Actively support participation by members of the Ugandan research community in collaborative multi-country consortia targeting international funding opportunities (particularly Horizon 2020
- Assist institutions to prepare for new opportunities such as Horizon Europe, the next phase of the European Framework Programme which starts in 2021
- Raise awareness about activities undertaken in other African and European countries to identify good practices and lessons learnt and identify opportunities to adapt innovations to address Societal Challenges and policy priorities in Uganda

Through this strategic collaboration with **IST-Africa**, Uganda is now ranked as one of the top African countries in terms of securing competitive grants from the European Commission Framework Program. The **IST-Africa** partnership also enabled UNCST to undertake a study and contribute to the publication of comprehensive reports on ICT Initiatives, Research and Innovation Capacity as well as Digital Innovation Spaces and Living Labs in Uganda, to showcase what has been achieved to date and highlight collaboration opportunities to potential research and development partners in Africa and Europe. **IST-Africa** has also supported the creation of National Contact Points (NCPs) in Uganda and many other IST-Africa Partner Countries, which further strengthens government support to national Digital Innovation Ecosystems.

Hon. Dr Elioda Tumwesigye saluted **IST-Africa** and IIMC for creating this strategic partnership and network which is open to participation by all ACP (Africa, Caribbean, Pacific) Group Countries and for the commendable achievements it has facilitated over the last 19 years. The **Ministry of Science, Technology and Innovation**, which is relatively young, is so proud to be associated with and contribute to this productive international partnership, which

reflects our shared aspirations on the important societal contribution that Innovation, Science and Technology related Adoption, Implementation, Policy and Research can make across the African continent.

Uganda's development aspirations are articulated in Vision 2040, which underscores the need for Uganda to re-orient herself to make Science, Technology, Engineering and Innovation the main drivers of economic growth and a key pillar to enhance productivity and competitiveness in the identified opportunities of oil and gas, tourism, minerals, ICT business, abundant labour force, geographic location & trade, water resources, industrialization & agriculture. Fundamentals that are indispensable to fully harness these opportunities include, amongst others, Infrastructure (energy, transport, water, oil & gas and ICT); and Science, Technology, Engineering and Innovation (STEI). Vision 2040 underscores the need for government to strengthen the fundamentals of Science, Technology, Engineering and Innovation, by supporting Innovation Financing by introducing special grants, loans and guarantees for start-ups and new firms as well as subsidies, tax incentives to stimulate research and development in both the public and private sectors.

In recognition of the central and unique role of Science, Technology and Innovation globally, regionally and nationally in driving competitiveness, productivity, industrialization and socio-economic transformation, the president of the Republic of Uganda created a dedicated **Ministry of Science, Technology and Innovation** in June 2016. The mandate of the Ministry is to provide policy guidance and coordination on matters of Science, Technology, and the National Innovation Ecosystem. To operationalize this mandate, the Ministry inter alia formulates policies and plans for the entire STI sector; identifies National ST&I priorities and aligns them with the broader National Development Goals; and supports research, innovation and product commercialization in both the public and private sectors through implementation and coordination of the national research and innovation fund program.

The Ministry has a dynamic architecture that is well positioned to harness the entire value chain of research and innovation. It is structured into the technical Directorates of Science, Research and Innovation; Science, Technology and Innovation Regulation and Biosafety; and Technoprenuership and Outreach.

As the second IST-Africa Conference hosted by the Government of Uganda, **IST-Africa 2020** showcases discussion and knowledge sharing focused on a variety of important themes including:

- eInfrastructure
- Global Development,
- Societal Implications of Technology
- eGovernment
- Content Technologies
- eHealth
- Entrepreneurship
- Next Generation Computing
- CyberSecurity
- Technology-enhanced Learning
- eAgriculture and Environment Sustainability

These themes clearly reaffirm the role of ICT-enabled research and innovation as a key driver in all economic sectors. This conference also takes place against the backdrop of the fact that the world is now in the **Fourth Industrial Revolution (Industry 4.0)** which is evolving at an exponential rather than a linear pace and is disrupting almost every industry and sector by transforming entire systems of production, management, and governance. There is increasing convergence between the physical, digital, and biological worlds; a fusion of advances in artificial intelligence (AI), robotics, the Internet of Things (IoT), 3D printing, genetic engineering, quantum computing, and other technologies. It is therefore an immutable fact that ICT-enabled research and innovation is a fundamental driver of the 4th Industrial Revolution.

Innovation, Science and Technology has the potential to provide solutions to a wide variety of societal challenges including COVID-19. In view of this, the Ministry of Science, Technology and Innovation recently launched a research and innovation call to address the COVID-19 challenge. Among the key themes in the call was digital solutions. We were very impressed with the creative ideas that were articulated by the researchers and innovators who responded under the theme.

Hon. Dr Elioda Tumwesigye highlighted that while the papers to be presented during this conference were selected in December 2019, he was optimistic that some of exciting research, innovation and practitioner based insights and experiences to be shared during the conference can be applied to the current challenge of COVID-19.

Hon. Dr Elioda Tumwesigye indicated his confidence that given the lineup of contributions to be shared, **IST-Africa 2020** is set to be an exciting and productive conference again this year. He also believed that given the quality of participants, papers and presentations for which **IST-Africa** is renowned, this conference will achieve its strategic objectives. As the de facto host of this virtual conference, the Ugandan Ministry of Science, Technology

and Innovation stands ready to build on this mutually beneficial strategic partnership and to support taking it to even greater heights.

Hon. Dr Elioda Tumwesigye concluding by taking the opportunity to thank Paul Cunningham and Miriam Cunningham and the officers at his Ministry who contributed to the organization of this important virtual conference. He also recognizes presenters and delegates alike for making the time in sometimes difficult circumstances to be online during this conference. He prayed that we all continue to work together and remain committed to observing Standard Operating Procedures (SoPs) for avoiding COVID-19, so that we all stay safe and can look forward to meeting one another again face-to-face during **IST-Africa 2021**. He wished the participants fruitful deliberations during the **IST-Africa 2020** Conference.

Paul thanked **Hon. Dr Elioda Tumwesigye** and his colleagues in the Ministry of Science, Technology and Innovation.

Plenary Presentations

Plenary Presentations provided insights into the critical role International Cooperation plays in Information Society Technologies; the Digital Transformation Strategy for Africa (2020-30), EU-Africa Cooperation on Research and Innovation for Sustainable Development, AfricaConnect, Support for Innovation and Entrepreneurship in Southern Africa (SAIS2) and how IEEE is supporting Sustainable Development and activities in Africa. They were scheduled within the overall Programme to complement the Scientific tracks in the Programme.

IST Diplomacy in the Fight against Covid-19 - Perspectives from South Africa, Daan du Toit, Deputy Director-General: International Cooperation and Resources, Department of Science and Innovation, South Africa

Daan du Toit, Deputy Director-General: International Cooperation and Resources, Department of Science and Innovation, South Africa introduced himself and acknowledged that he is representing **Dr Phil Mjwara, Director General**, Department of Science and Innovation.

Daan commenced by providing insights into the history of **IST-Africa** and how South Africa were proud to host the first **IST-Africa** conference in Pretoria in 2006 and subsequently in 2010 and 2016. Daan outlined that the Department of Science and Innovation (DSI) has always valued **IST-Africa** 's unique and strategic ability to foster inter-African ICT, Research and innovation partnerships and also facilitate and enable Africa's participation in Global research and innovation programmes specifically those with the European Union. He confirmed that he was honoured to share their perspective on the critical role International Cooperation in Information Society Technologies (IST), IST diplomacies can and will play in our fight against the COVID-19 Pandemic. He thinks it is therefore appropriate to focus on this role.

A lot has been said about Science Diplomacy and DSI thinks the same applies to IST Diplomacy and ability to reinforce Global Solidarity and Cooperation which is so crucial in the fight against COVID-19.

He indicated that he would share some information on South African Science, Technology and Innovation response initiatives to COVID-19 and then conclude with Reflection on opportunities for international partnerships in information society technologies to fight a pandemic. Partnerships which we are confident **IST-Africa** can play a crucial role to enable and support.

There is a very popular definition of **Science Diplomacy** courtesy of the American Association for the advancement of Science in Society mainly that Science Diplomacy comprises the role of Science in Diplomacy, in other words global issues with a scientific basis and we can agree COVID-19 is such a challenge. Science Diplomacy is also the role of Diplomacy for Science - how International relations are harnessed for the benefit of Scientific Cooperation. We see this very clearly in the times of COVID-19 with big efforts to focus and promote International partnerships and then there is also Science for Diplomacy - the role science plays to enable Global solidarity and multilateralism. We like to say that Science knows no borders, Information Science and Technology knows no borders and more than ever during COVID-19 we need such Global Solidarity and Multilateralism. So the effort to collaborate on Information Society Technologies to fight the pandemic in our view meets all the definitions of Science Diplomacy.

Daan outlined that if we look at why we collaborate internationally, in this case looking at South Africa's objectives for International Cooperation in Science, they all very much apply and are relevant for the fight against COVID-19.

Collaboration is essential to share and learn from each other, to share experience, expertise and data. International Cooperation is also important to leverage investment, make joint investments with international partners or attract foreign funding. International partnerships reinforce Global Solidarity as we are all united in achieving the Sustainable Development Goals. So international cooperation is critical but will only be effective if some key principals inform it.

It should focus on global good and this is aligned with national agendas, All partnerships must add value, existing capacities are stretched, we have to seek to add value through **International Cooperation**. Therefore in our view

International Cooperation should respect the principals of **Open Science**, which includes open access to results of research, data and also the enterprise of Science and Innovation should be an open one, one which is open to society.

Having reflected on the basis of International Cooperation Daan shared insights into the South African Science response to COVID-19. The South African Scientific Community has been at the forefront with Dr Blade Nzimande, Minister of Science and Innovation, to present it in the National Command Council which has been constituted by the South African President to address COVID-19. DSI has seen a significant effort to leverage the best scientific ways possible to inform policy and decision making, mobilise funding, reconfiguration priorities creating every ethical regulatory frameworks and repurpose facilities including laboratories or public/private partnerships to respond to the crisis.

Data has been absolutely key, the Council for Scientific Industrial Research (CSIR) which is the South Africa public research organisation is responsible for the situational awareness platform for COVID-19, making sure the South African Government's actions are based on reliable data. University of Pretoria is working on pan-African databases and modelling, understanding how the disease spreads is at the heart of the effort. Interestingly South Africa has not only drawn on the traditional health science community but also data science experts from astronomy and theoretical physics, who have made crucial contributions. Medical research companies are part of the response, looking at the surveillance of the disease and genomic sequencing so that we can track the mutation of the disease and then leapfrog technologies. Community engagement and drug treatment trials are working in cooperation with the WHO.

The **South African response to COVID-19** is leveraging: Diagnostic Tools, manufacturing reagents for testing kits; Re-purposing and testing efficacy of existing drugs for treatment of COVID-19; and preliminary work on the development of vaccines leveraging work ongoing at the University of Cape Town, the CSIR and Biovac. The Human Sciences Research Council (HSRC) is conducting a survey aimed at better understanding of current behaviour and perceptions related to COVID-19 (rural population, social media) and the South African Population Research Infrastructure Network is analysing information on health, socio-economic well being of South Africans. The Goverment is mobilizing advanced manufacturing capability including additive manufacturing (ventilators, protective equipment, etc). It is important to open up and expedite supply chains to enable the local production of ventilators and associated equipment, (e.g., medical grade silicon material/isolation gowns) and there is a need for improved access and supply chain PPE equipment (e.g., masks, isolation clothing, etc).

International Cooperation activities are focused on:

- Sharing Information, experience multilateral platforms: UNESCO, OECD, WES

- Activate and strengthen Africa networks: Africa Union, Southern African Development Community, African Academy of Sciences

- Will provide additional South Africa Funding to European Developing Countries Clinical Trials Partnership calls for proposals/ co-fund EUREKA calls

- Extensive collaboration with Ministry of Science and Technology of China including Traditional Chinese medicine/ South African Indigenous Knowledge.

Opportunities for IST Partnerships include:

- E-infrastructure: networking, computing, data management resources

- Disease tracking technology, analytical solutions for health systems

- Smart technologies and support systems for critical production and supply chains under lockdown

- Safe mobility: migration data and trends, regional risk monitoring, protection of isolated and risk groups, safe use of public transports

- Education technologies and digital workplace. This should be high on the research and innovation agenda

Daan concluded by stating that it is our wish that **IST-Africa 2020** can be a platform for African researchers and innovators to collaborate with international partners in this whole range of areas to ensure an effective response to the COVID-19 pandemic. We have an opportunity for the world to be united for science and **IST-Africa** is at the heart of this enterprise. Daan thanked everyone for their efforts over the many years and reiterated that the South African Research and Innovation Community is actively interested in ongoing International Cooperation opportunities.

Paul thanked Daan for sharing these insights and opened the floor to questions and discussion.

The Digital Transformation Strategy for Africa (2020-30), Moses Bayingana, Senior Policy Officer for ICT, African Union Commission

Moses Bayingana, Senior Policy Officer for ICT, African Union Commission introduced himself and presented the **Digital Transformation Strategy for Africa's Socio-Economic Development (2020 – 2030)**.

The Digital Transformation Strategy (DTS) was presented and discussed at the third ordinary session of the Specialized Technical Committee for Communication and ICT (STC-CICT-3) held in Sharm el Sheikh, Egypt from 22-26 October 2019 and endorsed by the Thirty Six Ordinary Session of the African Union Executive Council held from 6-7 February 2020 in Addis Ababa, Ethiopia.

Developed to guide a common, coordinated response to reap the benefits of the Fourth Industrial Revolution, the Digital Transformation Strategy for Africa was developed in collaboration between the AU Commission, the UN Economic Commission for Africa, Smart Africa, AUDA-NEPAD, Regional Economic Communities, African Development Bank, Africa Telecommunications Union, Africa Capacity Building Fund, International Telecommunication Union, World Bank and other partner institutions. The private sector and civil society was also consulted.

The primary objectives were (a) to achieve an Integrated and inclusive digital society and economy in Africa that improves the quality of life of Africa's citizens; strengthens, diversifies and develops the economic sector, and ensure Africa participates in the global economy as a producer as well as a consumer and (b) to harness digital technologies and innovation to transform African societies and economies to promote Africa's integration, generate inclusive economic growth, stimulate job creation, break the digital divide, and eradicate poverty for the continent's socio-economic development and ensure Africa's ownership of modern tools of digital management.

The Digital Transformation Strategy (DTS) builds on solidarity between African Union Member States; Cooperation between the AUC, RECs, African Institutions and International organizations; and is linked to Agenda 2063 as well as the Sustainable Development Goals (SDGs).

The Conceptual Framework whose overall objective is to achieve a Digitally Transformed Continent for Prosperity and Inclusivity, is based on a series of **Foundational Pillars** (Enabling Environment, Policy and Regulation; Digital Infrastructure; Digital Skills & Human Capacity; Digital Innovation & Entrepreneurship). These are intended to underpin support for a number of Critical Sectors necessary to drive digital transformation. These sectors are Digital Industry; Digital Trade and Financial Services; Digital Governance; Digital Education; Digital Health; and Digital Agriculture.

The final layer of the DTS Conceptual Framework are cross-cutting themes, including Emerging Technologies; Digital Content and Applications; Cyber Security, Privacy and Personal Data Protection; Digital ID; and Research and Development. The

Moses described how each of the Foundation Pillars have associated policy recommendations. For **Enabling Environment, Policy and Regulation** for example, these include Supporting the development and implementation of national, regional and continental digital transformation strategies to create demand and enable scaling up of digital initiatives; Establishing harmonized policy, legal and regulatory frameworks; Integrate the provision of public and private sector developed eServices in such a way as to ensure that data needed to provide eServices for the community is openly available while fully respecting data protection rights; and Strengthen collaboration with African Institutions and regulators in charge of digitalization.

For **Digital Skills and Human Capacity**, policy recommendations include aligning educational curricula with the needs of the digital economy and society, developing multi-stakeholder partnerships, mainstream digital skills and responsible online behaviour among citizens and facilitate digital skills development with a particular focus on government and civil society.

For **Digital Innovation and Entrepreneurship**, policy recommendations include strengthen existing policies, create a conducive environment to empower citizens to innovate and facilitate access to funding for digital enterprises, create an enabling ecosystem for digital enterprise and strengthen multi-stakeholder partnerships and harmonise efforts at continental, regional and national level.

Having highlighted some of the critical sectors including Digital Education, Digital Health and Digital Agriculture and cross-cutting themes including Research and Development and Cybersecurity, Privacy and Personal Data Protection, Moses concluded by wishing everyone a very productive **IST-Africa 2020**.

Research and Innovation for Sustainable Development-Future Perspectives, Dr. Fadila Boughanemi, Deputy Head, International Cooperation II (Asia, Africa, Middle East & External Relations), DG Research and Innovation, European Commission

Miriam Cunningham, IST-Africa Institute provided a context for Fadila's presentation. The European Commission is one of the largest donors supporting Africa.There are 3 main Directorate-Generals (DGs) who are supporting engagement from different perspectives (DG DEVCO, DG Research and Innoavation and DG CONNECT). **DG DEVCO**

supports European Development Funds in cooperation with the Ministry of Finance to support national budgets and run development programs in agreed priority areas. DG DEVCO launched the Digital4Development Framework in 2017 to provide a new lens for development cooperation based on supporting skills development, eInfrastructure etc. The projects launched under this programme draw funds from other mechanisms as there is no dedicated funding. **DG Research and Innovation** and **DG CONNECT** support Research and Innovation Funding through Horizon 2020. DG Research and Innovation supports calls for engagement with Africa focused on Agriculture and Health. IST-Africa provided evidence to EU Member States and DG CONNECT to justify the inclusion of three calls under the LEIT Work Programme in Horizon 2020 supporting Research and Innovation based on African challenges.

In 2007 following the Africa-EU Summit in Lisbon, an Africa-EU Strategic Partnership was published. This formally recognised the important of Science Technology and Innovation Cooperation and lead to the establishment of working groups. In 2010 the EU-Africa High Level Policy Dialogue focused initially on Food Security and Nutrition and a pillar related to Innovation was added in 2019.

Now the EU is in a phase of adopting a new strategy for engagement with Africa. On 09 March 2020 the European Commission published the Joint Comm**unication to the European Parliament and the Council "Towards a Comprehensive Strategy with Africa**" in the context of preparing for the next EU-African Union Summit (October 2020) and new Partnership Agreement between the EU and the Africa, Caribbean and Pacific (ACP) Group of States expected to be concluded. It will replace the Joint Africa-EU Strategy 2007 by addressing mutual opportunities and challenges based on the current global context. It highlights five key areas for deepened partnership cooperation: (1) green transition and energy access; (2) digital transformation; (3) sustainable growth and jobs; (4) peace and governance; and (5) migration and mobility. The partnership for digital transformation highlights the importance of investment in infrastructure including reliable sources of electricity, a regulatory environment to support competitive and harmonised regional connectivity and a robust regulatory framework addressing data and consumer protection, digital financial services, cyber crime and e-governance. It proposes that digital infrastructures and support for digital entrepreneurship and innovation can contribute towards creating employment opportunities for young graduates and youth entering the work force. It proposes cooperation on the implementation of interoperable digital solutions to address digital skills gaps, promote the use of open data, strengthen cyber security and harness new technologies such as artificial intelligence, block chain and big data. It highlights the requirement to enhance digital skills, digital literacy, quality learning and vocational training.

Miriam introduced **Dr. Fadila Boughanemi, Deputy Head, International Cooperation II (Asia, Africa, Middle East & External Relations), DG Research and Innovation, European Commission.**

Dr. Fadila Boughanemi commenced by stating that it was her pleasure to participate in **IST-Africa 2020** and provide insights into the future of Europe's cooperation in Research and Innovation (R&I) with Africa, a priority area for the European Commission President, Ursula Von Der Leyen and EU Commissioner, Mariya Gabriel.

Fadila provided insights into the current top priority: to develop and implement the EU response to the COVID-19 pandemic, and prepare for the deep socioeconomic shocks that it has brought and will continue to bring. The recent Communication '**Global EU Response to the COVID-19**' sets the framework for our action in R&I cooperation, emphasising on sharing data and research results, supporting the most vulnerable countries and especially Africa, and strengthening multilateral platforms for addressing the pandemic. To this end, the European Union is working on several fronts. "Our goal is universal access to prevention, diagnostics and treatment", as President von der Leyen has said. With this objective in mind, the European Union has joined forces with many countries such as Canada, Japan, the Kingdom of Saudi Arabia, Norway and South Africa to kick-start a global pledging effort, the **Coronavirus Global Response**, on 4 May 2020 with the aim to raise at least €7.5 billion in initial funding. €7.4 billion (equivalent to 8 billion dollars) has been registered in pledges from donors worldwide. This is a solid starting point for the worldwide pledging marathon, will run until the end of May, to raise necessary funding to ensure universal and affordable access to new solutions to detect, treat and prevent COVID-19. This is the figure that world-leading scientists and health experts say is initially and most urgently needed to develop solutions to test, treat and protect people and to prevent the disease from spreading. True global solidarity and collaboration is required to help address this shortfall.

The EU is also stepping up its support to multilateral initiatives such as the **Coalition for Epidemic Preparedness and Innovation (CEPI) on vaccine development** and enhance visibility of the Global Research Collaboration for Infectious Disease Preparedness (GloPID-R) and consolidate their role as international coordinator of R&I in infectious disease outbreak. Specifically on Africa, the European Commission is supporting the **European and Developing Countries Clinical Trials Partnership (EDCTP)**, a long-standing partnership that is building the capacity of African countries to conduct robust clinical trials. Following the Ebola outbreak, it has already set up two clinical research networks, ALERRT and PANDORA, which are now gearing their efforts towards COVID-19. Moreover, on 3 April EDCTP launched an emergency call for expressions of interest for research projects to provide novel, critical and timely insights into the COVID-19 outbreak in sub-Saharan Africa and/or potential avenues for its management or prevention.

On **Open Science,** the EU will use its infrastructures and policies, including the Plan S, to push towards a worldwide Open Access shift in the area of infectious diseases, by connecting other existing and recent international cooperation efforts. For instance, the Commission at the end of March signed a letter to the scholarly publishing

community urging them to make Covid-19 and coronavirus publications, and the data supporting them, immediately accessible via public repositories to support the ongoing public health efforts. The Commission did so together with chief science advisors, ministers and leaders from 15 other countries including the United States, Australia, Brazil, Canada, India, Japan, New Zealand, and the Republic of Korea. This is already producing results as 44 publishers are making all COVID-19 related papers open access, including all major publishing houses. Together with the European Molecular Biology Laboratory (EMBL), the Commission will soon deploy a **pan European Research Data Platform on SARS-CoV-2 and COVID-19** to allow the scientific community to share, analyse, and process data rapidly, openly and effectively across the Member States and the globe. It is clear now that we must focus our efforts in the coming years on the global and European recovery from the consequences of the coronavirus pandemic, with measures targeting the economic and social impacts in particular, which means a specific focus on the **Green Deal**. The European Green Deal is a lifeline to get out of the corona virus crisis. Pan-European answers are needed and a green recovery is not only possible but crucial, as Europe would lose out twice if we mobilise investment to restore the old economy before we make it green and sustainable.

Fadila then focused on the **EU approach for R&I relations with Africa**. We have a long-standing history of successful cooperation with Africa, a continent with which we progressively developed along the years a partnership based on mutual interest and mutual benefit. Enhanced synergies between our policies and programmes is crucial for our cooperation with Africa, to enable us cover together the entire value chain from capacity building to research and innovation to deployment. Thanks to these synergies between Research and Development Policies and Instruments, the **R&I dimension** in the recently published **Comprehensive Strategy for Africa** is now substantial, and R&I are recognised as efficient engines for Sustainable Development in this strategic document. The European Commission intends to implement our Partnership with Africa further through a flexible and modular approach, also depending on the scientific and innovation capacities of the regions and countries concerned. At pan African level, we will pursue the implementation of the high-level policy dialogue in R&I launched 15 years ago with the African Union, the **EU-Africa High Level Policy Dialogue in R&I (HLPD)**, and strengthen the 3 partnerships resulting from this dialogue, on **food security, climate change,** and the most recent one on **innovation. I**n agreement with the African Union Commission we will be devoting the next meeting of the HLPD to COVID-19 virus outbreak in sub-Saharan Africa, in order to support reactiveness and prepare together potential avenues for its management.

As a reinforcement to the pan-African level, DG Research and Innovation wishes to engage in sub-regional cooperation, and establish an R&I dialogue with the Regional Economic Communities, starting with the RECs that positioned themselves vis-à-vis R&I, such as SADC (Southern African Development Community), which adopted a protocol on science, technology and innovation long ago. While some regions, such as SADC or the East African Community, are relatively well represented in the program, others, such as the Economic Community of West African States, are much less represented and should be paid further attention. At bilateral level, the intention is to deepen our relations with a certain number of countries in the continent, in particular those benefiting from a cooperation agreement in R&I, such as the 3 Maghreb countries, Egypt and South Africa. Countries that currently benefit from an association agreement, such as Tunisia, and the ones that might be interested by such a scheme in the future, such as Morocco, South Africa or Nigeria, will also be carefully looked at.

Fadila highlighted that we need to take into account the turn towards innovation taken in recent years in countries such as Nigeria, Rwanda, Kenya or Côte d'Ivoire. With relatively reduced but better targeted additional EU investment, it would be possible to put in place measures that would benefit not only these countries but also the entire region in which they play the role of regional champion catalyst: in West Africa, the podium of the best research centres and universities is dominated by a single country, Nigeria. The French-speaking area is, for its part, mainly represented by Senegal and Togo. This is what DG Research and Innovation is trying to do with its pilot initiative '**Africa Europe Innovation Partnership**' which brings together technological centres, incubators, accelerators and key players from public and private sectors of European and African innovation landscapes, to help them launch new partnerships and explore innovative models of technology exchange.

The European Commission is also exploring innovative paths to strengthen the share of R&I in Africa, including through new financial engineering aimed at increasing the Public-Public Partnerships for research and innovation within the next MFF: one could think inter alia, of blending of instruments and of public guarantees to attract private investments in research and innovation. In order to support our Partnership with Africa, we are launching a high level Advisory Group to advise DG R&I on the best way to implement the R&I dimension of the Comprehensive Strategy and enhance the Knowledge Pillar of the EU-Africa Alliance. We need to gain a comprehensive understanding of the state of play: successes of past interventions but also challenges and opportunities with regards to the future of Africa-Europe R&I cooperation, and identify relevant policy actions to foster such cooperation in the interest of sustainable investment and job creation. The experts will convene regularly, both physically and virtually with the aim of providing policy advice. Their recommendations will be based on scientific studies on the current reality of the AU-EU R&I cooperation, of their strengths and weaknesses, and of course on the way to overcome the latter in the future. Enhanced synergies between our policies and programmes are crucial. With this in mind, together with DG DEVCO, DG Research and Innovation is setting up an inter-service group on **"R&I for Development"** co-chaired by the two DGs with the intention to intensify the part of R&I in our overall cooperation with developing countries in

general, Africa in particular.

Fadila concluding by thanking Miriam Cunningham, Paul Cunningham and the **IST-Africa** team for their ongoing work and wished the participants good deliberations during **IST-Africa 2020.**

SAIS Programme - Supporting Innovation and Entrepreneurship in Southern Africa, Ilari Lindy, SAIS2, Namibia

Miriam Cunningham, IST-Africa Institute provided a context for the **SAIS 2** presentation. National Governments and donors have taken different approaches to supporting the national Innovation Ecosystems. **Bilateral cooperation support for ICT, Innovation and Research Capacity building** in an African context is primarily provided by Finland, Sweden, Norway, Germany, Italy, France, Switzerland, Ireland, Netherlands, UK, Belgium, Portugal, India, South Korea, Republic of China on Taiwan, China, Canada and Japan. **Multilateral support** is primarily provided by the European Commission, African Development Bank, World Bank, ITU, IICD, UNDP and UNESCO.

IEEE supports volunteers to undertaken community driven projects through **IEEE HAC** and **IEEE SIGHT**, which Paul Kostek will present later in the Programme.

The **Ministry of Foreign Affairs of Finland** (MFA) primarily focuses on supporting **Innovation capacity building**. Finnish Programmes are based on a needs assessment agreed with the beneficiary national government, implemented by a small technical support team from Finland in cooperation with a local team established by the hosting Ministry. They focus on building national institutional capacity. National Innovation Programmes has been undertaken in cooperation with the Government of South Africa, Mozambique, Tanzania.

ALICT - African Leadership in ICT which ran from 2010 - 2014 was an important and impactful regional programme. It focused on provided blended learning course with Professional Development Certificate in Botswana, Ethiopia, Ghana, Kenya, Malawi, Mauritius, Mozambique, Namibia, Rwanda, South Africa, Tanzania, Uganda and Zambia. Certification was provided with the option to continue to undertake a Masters Degree.

The initial **Southern Africa Innovation Support Programme** ran from 2011 - 2015, focusing on supporting a regional innovation system in SADC and promoting collaboration in relation to Innovation systems between Botswana, Mozambique, Namibia and Zambia.

Miriam introduced **Ilari Lindy**, whose presentation is focused on **SAIS 2** which started in 2017, focusing on supporting new businesses through strengthening innovation ecosystems in Botswana, Namibia, Tanzania, South Africa and Zambia.

SADC's (Southern African Development Community) vision is to develop into a region where Science Technology and Innovation drives sustainable social and economical development. The regional strategic development plan and other protocols show the strong political will to drive inclusive economic growth by building institutions, organisations and policies. Funded by the Ministry for Foreign Affairs of Finland in partnership with the Governments of Botswana, Namibia, South Africa, Tanzania and Zambia as well as the SADC Secretariat, the **Southern African Innovation Support Program** serves these requirements by fostering enhanced regional innovation cooperation and strengthening innovation eco systems. Now in its second phase the SAIS program focuses on 3 main areas. SAIS 2 provides Funding, Capacity building and Networking to achieve its goals.

The SAIS 2 Innovation Fund provides grants to projects that seek to pilot, demonstrate and replicate new or improved concepts and prototypes before rolling them out to the market as products, services or processes. All projects are required to be run by consortia organisations from at least two SADC countries. The SAIS 2 Innovation Fund has launched 2 calls for proposals in 2018 and went on to supports 21 Transnational projects with over 80 Beneficiary Organisations funded. Examples of innovation projects funded that are making a strong impact on the ecosystems include:

- Advanced IT Training and Online incubator for Women - Piloting an IT training and Tech Entrepreneurship Incubation model targeted at women (Funded in Call 1, Active Countries: Tanzania, DRC, Kenya)

- TechTribe Accelerator; A Scalable, Virtual, Technology-driven Accelerator - An e-learning and virtual mentorship project. (Funded in Call 1, Active Countries: South Africa, Botswana, Malawi)

- Seedstars Investment Readiness Programme - A unique project designed for scalable potential startups with the aim of identifying individual challenges and providing training related to these challenges. (Funded in Call 2, Active Countries: Botswana, Namibia, South Africa, Tanzania, Zambia, Angola, DRC, Zimbabwe, Mozambique, Mauritius)

- Angel Investor Training in Southern Africa - Training, mentoring and supporting angel investor groups and mapping entrepreneurial ecosystems. (Funded in Call 2, Active Countries: Botswana Namibia, South Africa, Tanzania, Mauritius)

- IDIN-SADC Consortium - Inclusive innovation project that partners with communities to co-create technologies that address immediate livelihood challenges. (Funded in Call 2, Active Countries: Botswana, Tanzania, Zambia)

The proactive support programme provides funded innovation projects with capacity building facilitated by leading expert organisations in their respected fields. To ensure all projects have the skills to succeed in making an impact all projects are required to participate, therefore active support program is broken into 3 parts.

- PSP 1: Data collection and Analysis

- PSP 2: Investment Readiness

- PSP 3: Inclusive Innovation

SAIS 2 Connected Hubs was launched to facilitate better connectivity between Tech Hubs and early role players that supports early stage entrepreneurship in SADC. Currently its membership comprises of 18 Organisations from 6 SADC countries. As of May 2020 SAIS 2 Connected Hubs has organised 3 regional cross border competitions, more than 500 early stage entrepreneurs and startups have been capacitated in pitching and business planning. The 2020 competition closes to applications on 31 May. Another important Connected Hubs activity is to create a Knowledge Product Production. Finally, the Connected Hubs members are also involved in organising and hosting trans regional events known as The Annual Southern Africa Innovation Forum (ASAIF) in partnership with SAIS. So far 2 ASAIF programs have been held in 2018 and 2019 with the next event be tentively scheduled for 2020.

SAIS 2 faces a variety of challenges in the SADC region. Despite SADC policies and protocols promoting regional markets, there are limited institutions fostering cross border co-operations and instruments funding cross border co-operations are rare or do not exist. The benefits of cross border Innovation Cooperation are not understood and skills to skills to implement cross border projects are limited. The innovation paradigm is still shifting from closed to open. This means that currently engagement of all ecosystem role players including users and consumers is rare when developing products, services and processes.

SAIS 2 is designed so that its interventions counter these challenges. The program puts data on the forefront of its activities documenting all processes and instruments as templates for further use. This information is used as evidence to promote data driven decision making. SAIS 2 also promotes opportunities for trans regional cooperation through the community of practice. Through the Connected Hubs, SAIS 2 Innovation Fund and the proactive support program, it also strengthens innovation support organisations capability to support entrepreneurs.

SAIS 2 has the following events and activities planned: 3rd call for proposals is planned for the third quarter of 2020; ASAIF 2020 will be held in partnership with an existing innovation event in the region; impact case studies from innovation fund projects will be available on the SAIS 2 website at the end of 2020 and BOOSTUP 2020 call for applications is open until 31 May, with the competition running until November.

Further information about the programme can be found on: www.saisprogramme.org

Paul thanked Ilari for preparing this presentation and opened the floor to questions.

IEEE Humanitarian Activities Committee - Supporting Sustainable Development, Paul Kostek, IEEE Humanitarian Activities Committee Events Chair

Paul Kostek, IEEE Humanitarian Activities Committee Events Chair presented the activities supported by IEEE through the Humanitarian Activities Committee. IEEE has 419,000 members worldwide in 160 countries and 124,000 student members. IEEE has 342 societies in 10 geographic regions, 2,400 chapters, 39 technical Societies and 7 Technical Councils representing in a wide range of technical interests. It also has 543 Special Affinity Groups including Women and Engineering and Young Professionals. There are over 4.5 million documents in the IEEE Xplore Digital Library with more than 8 million downloads a month. IEEE supports more than 1,900 conferences in 103 countries each year.

Humanitarian Activities Committee (HAC) is a Committee of IEEE, which started its work initially in 2011 to support the IEEE Board of Directors endorsed vision of IEEE volunteers around the world carrying out and supporting impactful, humanitarian activities at a local level. IEEE HAC supports achievement of the IEEE Strategic Plan 2020 - 2025 by: Supporting cooperation across and beyond IEEE to support Sustainable Development; Increasing understanding of the role of engineering and technology in Sustainable Development; Providing access to educational resources through the IEEE Learning Network, webinars, virtual forums and workshops; Fostering opportunities for hands-on, career-relevant experience through SIGHT and HAC projects and Creating impact in underserved communities around the world through its global network.

The IEEE Uganda Section has been involved in a number of SIGHT and HAC supported projects. This provides the opportunity for local members to leverage their skills to improve the quality of life for local communities. The Section has also seen an increase in local membership as these projects have increase visibility for IEEE activities.

IEEE HAC works to create awareness of the roles engineers can play in leveraging appropriate technologies to improve Sustainable Development activities through the IEEE Learning Network, virtual forums and face to face

workshops providing IEEE Members and Non-Members with the opportunity to learn more about how to support community driven projects. IEEE HAC created IEEE SIGHT (Special Interest Group for Humanitarian Technologies) as a subcommittee and program.

IEEE HAC provides a number of funding opportunities to support volunteers undertake community driven projects and disseminate the results from these initiatives. These include HAC Projects, SIGHT projects, HAC Events support and conference participation support. In the context of COVID-19 a number of projects received funding of up to $5,000 to support local volunteer activities. The Hyderabad, Madras, Nigeria, South Africa, Sri Lanka and Uganda Section were successful in securing funding towards supporting volunteer lead projects addressing local challenges as a result of COVID-19. The types of projects supported included creating simple ventilators, apps for smart phones and dashboards to collect information that can be shared with healthcare professionals. Some students have developed robots to support hospital staff.

IEEE Special Interest Group on Humanitian Technology (SIGHT) is a network of IEEE volunteers around the globe that partners with underserved communities and local organisations to leverage technology for sustainable development. There are 157 SIGHT Groups in 52 countries. In Africa there are SIGHT groups set up within the Sections for Egypt, Kenya, Nigeria, Uganda and Zambia. There are University SIGHT Groups set up in the Enugu State University of Science and Technology (Nigeria), Jomo Kenyatta University of Agriculture and Technology (Kenya) and Kyamgogo University Student Branch (Uganda). IST-Africa set up a Society SIGHT with the Society on Social Implications of Technology (SSIT), which has undertaken digital literacy training in a number of African countries. These SIGHTs provide opportunities for students, IEEE Members and non-IEEE Members to apply their knowledge in new and innovative ways to address local challenges leveraging technological solutions. An example of a SIGHT funded project in Uganda was the installation of solar panels at a Health Centre to support access to a more stable electricity supply to facilitate longer operating hours.

The HAC Education Forum has published a Sustainable Development and Humanitarian Technology at IEEE Curriculum on the IEEE Learning Network. More information is available at www.hac.ieee.org and www.SIGHT.ieee.org.

Paul wished the participants good luck with the rest of the conference.

AfricaConnect: a Past, Present and Future Success Story for African Research and Education, Tom Fryer & Leila Dekkar, GÉANT in cooperation with UbuntuNet Alliance, WACREN and ASREN

Tom Fryer and **Leila Dekkar** of **GÉANT** worked with the AfricaConnect III team to prepare the presentation, which included presentations from **Erik Huizer, CEO, GÉANT** and the implementing Regional Research and Education Networks: **Matthews Mtumbuka, CEO, UbuntuNet Alliance; Boubakar Barry, CEO WACREN;** and **Yousef Torman, Co-Managing Director, ASREN.**

AfricaConnect 3 has a vision to connect Africa to a world of vast knowledge through high speed, reliable connectivity, a world of unique solutions through digital technologies and a world of unlimited opportunities and possibilities through research and education collaborations. This vision has been translated into supporting: new treatments for diseases; apps and solutions to address environmental problems: creating and openly sharing knowledge; trained staff for high performance; employable skills for the job market; digital inclusiveness and participation and a generation of innovation and solution providers. AfricaConnect 3 is a shared vision, a shared commitment, a shared action and a shared impact..

At the end of 2019, following the success of previous projects (EUMED connect, AfricaConnect and AfricaConnect 2), Africa's three Regional Research and Education Network Organisations - UbuntuNet Alliance, Western Central African Research and Education Network (WACREN) and ASREN (Arab States Research and Education Network) in partnership with the PAN European Network organisation GÉANT signed a €37.5 million contract with the European Union for the successor project AfricaConnect 3 to extend Research and Education Networks and to provide high-speed internet connectivity and services to National research and education networks (NRENs) and to communities across Africa. Mostly publicly funded NRENs such as GARNET Academic and Research Network provide dedicated uncongested internet connectivity and value added services for Knowledge institutions in their country such as universities, research centres and libraries. NRENs are typically connected to regional counterparts such as WACREN, which in turn is linked to Global Research and Education Networks across the globe via its interconnection with GÉANT. This facilitates collaborative research in innovative learning worldwide, NRENs and connected institutions benefit from being part of a learning and sharing community with knowledge transfers, skills development and a joined up response in times of crisis such as COVID-19. There are over 120 NRENs worldwide, 38 of which are in Africa.

Between 2011 and 2014, the EU co-funded **AfricaConnect project** helped establish the UbuntuNet backbone, a regional gateway for collaborative research and education in Eastern and Southern Africa operated by the Regional Research and Education Network UbuntuNet Alliance. In 2015 the successor project **AfricaConnect 2** supported

creation development and use of high capacity internet networks for Research and Development adopting a pan African approach including 2 other regions, Western and Central Africa and North Africa alongside Eastern and Southern Africa. As a result of **AfricaConnect** and **AfricaConnect 2**, 19 countries are currently connected to the 3 Regional Research and Educational Networks in Africa. With the increased support of its project partners to deliver results in each region, AfricaConnect 3 seeks to consolidate the results of previous projects and unlock the potential of education and research and enhancing human capital development in Africa by improving access to digital infrastructures and technologies.

Since the start of AfricaConnect we have enabled: scientists to monitor and notify asthma sufferers of sandstorms in Egypt; enhanced academic services and equipping youth with tools to unleash their entrepreneurial skills in Uganda; provided remote training and knowledge exchange to strengthen geoinformatics expertise to support sustainable development in Kenya; connecting students and staff at Tanzanian Aga Khan University and enabling collaboration with sister institutes across the globe; intensive data and modelling mapping to monitor soil degradation and to develop sustainable land management in Zambia; opened up career opportunities for women in STEM through training, networking and strategic partnerships across Africa.

Tunisia and Morocco re-joined the international R&E networking community. The African partners have empowered NRENs through capacity-building, knowledge-sharing and participation in regional and international fellowship programmes connecting 6.2 million students in North Africa, 3.5 million in Eastern and Southern Africa and 400,000 in Ghana and Nigeria, in addition 300 women were trained in ICT for development thanks to the Woman in WACREN initiative. Since 2011 bandwidth prices have decreased by 94% in Zambia and 60% in Somalia, Finally WACREN is leading a new initiative LIBSENSE aimed at establishing frameworks for scholarly communication and research infrastructures.

Boubakar Barry, CEO, WACREN outlined that WACREN is very pleased and fortunate to be a beneficiary of **AfricaConnect 3** project funded by the European Commission. WACREN was also a beneficiary of **AfricaConnect 2** and it allowed WACREN to start deploying its backbone with a link from Lagos to London, by connecting its first members namely Ghana, Nigeria and Togo. WACREN is now in the process for connecting four more countries - Cote d'Ivoire, Mali, Burkina Faso and Benin. Under AfricaConnect 3 WACREN's target is to connect six more countries and at the end of the project plan to cover something c.700 Higher Education Institutions with 5 million users. AfricaConnect 3 will allow WACREN to deploy more services (such as cross video conference services, room platforms, provider services, cybersecurity and also a wide range of capacity building opportunities for our members) as well as strengthening existing services. WACREN hopes that LIBSENSE that it is leading in collaboration with UbuntuNet Alliance will be strengthened by involving more librarians and librarian services to our NREN community. WACREN also hopes that women In WACREN is strengthened by bringing more women into ICT in general.

Erik Huizer, CEO, GÉANT commenced by outlining that the world is facing many societal challenges and the current COVID-19 crisis is one of them. We can only resolve these crisis if all the researchers in the world come together and co-operate. To do that we need research networks and to train people to do that we need education networks. GÉANT is committed to supporting Research and Education Networks all over the world. In Africa, GÉANT does this through its long standing relationship with the UbuntuNet Alliance, with WACREN and with ASREN. We deliver connectivity services to Universities. GÉANT is grateful to the EU Commission who allows them to be a partner in this project and who funds it through their regional EU Projects. GÉANT is also grateful to its partners for the trust they put in it. GÉANT is delighted to be working on the third phase with AfricaConnect.

AfricaConnect 3 will greatly improve the access throughout Africa for Education and Research. It will connect Africa to the world and the world to Africa. GÉANT's role is to coordinate the overall project, undertake procurement and be responsible for Advocacy. Erik concluded saying that he is really looking forward to seeing the results of this project.

Matthews Mtumbuka, CEO, UbuntuNet Alliance commenced by highlighting that building on the success of AfricaConnect 1&2 the UbuntuNet Alliance will leverage the opportunities in AfricaConnect 3 to help support connection to affordable high speed internet services that are being offered by NRENs in their countries. AfricaConnect 3 will also create more opportunities to train more campus and NREN engineers as well as facilitate NREN staff exchange visits and enhance the sharing of knowledge and best practices in the region.

Under AfricaConnect 3 the Ubuntunet Alliance will hold annual sessions for women at its Ubuntunet Connect conferences over the next 4 years and also support women in Research and Education Networks. Thanks to AfricanConnect 3 its NREN members will continue to participate in the emerging NREN program which increases networking opportunities for researchers and engineers. In terms of Research and Education services AfricanConnect 3 will allow UbuntuNet Alliance to set up its own class-based eInfrastructure for open science as well as adopt rapid deployment of services and use for Research and Education Networking. UbuntuNet Alliance is grateful to the EU for making these opportunities possible through the funding of this flagship project.

Yousef Torman, Co-Managing Director, ASREN commenced by stating that ASREN intends to make the best of opportunities facilitated by participation in AfricaConnect 3. ASREN will continue developing its network and services for its community. ASREN plans to develop its own cloud strategy and deploy cloud services to its communities.

ASREN will promote open science and open access in the region, make use of the European Open Science Lab and coordinate with the African Open Science Platform. ASREN will continue to coordinate with LISENSE and support them in creation of an original platform. ASREN will focus on engagement with user communities to better utilise the infrastructure provided with AfricanConnect 3 including engagement with pan African Universities. ASREN will also coordinate under the leadership of our sister regional networks (WACREN, UbuntuNet Alliance) on capacity building and advocacy.

Following the presentation Paul opened the floor to discussion and questions which were addressed by **Tom Fryer** and **Leila Dekkar** of **GÉANT.**

IEEE Africa Council, Vincent Kaabunga, IEEE Africa Council Chair

Vincent Kaabunga, IEEE Africa Council Chair commenced by explaining the IEEE Africa Council is unit that brings together IEEE sections and subsections across Africa to enable the IEEE members and Sections in the region to collaborate across borders on efforts and initiatives that require joint efforts.

There are over 10,000 IEEE members in Africa, with representation in over 80% of African countries. Currently there are 11 IEEE Sections and 7 subsections in Africa (the SFAC subsection in Tunisia and the Alexandria subsection in Egypt, the other five subsections are under direct supervision of IEEE). Sections are the primary point of contact for members.

The IEEE Council was formed following demand from the African members for an entity that would enable the membership to leverage their collective voice and strengths to work together to achieve common goals that will be challenging goals to do on their own. The Council was approved by the IEEE AGM board in June 2018. Its mission is to enable IEEE Sections and subsections in African regions (Algeria, Botswana, Burkina Faso, Ghana, Kenya, Mauritius, Liberia, Morocco, Nigeria, South Africa, Tanzania, Tunisia, Uganda, Zambia) to collaborate, represent Members in Africa within IEEE and to external stakeholders and provide a mechanism for IEEE engagement in Africa.

The African Council also delivers on the IEEE strategy for Africa which has 3 main pieces;

- Education – Support engineering education and workforce development

- Community Building – Build a sustainable community of IEEE members and Volunteers

- Support Government Policy Development – Support national governments and regional institutions in policy development and increase opportunities for IEEE to serve as a resource for engineering capacity development.

In 2020 the activities aimed at expanding membership value including:

- IEEE Educational Activities – IEEE Continuing Education for Engineering professionals in Africa to expand IEEE's continuing education resources to address the needs of African technical professionals and their employers.

- Sponsoring Conferences including: Africa Virtual Conference Series; IST-Africa 2020; IEEE Power Africa 2020; IEEE ENERGYCON 2020; IEEE Africa IoT Smart Cities Summit

In building the IEEE community in Africa, the IEEE Africa Council is working on expanding the number of sections in the region so that more members have a direct link to the IEEE Network and also to ensure that they have the structures to provide the required services to our members on the ground. IEEE Africa Council is supporting the formation of new sections and subsections, technical chapters and also student branches within universities across Africa. It is also working hard to ensure that volunteers are suitably trained and have the skills and tools that they need to help local members and membership development and pointing them in the direction they need to be looking to ensure that the members are receiving the benefits that IEEE makes available to them.

On the Public Policy Development it is opening up opportunities for our members to participate in the development of public policies that will support the implementation of the Single digital market through our working relationship with Smart Africa Group.

IEEE Africa Council is continuing with UNESCO to expand engineering capacity in Africa Higher Education Institutions by modernizing and reforming computer science programs on the continent. It is also working with AUDA-NEPAD/ WB/ SAA on a new programme.

Vincent concluded by stating that it is very exciting work that IEEE Africa Council is doing and they hope to continue working with participants for their continued ideas on engagement with IEEE.

Scientific Programme

The Scientific Programme incorporated over 95 presenters from public, private, education and research organisations in 21 countries in 31 thematically focused sessions. Themes addressed include eGovernment, eHealth, eInfrastructure, Technology Enhanced Learning and ICT Skills, CyberSecurity, Next Generation Computing, ICT4D, eAgriculture, Content Technologies, Entrepreneurship 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 Programme was designed with complementary tracks to facilitate participants to attend as many sessions as possible. Paper Sessions on Monday 18 May included eInfrastructure, Global Development, Societal Implications of Technology. The Scientific Programme on Tuesday 19 May incorporated eGovernment, Content Technologies, eHealth; Wednesday 20 May - Entrepreneurship, Next Generation Computing, CyberSecurity; Thursday 21 May - Technology-enhanced Learning and Friday 22 May - eAgriculture, Environment Sustainability.

Two interactive workshops focused on Entrepreneurship and Green-energy driven Technology Solutions for Sustainable Small-scale Farming.

There is now a focus on Digitisation in the context of global development, through national programmes supporting Innovation and entrepreneurship and support from foundations and donors. Over the past decade IST-Africa has been tracking and encouraging national governments to support Innovation Spaces in Africa Member States. These innovation spaces range from co-working spaces, incubators, accelerators, community building, capacity building events (hackathons, technical training workshops etc). In Europe after the financial crisis in 2008 the European Commission and national governments have invested significantly in setting up and supporting Digital Innovation Hubs. These DIHs are primarily focused on next generation technologies (AI, robotics, smart manufacturing, IoT, big data etc). They are focused on supporting entrepreneurship, small and medium size enterprises to use NGIs to address Industry 4.0. Supporting entrepreneurship is critical in the context of the changing world dynamics. It is necessary to equip youth, disadvantaged communities, students, graduate students and technically skilled people to look at self employment as an option. Africa has a strategic advantage in terms of youth. It is important to capitalise on this. In Africa Entrepreneurship is supported through Ministries such as Department of Science and Innovation in South Africa and Ministry of Science Technology and Innovation in Uganda. This workshop provided insights into how IEEE is supporting entrepreneurship. **Janati Nakimera, IEEE Uganda Section, Uganda** presented IEEE Entrepreneurship Programme and how IEEE Members in Uganda are being supported. **Kenneth Bintu, Cavendish University Uganda** presented examples of Online Digital Payments that startups in Uganda can leverage. Following the presentation there was an interactive discussion on how entrepreneurship is being supported in different African countries.

Prof Darelle van Greunen of Nelson Mandela University, South Africa organised and moderated the workshop on **Green-energy driven Technology Solutions for Sustainable Small-scale Farming**, which shared results from **Project Africa - On-site air-to-fertilizer mini-plants relegated by sensor-based ICT technology to foster African agriculture** funded under the **LEAP-Agri Project**. Darelle commenced by introducing the LEAP-Agri project and Project Africa. The Leap Agri Project is a long-term EU-Africa research and innovation partnership on Food and Nutrition Security and Sustainable Agriculture (FNSSA). LEAP-Agri is built as an “ERANET Cofund project”, with joined forces from 30 European and African partners (including 24 Funding Agencies from 18 countries) based on shared responsibilities and duties, with the financial support of the European Commission. Projects funded under the LEAP-Agri Project are classified into four categories inclusive of Sustainable Intensification Projects, Agriculture and Food Systems for Nutrition Projects, Expansion and Improvement of Agricultural markets and trade projects and Multisectoral Projects. They aim to support effective trans-national, European-African research and innovation networking and better coordination and synergies between national, international and EU research programmes relevant to food and nutrition security and sustainable agriculture. The primary objective of Project Africa is to develop a green-energy driven technology solution to support the on-site fertiliser production in Africa, providing cost-affordable fertilisers to local small-scale farms. This research will enable the production of liquid fertilisers on demand to be applied directly to the soil, dissolved into irrigation water for foliar application. The research is based on nitrogen fixation with non-thermal plasma technology. Using nothing else than air or N2/O2 (air with additional oxygen) as raw material, NOx is produced through the chemical reaction in plasma which is generated from a variety of renewable energy sources such solar, wind and biomass. The use of sensor technology attached to mobile devices will be explored to enhance the quality of soil and food. Even more, it is meant to provide rural farmers with the necessary knowledge and insights. It has three main goals: 1. Provide a green fertiliser production process for sustainable agriculture; 2. Reduce the yield gap in African agriculture using a cost-affordable fertiliser; 3. Improve farmer’s knowledge and awareness of agriculture by training and online chat centre. The research is focused on:

· Lab scale development of fertilizer mini-plant.

· Development of sensors and ICT enabled process control and provision of information such as soil data, weather conditions, liquid fertilizers and market prices.

· Agronomic/soil research based on liquid fertilizer and local farming situation.

· Implementation of mini-plant in Africa.

· Evaluate sustainability and economic impact.

· Training and education especially to local female and youth.

Waldir Moreira, Fraunhofer AICOS, Portugal shared initial results from Project Africa including IoT Sensing Platform for e-Agriculture in Africa. **Prof. Darelle van Greunen, Nelson Mandela University, South Africa** presented Mobile Applications in Support of Small-scale Crop Farming. Following the presentations there was an interactive discussion in relation to how such technologies can be deployed in different settings in Africa.

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www.ist-africa.org/conference2020/default.asp?page=paper-repository

Conclusion

On behalf of **IST-Africa** Miriam Cunningham thanked the plenary presenters and paper presenters for preparing high quality presentations and to all participants for the level of interactivity and knowledge sharing. Miriam also thanked the the International Programme Committee for blind peer reviewing papers and providing constructive feedback on papers to improve quality.

From our perspective the virtual conference has been highly participatory, which is even more important this year when interacting remotely. This has facilitated an excellent level of knowledge sharing with participation from a broad range of public, private, research, innovation and education, societal and funding organisations from 44 countries around the world. The feedback received from participants to date has been very positive.

Miriam and Paul acknowledged and thanked the various support organisations - Government of Uganda through the Ministry of Science, Technology and Innovation, European Commission, African Union Commission, IEEE Africa Council, IEEE Uganda Section, IEEE Society on Social Implications of Technology and IEEE Humanitarian Activities Committee.

Miriam and Paul wished the participants a lovely weekend and we look forward to seeing you hopefully in face to face mode for in **IST-Africa 2021** in May 2021.

Participants

IST-Africa 2020 Conference attracted over 400 delegates from 44 countries representing policy makers, practitioners, and researchers from leading commercial, government and research organisations around the world.

European, US, South American and Asian Organisations

Organisation	Country
DG Research and Innovation, European Commission	Belgium
University of Antwerp – imec	Belgium
GRENEN Consulting	Denmark
Aalto University	Finland
University of Turku	Finland
University of Freiburg	Germany
IIMC / IST-Africa Institute	Ireland
NAFASI	Ireland
GEANT	Netherlands
University of Olso	Norway
Fraunhofer AICOS	Portugal
Universidad Carlos III de Madrid	Spain
ADES	United Kingdom

Organisation	Country
De Montfort University	United Kingdom
Royal Holloway University of London	United Kingdom
IEEE Humanitarian Activities Committee	Argentina
BUET	Bangladesh
Aligarh Muslim University	India
KSITM	India
IEEE R8 HUAC	Iran
IEEE Humanitarian Activities Committee	United States
Neurological Monitoring Associates, LLC	United States
University of North Texas	United States

African Organisations

Organisation	Country
Universidade Agostinho Neto	Angola
Ministry of Transport and Communications	Botswana
University of Botswana	Botswana
Université Nazi Boni	Burkina Faso
National Agency for Information and Communication Technologies (ANTIC)	Cameroon
University of Dschang / IUT-FV of Bandjoun	Cameroon
University of Kinshasa	Congo (DRC)
City for Scientific Research and Technology Applications	Egypt
ITIDA	Egypt
Technology Innovation and Entrepreneurship Center	Egypt
African Union Commission	Ethiopia
Ministry of Communications and Information Technology	Ethiopia
Accra Technical University	Ghana
Ghana Technology University College	Ghana
Gold Field Mines	Ghana
Valley View University	Ghana
WACREN	Ghana
Africa Nazarene University	Kenya
Dedan Kimathi University of Technology	Kenya
eLimu	Kenya
IEEE Kenya Section	Kenya
IREX	Kenya
Jomo Kenyatta University of Agriculture and Technology	Kenya
Kabarak University	Kenya
KCA University	Kenya
Kenya Airports Authority	Kenya
Kenya Institute for Public Policy Research and Analysis	Kenya
Kenyatta University	Kenya
Kibabii University	Kenya
Kisii University	Kenya
Maseno University	Kenya
Masinde Muliro University of Science and Technology	Kenya

Organisation	Country
Ministry of Education	Kenya
Moi Teaching and Referral Hospital	Kenya
Moi University	Kenya
Murang'a University of Technology	Kenya
Oracle	Kenya
Pioneer University	Kenya
Population Council	Kenya
Riara University	Kenya
SEKU University	Kenya
Strathmore University	Kenya
The Technical University of Kenya	Kenya
United States International University-Africa	Kenya
University of Nairobi	Kenya
Department of Science and Technology	Lesotho
Mzuzu University	Malawi
National Commission for Science and Technology	Malawi
UbuntuNet Alliance for Research and Education Networking	Malawi
Chancellor College - University of Malawi	Malawi
National Computer Board	Mauritius
Abdelmalek Essaadi University	Morocco
Al Akhawayn University	Morocco
IEEE Morocco Section	Morocco
Sidi Mohamed Ben Abdellah University	Morocco
Catholic University of Mozambique (FGTI)	Mozambique
INTIC	Mozambique
International University of Management	Namibia
Namibia University of Science & Technology	Namibia
National Commission on Research,Science and Technology	Namibia
SAIS II	Namibia
University of Namibia	Namibia
University of South Africa	Namibia
American University of Nigeria	Nigeria
Eagle Engineering and Management School	Nigeria
Electro Copier Limited	Nigeria
Farmideas	Nigeria
Federal University of Technology, Akure	Nigeria
Federal University of Technology, Owerri	Nigeria
Goristy Ventures Ltd	Nigeria
IEEE Humanitarian Activities Committee	Nigeria
IEEE Nigeria	Nigeria
IEEE R8 HUAC	Nigeria
Shaybis Nigeria Ltd	Nigeria
University of Agriculture Makurdi	Nigeria
Ministère de l'Enseignement Supérieur de la Recherche	Senegal
Cambridge University Press	South Africa
Central University of Technology	South Africa

Organisation	Country
Code for Change	South Africa
CSIR	South Africa
Department of Science and Innovation	South Africa
Durban University of Technology	South Africa
Nelson Mandela University	South Africa
North West University	South Africa
REEDiSA	South Africa
Sefako Makgatho Health Sciences University	South Africa
Stellenbosch University	South Africa
The University of the Western Cape	South Africa
Tshwane University of Technology	South Africa
University of Fort Hare	South Africa
University of Johannesburg	South Africa
University of Kwazul Natal	South Africa
University of Pretoria	South Africa
University of the Free State	South Africa
Walter Sisulu University	South Africa
XON Systems	South Africa
Ibn Sina University	Sudan
National University Sudan (NUSU)	Sudan
Ministry of Information Communication Technology	Swaziland
Royal Science and Technology Park	Swaziland
Buni Hub, COSTECH	Tanzania
College of Business Education	Tanzania
COSTECH	Tanzania
Dar es salaam University College of Education	Tanzania
Institute of Accountancy	Tanzania
Muhimbili National Hospital	Tanzania
Muhimbili University of Health and Allied Sciences (MUHAS)	Tanzania
Rlabs-Iringa	Tanzania
Sokoine University of Agriculture	Tanzania
University of Dar es Salaam	Tanzania
IEEE R8 HuAC	Tunisia
IEEE Tunisia Section	Tunisia
Ministere de l'Enseignement Superieur et de la Recherche Scientifique	Tunisia
Bugema University	Uganda
Busitema University	Uganda
Cavendish University Uganda	Uganda
Gulu University	Uganda
IEEE Africa Council	Uganda
IEEE Uganda Section	Uganda
Islamic University in Uganda	Uganda
Kabale University	Uganda
Kamapala International University	Uganda
Makerere University	Uganda

Organisation	Country
College of Engineering, Design, Art and Technology (CEDAT), Makerere University	Uganda
Makerere University Business School	Uganda
School of Public Health, Makerere University	Uganda
Mbarara University of Science and Technology	Uganda
Ministry of Science Technology and Innovation	Uganda
RENU	Uganda
UbuntuNet Alliance	Uganda
Uganda Bureau of Statistics	Uganda
Uganda Electricity Generation Company Limited	Uganda
Uganda Martyrs' University	Uganda
Uganda National Council for Science & Technology	Uganda
Uganda Technology Management University	Uganda
Woxsan City Project	Uganda
CBU	Zambia
EIZ	Zambia
Kwame Nkrumah University	Zambia
University of Zambia	Zambia
Zambia Airports	Zambia
Zesco	Zambia
Midlands State University	Zimbabwe
SolidarMed	Zimbabwe
UNISA	Zimbabwe
Vanstam	Zimbabwe
ZSAES	Zimbabwe