Global Forum — Shaping the future
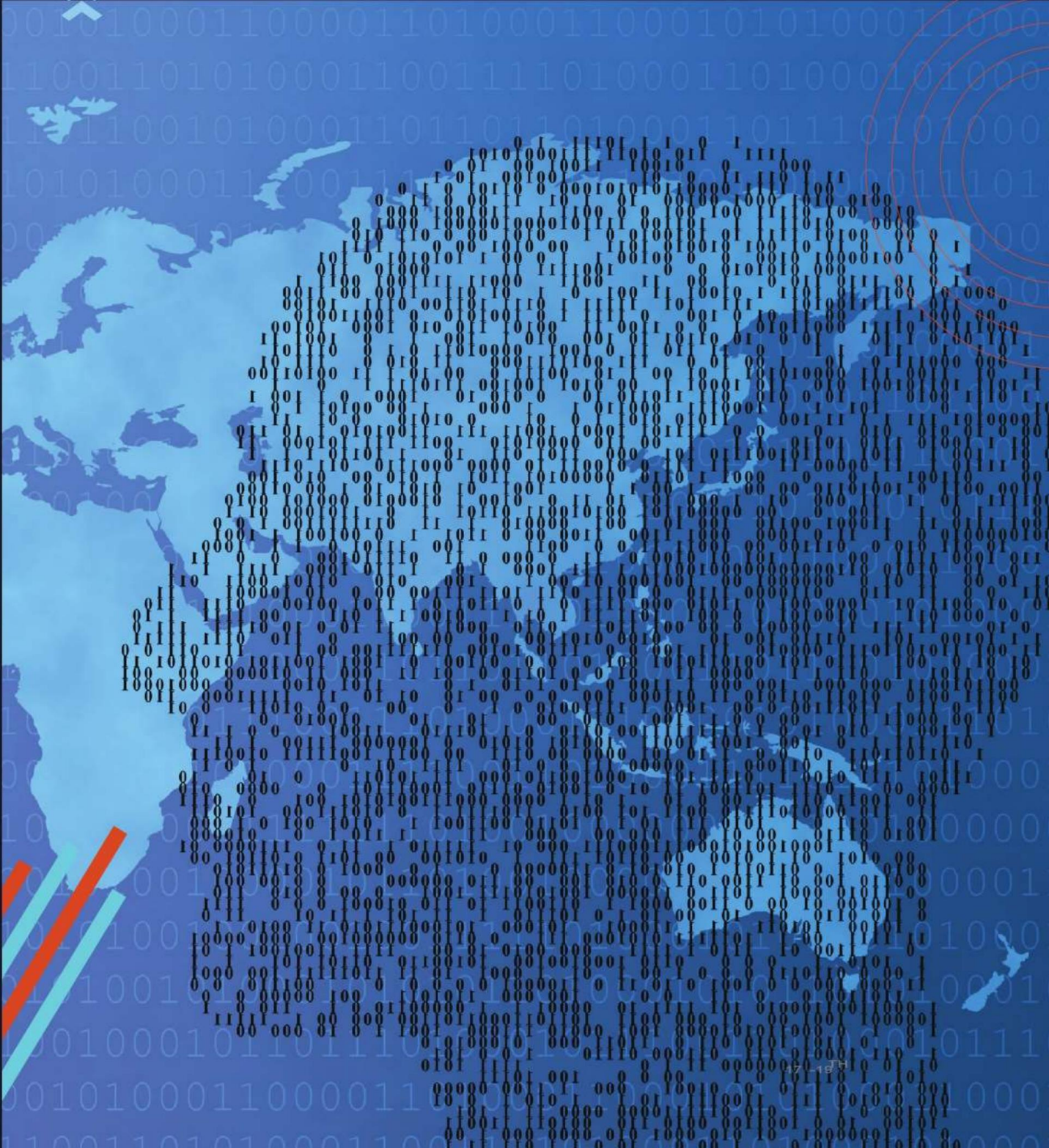
WATER AND HUMANITY

GLOBAL FORUM:
TECHNOLOGY, SUSTAINABILITY AND HUMANITY

2022

17-19TH OCTOBER
GLOBAL FORUM AND WATER & HUMANITY

The 29th edition of the Global Forum Shaping the Future took place from 17 to 19 October at the W Hotel in Muscat, Oman. This year's substantive orientation represented an approach combining technology, sustainability and humanity.

For the very first time, Global Forum Shaping the Future took place in the Middle East. The internationally renowned think-tank dedicated to addressing main challenges affecting our today's digital society has been acting as a catalyst for new and innovative thinking since 1992. Against this backdrop, the Sultanate of Oman, with Muscat being Arab Digital Capital for 2022, was a perfect place for this event. On the occasion, the Global Forum benefited from co-arrangements with Water & Humanity, a dynamic international network arranged by a multi-stakeholder platform hosted by Oman.

Within 3 days, more than 250 experts, thought leaders, business representatives and decision makers from 40 countries gathered in Muscat to explore the challenges of digital transformation and to confront their ideas and visions on solutions for a smarter, more sustainable, more liveable and resilient world.

The Global Forum and Water & Humanity 2022 has been organized in strategic partnership with the Oman Society for Petroleum Services (OPAL) and we can hardly put into words how grateful we are for this excellent collaboration and the valuable help provided by OPAL.

Global Forum & Water and Humanity had a unique and challenging format by bringing together experts from different backgrounds and perspectives. We would like to address our sincere thanks to all of them for the very substantial, constructive and informative contributions. We were very pleased to also have the opportunity to meet and talk informally and hope that there will be many opportunities to meet again in the near future.

Kindly note that all slides, speaker profiles, videos, photos and other documentation are available for download on the website http://globalforum.items-int.com.

We hope you enjoyed the conference as much as we enjoyed welcoming you in Muscat and are looking forward to meeting you at the Global Forum 2023.

Sylviane Toporkoff
President Global Forum
Shaping the Future Association

Ingrid Andersson
Vice- President Global Forum
Shaping the Future Association

PROGRAMME

Welcome Addresses

1ˢᵗ Day

- Chair: **Sylviane Toporkoff**, Founder & President, Global Forum / Shaping the Future, France
- Moderator: **Ingrid Andersson**, Vice-President Global Forum, Senior Expert, IKED, Sweden
- **Abdul Rahman Al Yahyaei**, Chief Executive Officer, OPAL, Oman
- **Muna Luqman**, Founder, Food4Humanity and Co-Founder, Women in Solidarity Network, Yemen
- **HE Stella Kloth**, Ambassador of the Kingdom of the Netherlands
- **HE Thomas Oertle**, Ambassador of Switzerland

Opening Session: Future Visions

1ˢᵗ Day

- Chair: **Abdul Rahman Al Yahyaei**, Chief Executive Officer, OPAL, Oman
- Moderator: **Daniel Van Lerberghe**, Founder & Director, InnoGage, Estonia
- **H.E. Dr. Ali Al Shidhani**, Undersecretary for Communications and Information Technology at Ministry of Transport, Communications and Information Technology (MTCIT), Oman
- **Craig Wright**, Chief Scientist, nChain, United-Kingdom
  Bitcoin as Electronic Cash and Decentralisation
- **Gilles Babinet**, Co-president of the National Digital Council; Digital Champion, representing France at the European Commission for digital matters, France
- **Jean-Yves Le Gall**, Former President CNES (French Space Agency), ESA Council (European Space Agency) and Arianespace, France
  Responding to Crises - The Fundamental Role of Research and Innovation

S1: Wireless and Wireline: Evolving Infrastructures & Applications

1ˢᵗ Day

- Chair: **John Giusti**, Chief Regulatory Officer, GSMA Association, United Kingdom
- Moderator: **Hervé Rannou**, President Items International, France
- **Giovanna Zavettieri**, Geography Researcher, University of Rome "Tor Vergata", Italy
  GIS of Place, GIS of People. Pervasive Technologies and New Geographies of Mobility and Production
- **Jean-Yves Le Gall**, Former President CNES (French Space Agency), ESA Council (European Space Agency) and Arianespace, France
  The Global Stakes of Space Policy
- **Nayef Alawadhi**, Senior Technical Support and Operation Engineer, CITRA, Kuwait
- **Yaseen Al-Mulla**, Director, Remote Sensing & Geographic Information System Research Center, SQU, Oman
  IoT in Remote Sensing

Keynote Session: Digital and Human Worlds

1ˢᵗ Day

- Chair: **Alexandre Hedjazi**, Senior Global Governance & Urban Sustainability Transition Expert, University of Geneva, Switzerland
  Digital and Human Worlds
- **Alfredo Ronchi**, Secretary General, EC MEDICI Framework, Italy
  ArtCast4D Project
- **Armen Orujyan**, Founding CEO, Foundation for Armenian Science and Technology (FAST)
  Breakthrough Innovations and their Impact on Human Life
- **Michael Stankosky**, Professor, Author, Scholar, Lecturer, and Editor-Emeritus, George Washington University, USA
  Cultural Anthropology of Digitalization & Globalization
- **Walid El Abed**, Founder & CEO, Global Data Excellence, Switzerland
  Collaboration Between the Digital and Human Worlds: Importance of a Human Centered Approach

S2: Managing Disruptive Digital Technologies

- Chair: **Fatma Al Mukhaini**, Robotic Process Automation Developer, Petroleum Development Oman (PDO), Oman
  Working with Digital Work Force

- Moderator: **Michael Stankosky**, Professor, Author, Scholar, Lecturer, and Editor-Emeritus, George Washington University, USA

- **Craig Wright**, Chief Scientist, nChain, United-Kingdom
  Bitcoin, IPv6, and the Future of the Internet

- **Daniele Tumietto**, Management, Business and Tax Consultant & Adjunct Professor, Politecnico di Milano (PoliMi), Link Campus & O.M. Beketov University, Italy
  Industrial IOT and SMEs

- **Halah Al Zadjali**, Senior Executive of Governance, Policies & Governance Directorate, MTCIT, Oman
  The Promise and Pitfalls of Disruptive Digital Technologies

- **Latif Ladid**, Chair IPV6 FORUM-UL, IEEE ComSoc IoT and Chair, Research Fellow University of Luxemburg, Luxemburg
  IPv6 – Based Blockchain

S3: Designing Ethics for Artificial Intelligence and Effective Governance in a Complex World

- Chair: **Rasha Al Abdali**, Assistant Director General of Policies and Governance, Ministry of Transport, Communications and Information Technology (MTCIT), Oman
  Future Landscape for AI Governance

- Moderator: **Geneviève Fieux-Castagnet**, Ethics Officer, SNCF Group, France
  Ethics and Regulation For AI

  Alessandro Guarino, Founder and CEO, StAG, Italy
  The European approach to AI regulation and its impact on global cyberspace. Could doing good in fact hurt Europe?

- **Fahd Batayneh**, Senior Manager Stakeholder Engagement, Middle East ICANN, Jordan
  ICANN, Domain Names, and Legislation

- **Gilles Babinet**, Co-president of the National Digital Council; Digital Champion, representing France at the European Commission for digital matters, France

- **Sarah Zhao,Partner**, Rimon Law, USA/China
  New Development of China Cybersecurity Rules

S4: Public Health and Prevention/ Digital Health Opportunities

- Chair: **Fahad Al Zadjali**, Associate Professor and Vice Dean of Research, Sultan Qaboos University (SQU), Oman
  Change in Healthcare

- Moderator: **Mariane Cimino**, CEO, Hoa-Ora; Consultant in Digital Health Transformation (ITG), France
  eHealth Solutions

- **Amir Johri**, Environmental/ Public Health Professional, Ministry of Health, Oman
  Public Health & Digitalization

- **Gunnar Norstedt**, Professor, Karolinska Institute, Sweden
  AI & Disease Prevention

- **Hashil Al Hatmi**, Health Psychologist, Royal Hospital, Oman
  Digital Health & Behaviour Change

- **Muhammad Ashkanan**i, Regional Director, W3C Gulf Cooperation Council, Kuwait
  The Challenges of Digital Accessibility in the Arab Region

- **Niki V. Santo**, Co-Founder/CEO of Swaza – Oxygen Nanotechnology

Keynote Opening Session Day 2

2ⁿᵈ Day

- Moderator: **Thomas Andersson**, CEO, Organisation for Quality and Innovation Strategies (Qualies), President, Water & Humanity, Oman
- **Ajay Shukla**, President World Class Scholars, UAE Sustainability & Technology Enabled Education
- **Saif Al Shaksy**, President, Oman Water Society, Oman
- **Stéphane Grumbach**, Senior Scientist, INRIA, France

S5: Sustainable Smart Cities, Regions & Communities & Tech for Good

2ⁿᵈ Day

- Moderator: **Hugo Kerschot**, Founder & Managing Director, Is- Practice, Belgium
  DUET – Digital Urban European Twins or How to Model Sustainable Cities
- **Alexandre Hedjazi**, Senior Global Governance & Urban Sustainability Transition Expert, University of Geneva, Switzerland
  From Multi-faceted Crisis to Co-benefit production, Lessons from Post-Covid recovery in Geneva
- **Anixi Antonakoudi**, Innovation Management, Innovation & Entrepreneurship Office, The Cyprus Institute, Cyprus
  Building Resilience of Natural Infrastructures & Communities Through Technology, Innovation and Entrepreneurship
- **Daniel Van Lerberghe**, Director & Co-founder, InnoGage, Estonia
  Enhancing Culture & Fighting Climate Change in Urban Environments
- **Haitham Al Rawahi**, Architect and Urban Planner, Ministry of Housing and Urban Planning, Oman
  Sustainable Smart Cities
- **Marc Watum**, Co-founder, Vertex Ecosystem, South Africa
  Sustainable Smart Cities and Their Prevalence, Are Sustainable Smart, Cognitive Cities Objectively Desirable?
- **Nitya Karmakar**, Professor School of Business, Le Cordon Bleu, Australia
  Role of ICT in Helping Sustainable Development and Conservation During COVID-19 Pandemic

S6: Digitalisation in Energy Transition & Water Dynamics

2ⁿᵈ Day

- Moderator: **Thomas Andersson**, CEO, Organisation for Quality and Innovation Strategies (Qualies), President, Water & Humanity, Oman
- **Buthaina Al Wahibi**, Research, Development and Innovation Director, Oman Wastewater Service company, Oman
  Energy Transition and Water Sustainability
- **Gérald Santucci**, Ambassador INTEROP-VLab, France
  IoT and the Smart Water Management Challenge
- **Ghalib Al Maamari**, VP Low Carbon Molecules, OQ Alternative Energy, Oman
  Digitalization in Energy Transition and Water Management Applications from the Energy Sector
- **Khalfan Al Burtamani**, Nama Group, Oman
  Nama Group Advanced Metering Infrastructure Rollout Project
- **Mohammed Al Mahrouqi**, General Manager of Anwar Almajed United at National Energy Centre, Oman
- **Paris Kokorotsikos**, President & CEO, Euroconsultants SA, Greece
  Net Zero Strategies and roadmap for achieving CO_2 emissions at water / waste companies - A Greek case study that could serve as Generic example

S7: Cross-border Water Issues and Diplomacy

2ⁿᵈ Day

- Moderator: **Stéphane Grumbach**, Senior Scientist, INRIA, France

- **Etienne Monbaron**, Head of Hydrology & Hydraulics Sector, Geneva State Water Protection Agency, Switzerland
  Tools for Transboundary Management of Water and Water Uses in the Greater Geneva

- **Fariz Ismailzade**, Executive Vice Rector, ADA University, Azerbaijan

- **Jean-Eric Aubert**, President, Université Internationale de la Mer, President of the French Foresight Society, France
  Cross Border Waters: Lessons from Success Stories

- **Majid Labbaf**, Professor and UNESCO Chair, University of Nizwa, Oman
  Water War and Peace in the Middle East

- **Muna Luqman**, Founder of the organisation Food4Humanity and Co-Founder of the Women in Solidarity Network, Yemen
  Community Based Approaches to Water Conflict Mitigation

S8: Framing Tools for Future Cross-Border Collaboration

2ⁿᵈ Day

- Moderator: **Sanith de S. Wijeyeratne**, CEO, Climate and Conservation Consortium, Sri Lanka
  Framing Tools for Future Cross Border Collaboration

- **Alexandre Hedjazi**, Senior Global Governance & Urban Sustainability Transition Expert, University of Geneva, Switzerland
  Infrastructure Integration as Cross-boundary

- **Chloe Treger**, Head of Research & Analysis, Dark Matter Labs, United-Kingdom
  Trees AI: Establishes Nature as an Investable Part of Urban Infrastructure

- **Marcela Brugnach**, Research Professor, bc3 Bilbao, Spain
  The Grand Challenge of Getting Useful Knowledge Under A Changing Climate

- **Roberto Ordonez**, Managing Partner & Founder, Alkimya Catalyst, UAE

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S9: Women in Tech and Women in Water

2ⁿᵈ Day

- Moderator: **Dalia A. Badawi**, Co-Founder, Save Faces Foundation, Innovation Luminary, Futurist, Egypt

- **Aasia Saail Khan**, Director, Schazoo Zaka, Women's Business Development Expert, Pakistan
  Women in E-Commerce

- **Hamed Al-Dhuhli**, Research Director, Ministry of Agriculture, Fisheries and Water Resources, Oman
  Women in Agricultural Research

- **Marwa al Madouri**, Senior Planning Engineer, Oman Water and Wastewater Services Company
  Women in Water

- **Mariane Cimino**, CEO, Hoa-Ora; Consultant in Digital Health Transformation (ITG), France
  Women in Tech and Women in Water

S10: Smart vs Nature Based Solutions

2ⁿᵈ Day

- Moderator: **Marc Watum**, CEO, Vertex Ecosystems, South Africa

- **Andile Khoza**, CEO, Metsi, South Africa
  People, Infrastructure, and Technology

- **Bart Wubben**, Founder and CEO, Muscat Landscaping, Oman
  Smart Solutions in Natural Landscapes

- **Etienne Monbaron**, Head of Hydrology & Hydraulics Sector, Geneva State Water Protection Agency, Switzerland
  Geneva – PAV River Project: River Restoration as a Tool for Industrial Area Requalification

- **Hassan Al Raisi**, Urban Planner, Ministry of Housing and Urban Planning, Oman

- **José Miguel Lameiras**, Prof. University of Porto, Researcher, CIBIO, Portugal
  Science and Knowledge in the Development of NBS

- **Rowa Elzain**, Managing Coordinator & Co-Founder, MCTspaceLab, Oman
  Role of Neighborhoods in Nature-Based-Solutions

S11: Digitalisation and Innovation for Heritage & Culture

2ⁿᵈ Day

- Moderator**: Giovanna Zavettieri**, Geography Researcher, University of Rome "Tor Vergata", Italy
  Digitalisation and Innovation for Heritage & Culture

- **Abdullah Al Ghafri**, Professor of the UNESCO Chair on Aflaj Studies-Archaeohydrology, University of Nizwa, Oman
  Aflaj Museum: Design and Concepts

- **Guido Ferilli**, Professor, Cultural Economics, IULM, Milan, Italy
  Digitalisation and Innovation for Heritage & Culture

- **Husni Al Abri**, Repr. Misfat al Abriyeen Village, UNWTO best tourism village in the world, Oman
  Misfat Al Abreen Village / Video Presentation Misfat al Abreen

- **Valentina Vassallo**, 4CH' Project to Design a European Competence Centre for the Conservation of Cultural Heritage, Cyprus
  Towards a Competence Centre for the Conservation, Preservation and Valorization of Cultural Heritage

Youth, Education and Awareness-Creation: Valuing Water

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3 r d D a y

- Moderator: **Ingrid Andersson**, Vice-President Global Forum, Senior Expert IKED, Sweden
  Engaging Children and Youth Activity was undertaken under "The Future of Water and Humanity"

- **Azimeh Jafari**, Researcher, Monash University, Malaysia
  Workshops Valuing Water: Engaging Children and Youth

- **Guido Ferilli**, Professor, IULM, Milan, Italy

- **Juliane Schillinger**, Research Group Coordinator, World Youth Parliament for Water, The Netherlands
  Making Waves for Youth-Inclusive Global Development

- **Marc Watum**, CEO, Vertex Ecosystems, South Africa & Andile Khoza, CEO, Metsi, South Africa
  Water Insecurity in Sub-Saharan Africa

- **Neeshad Shafi**, Executive Director, Arab Youth Climate Movement, Qatar

- **Tilly Stroo**, Founder, Wavemakers United, The Netherlands
  Video Introduction; Wavemakers

Visualising and Mobilising Action Defending the Global Commons

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3 r d D a y

- Moderator: **Jean-Eric Aubert**, President, Université Internationale de la Mer, President of the French Foresight Society, France

- **Ali Al Maktoum**, Director of Water Research Centre, SQU, Oman

- **José Miguel Lameiras**, Professor, University of Porto, Portugal
  Climate Resilience: Key Actions

- **Juha Alatalo**, Professor, Qatar University, Qatar
  Climate Change and Biodiversity Crisis: Where Do We Stand and The Way Forward?

- **Olof Lindén**, Professor, Linnaeus University, Senior Advisor, World Maritime University, Sweden

- **Sanith de S. Wijeyeratne**, CEO, Climate and Conservation Consortium, Sri Lanka
  Protecting our Biodiveristy and Forests

The Role of Business and Stakeholder Engagement

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3 r d D a y

- Chair: **Sven Oehme**, President & CEO, European-American Business Organization, USA

- **Aasia Saail Khan**, Director, Schazoo Zaka, Women's business development expert, Pakistan

- **Américo Mateus**, Director, Transdisciplinary Research Center for Entrepreneurship & Innovation Ecosystems (TRIE), Portugal
  From Co-Creation to Co-Nature'ing

- **Pierre De Geest**, Senior Geologist & Researcher, DEME Group, Belgium
  Dredging Environmental Marine Engineering

- **Wilfred Hoffman**, CEO Axionomic, Co-founder Ambrac, The Netherlands
  Convergence of Technologies

A Comprehensive Approach to Mangroves and Wetlands Development

3ʳᵈ Day

- Moderator: **Olof Lindén**, Professor, World Maritime University, Sweden

- **Anna Grichting**, Senior Fellow University of Vermont, United States and Switzerland

- **Badar Al Busaidi**, Environmental System Specialist, Environmental Authority, Oman
  Mangrove Project in Oman

- **François De Keuleneer**, Environmental Director, DEME Group, Belgium
  A Vision for Oman Wetland Development

- **Rahma Suleiman Al Nadhairia**, Environmental Management Expert, Environmental Authority, Oman
  Green Environment Ideas

- **Wafa Al Maamari**, CEO, Sustainability for Environmental Services & Consulting, Associate Expert, Qualies, Oman
  Planting in Oman with Water Saving Technology

Circularity and Unconventional Water Resources

3ʳᵈ Day

- Moderator: **Américo Mateus**, Director, Transdisciplinary Research Center for Entrepreneurship & Innovation Ecosystems (TRIE), Portugal

- **Alireza Bazargan**, Professor, University of Tehran, Consultant, UNDP, Iran

- **Ekkehard Holzbecher**, Professor, Gutech, Oman

- **Patricia González**, Country Manager, H2O Biofouling Solutions, Spain
  Finding a Balance to Protect the Environment from the Industry and at the Same Time Protect the Industry from the Environment

- **Rajamohan Natarajan**, Professor, Sohar University, Oman
  Challenges in Oman

- **Wilfried Hoffman**, CEO Axionomic, Co-founder Ambrac, The Netherlands

Water, Food and Energy Nexus

3ʳᵈ Day

- Moderator: **Anna Grichting**, Senior Fellow University of Vermont, United States and Switzerland

- **Bahram Taheri**, Director at Nexus & HSE Center, Amirkabir University Technology Park, Iran

- **Hamed Al Dhuhli**, Research Director, Ministry of Agriculture, Fisheries and Water Resources, Oman
  Water Management Challenges for Agricultural Production in Oman

- **Jumana Saleh**, Professor, Sultan Qaboos University, Oman

- **Muna Luqman**, Founder of the organisation Food4Humanity and Co-Founder of the Women in Solidarity Network, Yemen
  Community Based Approaches to Water Conflict Mitigation; Video

- **Talal Al Awadhi**, Head of Geography Department, Sultan Qaboos University, Oman

⋙ The Global Roadmap

2022   Global Forum on Technology, Sustainability & Humanity – Muscat, Oman

2019   The Roll Out of Digital Transformation - Facing Innovation, Simulation & Realities – Angers, France

2018   The Digital Transformation in the Broader Ecosystem – Copenhagen, Denmark

2017   Digitalization - Intelligent Pathways – Winnipeg, Canada

2016   Digitalization – The Global Transformation – Eindhoven, Netherlands

2015   Digitalization - From Disruption to Sustainability – Oulu, Finland

2014   A Connected Age – Geneva, Switzerland

2013   Driving the Digital Future – Trieste, Italy

2012   Shaping a Connected Digital Future – Stockholm, Sweden

2011   Vision for the Digital Future – Brussels, Belgium

2010   ICT for an Empowered Society – Washington DC, USA

2009   ICT & The Future of Internet – Bucharest, Romania

2008   Collaborative Convergence – Athens, Greece

2007   Global Convergence 2.0 – Venice, Italy

2006   The Digital Convergence – Paris, France

2005   The Broad Convergence – Act II – Brussels, Belgium

2004   The Broad Convergence – Malmö, Sweden

2003   Connecting Businesses & Communities – Rome, Italy

2002   The Promise of Broadband Services – Washington DC, USA

2001   Expanding the Global e-Society – Newcastle, United Kingdom

2000   Towards a Global e-Society – Sophia-Antipolis, France

1999   New Satellite and Terrestrial Applications – Sophia-Antipolis, France

1998   Networked Communities – French Senate, Paris, France

1997   Smart Communities Forum – Economic Development in a Global Information Society – Sophia-Antipolis, France / Rome, Italy

1996   Smart Communities Forum - US Tour of cities and regions – New York / Washington / San Francisco / Silicon Valley, USA

1995   The Second Europe / Japan Forum on Communications – Kyoto, Japan

1994   Europe / Japan Forum on Cooperation and Competition in Communications – Paris, France

1993   Europe / United States Meetings on Cooperation and Competition in the Field of Communications – Rome, Italy

1992   Europe / United States Meetings on Cooperation and Competition in Telecommunications – Washington / New York, USA

📶 **17 October 2022**

Welcome Addresses

1ˢᵗ Day

Ingrid Andersson
Moderator
Vice-President Global Forum,
Director, IKED, Sweden

Muna Luqman
Founder & Co Founder,
Food4Humanity & Women in
Solidarity Network, Yemen

H.E. Thomas Oertle
Ambassdor of Switzerland

Sylviane Toporkoff
Chair
Founder & President, Global
Forum / Shaping the Future,
France

AbdulRahman Al
Yahyaei
CEO, OPAL, Oman
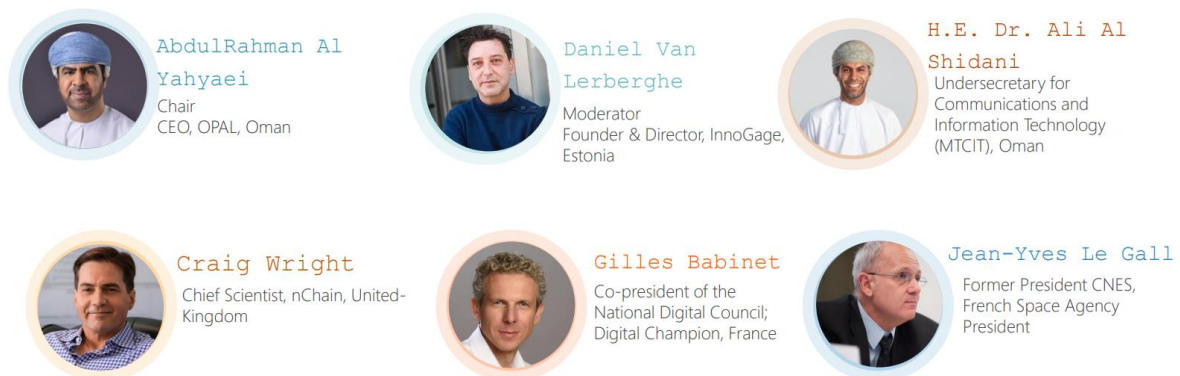
H.E. Stella Kloth
Ambassador of The Kingdom
of the Netherlands

The conference has been opened on 17ᵗʰ October, Omani Womens Day, with welcome addresses given by **HE Dr Ali Al Shidani**, Undersecretary of the Ministry of Transport, Communications and Information Technology, and **Abdul Rahman Al Yahyaey**, CEO OPAL, as well as **HE Stella Kloth**, Ambassador of the Kingdom of the Netherlands, and **HE Thomas Oertle**, Ambassador of Switzerland, and **Muna Luqman**, Founder of Food4Humanity and Co-founder of the Women in Solidarity Network.

Opening Session: Future Visions

1ˢᵗ Day

AbdulRahman Al
Yahyaei
Chair
CEO, OPAL, Oman

Daniel Van
Lerberghe
Moderator
Founder & Director, InnoGage,
Estonia

H.E. Dr. Ali Al
Shidani
Undersecretary for
Communications and
Information Technology
(MTCIT), Oman

Craig Wright
Chief Scientist, nChain, United-Kingdom

Gilles Babinet
Co-president of the
National Digital Council;
Digital Champion, France

Jean-Yves Le Gall
Former President CNES,
French Space Agency
President

Moderated by **Daniel Van Lerberghe**, the Opening Session was structured as a dialogue. It brought together multi-disciplinary presentations on visions of the role of technology in human endeavour, recognizing the need to place technology in the context of solving the great problems facing all societies today.

Abdul Rahman Al Yahyaei, CEO of the Oman Society for Petroleum Services (OPAL), welcomed the participants and briefly introduced the state of the art in Oman in terms of Information and Communication Technologies.

H.E. Dr. Ali Al Shidhani, Undersecretary for Communications and Information Technology at the Ministry of Transport, Communications, and Information Technology, briefly outlined the national digital strategy of the Sultanate of Oman. Oman's Vision 2040 is an inspirational vision driving the country through the next 20 years. Muscat has been nominated Arab Digital Capital for 2022. Oman is welcoming new technologies to be tested and developed. Climate change is a serious subject for Oman as well as carbon neutrality. Oman relies on ICT to increase efficiency in all the other economic sectors and foster the development of a digital industry in the coming years. Oman wants to be a digital testbed for new technologies. Oman is emerging as a leading digital country in the Arab World and beyond.

Craig Wright, Chief Scientist at nChain, explained that Bitcoin is far from being an anarchic system. Bitcoin is a global decentralised electronic cash system that is very security-oriented with regard to the transmission of private data and documents. Bitcoin aims at decreasing cash transfer fees, while at the same time increasing transactions worldwide. The Bitcoin system strengthens both the fight against criminal activities and improved security. Bitcoin is about increasing security, multiplying secure transactions and reducing cost.

Gilles Babinet, Co-president of the National Digital Council and French Digital Champion, compared the U.S. model and the EU model with regards to innovation and regulation. Regulation needs to support entrepreneurship. We need to understand how things work in the whole digital ecosystem. Innovation is composed of different systems, but it is also a matter of culture. Innovation is a complex ecosystem based on culture and heterogenous actors. Regulation needs to take that into account.

Jean-Yves Le Gall, Former President of the French Space Agency CNES, addressed the question of what research and innovation can bring to management of uncertainty? Managing uncertainty is crucial for our connected societies. ICT and innovation are at the forefront of providing accurate data to manage crisis and foreseen uncertainty. Research is key for innovation to develop. Uncertainty is present in innovation ecosystems and needs to be measured and better apprehend.

Conclusions: We must find ways for governments to develop policies regarding the role of technology that protect privacy while stimulating innovations that contribute to problem solving.

S1: Wireless and Wireline: Evolving Infrastructures & Applications

1ˢᵗ Day

John Giusti
Chair: Chief Regulatory Officer, GSMA Association, United Kingdom

Hervé Rannou
Moderator: President Items International, France

Ali Al Hashmi
General Manager, Networks at Omantel, Oman

Giovanna Zavettieri
Geography Researcher, University of Rome "Tor Vergata", Italy

Jean-Yves Le Gall
Former President CNES, French Space Agency

Nayef Alawadhi
Vic regional manager and Evangelist, W3C GCC office, Kuwait

Yaseen Al-Mulla
Director, Remote Sensing & Geographic Information System Research Center, SQU,

The session provided a multi-disciplinary perspective on emergent wireless and wireline applications. As Chief Regulatory Officer for the GSMA Association and President of the GSMA Mobile for Development Foundation, **John Giusti**, chairing the session, underlined that 49% of the world's population are connected to mobile broadband. Thus, one half of the world population is not

using mobile broadband connectivity at all. Less than 10% of the population lives outside of mobile broadband coverage. The biggest issues are not infrastructure, infrastructure investment or coverage, but barriers to usage, such as digital literacy, relevant content in local languages or affordability. The GSMA Mobile for Development Foundation was created for the purpose of developing and engaging in projects that utilise mobile communications to support underserved and vulnerable populations. It brings together mobile operators, donors and the international development community to harness the power of mobile to achieve social impact and to broaden digital and financial inclusion.

Moderator Hervé Rannou, President of Items International, France set the scene by giving some background information. Regarding the worldwide Internet subscription (fibre and mobile) three blocks can be distinguished: a first block of hyper-connected countries gathering Western Countries and the richest countries in Asia, i.e. China, Japan and Singapore; a second block is made of Latin Americas countries, Middle-East and North Africa and rich Sub-Saharan Africa countries; a third block is gathering poorer African countries. Economy, independency and societal challenges are closely related to mobility and energy use cases, such as connected cars, GIS services, smart grids, low carbon emission, multimodal mobility and power supply.

Using the example of Oman, **Giovanna Zavettieri**, Geography Researcher at "Tor Vergata" University, questioned whether putting GIS technology at the service of tourism mobility through interactive tools and GIS based applications would be useful for mobility and tourism purposes. A prototype of an app has been created - a dynamic platform, mediated by ICT and GIS technologies to support the exchange of information on tourism activities through information filtering. However, the underlying 5G revolution requires widespread outdoor and indoor coverage. Wireless infrastructures need be deployed in places with excellent 5G coverage allowing to develop not only coverage and data capacity, but also innovative vertical services. The advantage of the IoT is to encourage a spread of tourists throughout the Sultanate and not only in the country's well-established tourist destinations. Personalized or themed itineraries open the country to new modes of participatory tourism. A dedicated app fosters a continuous process of co-creating territorial identities. Nature, culture, landscape become the subjects of memorable tourism experiences to be told, suggested and preserved. There are non-invasive tools for 5G deployment where there are places of cultural interest to be preserved, such as microcoverage systems. 5G is the push we need to take a decisive step into the future.

Jean-Yves Le Gall, Former President of the French Space Agency CNES, outlined the global stakes of space policy. Humanity can look back at 65 years in space. The period between 1957-2010 was a period of competition then stability, characterised by the Sputnik shock and the race to the Moon, science, Earth observation and telecommunications, not to forget the International Space Station. Since 2010, a new era has dawned, characterised by miniaturization and digital, private initiatives and an increasing number of players. The global landscape has changed, with the big legacy players being U.S., China, Europe, Japan, India, and Russia (Ukraine). Traditional agencies are adapting but new agencies are different. Initiatives in all directions are being carried out (private funding, launchers, constellations, and applications). The global stakes of space policy today are vital access to space, the weight of "big projects", and the potential of applications.

Yaseen Ahmed Al-Mulla, Director, Remote Sensing and GIS Research Center at the Sultan Qaboos University, discussed IoT in remote sensing.

Keynote Session: Digital and Human Worlds

1ˢᵗ Day

Alfredo Ronchi
Secretary General, EC MEDICI
Framework, Italy

Michael Stankosky
Professor
George Washington
University, USA

Alexandre Hedjazi
Chair
Senior Global Governance &
Urban Sustainability Transition
Expert, University of Geneva,
Switzerland

Armen Orujyan
Founding CEO, Foundation
for Armenian Science and
Technology (FAST), Armenia

Walid El Abed
Founder & CEO, Global Data
Excellence, Switzerland

The session's chair, **Alexandre Hedjazi**, Senior Global Governance & Urban Sustainability Transition Expert at the University of Geneva, introduced the topic by highlighting the three challenges of urban data, which are cost (systematic, reliable, complete and timely data is costly), time (time to market vs. obsolescence), and scale (for some types of data, e.g. housing, it is difficult to have enough resolution to appropriately inform policies). Involving citizens can be a solution to address these challenges: Citizens gather and package information through apps and transmit it to institutional databases. Such an approach has the potential for cost-cutting, redundancy, scale, and flexibility. Successful experiences have been made in science-based projects, less so in collecting urban data. It represents high potential for maintenance of urban infrastructure, including housing. However, the strongest incentive here is impact: Citizens drop out when they see the data they input has no impact. Localities drop out when they see citizens do not care or report enough.

Alfredo Ronchi, Secretary General of the EC MEDICI Framework, presented the project "Artcast4D: Unleashing creativity!", a Research and Innovation Action, funded by the European Commission under the Horizon Europe Programme, that aims to design, develop, and test a global framework for Cultural Creative Industries in Europe for producing efficient, cost-effective software and hardware, multi-user, multi-site, multi-platform non-invasive immersive and interactive users' experiences. Artcast4D aims to approach culture as an emotionally engaging "communicative experience" in public spaces, to test its potential on four different pilots and four different scenarios. Pilots will showcase the potential of immersive experiences to boost CCIs as a driver of innovation and competitiveness using impact assessment and measurement techniques.

Armen Orujyan, Founding CEO of the Foundation for Armenian Science and Technology (FAST) addressed breakthrough innovations and their impact on human life. He started with a travel through the different eras in history: The nomadic hunter-gatherers, the Metal Ages, the first Machine Age, the beginnings of the quantity production, the full flowering of the Steam Age, the rapid spread of internal combustion engine, the Electrical and Electronic Age, the Information or Digital Age, up to the Age of Deliberate Evolution. He also reminded the fragility of humans, who can't live more than 3 minutes without air, 3 days without water, and 3 weeks without food. Humans need 21% oxygen concentration in the air to breath and altitudes under 4,500 meters. Human body temperature is 36.6°C; body temperatures of 42°C or below 21°C are rapidly lethal. Humans must have water, food and shelter to survive. If any one of these basic needs is not met, humans cannot survive. With regards to the evolution of innovation, early technologies secured basic needs, later technologies addressed building redundancies; future technologies will relate to capacity building.

Michael Stankosky, Professor at the George Washington University, talked about cultural anthropology of digitalization and globalization. The 21st Century is one of momentous change. It has two defining elements: accelerated advances in digitalization; and the spread of globalization in just about every aspect of our lives – both have changed in ways we are still trying to fully understand; let alone manage and govern. We need an entire new lens to do this. The world went from a bi-polar competition to one with multiple axes. Digitalization is the glue that holds globalization together. Hence, Cultural Anthropology should be that new lens. Unfortunately, we are all humans with such complex minds that we don't even fully understand ourselves, let alone each other. Anthropology is an underestimated and underused discipline. Some people even suggested to rename Artificial Intelligence to Anthropological Intelligence. Imagine the depth, or lack of it, of cultural understanding by the designers and programmers who create the algorithms and code for AI. We need to reconceptualize/reprogram ourselves and our environment to adapt to this reality. If we have the right questions, we can find the right answers.

Walid El Abed, Founder & CEO of Global Data Excellence, discussed the collaboration between the digital and human worlds, i.e. the importance of a human centred approach. A new kind of AI is needed to enable the connection and coordination between human and machine using semantics and knowledge modeling to standardise, enrich and gain insights from data. DEMS-NiXus (Data Excellence Management System – Natural Intelligence eXpanded Universe System), uses a semantic and linguistic AI to translate human language business rules to machine code. DEMS is a multilingual system for the interrogation of databases in natural language and it automates data governance. It enables reasoning over textual data and operating with textual knowledge. Moreover, it is autonomous and independent encapsulating a kind of consciousness with the current standards, regulations and ethics with the ability to interpret knowledge's prescriptions from all parties of the ecosystem.

S2: Managing Disruptive Digital Technologies

1ˢᵗ Day

Fatma Al Mukhaini
Chair
Robotic Process Automation
Developer, PDO, Oman

Michael Stankosky
Moderator
Professor, George Washington
University, USA

Crag Wright
Chief Scientist, nChain,
United-Kingdom

Daniele Tumietto
Adjunct Professor, Politecnico di
Milano, Italy

Halah Al Zadjali
Senior Executive of
Governance, Policies &
Governance Directorate,
MTCIT, Oman

Latif Ladid
Chair IPV6 FORUM-UL,
IEEE ComSoc IoT and
Chair, Research Fellow
University of Luxemburg,
Luxemburg

Moderated by Prof. **Michael Stankosky**, George Washington University, the session featured insights and perspectives from leading innovators.

The session's chair **Fatma Al Mukhaini**, Senior Robotic Process Automation Consultant at Petroleum Development Oman, presented the benefits of working with digital work force, i.e. Robotic Process Automation. Main benefits of RPA are a reduced burden on IT, reliability, cost reduction, no coding being required, increased accuracy and productivity, compliance and consistency. Some of the main applications of RPA include customer services, accounting, financial services, healthcare, human resources and supply chain management.

Craig Wright, Chief Scientist at nChain, addressed Bitcoin, IPv6, and the future of the Internet. Bitcoin, Blockchain, and IPv6 provide security and individual control. Peer-to-peer transactions are enabled without any third-party intervention. Blockchain technology can be used to facilitate an inexpensive, secure, and transparent procedure for the purchase, integrity, and licensing of proprietary software. Consumers benefit from continuous integrity and transparency. Software vendors can ensure that the conditions associated with their license are adhered to on a continuous and cost-effective basis. Vendors could enhance their reputation and increase their trustworthiness by being seen to be transparent. The immutable record of transactions between the software vendors and consumers could be valuable for both audits and cases of dispute resolution. The future of the Internet and digital currency is here!

Daniele Tumietto, Adjunct Professor at Politecnico di Milano, presented an industrial IoT developed for SMEs. The industrial IoT addresses the need for valid and timely data as well as the need to calculate equipment effectiveness. The IoT is continuously proving to enhance accessibility, competitiveness, and resilience of SMEs. It is an effort to provide small businesses with a lightweight presentation to adopting industrial IoT solutions to digitalise and improve their operations within a secure environment. The developed solution is a good practice for the sustainability for safe production (continuous control) and circular economy (no waste of raw materials).

Halah Al Zadjali, Senior Executive of Governance at the Oman Ministry of Transport, Communications & Information Technology, addressed the promise and pitfalls of disruptive digital technologies and underlined the need to balance between digital innovation and the growing demand for renewable energy. Predictive technologies allow to increase renewable energy adoption, lower costs and minimize timeframes by the development of leaner, more efficient design and operations. More investment into recycled technologies is needed, but this requires behavioural changes.

Latif Ladid, Chair of the IPv6 Forum and Research Fellow at the University of Luxemburg, considers IPv6-based blockchain as the New Internet. IPv6 has 2.5 billion users worldwide and governments around the world are promoting IPv6 adoption: The U.S. Office of Management and Budget memorandum requires federal agencies to create plans ensuring that at least 80% of IP-enabled assets on federal networks are IPv6-only by the end of fiscal 2025. The EU actively promoted IPv6 adoption, particularly through its GEN6 project. The Chinese government issued an "Action Plan for the Large-scale Deployment of IPv6" and set a national goal to get all its Internet users on IPv6 by 2025. Blockchain and IPv6 are a perfect fit. Blockchain needs IPv6, blockchain is peer-to-peer and needs end-to-end secure routing.

Some of the questions raised during the discussions with the audience were: Will Governments/Central Banks regulate cryptocurrencies? Will there be an IPv7 or 8? Will the European Union and governments adopt these news ideas discussed?

Conclusions: We will always have new disruptive technologies. Their adoption and adaptation will always be a challenge, but necessary to economic growth and sustainability. Governance and ethics will always be a challenge. The key questions are: Whose ethics? How adapt to a given culture/environment?

S3: Designing Ethics for Artificial Intelligence and Effective Governance in a Complex World

1ˢᵗ Day

Rasha Al Abdali
Chair
Assistant Director General of Policies and Governance, MTCIT, Oman

Geneviève Fieux-Castagnet
Moderator
Ethics Officer, SNCF Group, France

Alessandro Guarino
Founder and CEO, StAG, Italy

Fahd Batayneh
Senior Manager Stakeholder Engagement - Middle East ICANN, Jordan

Gilles Babinet
Co-president of the National Digital Council; Digital Champion, France

Sarah Zhao
Partner, Rimon Law, USA/China

Setting the scene, Moderator **Geneviève Fieux-Castagnet**, Ethics Officer at SNCF Group, explained that AI has great applications in health, environment, security, mobility, transport, and the identification of human needs and desires, but at the same time, it puts human rights and fundamental freedoms at stake. SNCF follows the Ethics-by-Design approach for AI systems. From the very beginning of any AI project, a multidisciplinary governance team maps the ethical risks of the project. Then, SNCF identifies remedies and risk mitigations. Another important aspect of SNCF's Ethics-by-Design approach for AI systems is to really ask the right questions. A catalogue of more than 100 questions is used at SNCF to map risks. The identification of potential ethical dilemmas is another crucial aspect. Examples of international initiatives towards creating general principles in the context of ethics for AI include the UNESCO Recommendations, the EU Guidelines for Trustworthy AI, the US Blueprint for an AI Bill of Rights, but also legal texts that support ethics for AI, such as the EU's General Data Protection Regulation (GDPR).

The session's chair **Rasha Al Abdali**, Assistant Director General of Policies and Governance at the Oman Ministry of Transport, Communications and Information Technology, outlined the future landscape for AI governance. The purpose of AI governance is to encourage using AI technologies in an ethical, fair, and safe manner through a set of rules and regulations designed to consider Human as a main aspect. This includes societal context and privacy, governing data collection and algorithms development, global collaboration and international standards. Focus in Oman in this is context is put on: medicine (breast cancer diagnosis), power ("Nibras", the digital integrated asset management platform of iNNOVATEQ, a leading digital transformation solutions provider), agriculture (plant pollination and disease discovery), and utilities (smart water & electricity meters).

Alessandro Guarino, Founder and CEO of StAG, addressed the European approach to AI regulation and its impact on global cyberspace by focussing on the question: Could doing good in fact hurt Europe? The European Commission's proposed Artificial Intelligence Act attempts to regulate a wide range of AI applications, aligning them with EU values and fundamental rights through a risk-based, ethics-inspired and precautionary approach. The scope, instruments and governance framework introduced by the proposal are still being debated and refined. An agreement seems possible by 2024, but this will depend on whether the co-legislators converge on key issues such as the definition of AI, the risk classification and associated regulatory remedies, governance arrangements and enforcement rules. Under this approach, mandatory requirements are applicable to the design and development of AI systems before they are placed on the market. However, the risks of such a risk-based approach are manifold.

Fahd Batayneh, Senior Manager Stakeholder Engagement at Middle East ICANN, provided an insight in ICANN's vision of "One World, One Internet". Created in 1988, the Internet Corporation for Assigned Names and Numbers (ICANN) is a not for-profit, public benefit corporation that helps to keep the Internet secure, stable and interoperable. It serves as the authority on domain names and

on a series of Internet-related tasks. The rationale behind the creation of this group was that it was important to establish a central figure which could not only determine but also enforce Internet and Internet domain rules, regulations, and policies. ICANN has played, and continues to play, an essential role in the creation and maintenance of the Internet. Since the Internet is a "borderless innovation" and the world is pushing hard for "digital transformation", ICANN sees its role as one of ensuring that the Internet doesn't break and remains functional. To achieve this, ICANN shares its technical expertise with legislators, regulators, and intergovernmental agencies in order to assess the potential impact of their initiatives on the functioning of the Internet, and to better understand and define the situations they seek to address. ICANN calls on politicians "Don't politicize the core of the Internet!"

Gilles Babinet, Co-president of the National Digital Council and French Digital Champion, demonstrated that in IT, the power of stories is defining the ethical standards. IT technologies went through quite different phases. At first, there was a community phase, built around the military who invented the Arpanet and the mainframe. Then the hippies came and invented the microcomputer. It was a true utopian phase and technologies were aiming for greater good. From the 80's came the business phase of the Internet. Deregulation was an irresistible policy. In 2000', the cloud was invented and a new phase of data recentralization allowed it to take control of hundreds of millions of individuals' data. The digital revolution moved progressively from a utopian to a dystopian era. It curiously resonates with the narrative of the transhumanism, the libertarian and the neo reactionary movements that were taking shape ever since the mid-nineties. At the same time there is a regulatory wave like never seen before. If regulation is certainly important, one can question the importance of common imaginaries. What strikes us is the kaleidoscope of imaginaries. Are we entering a new phase with multiple realities? That would resonate with the quantum computer that can be in several states at the same time. But the question remains: can there be any common imaginary that would be of the size of the Internet, i.e. almost the entire humanity? Digital has proven to be the only way to catalyse global consciousness to deal with interdependent crisis: environmental, economic, political, societal. But we cannot deal with it as fragmented and an individualized humanity. We need some technologies that can both deal with our fragmented communities and our Gaia communities. The one that sticks us together.

Sarah Zhao, Partner of Rimon Law, presented the new developments of China's cybersecurity rules – a very important issue in any discussion on AI ethics from a global perspective. China has today a comprehensive framework governing cybersecurity, data protection and privacy. China has also implemented measures for security assessment of cross-borders data transfer: Based on the Cybersecurity Law and Privacy Law, data collected in China shall be stored in China, unless exceptions apply. For the purpose of being qualified to conduct cross-border data transfers, certain security assessments may be conducted. In the past, such security assessments were difficult to be enforced because the security assessments standard did not exist. This confusing situation has been clarified by the new rule, Measures for Security Assessment of Cross-Borders Data Transfer, which became effective last month on September 1, 2022. This new rule has set forth a road map for conducting a security assessment if it is necessary.

Conclusions: Ethics has a double nature: Etymologically, ethos means the place of life, the habits and manners of people trying to live together in a city, a company etc. This very much depends on where you live, what you want to do and what your values are. AI systems being universal, the panellists agreed we should work on a system of international core values that the different stakeholders agree on. The majority of experts believe that regulation should be seen as a matter of degree. It is significant that over the past few years about 30 per cent of the countries in the world have advanced regulations or similar initiatives to keep AI accountable. This is good news, but at the same time the question arises whether, and to what extent, such proliferation of regulations, guidelines etc. could lead to an exacerbation of the fragmentation of technological regimes and governance mechanisms internationally. Efforts should be conducted to ensure greater alignment across countries.

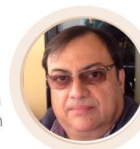## S4: Public Health and Prevention/ Digital Health Opportunities

1ˢᵗ Day

The introduction has been made by the chair of the session, **Fahad Al Zadjali**, Associate Professor and Vice Dean of Research at the Sultan Qabous University at Oman. He demonstrated how digital health brings opportunities to public health and prevention, through telehealth and telemedicine services, or digital therapeutics (DTx) and analytics. He illustrated by genetic testing &smart healthy homes/cities applications and explained how this market is regulated and enforced.

The session's moderator, **Mariane Cimino**, CEO of Hoa-Ora, consultant in Digital Health Transformation (ITG) and Delegate on Digital Health in Numeum in France, explained the different trends she observes in the health sector: IT solutions all along the journey of a patient, the United Nations – Sustainable Development Goals (SDGs) dedicated to Health (in fact, all SDGs), the "Global health" (WHO) definition with all the aspects for the wellbeing of the persons, andthe "One health" definition (including animal health and environment conditions). She finished by the presentation of the Kaiser Permanente Pyramid for Health Population Management.

Muhammad Ashkanani, Regional Manager at W3C GCC Chapter in Kuwait, tacked the challenges of Digital Accessibility in the Arab Region. He gave a definition of "accessibility" as "usability for people with disabilities". He explained how flexibility can bring to accessibility, the difference with usability, and for whom accessibility provides benefit. He listed some standards and guidelines established by World Wide Web Consortium (W3C) and the issues they raise. He concluded on the challenges raised by Digital Accessibility.

Amir Johri, Environmental/Public Health Professional, currently working with Ministry of Health in Oman, explained the public health approach, with the curative and preventive aspects and the three levels of prevention (primary, secondary and tertiary) with examples of each. He illustrated strategic digital capabilities in public health and how interconnected digital technologies were used in the public-health response to COVID-19 crisis. He concluded by the necessity to think globally and act locally, particularly during such a pandemic.

Hashil Al Hatmi, Health Psychologist at the Royal Hospital in Oman, exposed the future of health that will bridge the gap between healthcare professionals and patients with the benefit of remote care and will allow access to data, once 5G and AI will be taking healthcare to a whole other level. Thanks to UX Design, self-management, patient empowerment, accessibility and usability of applications will allow building our "wealth" (= health and wellbeing). He exposed how health behaviour can change and illustrated by Udacity an online learning platform he developed.

Gunnar Nordstedt, Professor Emeritus, Department of Molecular Medicine and Surgery at the Karolinska Institutetin Sweden, listed the areas of disease prevention and explain the primary and second preventions. He explained how AI can be used in preventive medicine to search medical data and uncover insights to help improve health outcomes and patient experiences, and also what

are the challenges that AI is raising. He concluded in explaining how prevention is useful in a chronic disease like diabetes, and more specifically in gestational diabetes.

Niki V. Santo, Co-Founder/CEO of Swaza – Oxygen Nanotechnology, explained that, as populations age and we become ever more interconnected, we will continue to see respiratory illnesses emerge and lung injury increase. We need to learn the lessons of the pandemic to build material resiliency and knowledge resiliency into our medical systems. We also need to expand our toolkits of therapeutic options to respond to changing landscapes.

🔊 **18 October 2022**

Keynote Opening Session Day 2

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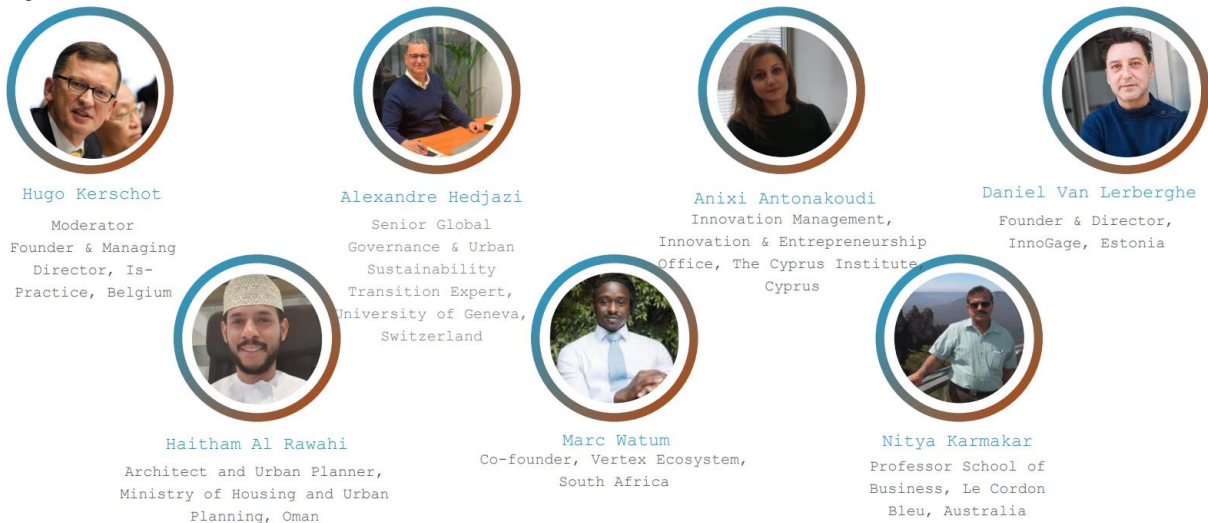**2ⁿᵈDay**

The second day of the conference was opened with keynotes given by **Ajay Shukla**, President World Class Scholars, UAE Sustainability & Technology Enabled Education, **Saif Al Shaksy**, President of the Oman Water Society, and **Stéphane Grumbach**, Senior Scientist at INRIA, France.

S5: Sustainable Smart Cities, Regions & Communities & Tech for Good

....
2ⁿᵈDay

Hugo Kerschot, Founder & Managing Director of Is- Practice, moderating, opened the session by reflecting on the evolution of this session over the years, starting many years ago as an eGovernment session, evolving towards intelligent and smart cities extended to smart regions and communities and today focussing on "sustainable" cities and regions. He then introduced DUET Digital Twins, an EU Horizon 2020 innovation project, providing virtual city replicas which make it

easy to understand the complex interrelation between traffic, air quality, noise and other urban factors. Powerful analytics model the expected impacts of potential change to help you make better evidence-based operational decisions and longer-term policy choices. The pilot cities in the project Pilzen, Gent and Athens make use of their traffic and air pollution data to simulate potential structural changes in their cities…. DUET is developed by cities for cities. DUET's digital twins promote data-driven decision making by building a comprehensive, virtual representation of a city's processes. With the right data points, DUET digital twins provide a business-level view that can be used to measure, analyse and predict operational impact across an entire city or region. This end-to-end, real-time, visibility enables cities to understand what is happening across its multi-disciplinary domains and services. With this knowledge, cities can react quickly to events and simulate alternative policy and operational approaches based on real data like traffic information, air and noise pollution…

Haitham Al Rawahi, Architect and Urban Planner at the Ministry of Housing and Urban Planning, Oman addressed the topic of sustainable smart cities. Sustainable cities is not a new form of urban development. These urban developments can be seen from the past, where cities used to be developed around the needs of its inhabitants. Smart technology will not make any city sustainable. It might only help in monitoring it. A successful sustainable city design would look at "live, work & play" all in a walking distance. Barcelona is a good example of this. With a 150-year-old master plan, Barcelona is designed around walkability with the human scale in mind. Adding to this, the city's master is very flexible to change and upgrades "the superblock project". Superblocks help cities achieve a better social, outdoor, living environment for pedestrians by reclaiming the streets. 40% of the world cities could also develop superblocks. The city of Muttrah in Oman can also be developed into a superblock, which will make it more attractive for tourism and it will support preserving its heritage buildings. Sustainable cities are developed around the needs of their inhabitants. Walkable cities are the core of any sustainable city. Human scale makes a city more sustainable. Smart new technology is only the Icing on the cake it will not make a city sustainable.

Alexandre Hedjazi, Senior Global Governance & Urban Sustainability Transition Expert at the University of Geneva, outlined lessons learnt from post-Covid recovery in Geneva. The conjunction of Covid pandemic and environmental challenges has elevated cities role as living labs where a great number of new strategies are being formulated in response to multifaceted and interconnected challenges. The variety of response mechanisms and policy frameworks draw from the common understanding that current city planning and management tools are unsuited to deal with intertwined challenges and the need for integrated solutions. To design and deploy new tools there is a need to disseminate best practices, input on policy and legal aspects, develop tools of project financing that solidly bridge the Built Environment and Infrastructures with Natural Environment in Cities. Such connection can only be secured in time by associating citizens to: co-defining the challenge, co-designing the solutions, co-implementing the strategies and policies, and co-monitoring the outcomes of projects driven by those strategies. Cities in reducing their negative impacts on natural environment must recast the planning process. Within a transitional period, cities are set to reduce energy and materials flows, and consider alternative models of growth while focusing the planning on people, place and environment. This entails directing urban resources and flows towards greater resource efficiency in respect to: Energy, waste, water, food and public services such as transport. Cities need to aim for the well-being of citizens acknowledging new socio-cultural dynamics and aspirations of the population and desire for urban systems respectful of the natural environment.

Anixi Antonakoudi, Innovation Management, Innovation & Entrepreneurship Office at The Cyprus Institute, explained how to build resilience of natural infrastructures and communities through technology, innovation and entrepreneurship. The Eastern Mediterranean has been identified as a critical climate hotspot that will be significantly affected in the next 20 years. Creating, preserving and protecting natural infrastructures in the region is crucial for mitigating negative environmental, social and economic impact. A series of interventions and initiatives focusing on the Pedieos river in Cyprus and its natural corridors have been presented to exhibit how climate change and adaptation,

the creation of nature-based solutions and preservation of natural infrastructures can be addressed through the combination of technology, open innovation and entrepreneurship. Applying open innovation, co-participatory and co-design methodologies, complemented by digital technologies, visualization and ICT tools can efficiently mobilize all ecosystem actors, enable the collection of meaningful data and inspire entrepreneurial ideas to address climate adaptation.

Marc Watum, Co-founder of Vertex Ecosystem, South Africa, addressed the question whether sustainable smart, cognitive cities are objectively desirable? The benefits of adopting a sustainable smart and cognitive innovation model can be described as intrinsic, that is, benefiting the self, or the inner institutions of the particular city who has implemented them. In doing so, a city produces more positive externalities – more common access goods, more mobility, more education and healthcare, etc. Simultaneously, the city will reduce the negatives - less emissions, less waste, less crime, less problems. However, it is not that simple. Short of New York and Singapore who engages in emission offsetting activities to qualify as nearly if not fully net-zero emitters, while today appearing in every top 10 emissions list, none of the most revered smart, cognitive cities have ever been describable as responsible for the world's unsustainable and mindless environmental practices. There are typically few types of impact we consider. All under the caveat that within the different types of impact exist different qualifying metrics, and thus different lenses. Take sustainability as a type of impact, for example. Within all of the metrics that form our opinions on sustainability sits emissions. When analysing emissions, the most common lenses include total or net carbon emissions, versus per capita metrics. Switching between the two lenses will reveal a totally different top 10 culprits list for the world. Look at a map of the world's top 100 carbon emitting cities: For the global South there are 9 or 10 cities appearing, none of whom are in the red. Canada, a North hemisphere example, is virtually blank on this map. Once we change to per capita instead - understandably Australia and Canada, who have relatively small populations, blow up as hot spots. Meanwhile, aside from Johannesburg and Cape Town, Africa is the only place on this comparison to remain dark. Sustainability is both an adaptive and relative term. To achieve sustainability in a context of severe vulnerability to environmental changes matched with pathways of poverty and illness requires localised innovation, not ideas drawn up by communities who have enjoyed a totally separate set of endowments and thus faced a totally separate set of problems.

Daniel Van Lerberghe, Director and Co-founder of InnoGage, presented two projects dedicated to enhancing culture and fighting climate change in urban environments. The EU funded Artcast4D project aims to design, develop, and test a global framework for Cultural Creative Industries in Europe for producing efficient, cost-effective software and hardware (projectors, computers, cameras, and detectors), multi-user, multi-site, multi-platform non-invasive immersive and interactive users' experiences. Artcast4D provides evidence on the role of the cultural and creative industries as drivers of innovation in other economic sectors such as citizen's engagement in public space, art and creativity in public spaces, innovation in art and experience, and tourism and advertising of cultural events like a global social sculpture. The Purifungi project is a perfect example of bio-recycling waste, while empowering local and circular economies in urban environments. Tobacco products are the most prevalent of all collected waste and litter in the world. Purifungi is a Belgian female-lead start-up that treats and transforms cigarette butts with fungi and makes products out of it closing the loop of the material cycle – such as ashtrays, isolating panels, biodegradable packaging, or artistic sculptures. Mycoremediation is an innovative fungal decontamination method originally used to clean-up polluted sites. Purifungi transposes this technique on cigarette buds and owns a patent on the technique. After remediation, a new material is created from the combination of butts and mycelium. This myco-material has many properties such as flame and water resistance, mechanical absorption, lightness, and carbon sequestration during production. Fungi are well known to be the best recyclers in Nature: they can degrade organic and inorganic materials. Combining mycoremediation and bio-fabrication can create new opportunities from waste recovering to material production with a fully sustainable approach.Purifungi.com is working with Nature to regenerate Nature.

Nitya Karmakar, Professor at School of Business, Le Cordon Bleu, Australia, discussed the role of ICT in helping sustainable development and conservation during COVID-19 pandemic. The world is facing new challenges in relation to balancing sustainability and conservation with the proper utilisation of ICTs. The speaker addressed the following four questions 1. Do you think that the world is better place now than 10 years ago? Will it be better after 10 years? In both cases, no positive answers, Australia for example, 3 dangerous floods in 2022, heavy rain and bush fires, getting worse when comparing with 10 years and it may go worse after 10 years. 2. What is the most important issue in your life? The answer varies: Climate change to health care or other important issue such as quality education, pollution, clean water etc. 3. What is the most critical issue facing the world? Currently energy, however, next conflict could be with water which could be more serious as well as dangerous than energy. 4. Can we attain the 17 Sustainable Development Goals adopted by the UN in 2015 as a universal call to action to end poverty, protect the planet, and ensure that by 2030? It is doubtful to meet the goals by 2030, however, SDGs are the blueprint to achieve a better and more sustainable future for all. The creativity, innovation, knowhow, technology and financial resources from all of society is necessary to achieve the SDGs in every context incrementally beyond 2030. Sustainability cannot not be considered in isolation without conservation which is preserving our biological and ecological resources while sustainability focuses on protecting and preserving the natural resources as well as environment for the benefit of future generations. The speaker focused also on the SDG 11: Make cities and human settlements inclusive, safe, resilient, and sustainable and SDG 13: Take urgent action to combat climate change and its impacts. Global warming has become an undisputed fact about our current livelihoods; our planet is warming up and we are part of the problem as the population has grown up almost 3 times during the last 60 years. There are several current and emerging challenges that humanity must fight not only to achieve sustainable development but to survive on Earth as well. The ICTs will act as enabler for sustainability and conservation.

S6: Digitalisation in Energy Transition & Water Dynamics

2ⁿᵈ Day

Thomas Andersson
Moderator
CEO, Qualies,
President Water &
Humanity, Oman

Buthaina Al Wahibi
Research, development and
innovation director, Oman
Wastewater Service company,
Oman

Gérald Santucci
Ambassador INTEROP-VLab,
France

Ghalib Al Maamari
VP Low Carbon
Molecules, OQ
Alternative
Energy, Oman

Khalfan Alburtamani
Senior Manager of Regulatory
and Corporate Affairs at MZEC

Mohammed Al Mahrouqi
General Manager of ANWAR ALMAJED
United at National Energy Centre,
Oman

Paris Kokorotsikos
President & CEO,
Euroconsultants SA
Greece

S7: Cross-border Water Issues and Diplomacy

2ⁿᵈDay

Stéphane Grumbach
Moderator
Senior Scientist, INRIA, France

Etienne Monbaron
Head of Hydrology &
Hydraulics Sector, Geneva
State Water Protection
Agency, Switzerland

Fariz Ismailzade
Executive Vice Rector,
ADA University, Azerbaijan

Jean-Eric Aubert
President, Université
Internationale de la Mer, and
President, and President of
the French Foresight Society,
France

Majid Labbaf
Professor and UNESCO
Chair, University of Nizwa,
Oman

Muna Luqman
Founder & Co Founder,
Food4Humanity & Women
in Solidarity Network,
Yemen

The session's moderator **Stéphane Grumbach**, Senior Scientist at INRIA, France, underlined that the topic of cross-border water Issues and diplomacy is a topic with both essential historical roots and complex contemporary geopolitical dimensions. The goal is to understand history, and design sustainable solutions for the future, while discussing what role innovation can play towards this objective.

Fariz Ismailzade, Executive Vice Rector of the ADA University, Azerbaijan provided a presentation about the water resources in the Caspian basin, the ongoing challenges that the sea is facing due to the oil and gas industry, climate change, industrial pollution as well as the rapidly decreasing levels. At the same time, recent cooperation efforts between the Caspian states were highlighted and future necessary steps were identified for the effective cooperation and diplomacy for the sake of preservation of the flora and fauna of the sea. A key question is: How to foster diplomatic efforts in conflicting areas for preserving essential environmental resources?

Etienne Monbaron, Head of Hydrology and Hydraulics Sector at the Geneva State Water Protection Agency, presented tools for transboundary management of water and water uses in the greater Geneva. Key success factors to be taken into account are: The existence of a community of practices, functioning in the transboundary dimension and cutting across different sectors The existence of a shared political will and vision, carried forward by regional policymakers with more room for manoeuvre than central governments. The evolution from an essentially sector-based, troubleshooting outlook to an integrated, pre-emptive perspective. The role of civil society. One key message was how different legal organizations increase the complexity of trans border discussions.

Jean-Eric Aubert, President of the Université Internationale de la Mer, President of the French Foresight Society, France, presented lessons from success stories regrading cross border-waters. In search for useful principles for the management of cross-border waters, the presentation sketched out three success stories of different "granularity": the Senegal river, the Antarctic Ocean and the Pelagos marine area in Western Mediterranean. Common features could be derived from the three cases: initial modest, clearly focused objectives, followed by gradual extension to broader goals; fair sharing of benefits between involved nations; agreed mechanisms for monitoring and controlling the engagements. The question was then raised: can such principles be applied to deal with situations already affected by conflictual relations between concerned nations (such as the Mekong Delta, the Nile sources, the Eastern Mediterranean basin, etc)? There are success stories of management of cross-border large rivers and marine areas, allowing to draw possible lessons for broader application.

Muna Luqman, Founder of the organisation Food4Humanity and Co-Founder of the Women in Solidarity Network, Yemen, pointed out the difficulties and impacts of practical actions on the ground in a time of war and presented community-based approaches to water conflict mitigation. Both global and local climate change impacts are likely to matter for future development, given Yemen's high levels of food import dependency, food insecurity, and poverty. The international community should aim at providing urgent support livelihood programs focusing on the agriculture and fisheries, livelihood sectors and support fishermen/women, farmers and agricultural laborers and provide specific grants to support their contributions to food security. Access to safe, dignified livelihoods mitigates the risk of exploitation and abuse and reduces violence. Strengthening gender equality and women's empowerment in fragile situations is critical for achieving sustainable peace and the Sustainable Development Goals (SDGs). Gender inequality, conflict and fragility are key challenges to sustainable development, and they are inextricably. Food4Humanity is helping empower women and youth to bring their communities out of poverty and dispute by providing close, clean water supplies, awareness programs and income generating projects through holistic approaches.

Majid Labbaf, Professor and UNESCO Chair at the University of Nizwa, Oman, talked about water war and peace in the Middle East and the importance of looking back at history to better plan the future. In the Middle East, a population that grows out of proportion to the available water resources may convince us that a water conflict is always around the corner. Nonetheless, some scholars rule out the possibility of an impending water war, based on their historical evidences. In the history of the Middle East, the rarity of actual water wars is attributable to "hydro-political borders" and "virtual water", both of which have lost their historical functions in the modern geopolitical paradigm, exposing the Middle East to "water war".

The session triggered a number of different issues related to the capacity of diplomatic means to successfully ensure safe water access to human populations and the natural environment, as well as a strong applaud to the projects of Muna Luqman in Yemen.

Conclusions: This session addressed a very fundamental issue, source of increasingly many conflicts today, but which is deeply rooted in history, and in fact contributed greatly to the shape of past and present societies. The diversity of speakers and topics allowed to address a large spectrum of topics of very diverse granularities.

S8: Framing Tools for Future Cross-Border Collaboration

2nd Day

Alexandre Hedjazi
Senior Global Governance & Urban
Sustainability Transition Expert,
University of Geneva, Switzerland

Marcela Brugnach
Research Professor, bc3
Bilbao, Spain

Sanith de S. Wijeyeratne
Moderator
CEO, Climate and
Conservation Consortium, Sri
Lanka

Chloe Treger
Head of Research & Analysis,
Dark Matter Labs, UK

Roberto Ordonez
Managing Partner & Founder,
Alkimya Catalyst, UAE

The session's moderator **Sanith de S. Wijeyeratne**, CEO of Climate and Conservation Consortium, Sri Lanka briefly introduced the topic of framing tools for future cross border collaboration. The definition of cross border collaboration extends to migration, wildlife conservation and natural resources. And it can be a basis for starting global conflict.

As a professor and teacher in the Strategy of negotiation, **Roberto Ordonez**, Managing Partner and Founder of Alkimya Catalyst, UAE, was able to elaborate on the difficulty that parties to conflict face when try to get to a mutually satisfactory outcome. A keen understanding of what real value is at play is key to a successful negotiation that is mutually beneficial. 'Equal shares' does not always mean equal value.

Marcela Brugnach, Research Professor at bc3 Bilbao, addressed the grand challenge of getting useful knowledge under a changing climate. One of the grand challenges that we face today concerns knowledge, and the very question of what constitutes useful knowledge to cope with problems such as the adaptation and mitigation to climate change. When we talk about knowledge in the context of climate change, the situation gets even more complicated. We need to avoid uncertainty and ambiguity to ensure an acceptable outcome.

Chloe Treger, Head of Research and Analysis at Dark Matter Labs, demonstrated a new tool establishing nature as an investable part of urban infrastructure. Trees AI is being developed to capture the value of nature-based solutions and to assign them a monetary value based on the avoidance of risk. Institutions that bear the risk can fund the development of these solutions in order to minimize their financial liability. A versatile tech platform that has the potential to create a new market place for urban nature-based solutions.

Alexandre Hedjazi, Senior Global Governance and Urban Sustainability Transition Expert at the University of Geneva, provided an example of infrastructure integration as cross-boundary. Alexandre presented the successful cross border collaboration achieved with the Geneva airport. A practical real work demonstration of the positive outcomes that are associated with a successful cross border collaboration between countries.

S9: Women in Tech and Women in Water

2ⁿᵈ Day

Aasia Saail Khan
Director, Lahore Chamber of Commerce, Pakistan

Marwa Al Madouri
Senior Planning Engineer, Oman Water and Wastewater Services Company.

Dalia Badawi
Moderator
Co-Founder, Save Faces Foundation, Futurist, Innovation luminary, Egypt

Hamed Al-Dhuhli
Research Director, Ministry of Agriculture, Fisheries and Water Resources, Oman

Mariane Cimino
CEO, Hoa-Ora; Consultant in Digital Health Transformation; Delegate on Digital Health in Numeum, France

Addressing the topic of women in e-commerce, **Aasia Saail Khan**, Director of Schazoo Zaka and Women's Business Development Expert, Pakistan, started by describing her own (multiple) career path – a path she successfully followed in spite of being a woman and a single parent in a patriarchal society. The problems she faced during the last 30 years made her a passionate advocate for women development and women empowerment. The pandemic and the associated

lockdowns, travel restrictions, and the shutdown of all economic activity to curtail the virus most impacted SMEs and women owned businesses. e-Commerce became a matter of survival even for the most well-established brands in Pakistan. Because Pakistan had no established payment gateways, Pakistan's leading brands developed a unique system of payment Cash on Delivery (COD) where goods were ordered online, delivered via courier and cash was received on delivery. Women owned businesses were rapidly closing down in 2020 due to lockdown, lack of finances to build independent e-commerce websites, lack of training to utilize social media platforms for sales. Women Business Development supported women entrepreneurs by providing training on how to sell on social media platforms, including social media marketing.

Hamed Al-Dhuhli, Research Director at the Oman Ministry of Agriculture, Fisheries and Water Resources, stressed that that half of Oman's students in higher education institutions are female and more than half of Omani graduates nationwide are women.

As Senior Planning Engineer at the Oman Water and Wastewater Services Company, **Marwa al Madouri** described her daily work at a wastewater treatment plant - a working environment often characterized as dominated by men. Marwa is responsible for the plant's performance, for process optimization, the treated water quality as well as the treated water reuse and applications – a professional who both talented and passionate about what she does. Water recycling and wastewater reuse is considered as an alternative water source and a feasible solution to prevent desertification. It will be important to increase public awareness to reuse water in the planting and irrigation instead of the potable water.

Mariane Cimino, CEO of Hoa-Ora and Consultant in Digital Health Transformation (ITG), France, started with an overview on women on female IT pioneers, such as Ada Lovelace, who developed the first real computer program, Margaret Hamilton working on the embedded system for the Apollo space program at MIT, and Hedy Lamarr, mother of the transmission signal used today for wifi, satellites or mobile phones. She also named some some inspiring contemporaries, such as Susan Diane Wojcicki, CEO of YouTube, Melanie Perkins, CEO of Canva, and Julia Hartz, co-founder of Eventbrite. However, the reality is that women represent only 33% of the employees in the digital sector and only 18% of the ICT specialists in Europe. Only 5% of start-ups are created by women (20% by a mix team). 90% of the funds raised in 2020 were raised by 100% male teams. In order to change this situation, it will be necessary to highlight the contribution of digital technologies in all sectors and in their daily usefulness, to raising girl's awareness of digital careers, to promote diversity in digital professions, and to increase the visibility and promotion of women in digital.

S10: Smart vs Nature Based Solutions

2ⁿᵈDay

Marc Watum
Moderator
Co-founder, Vertex
Ecosystem, South
Africa

Andile Khoza
CEO, Metsi, South
Africa

Bart Wubben
Founder and CEO, Muscat
Landscaping, Oman

Etienne Monbaron
Head of Hydrology
& Hydraulics
Sector, Geneva
State Water
Protection
Agency,
Switzerland

Hassan Al Raisi
Urban Planner, Ministry of
Housing and Urban Planning,
Oman

José Miguel Lameiras
Prof. University of Porto,
Researcher, CIBIO, Portugal

Rowa Elzain
Managing Director/Co-
Founder, MCTspaceLab,
Oman

The session was observed by an international audience of environmental and urban planning specialists whose experience ranges a diverse balance of government, civil society, and private sector expertise.

Marc Watum, CEO of Vertex Ecosystem and founder of Africa's Vision 2030 Fund opened the session and moderated conversations surrounding the interlinkages between smart, technology-enabled climate conservation innovations, and nature-based solutions. Smart innovations tend to be introduced or trialled in urban areas or strategic clusters where key players or affected parties collaborate. They harmonise science and technology, and when successful usually result in the obsoletion or replacement of certain inputs, processes, ways of doing, and their associated outputs. The objectives usually resolve around optimisation; efficiency, cost saving, and when a sustainable end is pursued, improvements to the ecological burden are an objective. On the other hand, nature-based solutions seek to harmonise existing ecological systems with available innovations, usually localised according to the environment's landscape through endeavours that can be described as entrepreneurial, research intensive, conservational, adaptive, or preventative. Modern solutions will need to harmonise these phenomena.

Throughout the panel presentations and discussion, speakers demonstrated the various developments innovations, and the associated challenges that are being experienced in their respective jurisdictions. Of the European, Middle-Eastern, and Africa-focused initiatives, the use of natural landscapes and 4th generation technology played a critical role in resolving predominantly urban living difficulties. Pollution, clean water systems, the depletion of biodiversity, and social organisation were the main themes being confronted by the panellists and their organisations.

Andile Khoza, Founder of South African water infrastructure repair services company Metsi, shared an emotive presentation on South Africa's dire water insecurity. Sharing astonishing statistics surrounding the rate of water loss, as well as the lack of employment opportunities for qualified water engineers and maintenance workers, he highlighted the social case for communities who are today using smart applications such as Metsi to create a new narrative. Through his app, users can upload photographs of faulty water infrastructure, have it assessed in real time, and have the nearest qualified repair worker dispatched to the site.

Etienne Monbaron of the Geneve State Water Protection Agency delivered an inspirational project management case as he showcased his agency's river restoration interventions. Using the success of his PAV River Project, he showed how a true river can be restored in a way that mitigates flood &

runoff risks, thrives even under the most immense pressures from population density, and delivers a clean, safe water resource for its surrounding community.

The role of neighbourhoods in nature-based solutions by **Rowa Elzain**, Co-founder and Managing Coordinator at MCT Space Lab, gave a thought-provoking analysis of the public-civil-private society nexus in Muscat's local context. Her positioning of citizen power as the antithesis to exclusionary environmental action challenged the audience and her peers to adopt participatory processes that can accelerate the achievement of SDG 11: Sustainable Cities and Communities.

Hassan Al Raisi, Urban Planner at the Oman Ministry of Housing, gave a refreshing introduction to a new and inclusive policy agenda being introduced in Oman – The National Spatial Strategy. During this presentation, Hassan detailed the ministry's intentions to achieve the country's Vision 2040 objectives by delivering on strategic infrastructure that bolsters the country's relationship with the environment, her transportation, and use of natural resources. The keys to this strategy were awareness; both at the global (public-civil-private) and local levels, the introduction of planning standards, and the use of data to inform and manage them forward.

Urban architect and design professor **José Miguel Lameiras** from the University of Porto led the audience through a visual demonstration of the applicability of smart mapping technologies in the erection of parks, forestry, and green public spaces in his city. Through this presentation he drew on acquired experiential knowledge to teach observers the value of letting nature lead. José's examples included the use of sophisticated mapping technology to assist in non-invasive, structurally and environmentally convenient landscaping that produced incredible reafforestation while saving and absorbing as much as 2500 cubic meters of water, 35 kg of carbon, and stabilising average temperatures in the city every year.

Bart Wubben, an urban architect with vast experience in both the Netherlands and Oman through the success of his company, Muscat Landscaping, presented the importance of using informed processes to introduce state of the art technology in local spaces. He started by highlighting the ways in which natural landscapes and society can and must integrate, before sharing case studies that communicate the merits of holistic approaches to environmental action and construction. A key take-away from this was the importance of inclusion, education, and local buy-in from the first explorations of any environmental action through to its operation and lifetime.

S11: Digitalisation and Innovation for Heritage & Culture

2ⁿᵈ Day

Giovanna Montieri
Moderator
Assistant Professor University of
Rome Tor Vergata, Italy

Abdullah Al Ghafri
Professor, University of Nizwa
Chair Holder, UNESCO Chair
on Aflaj Studies, Oman

Guido Ferilli
Professor, Cultural Economics,
IULM, Milan, Italy

Husni Al Abri
Repr. Misfat al Abriyeen
Village, UNWTO best
tourism village in the
world, Oman

Valentina Vassallo
4CH Project to Design a
European Competence
Centre for the
Conservation of Cultural
Heritage, Cyprus

Youth, Education and Awareness-Creation: Valuing Water

3ʳᵈ Day

Ingrid Andersson
Moderator: Vice-President Global Forum, Director, IKED, Sweden

Andile Khoza
CEO, Metsi, South Africa

Azimeh Jafari
Researcher, Monash University, Malaysia

Guido Ferilli
Professor, Cultural Economics, IULM, Milan, Italy

Juliane Schillinger
Research Group Coordinator, World Youth Parliament for Water, The Netherlands

Marc Watum
Co-founder, Vertex Ecosystem, South Africa

Neeshad Safi
Executive Director, Arab Youth Climate Movement, Qatar

Tilly Stroo
Founder, Wavemakers United, The Netherlands

Visualising and Mobilising Action Defending the Global Commons

3ʳᵈ Day

José Miguel Lameiras
Professor, University of Porto, Portugal

Olof Lindén
Professor, World Maritime University, Sweden

Jean-Eric Aubert
Moderator
President, Université Internationale de la Mer, and President, and President of the French Foresight Society, France

Juha Alatalo
Professor, Qatar University, Qatar

Sanith de S. Wijeyeratne
CEO, Climate and Conservation Consortium, Sri Lanka

Moderator **Jean-Eric Aubert**, President at the Université Internationale de la Mer and President of the French Foresight Society, explained that Global Commons are usually perceived as the Ocean, the Space, etc. that belong to the Humanity as a whole, and engage it and all its members in their preservation. The climate change issue makes the latter a Global Common in the true sense. So, let's see how the Humanity can be mobilized for climate preservation – notably from the mitigation viewpoint – at different levels, from the global level to the local one, through specific examples and initiatives.

Olof Lindén, Professor at Linnaeus University and Senior Advisor of the World Maritime University, Sweden, described the G20 Global Land initiative launched 2021 by G20 Leaders in Riyad. The

initiative focuses on reducing land degradation and enhancing conservation of terrestrial habitats. It builds on existing commitments with the ambition to achieve a 50 percent reduction in degraded land by 2040. The initiative which is directly responding the SDG15 has three objectives: i) conservation of ecosystems; ii) promote sustainable land management; and iii) restoration of degraded land. The initiative is showcasing methods and approaches through building information sharing hubs, engaging the private sector and civil society, and sharing knowledge and building capacity. It is a global initiative with high ambitions that aims at mobilizing thousands and thousands of communities of all sorts throughout the world (private sector, academics, civil society, etc.) with a diverse scope of instruments (web information, show cases, capacity building…). Key performance indicators are settled. It will be important to monitor how the G20 objectives of land preservation will be gradually achieved around the globe.

Juha Alatalo, Professor at Qatar University, addressed Swedish experiences with land and climate issues. The presentation discussed the lobbying made by forest companies in Sweden for reducing significantly the forest preservation quotas envisaged initially by the government. The latter bent on the industry's demands and acted in fine in contradiction with its engagements made vis a vis the global community. Even in countries that are usually considered particularly keen and proactive on ecological and climate-related discipline, resisting to industrial lobbies is not easy. Changing industrialists' behaviours – of the forest sectors as of other ones – would require strong and firm financial and tax measures in order to penalize anti ecological projects.

Sanith de S. Wijeyeratne, CEO of the Climate and Conservation Consortium, Sri Lanka, presented the PLANT Initiative in Sri Lanka. In 2020, The Wildlife and Nature Protection Society of Sri Lanka (WNPS) established a land trust called PLANT (Preserving land and nature (guarantee) limited) to operate under the auspices of the WNPS. This new visionary landmark initiative was set up with the aim of acquiring privately owned lands for the purpose of conservation (outright or on a long-term lease) and to collect funds through the trust, and the WNPS, to purchase lands for the purpose of conservation. Thus, the main legal vehicle is a non-profit trust that works hand in hand with private owners to help preserve private lands or will use its own funds to purchase land to be held a part of the trust for conservation. PLANT hopes to have 1000 acres under its coverage within early 2023. Even in a difficult political and economic context, it appears possible to take important initiatives for land preservation and restauration, based on clever non-profit/private partnership. They should inspire other actors in the country and elsewhere.

José Miguel Lameiras, Professor at the University of Porto, outlined key actions related to climate resilience by focussing on basic solutions for land preservation and restauration. The presentation focuses on two key ideas: 1. Make cities more permeable and infiltrate and store water underground. 2. Plant more trees and restore degraded ecosystems. Both ideas were illustrated with examples from Portugal, providing methods that are replicable all around the globe.

Questions raised during the discussions with audience: How to disseminate and scale up – "contaminate" broadly in the good sense of the term – initiatives needed to fight efficiently against climate change and its negative consequences? Will global mechanisms such as the G20 initiatives be efficient enough for creating the needed global dynamics?

Conclusions: We need to mobilize all means—including notably social medias and their transformative power—in order to increase global awareness and develop competences facilitating appropriate projects throughout the globe, down to the local level.

The Role of Business and Stakeholder Engagement

3ʳᵈ Day

Sven Oehme
Moderator
President & CEO, European-American Business Organization, US.

Aasia Saail Khan
Director, Schazoo Zaka, Women's business development expert, Pakistan

Américo Mateus
Director, Transdisciplinary Research Center for Entrepreneurship & Innovation Ecosystems, Portugal

Pierre De Geest
Senior Geologist & Researcher, DEME Group, Belgium

Wilfried Hoffman
CEO Axionomic, Co-founder Ambrac, The Netherlands

A Comprehensive Approach to Mangroves and Wetlands Development

3ʳᵈ Day

Olof Lindén
Moderator
Professor, World Maritime University, Sweden

Anna Grichting
Senior Fellow University of Vermont, United States and Switzerland

Badar Al Busaidi
Principal Expert Mangroves & Wetlands, Environmental Authority, Oman

François De Keuleneer
Environmental Director, DEME Group, Belgium

Rahma Suleiman Al-Nadhairia
Expert in ocean, atmospheric, and climate sciences at the environmental authority (EA), O...

Wafa Al Maamari
CEO, Sustainability for Environmental Services, Oman

The session's moderator **Olof Lindén**, Professor at World Maritime University, Sweden, addressed the issue of Mangrove rehabilitation in the Niger Delta. Approximately 1,500 ha of mangroves killed due to oil spills are presently being restored in Ogoniland, an area southeast of Port Harcourt. The techniques used involve cleaning of contaminated sediment using high pressure seawater flushed through the sediment from about 1 m below the sediment surface. Free oil is collected using booms. About 1,5 million plants (several species) have been planted so far. Survival rates are on average 75%, monitoring and replanting are carried out after 6 month, 2 years and 5 years. The methods used have been published in several reports, see for example: Gundlach, E.R., Bonte, M., Story, N.I. and Iroakasi, O. (2022). Using high-resolution imagery from 2013 and 2020 to establish baseline vegetation in oil-damaged mangrove habitat prior to large-scale post-remediation planting in Bodo, Eastern Niger Delta, Nigeria.

Anna Grichting, Senior Fellow University of Vermont, talked about wadis and wetlands and the co-creation of regenerative blue landscapes in drylands. The landscape urbanism approach centers urban development and regeneration on productive landscapes, water management and biodiversity conservation and fosters a participative approach to planning and a symbiosis with nature and all species. Examples in the Gulf region of Wadi remediation projects, constructed wetland and Urban Forestry projects using TSE, and the importance of working with water engineers and environmental experts in urban design. Developing integrated coastal management at the interface of land and sea, and addressing future climate threats, sea level rise, storm water management, etc. Using and reusing all types of water, and exploring the use of sea water and halophytes to reduce desalination. Key messages: Blue Design, the importance of water management in urban design. Regenerative urbanism, which repairs, remediates and restores our

urban areas and ecosystems. Wadis and Wetlands as ecological infrastructure – soft engineering to replace hard engineering. A multi-stakeholder approach to design and management of urban landscapes.

Badar Al Busaidi, Environmental System Specialist at the Environmental Authority, Oman, presented the Oman Mangrove project. There are 3 Ramsar Sites in Oman, 2 registered and 1 in the process of registration, and e 9 mangrove forests (only one species: Avicennia marina). Four mangrove nurseries are operated. Tidal water is used; seeds of Avicennia are collected and washed for 6 hrs before being planted. Germination takes place after 14 days. He also described the method of planting; so far 32 sites have been planted. 766,000 trees over 800 ha have been planted. Trees have grown up to 9m. Grazing (camels and goats), insect attacks, and litter cause problems. Information campaigns are conducted to raise awareness. Methods for mangrove restoration in Oman have been developed and significant areas have already been replanted.

Rahma Suleiman Al Nadhairia, Environmental Management Expert at the Environmental Authority, Oman, presented the Oman Environmental Authority. The Environment Authority in Oman is responsible for the protection of the environment by applying laws and regulations and developing research programs exchanging experiences, and collecting environmental data. The authority is also in charge of combatting pollution and preserving the ecosystems. Furthermore, the authority is responsible for spreading awareness and establishing the principles of preserving the environment and its resources. Key-Takeaways: Mangrove ecosystems in Oman is affected by the changing climate, in particular the changing cyclone pattern in the Arabian Sea. Also, the upwelling of oxygen limited water is of concern as well as increasing problems with coastal erosion and coral bleaching.

François De Keuleneer, Environmental Director of DEME Group, Belgium, outlined a vision for Oman wetland development. In order to find sites suitable for the development of wetlands/mangroves, about 10 sites (wadies) were studied and two identified as suitable based on inlet stability, topography, soil fertility and freshwater availability and using a 3D hydrodynamic model. Based on the modelling about 30% of the coastal lagoon to be created would be hosting mangrove vegetation, 32% would become intertidal mudflats, the shallower areas will become marshlands and deeper areas will be suitable to host seagrass meadows. Plans were presented for the technical aspects of the work. The preliminary study shows: It is feasible to develop large coastal areas suitable for mangrove growth. Optimal result achieved when fully functional coastal lagoons are developed. There are multiple potential locations. A thorough feasibility study is a logical next step. A Public Private Partnership (PPP) shall be created; such PPP would qualify to attract very competitive green financing.

Wafa Al Maamari, CEO of Sustainability for Environmental Services & Consulting and Associate Expert at Qualies, Oman provided an insight in the experimental use of a water saving technology ("Waterboxx") in sites in Oman (Mirbat). The experiments showed: The technology protects the seedling, saves water and makes it possible to plant in dry regions such as in Oman. The Waterboxx makes the root structure develop naturally, rather than stay near the surface. Furthermore, there is less need of pesticides. Only 50 ml of water is channelled from the reservoir per day with the help of a wick. This is enough for the plant to stay strong and seek out water deep down. The technique makes the tree independent, and after 6-18 months the Waterboxx can be removed and reused. Techniques are available to enable trees to grow in the dry areas in Oman.

Issues raised during discussions with the audience focused on the presentations related to restoring mangroves in lagoons on the Omani coast, as well as on the tree-planting technology. The experiences from Qatar regarding greening of urban areas were also discussed as well as techniques for mangrove plantations in contaminated sites. There was also a discussion on the topic of what is a "tree plantation" and is this really restoration of an ecosystem.

Conclusions: With better technology, "greening" of dry landscapes as those in Oman is possible. Attempts should be made to restore ecosystems, not just single species of trees.

Circularity and Unconventional Water Resources

3ʳᵈ Day

Américo Mateus
Moderator
Director, Transdisciplinary Research Center for Entrepreneurship & Innovation Ecosystems, Portugal

Alireza Bazargan
Professor, University of Tehran, Consultant, UNDP, Iran

Ekkehard Holzbecher
Professor, Gutech, Oman

Patricia González
Country Manager, H2O Biofouling Solutions, Spain

Rajamohan Natarajan
Professor, Sohar University, Oman

Wilfried Hoffman
CEO Axionomic, Co-founder Ambrac, The Netherlands

Water, Food and Energy Nexus

3ʳᵈ Day

Anna Grichting
Moderator
Senior Fellow University of Vermont, United States and Switzerland

Bahram Taheri
Director at Nexus & HSE Center, Amirkabir University Technology Park, Iran

Hamed Al-Dhuhli
Research Director, Ministry of Agriculture, Fisheries and Water Resources, Oman

Jumana Saleh
Professor, Sultan Qaboos University, Oman

Muna Luqman
Founder & Co Founder, Food4Humanity & Women in Solidarity Network, Yemen

Talal Al Awadhi
Head of Geography Department, Sultan Qaboos University, Oman

Water, energy and food are necessary for the benefit of human well-being, poverty reduction and sustainable development. Improved water, energy, and food security on a global level can be achieved through a nexus approach—an approach that integrates management and governance across sectors and scales. This panel on the Food Water Energy nexus gathered speakers from different sectors - Academia, Government and NGOs, discussing the Nexus at multiple scales, from micronutrients, to community projects, university campuses and large watersheds, and in different cultural and political contexts, including Oman, Qatar, Iran and war-torn Yemen. As an introduction, the session's moderator **Anna Grichting**, Senior Fellow University of Vermont, United States and Switzerland, presented a practical application through the Nexus through Urban Design on a University Campus entitled "The University as a microcosm of the City. Qatar University Living Laboratory for the Food Water Energy Nexus".

Bahram Taheri, Director at Nexus & HSE Center, Amirkabir University Technology Park, Iran, provided insights in systems thinking and cognitive gaps related to the food water energy nexus. NEXUS is an old Latin word which refers to the intricate interconnection of things and refers to a "System of Systems (SOS)" in which each subsystem and its elements, acquire additional qualities or capabilities that they did not possess on their own alone. It refers to the paired, tripled or multilateral interconnections/interactions between and among subsystems. The concept of circularity is an important aspect and application of nexus thinking, as are the concepts of Virtual water and embedded water. There is necessity to discuss the current status of nexus policy

development and nexus solutions. We need to understand the subject of "wicked problems" and the relationship with nexus thinking. The role of digitalization and IOT within the system of systems approach and the nexus framework.

Muna Luqman, Founder of the organisation Food4Humanity and Co-Founder of the Women in Solidarity Network, Yemen, presented community-based approaches to the water food and energy nexus. The current dramatic levels of food insecurity in Yemen and the threat of famine are the results of over 8 years of war, adding to the already high levels existing pre-war. Yemen faces environment-related threats to human security, such as displacement, epidemics, and food insecurity; and this is fueled by the conflict, particularly the mass displacement of women and young girls, which also leads to conflict-related gender-based violence. Food4Humanity provides lifesaving emergency aid, clean water, education, women's protection and medical care to thousands of families in Yemen affected by violent conflict, climate change. This multilevel approach has resulted in: resilience, peacebuilding and recovery; empowering local communities through water initiatives (Water4Peace); and fostering social cohesion between the fragmented society. Food4Humanity is a practical application of local nexus implementation to provide food, water and energy to local communities in conflict situations. The importance of listening to civil society to find and build the best and most resilient solutions. Resources are the most important area and roots of conflict. We need much more awareness on the ground. The presentation provided practical examples of renovating water stations, solar energy, the resilience of local solutions and role of civil society.

Hamed Al Dhuhli, Research Director at the Ministry of Agriculture, Fisheries and Water Resources, addressed water management challenges for agricultural production in Oman. One of the main problems of irrigation water in Oman is agriculture which depletes the largest amount of water accounting for 83% of total consumption. Usage of traditional irrigation methods (80% flooding – 20% modern irrigation) with a low system efficiency and a big loss of water transferring and distributing. In many areas water demand exceeds supply and this draws saline water in to the aquifers. The key challenges could be classified as: Natural and environmental challenges, economic challenges, social challenges and institutional and administrative challenges. The presentation pointed to the importance of collaborating with researchers, NGOs, private sector and civil society to find sustainable solutions for water management and the challenges that Oman is facing, as well as to the importance of integrating traditional methods and new technologies and research.

Jumana Saleh, Professor at the Sultan Qaboos University, Oman, talked about magnesium - the healing gemstone of the Omani coast. During modern times, dietary calcium has become highly abundant, however, magnesium has become increasingly deficient as a result of modern agricultural, water purification and desalination practices Therefore drinking water and dietary sources have become magnesium deficient. On the other hand, sea water has three times more magnesium than calcium, and exceeds all sea minerals except sodium chloride. Oman is blessed with a vast coastal stretch along sea water that keeps this precious mineral within reach. Thus, swimming in seawater, and creating open seawater pools maximizes the benefits of this precious mineral, including vitamin D from the abundant sunshine in Oman. The presentation highlighted the importance of micronutrients in our health and their presence in water and soil. It proposed simple and natural solutions to absorbing sufficient magnesium through sea water bathing and proposing sea water pools, as opposed to supplements which are not easily assimilated.

Talal Al Awadhi, Head of Geography Department at the Sultan Qaboos University, Oman, presented a research work on water sustainability, food security and GIS technologies. This research presents potential strategies using GIS and nexus thinking to optimize water efficiency and use. One potential strategy to simultaneously achieve higher food security and water sustainability is to optimally use ecosystem services of the arid and semiarid ecosystems. Grazing is one of the essential ecosystem services that may enhance food and water security by reducing the water consumption for fodder production. The steady increase in fodder production is partially attributed to

land degradation, which deprives the natural ecosystems of its critical services such as grazing. Understanding the physical characteristics of the water streams is critical as it could help determine high-risk areas for future cyclones and support decision-makers in developing proper risk management programs. The presentation underlined the importance of developing an integrative method using remote sensing and GIS to understand the role of the physical characteristics of the streams during Shaheen cyclone. We have to continue developing quantitative characterization Nexus models to understand the interlinkages and trade-offs between the natural ecosystems and agro-agriculture systems using advance remote sensing techniques including UAVs.

During the lively discussions with the audience, a question from Dr. Abdulla Al-Ghafri on the management of the Aflaj traditional water systems raised important issues on managing common resources, and how we can learn from, and bridge, technology and tradition, while modernizing and adapting to contemporary and future situations. Some additional questions: What are the main aspects of Yemen's Food, water and energy crisis? How do they interlink with the ongoing conflict? What is the relation between addressing the nexus and peace-making and are there any other examples from Yemen? Have any local studies of the effect of magnesium on health been performed? Are people aware of the benefits of sea bathing or walking in sea water?

Conclusions: The session highlighted the complexity of addressing these "wicked" problems of systems and nexus thinking, and how our education and governance systems need to adapt to remove barriers and silos. GIS and modelling tools can assist to integrate complex data and envision scenarios for more efficient management of resources, and collaboration between the academic researchers with the government ministries managing food water and energy resources is important to develop new and practical solutions. The nexus solutions must also address the quality, and not just the quantity of resources, be it water or food, as these have an important impact on human and ecosystem health. Sea water should also be considered a water resource for its benefits of minerals (magnesium) and production of halophytes and sea water pools could both save fresh water and provide much needed minerals. Practical examples in Yemen demonstrate the effectiveness and resilience of community led projects to address food, water and energy shortages and how they can improve the livelihoods and education of the population, especially women and youth. Finally, discussions on creating a Living Laboratory for the Food Water Energy Nexus at Sultan Qaboos University could be a way to engage multiple stakeholders on a practical project and physical site.

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