Global Forum
Shaping the future 2017

THE INTERNATIONAL THINK-TANK
ON THE DIGITAL FUTURE

ITEMS INTERNATIONAL

THE UNIVERSITY OF WINNIPEG

Winnipeg

DIGITALIZATION: INTELLIGENT PATHWAYS

Monday 2nd & Tuesday 3rd,
October 2017
Winnipeg, Canada

PROCEEDINGS

CONTENTS


Report written by
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Communications Consultant

ACKNOWLEDGEMENTS

The 26th edition of Global Forum/ Shaping the Future took place on 2nd and 3rd October in the city of Winnipeg, Canada. The Global Forum 2017 marks the first Canadian edition of the think-tank.

We would like to express our sincerest thanks to our coorganizer the University of Winnipeg and especially Dr. Sylvie Albert and her team as well as the City of Winnipeg for welcoming the Global Forum.

We would like also to address our thanks to all those who have put so much time, effort and support in making the Forum another success.

The keynotes, expert panels and lively debates were truly inspiring and once more the Global Forum allowed great networking. A heartfelt thanks to all our distinguished experts, moderators, chairpersons and speakers for their participation, engagement and enthusiasm! Thank you for sharing your insight, knowledge and your experience with us and for making this event a success..

Thank you to our engaged participants for their inputs.

We would like to extend a special thanks to the main sponsors of the Global Forum 2017 for their spirit of sharing and support (in alphabetical order):

> Air Canada, AT&T, Audi, ebay, the Great-West Life Assurance Company, GSMA, IBM, Manitoba Hydro, NxtVn, Powerland, Tourism Winnipeg.

As well as the supporting sponsors, which are (in alphabetical order):

> ActiveMedia, Cityzen Data, Courage, European Education New Society Association ENSA, Fondation Sophia Antipolis, ICANN, Innogage, MEDICI, Morgan Lewis, New Flyer, PEG Beer Co., Public Technology Institute PTI, Technology of Peace TOP3, Woldcrunch.

The numerous and strong feedback we received confirm, once more that the event was a success and helped the creation of new initiatives, partnerships & visions.

We look forward to collaborate, exchange knowledge and new insights in the framework of the twenty-seventh Global Forum.

Sébastien Lévy
Vice-President of the Global Forum

Sylviane Toporkoff
President of the Global Forum

The Global Forum 2017 was realized with the active and efficient support of its sponsors and support partners

SPONSORS

SUPPORTING PARTNERS

PROGRAMME

1 October 2017

on the eve of the Global Forum
at the Assiniboine Park Conservancy / Gateway to the Arctic Building

with welcoming words of

Blaine Pedersen, Minister of Manitoba Growth, Enterprise and Trade, Manitoba

Annette Trimbee, President & Vice-Chancellor, University of Winnipeg, Canada

2 October 2017

1st Day

Sébastien Lévy, Vice President Global Forum/Shaping the Future; Partner Items International, France

Sylviane Toporkoff, President Global Forum/Shaping the Future; Founder & Partner Items International, France

Brian Bowman, Mayor, City of Winnipeg, Canada

Dayna Spiring, President & CEO, Economic Development Winnipeg, Canada

Annette Trimbee, President & Vice-Chancellor, University of Winnipeg, Canada

Opening Session

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Future Vision

1st Day

Chair:
Gary Shapiro, President & CEO, CTA Consumer Technology Association, USA

Moderator:
Jørgen Abild Andersen, Founder & CEO Abild Andersen Consulting, Denmark

Keynote Speakers:

Paul Mahon, President and Chief Executive Officer, Great-West Life, London Life and Canada Life, Canada
Future Vision: Customers at the Centre of the Digital Economy

Olivia Neal, Executive Director of Digital Change, Treasury Board of Canada Secretariat, Government of Canada
Global Leaders

Yoshio Tanaka, Professor, Tokyo University of Science (TUS), Graduate School of Innovation Studies; Emeritus Councillor, National Institute of Advanced Industrial Science and Technology (AIST), Japan
Things & Systems

Session 1

Agile Infrastructures

Evolution of Connectivity: The Future of Networks & the Cloud

1st Day

Chair:
John Giusti, Chief Regulatory Officer, GSMA

Debate & Introduction
John Giusti, Chief Regulatory Officer, GSMA
Wladimir Bocquet, Director of Spectrum Management & Policy, Eutelsat, France

Moderator:
Jean-Pierre Chamoux, Professor Emeritus, Université Paris Descartes, France

Speakers:

Adiel Akplogan, Vice President Technical Engagement, ICANN – Internet Corporation for Assigned Names and Numbers
Extension of the TLD in the DNS, how ready are we?

Tim Nickerson, Senior Vice-President and Chief Technology Officer – Shared Enterprise Services, Great-West Life, Canada
Agile Infrastructures

Joel Ogren, Board Member, NxtVn, The Netherlands

Nagaaki Ohyama, Professor Imaging Science and Engineering Laboratory, Tokyo Institute of Technology, Japan

Jason Olson, Director – International External Affairs, AT&T, USA

Keynote Session

1st Day

Keynote Speakers:

Julia Glidden, General Manager, Global Government Industry, IBM, USA
Digital Government Transformation: Toward More Personalised and Accessible Services for All

Anja Wyden Guelpa, Chancellor of State, Republic and Canton of Geneva, the Switzerland
Trust & Confidence

Session 2

Safety, Security & Privacy in an Hyperconnected Society & Economy

1st Day

Chair:
Lewis Shadle, Member of the Board of Directors, NxtVn, USA

Moderator:
Steven Lafosse Marin, CEO, Dgt4leaders, France

Speakers:
Gulshan Kisoona, Manager, IT Security, Risk and Compliance, Air Canada, Canada
Cyber Security in the Aviation Industry

Dan Shoemaker, Principal Investigator and Senior Research Scientist, University of Detroit Mercy – UDM's Center for Cyber Security and Intelligence Studies, USA
Why I Sleep Like a Baby

Eikazu Niwano, Research Professor, Secure Platform Laboratories, NTT Corporation, Japan
IoT Security with Trusted Secure Module

Colin Williams, Director SBL, United-Kingdom
Homo Sapiens Cyborgia

Sarah Zhao, Partner, Faegre Baker Daniels, China
China Cybersecurity Law

Michael Nelson, Public Policy, CloudFlare, USA

Session 3

Future Trends in Artificial Intelligence & Data

1st Day

Chair & Moderator:
Annette Trimbee, President & Vice-Chancellor, University of Winnipeg, Canada

Speakers:

Guy Levesque, Vice-President, Programs and Performance, Canada Foundation for Innovation, Canada
Innovation.ca view

Herve Rannou, President, Items International & CEO Cityzen Data, France
Connection from Big Data to AI

Grady Johnson, Senior Solution Architect, CGI Federal, USA
Adaptive Artificial Intelligence

Sebastian Stoessel, Big Data and Business Intelligence Strategy, Audi of America, USA
Audi

Philip Armstrong, Executive Vice President & Global Chief Information Officer, Great-West Life
Canada Convergence Automation, Robotics & AI

Don Davidson, Acting Director Cybersecurity Risk Management, Office of the Deputy DOD-CIO for Cybersecurity (CS), US Department of Defense, USA
Artificial Intelligence & Cybersecurity

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Public Policy & Regulation

1st Day

Chair & Moderator:
Andrew Lipman, Chair Media and Technology Practice, Morgan Lewis & Bockius LLP, USA

Speakers:

Gérard Pogorel, Professor of Economics and Management-Emeritus, Telecom ParisTech, France

Alice Pezard, Attorney at Law and Arbitrator, France

Jurgen van de Kemenade, Co-Founder, Board Member & Member Senior Leadership & Strategy Team, NxtVn, The Netherlands

Jason Olson, Director – International External Affairs, AT&T, USA

Christopher Mondini, Vice President, Stakeholder Engagement, North America and Global Business, ICANN – Internet Corporation for Assigned Names and Numbers

Stuart Brotman, Howard Distinguished Endowed Professor of Media Management and Law and Beaman Professor of Communication and Information, University of Tennessee, Knoxville, USA

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at the Canadian Museum for Human Rights

Dr. Sylvie Albert, Dean of the Faculty of Business and Economics, University of Winnipeg, Canada

Olin L. Wethington, Board of Trustees, Freedom House, USA

Bruno Burnichon, Honorary Consul of France

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Chair & Moderator:

Jay E. Gillette, Professor Emeritus of Information and Communication Sciences, Center for Information and Communication Sciences, Ball State University, USA
Evolve the Knowledge We Need for the Digital Era

Keynote Speakers:

Dylan Jones, Deputy Minister, Western Economic Diversification, Canada

Samia Melhem, Chair, Digital Development Group Information and Communication Technologies Sector Unit, World Bank Group, USA
Transport & ICT Global Practice

Walid el Abed, Founder & CEO, Global Data Excellence, Switzerland
Data Excellence Science - Automate Business Excellence Management and "Govern by Value"

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Innovation for Society

2nd Day

Chair:
Randy Zadra, Director, Government and International Relations; Senior Advisor Eureka Clusters, National Research Council of Canada (NRC), Canada
Innovating Innovation

Moderator:
Jeremy Millard, Senior Consultant, Danish Technological Institute, Denmark

Speakers:

Ted Hewitt, President, Social Sciences and Humanities Research Council of Canada, Canada

Charles Lemoine, Senior Project Analyst, CSA – Canadian Space Agency, Canada
Space Projects and Open Data as Innovation Drivers

Steven A. MacLaird, Senior Vice President, Government & Industry Strategy, OMG – Object Management Group, USA
Object Management Group

Joel Semeniuk, Laudato Si' Challenge Mentor; Imaginet Cofounder, Global Microsoft Regional Director, Fresco Capitol Impact Partner, Horizon Three Founder & Executive Director, Canada
Horizons of Innovation

Jurgen van de Kemenade, Co-Founder, Board Member, & Member Senior Leadership & Strategy Team, NxtVn, The Netherlands

Bert van den Berg, Acting Vice President, Research Partnerships, NSERC-Natural Sciences and Engineering Research Council of Canada, Canada
Innovating Innovation

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Intelligent Cities, Regions & Communities

2nd Day

Chair:
John Jung, Chairman & Co-Founder, ICF – Intelligent Community Forum, USA
Developing Intelligent Cities & Regions for Sustainable Growth

Moderator:
Hugo Kerschot, Founder & Managing Director, Is- Practice, Belgium
bIoTope, IoT open innovation ecosystem for connected smart objects

Speakers:

Catherine Warren, President & Board Director, Centre for Digital Media; Founder & President, FanTrust, Canada
Vancouver: From Entertainment to Place Making

Wayne Kelly, RPLC Project Coordinator, Brandon University, Canada
Understanding digital rural

Rob McCann, Founder and President of Clearcable Networks; Owner & Operator, Hamilton Technology Centre, Canada
Hamilton – ICF Smart21 2016

Sehl Mellouli, Full Professor, Department of Information System, University of Laval, Canada
From Intelligent Cities to Intelligent Communities

Karl-Filip Coenegrachts, Chief Strategy Officer, City of Gent; President of the Executive Committee of Eurocities, Belgium
Smart (wise) City of People

Alan Shark, Executive Director & CEO, PTI – Public Technology Institute, USA
Beyond Intelligent & Smart Technology: It's Still About People

Michael Legary, Chief Innovation Officer, City of Winnipeg, Canada
Intelligent Community - Culture Enablement

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Digitalization in Healthcare

2nd Day

Chair & Moderator:
Mariane Cimino, CEO, Hoa-Ora, France
Better Coordination of Health and Social Services for Fragile Persons at Home

Speakers:

Eyal Bloch, Cofounder & Co-director, Institute Education for Sustainability & Social Change, Israel & **Philippe Scheimann**, Co-Founder & CTO, TOPGlobal.org, Israel
Improve Health in Developing Countries—From Foreign Aid to Self Aid

Ryan C.N. D'Arcy, Professor and Surrey Memorial Hospital Foundation BC Leadership Chair in Multimodal Technologies for Healthcare Innovation Faculty of Applied Sciences, Simon Fraser University, Canada
Digital Health NeuroTechnology

Joe Jarzombek, Global Manager, Software Supply Chain Solutions, Synopsys, USA
Enabling Cybersecurity Assurance for Network-Connectable Medical Devices

Josh Payne, Executive Director, Sales & Enterprise Solutions, Powerland, Canada
Digitization within Healthcare

Michele Thonnet, eHealth European & International Affairs Executive, Ministry of Solidarities and Health, France
Digitalisation Healthcare: A National Strategy

Paul Wormeli, Executive Director Emeritus, Integrated Justice Information Systems Institute, USA
Creating Trusted Data

Session 8

Industry 4.0

2nd Day

Chair & Moderator:
Gérard Pogorel, Professor of Economics and Management-Emeritus, Telecom ParisTech, France

Speakers:

Namir Anani, President & CEO, ICTC – Information and Communications Technology Council, Canada

Alan Elias, Senior Manager Global Public Policy; Member eBay Public Policy Lab, USA
Industry 4.0 & eBay

Jeremy Millard, Senior Consultant, Danish Technological Institute, Denmark
Shift to Distributed Manufacturing, Mass Customisation and the Future of Work

Michaël Stankosky, Research Professor, George Washington University, USA
Industry 4.0

Nitya Karmakar, Professor, Australian Catholic University, North Sydney, Australia
Emerging Issues Challenges in Managing Global Supply Chains

Session 9

Digital Agri-Business Ecosystem

2nd Day

Chair & Moderator:
Danny Blair, Director of Science, Prairie Climate Centre, University of Winnipeg, Canada
Agri-Business Introduction

Speakers:

Mitch Rezansoff, Integrated Solutions Manager, ENNS Brothers, Canada
The Rules of Agriculture are Changing

Louis Longchamps, Research Scientist in Precision Horticulture, Agriculture and Agri-Food Canada
Big Data: Role of Public Organizations for a Proper Use of Agricultural Data

Maurice Moloney, Executive Director & CEO, GIFS – Global Institute for Food Security, Canada
Agri-Tech and Big Data & Video

Pascal Poitevin, Digital Strategy Consultant, ITG, France
The Role of Public Organizations for a Proper Use of Agricultural Data

Philippe Scheimann, Co-Founder & CTO, TOPGlobal.org, Israel
representing **Emmauel Simiyu**, Co-Founder & CEO, GOIP GROUP, Kenya
Digital Agriculture Extension Services Support System

Ali Kone, COO & Co-Founder, Coders4Africa Inc, USA
Affordable Technologies to Empower Rural Economies

Session 10

Women in Digital Services

2nd Day

Chair & Moderator:
Lisa Zellers, Director Agile Enablement Group, CGI Federal Emerging Technologies Group, USA

Speakers:

Marta Arsovska-Tomovska, Former Minister of Information Society & Administration of the Republic of Macedonia; Digital Transformation Strategist & Business Development Consultant, Macedonia

Tamara Shoemaker, Director University of Detroit Mercy – UDM's Center for Cyber Security & Intel Studies; Operations Manager for CISSE (Colloquium for Information System Security Education), USA

Beth Bell, Vice President & Partner, Canadian Public Sector Leader, IBM Global Business Services, Canada

Martine Delannoy, Chief Foresight Officer of Digipolis, the IT organization of the cities of Ghent and Antwerp, Belgium

Kathy Knight, CEO, ICTAM – Information & Communication Technologies Association of Manitoba, Canada

ABOUT THE GLOBAL FORUM

The Global Forum/Shaping the Future is an annual, independent international event dedicated to business and policy issues affecting the successful evolution of the Information Society. As a high-profile international Think Tank, bringing together senior government officials, policymakers and industry leaders from Europe, North and South America, the Pacific Rim and Africa, the academia, and the civil society – both from advanced and developing economies, its main purpose is to promote interaction and dialogue between the different stakeholders, to give impulses for the formulation of common visions, and to pool knowledge, expertise, research, policy analysis and networking capability.

The Global Forum/Shaping the Future is a not-for-profit initiative of ITEMS International. It is sponsored by organizations from all over the world, interested in sharing and influencing global IT-agendas, and enabling business and government leaders from all sectors of the ICT communities to meet and work with suppliers and service providers.

The Global Roadmap

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

THINK TANK SYNTHESIS REPORT

The 26th edition of Global Forum took place on Monday, 2nd and Tuesday, 3rd, October 2017 in Winnipeg, Canada.

Once again, the Global Forum attracted high-level delegates from the world of politics, the business community, and academia for a two-day discussion on latest achievements and ongoing developments in the world of ICT. Influential leaders and prominent speakers from around the world came together to share their visions and concerns and to discuss the most recent developments and the most fundamental questions related to the topic of this year's Global Forum:

DIGITALIZATION
Intelligent Pathways

The following synthesis report highlights the key issues of each presentation and summarizes the discussions that took place during the sessions. All slides, speaker profiles, and other documentation are available for download on the website of ITEMS International http://globalforum.items-int.com.

Do not hesitate to contact ITEMS International if you wish to get in touch with one of the speakers.

The Global Forum's report is structured according to the actual sequence of presentations during the two conference days. The summaries of the presentations made during the Global Forum 2017 are listed in chronological order corresponding to their sequence in the final conference programme, as listed in the beginning of the present document.

Welcome Event

Eve of the Global Forum

The **HONOURABLE BLAINE PEDERSEN**, **Minister of Growth, Enterprise and Trade**, Manitoba, on behalf of Premier Brian Pallister.

Good evening Global Forum participants and distinguished guests,

I wish to personally welcome Dr Sylviane Toporkoff, the President of the Global Forum, to Manitoba.

I am very pleased to be here to bring greetings on behalf of the Government of Manitoba, Premier Brian Pallister, and my own department of Growth, Enterprise and Trade.

It is truly and honour to welcome the Global Forum/ Shaping the Future 2017—first ever Canadian edition—to Winnipeg.

This 25 year-old event has never been held in Canada and only once in North America over the past decade, that time in Washington.

Your decision to hold the Global Forum in Winnipeg, Manitoba is the right choice for many reasons. Not only are we home to innovative and cutting edge companies within out information technology, arts and new media, aerospace, agriculture and manufacturing sectors, but we are also experiencing a tremendous new sense of optimism and momentum in our business sector that I know is going to lead to long term growth.

It is also timely to hold this prestigious event in Manitoba. Our government recognizes the importance of the digital economy to our growth and sustainability as a province.

The digital economy is so integral to economic success in all sectors that—it is now, simply, just the 'economy'.

And there are many Manitobans who are already making their mark on the world that are perfect examples of this philosophy—Norima Consulting, TRAINFO Corporation and Bold Commerce—to name just a few.

Our government has a ten-point plan to grow the economy and increase our competitiveness so we'll to continue to see companies start here, grow here and flourish in the global marketplace. We'll create the conditions necessary for business success—and we'll do that by working with business and entrepreneurs to expand their opportunities in areas such as agri-business, artificial intelligence and machine learning—and through promoting Manitoba as an attractive place to invest and trade.

I am also excited to let you know that our government is working toward creating a

framework for economic alignment and growth which we expect will further highlight opportunities within this sector and across our entire economy.

In closing, I would like to extend my best wishes to all participants from around the world as you learn and exchange ideas on the future of the digital economy over the next few days.

The Government and people from Manitoba welcome you and wish you a meaningful dialogue as we navigate global intelligent pathways together.

Have a great conference.

Thank you.

Welcome Addresses

Day 1 – Morning – Plenary Session

SÉBASTIEN LÉVY, Vice President Global Forum/Shaping the Future; Partner Items International, France, opened the Global Forum 2017 edition in Winnipeg.

The Vice President welcomed everybody to the Global Forum 2017 conference here in Winnipeg and stressed the immense pleasure to see so many familiar faces—it was almost like coming home to friends and family. But there were also a lot of new ones—which was fantastic.

He stressed the privilege of holding this conference in such a beautiful city. Winnipeg is not only among the top five best places to live in Canada. The city, with its exceptional cultural heritage, also demonstrated how to embrace technology and innovation in order to become a true smart city. Winnipeg is a city of character!

The theme of this year's Global Forum 'Digitalization: Intelligent Pathways' seems more appropriate than ever in today's global environment. The world is facing turbulent times. Everyone has been so thrilled by the speed of globalization and this global network were everything was linked together, when suddenly realising that there is another side of it: that not everyone is happy with it. People, on both sides of the Atlantic and for various reasons, are discontented and worried about the present. People have the impression of living too fast, there is this feeling of inequalities and that too many people are left behind, the integrity of democracies is put into question.

We all know about the significant role technology plays for economic welfare and societal stability—starting from safety and security over artificial intelligence, societal innovation and intelligent communities of different sizes to the digitalization of our industries and business models.

Shaping the future—to the benefit of all. This is the task.

The vice president concluded with a final heartfelt thank you to all those who have contributed to make this twenty-sixth Global Forum possible, especially to its incredible sponsors and speakers.

However, as important as all the Global Forum's fantastic speakers are, it is all the people in the audience who make the forum so special and therefore a very warm welcome was given to everyone in the room for taking the time to be here.

The participants were facing a fast-paced programme full of inspiring presentations and awesome speakers, and the Vice President was looking forward for having everybody engage actively in these two days.

He closed by wishing everyone a delightful and stimulating conference.

SYLVIANE TOPORKOFF, President Global Forum/Shaping the Future; Founder & Partner Items International, France, warmly welcomed the participants to the Global Forum 2017 and thanked everyone for coming to Winnipeg.

The Global Forum's President then gave a sincere thank you to the sponsors of the event. Without their generous support the Forum would not be able to happen.

The President extended a big thank you to both the University of Winnipeg and the City of Winnipeg.

Dr. Toporkoff also expressed her gratitude to every participant—presenters, chairs, moderators and audience alike—for dedicating their time and wisdom to discuss latest trends and create a vision of the future of digitalization.

A special thank you was given to the speakers and moderators who did a great job in preparing the different sessions.

The President stressed that the Global Forum is first and foremost a networking event and encouraged the participants to network as much as possible. Items International would be more than happy to assist whenever help is needed to get in touch with one of the participants of the Global Forum 2017.

Dr. Toporkoff then introduced the first speaker and handed over to Brian Bowman, Mayor of Winnipeg.

BRIAN BOWMAN, Mayor, City of Winnipeg, Canada, welcomed the distinguished guests and speakers. He whished everybody a pleasurable time in Winnipeg and incredible discussions and dialogue over the two coming days.

The Mayor acknowledged (in French) that the Global Forum 2017 takes place on Treaty One land, in the heart of the Métis homeland.

Winnipeg is home to many diverse people and has many claims to fame: Winnipeg is home to the world's longest skating rink. It is also home to the Royal Winnipeg Ballet, one of Northern America's oldest dance companies.

Moreover, Winnipeg is home to the Canadian Museum for Human Rights at the historic junction of the Assiniboine and Red rivers, where members of the indigenous community have been gathering for over 6 000 years. And of course, Winnipeg is home to Winnie-the-Pooh!

Winnipeg is the geographic centre of Canada—it is very much where "West meets East". The city has over 735 000 inhabitants and is well on track to grow to one million people. However, Winnipeg is not just winter, ballets and bears. Winnipeg is increasingly gaining national and international attention for tourism and recognition for its smart growth and innovation. National Geographic identified Winnipeg as one of the best trips on earth in 2016 and the only Canadian city to make that Top 20 list. One can add 'LA Times' and 'USA Today' to the list of those who have made special mention of Winnipeg as a must-see destination.

2 of the last 4 years, Winnipeg has been listed in the Top 7 Intelligent Communities chosen from over 400 cities around the world. It exemplifies best practices, broadband deployment and use, workforce development, innovation, digital inclusion and advocacy that offer lessons to those around the world.

But what people do best in Winnipeg is technology and innovation. The mobile phone is one of the single most transformative pieces of hardware ever developed. It was invented by Martin Cooper who grew up in the north end of Winnipeg. Electricity power and networks around the world have relied upon Winnipeg innovation. New Flyer Industries built and introduced the industries first 60-foot electric heavy-duty transit bus right here in Winnipeg.

Winnipeg companies continue to contribute through the emerging global field of artificial intelligence in many sectors including medical sciences and collaboration with the National Microbiology Laboratory. Winnipeg's National Microbiology Lab is responsible for identification, control and prevention of infectious diseases and is equipped with laboratories that range from biosafety level 2 to level 4, designed to accommodate the most basic and the most deadly infectious organisms on the planet.

The global agribusiness sector has always benefited from Winnipeg innovation. From the mid-1970s, when researcher Baldur Stefansson led the development of canola through to advancements in precision farming technology, like Farmers Edge.

Back when cybersecurity used to mean getting the latest antivirus software installed on your computer, a Winnipeg company called Seccuris was busy protecting governments, casinos and the banking industry from international cyber attacks.

Three entrepreneurs came to Winnipeg in 2012, looking for a roof and some mentorship. SkipTheDishes now employs hundreds of people and continues to disrupt the simple concept of food delivery.

Take a walk down Winnipeg's innovation alley—from information security to computer design, customized skateboards—the diversity and the creativity are absolutely incredible. Winnipeg's start-up community profile is growing thanks to organizations like North Forge and of course the Manitoba Technology Accelerator. Winnipeg's innovators are not only breaking new ground, they are achieving international success.

There are also many different cultural, entertainment and hospitality venues across this beautiful city. Of course there is the Canadian Museum for Human Rights, the Journey to Churchill exhibit at the Assiniboine Park Zoo, or the recently opened Outlet Collection Winnipeg at the Seasons of Tuxedo. Winnipeg has iconic turn-of-the-century architecture in its historic Exchange District, its increasingly transformative downtown which has seen over 1 billion dollars in investments recently, and of course its soon-to-be pedestrian friendly Portage and Main intersection.

The Mayor thanked the organizers of the Global Forum for choosing Winnipeg and wished the participants a very successful conference.

DAYNA SPIRING, President & CEO, Economic Development Winnipeg, Canada, welcomed

the participants and thanked the organizers for choosing Winnipeg as the location for this year's Global Forum. It is the first time in 25 years that the Global Forum is been hosted in Canada.

Economic Development Winnipeg's Bring It Home Program worked with the University of Winnipeg to bring this conference to Winnipeg.

"Why Winnipeg?" is a great question. Over the next two days all of the Winnipeggers attending the Forum will attempt to explain in great detail why Winnipeg!

ANNETTE TRIMBEE, President & Vice-Chancellor, University of Winnipeg, Canada, welcomed the attendees.

Winnipeg is very proud to co-host this 26th Global Forum. The University of Winnipeg has a number of disciplines represented, which is what AI is all about. Sometimes people think artificial intelligence is just for computer scientists, but there are physicists and urban studies professors, politics and geography represented.

When participants of the Global Forum talk about AI, they know what they are talking about—but when you talk to the men on the street, they think it is just all about robots. It is important to develop a common language.

It is important to make sure that our children are graduates and prepared in a resilient way for the future. Many people are very interested in the applications of artificial intelligence in the context of wicked problems and things that are very important to society.

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Opening Session

Day 1 – Morning – Plenary Session

Future Vision

JØRGEN ABILD ANDERSEN, Founder & CEO Abild Andersen Consulting, Denmark, moderating, warmly welcomed the participants to this opening session of the Global Forum 2017.

Some of the most prominent challenges for government leaders all over the world are poor innovation, slow growth and much too high unemployment. It is widely recognised by OECD, and many others across the globe, that a flourishing digital economy is one of the most powerful tools to address these challenges. This was discussed last year at the OECD Ministerial Meeting in Mexico, and, last week in Turin, when the G7 ministers for ICT underlined and affirmed the importance of the digital economy to support the next production revolution.

Moreover, it is recognised that making the digital economy flourish requires a holistic approach including all the elements of the ecosystem of the digital economy—the most important ones being e-infrastructure, e-skills, e-literacy, e-security, e-privacy, and e-content.

Throughout the sessions of the Global Forum, different elements of this ecosystem are touched upon.

The moderator recalled the title of this opening session and briefly introduced the panellists. Based on their great insight, the panellists shared, from a helicopter perspective, their thoughts and ideas about which areas of this ecosystem they consider to be in particular important to focus on when applying a holistic approach to make the digital economy flourish in the interest of innovation, growth and employment.

The session's chair, **GARY SHAPIRO, President & CEO, CTA Consumer Technology Association**, USA, captivated the audience with a great talk on innovation and current trends.

[The talk started with a short video clip on CTA's vision of innovation]

The Consumer Technology Association (CTA) is a non-profit, non-governmental organization, based in Washington D.C. CTA has over 2,000 technology companies as members from the U.S. and Canada, including U.S. subsidiaries of overseas companies.

CTA is dedicated to innovation. Innovation is what matters in terms of the organization's advocacy efforts, events and promotions. CTA fundamentally believes that innovation is changing the course of the world. However, there is some concern about jobs.

CTA considers innovation to be a tool, just like fire, the wheel, the printing press, like the car or the air plane. It is a neutral tool—it could be used for good, and it could be used for bad, and one has to deal with that.

There is growing concern that technologies' "negatives" could outweigh the "positives". For instance, the Indian Minister for Roads and Transport declared that self-driving cars shall not be allowed in India because it will take away jobs. Driving jobs are one of the most common jobs in the entire world and there is concern. Even a service like Uber is talking about replacing its drivers with self-driving cars.

There are a lot of think-tanks which have issued projections that in the next five to 15 years, a large percentage of today's jobs will no longer exist and will be replaced—mainly jobs requiring repetitive manual labour.

President Trump announced that he wants to keep jobs in the U.S. and wants to bring factories back. But it is technology itself that is contributing more than anything else to the changing nature of jobs. Over 80 percent of the jobs lost in the U.S. are due to changing technology, not the changes in free trade, which is what he seems to focus on more.

You can find in factories around the world, e.g., in China, Vietnam, India, Mexico, etc., the type of factory jobs requiring an intense human activity and without a mechanised factory backing them up. It is that type of job most people with a small degree of schooling are not going to want to do. They are very difficult, they are very painstaking and they often come at some cost.

A "hand" robot has been developed by some of the best minds in Harvard and MIT. It actually takes very difficult labour conditions and replaces them with the factory. For instance, making a pizza dough on a national basis and getting it out to franchises is very difficult: It has to be done in a sterile environment, which requires it to be very cold (40°F/4.4°C), and it requires that the humans involved wear bulky suits to stay warm and germ-free. It is almost impossible for humans to do this for more than a few hours. These mechanised machines can do it now, 24 hours a day, and they can let the humans do the more complex tasks.

There is a dramatic change in so many different ways.

The Consumer Technology Association does advocacy work around the world. CTA has

lobbyists in Washington as well as in most of the U.S. states and in Canada, and is increasingly active around the world. The organization, which is fighting for innovation, increasingly realises that it starts to be up against the tide of anti-innovation. CTA is seeing challenges to some of its members, including Facebook, Google, Twitter, Uber, Lyft and Airbnb. CTA has even created a Disruptive Innovation Council, which is composed of some of those companies and a few others that have achieved major market significance—but they disrupted the status quo.

Innovation is a change. Innovation is about change that people put value on. Innovation is not something you just pay for—governments can be innovative as well. Government can create things that people aren't paying for, but it can be adopted and save money and be more effective.

CTA produces the largest innovation event in the world: CES. CES is a global consumer technology tradeshow that takes place every January in Las Vegas, with more than 180 000 participants from around the world.

In this world of shocks and crisis we are living today, some technologies are being used against us. But, technology is also part of the answer. There is a proposal at the U.S. government which would require visitors to give up the passwords to their social media accounts or smartphones if they come from certain countries. CTA has publicly resisted that proposal. The organization argues that technology itself will address this problem, and many of the other biggest problems we face today in society.

For instance, there is an app people can download for free, called Moodies. Moodies can analyse human emotions in real-time just by listening to a person talking. If we put all these things together that we are starting to see with voice analysis and facial recognition, we can solve many problems related to terrorism. We should use both old school and new school ways of figuring out how to minimise threats.

About 4 000 companies from around the world are exhibiting their innovative products at CES in Las Vegas. Some of the biggest answers to some of the world's biggest problems are showcased at CES.

It is not only the largest collection of self-driving cars from different companies, which will end eventually over 1 million deaths per year around the world. There are also tremendous breakthroughs in the world of health: e.g., wearable devices that can track how fast a person's heart is beating – which could be conveyed to a doctor or a system that figures out whether this person needs attention. These devices are becoming increasingly smaller and soon will be implantable.

One of the biggest problems that Canada, the United States and most of the other developed countries face today is a population that is getting older and older, whereas the birth rate is going down. There are less and less people to take care of the older ones. Increasingly technology is providing answers: whether or not someone got out of the bed, hit the floor, moved, took his/her medicine etc.

Soon, the seats in the cars and chairs will be able to tell a person whether or not he/she is likely to get sick unless he/she changes behaviour. There are so many things that are coming very quickly with regard to health.

But it is not only that. It is production of food and clean water, which a large part of the world desperately needs. There are demonstrations showing how to use the Internet of Things to put sensors in the ground to determine the precipitation level, the soil and acidity, etc.

And, it is all coming because of one product: Nothing has been more important in the last 10 years than the development of the smartphone, because a smartphone contains within it a dozen of different sensors. There are hundreds of millions smartphones that have been sold and the price of these sensors is going down dramatically. Sensors that indicate a person's geographical location, what the temperature is, what the pressure or humidity is—all these different sensors can be released for pennies a piece.

Smart people around the world are solving some fundamental problems and they are using the internet to connect us in a very big way. It is more than just about placing phone calls, it is about providing connectivity and providing solutions to the biggest problems of our time—whether they be security or health or others.

This is why we should be optimistic. However, at the same time we are dealing with big issues, like the future of work. CTA held a full day conference in Washington some months ago, where 38 speakers, including a dozen policy makers, gave their vision of the future of work. This is something CTA continues to explore at CES and at other events.

CTA also encourages the U.S. government to be focused on innovation. Four years ago, CTA started to rank the 50 U.S. states on how 'pro-innovation' they are. CTA looked at some basic aspects, such as broadband speed, STEM graduation rates, flexibility of the work force, but also aspects like 'Are they welcoming or not to disruptive innovation?'. Since then, the Innovation Scorecard, produced by the Consumer Technology Association, is a yearly index that evaluates the U.S. states' innovation-friendly policies.

CTA is about to make the next step in 2018 by going global: CTA will be looking at the top 40 or 50 countries for which data is available. The ranking will involve some of the criteria used for the national ranking, but also additional ones, e.g., access to information in the internet (Does the country allow that? Do they allow you to do searches and communicate with each other and explore?). This is very vital to the growth of innovation in a free society.

We are heading toward a world where there is two different visions of the world: One is a top-down control, where you don't allow various forms of communication, with North Korea and its total ban of access to innovation probably being the worst example, versus Canada and the U.S., which are much more democratic. There are free elections, there is freedom of access, freedom of speech and freedom of exchange. We are heading toward a world where you have a battle between these two competing structures—and in what way we go is very important.

The democratic world has to show that we can innovate, that we can solve world problems and reduce frictions. There will be challenges with jobs and cybersecurity, but we have answers coming with smart cities and with artificial intelligence. Thirty to 50 years from now, we are not going to be talking about the same things that we are talking about today, because we will solve those problems.

It is not the technology which is making the worst changes in our life. Technology is there for

the better. It is the fact that as technology progresses, we will be taking some of the worst parts of jobs away from the population of the world and have to solve the problem how people can have satisfying lives, feel like they are contributing, making a difference in society and having relationships—despite this gifted technology that we are all enjoying as we are living through this incredible revolution in the course of human history.

During the subsequent **Q&A**, the moderator addressed two questions to Consumer Technology Association president Gary Shapiro.

The first question concerned the impact of technologies on jobs. Six years ago, a McKinsey report claimed that the Internet created 2.6 jobs for every job it eliminated. Over the last years, things have changed. What is the solution to accommodate the concerns of politicians around the world with respect to the job challenge? Is it increased e-literacy, an increase of e-skills? What can be done?

The second question was about differences. How innovation can support the development of the digital economy in North America versus Europe? Two different cultures, a lot of similarities—how is innovation affecting the development?

Gary Shapiro emphasised that the history of technology is disruption and jobs are lost. It is difficult to say whether there will be more jobs created than lost this time. Especially self-driving cars represent a very big disruption. On the other hand, there are the benefits: it is not only the lives saved, it is the people empowered. Seniors will be empowered, people with disabilities will be empowered. To them it is life-transforming.

However, today in the U.S., there are at least 3 or 4 million jobs open where either Americans don't have the skills to meet them, or they have the skills but people are not willing to live where they can get a job. There is a phenomenal shortage. In the Washington, D.C., area alone, there are over 100 000 data analyst jobs open, there are programming jobs. Indeed, the U.S. exports a lot of jobs to India, because it is where people are available, it is where they are trained and it costs less to employ them.

The New York Times just has published a story about IBM having more employees in India than in any other country in the world, including the United States. There are jobs shifting around and it is a matter of skills.

CTA recently created a new position called Vice President of U.S. Jobs to look at bridging the skills gap. The U.S. higher education system is great, but they educate people and 70 percent of the STEM graduates are not American citizens, which then have to leave the U.S. upon graduation. And at a lower level, there is definitely a need to change. Germany, and to a certain extent other countries, have great models of apprenticeship programmes and training programmes.

By limiting internships, the Obama administration went the wrong direction and negatively affected start-ups. One of the most successful things are start-ups in the U.S. The U.S. has so many things that favour the creation of start-ups.

We should also look at the number of 'unicorns'. A unicorn is a young company that is valued

over $1 billion USD. There are very few unicorns in Europe! Arguably, Spotify was one and maybe one could come up with a couple of others. At the same time, Argentina has four unicorns. When we are looking at the number of unicorns there is a difference between the United States and Europe.

In this context, Consumer Technology Association president Gary Shapiro, expressed his appreciation for French President Emmanuel Macron, because he is willing to take on some of the French challenges to entrepreneurship. 'Entrepreneur' is a French word—but so is 'bureaucracy'. The unions in France have not been helpful to establish start-ups that will become growing companies. Same thing in Italy: once a company achieves a certain size, there is such a huge number of rules that inhibit growth.

Smart leaders are looking at the policies that are out there. It seems that Europe is not coming forth with its own creativity and innovation. It seems to be attacking the most successful American companies using the most vague antitrust laws. Although, even in the U.S., the laws are not that clear. Any business should know what the law is and be able to interpret the law and act accordingly. Being successful should not be a violation of the antitrust laws.

Another example is China: They have totally shifted in China in a manner of five years. Their 5-year programme is focussed on innovation; they measure innovation by the number of patterns per 100 000 people; they have now over 3 600 start-up accelerators in China; and they challenge every citizen to become entrepreneur. They are using soft power around the world to spread their programmes and their ideas and they are not doing badly. Today, there is real innovation in China.

Some of these battles will be fought out politically, some will be fought out economically. But there is a challenge going on in the world, and Europe has to step it up and change.

PAUL MAHON, President and Chief Executive Officer, Great-West Life, London Life and Canada Life, Canada, [www.greatwestlife.com], provided a great insight in the challenges and opportunities that technologies can bring for a global financial services company. He particularly focussed on the human impact of artificial intelligence and robotics.

Future Vision:
Customers at the Centre of the Digital Economy

Great-West Life was founded in the 1800s in Winnipeg. The company operates in Canada, Europe and the U.S. under 6 different branded financial services companies that came together through a series of acquisitions.

The oldest company, Canada Life, was founded in 1857. Canada just celebrated its 150th anniversary of birthday this year—Canada Life was founded 20 years before Canada came together! The youngest of the six companies is Irish Life, which was founded 1939.

Across its businesses Great-West Life has approximately 30 million customer relationships, 240 000 advisor relationships and 24 000 employees. In summary, the organization is old and fairly complex.

Consider the impact of industrialization and urbanization, workforce changes and changes in class structures and it is not hard to see the parallels between industrialization and the impact of technology.

The first computer acquired in 1958 by Great-West Life was an IBM computer—it was at the same time the first acquired in Western Canada. That computer changed the way the company approached complex financial and actuarial calculations. It had a major impact on the processes and productivity of very few actuaries and accountants in the organization.

Today, our GroupNet application provides access to the benefits of Great-West Life to almost 8 million Canadians. The GroupNet application can be accessed by smartphone or Apple watch.

Over 90 percent of the organization's 59 million health and dental claims, that it pays every year, are processed electronically and are never touched by human hands due to the use of these technologies and other digital processes.

Technologies like these have had a material impact on the company's processes and cost structure. They also have had a significant impact on customer experience.

The impact of technology on Great-West Life is not just about back office processes and faster services, it is about empowering the customer. Customer expectations for financial services are changing rapidly, and they are not shaped only by experiences with other financial services providers, they are shaped by other experiences customers have in their life. For example, our GroupNet app allows group customers to use their smartphones or Apple watch to find a service provider, file an e-claim, monitor that claim and access coverage information. This service hub built by Great-West-Life has been modelled after other customer service experiences, like Lift or Uber, for instant computing.

In the financial services sector change is moving fast. New entrants, such as KOHO, are

creating an open banking experience for the customers. This model digitally aggregates all the information a customer would have across all the financial institutions they work with. Open banking puts greater power in the hands of the consumer, but creates increased complexity, in particular in cybersecurity.

The organization is currently piloting an omni-channel solution called Wayfinder, which digitally aggregates a consumer's retirement and savings information across all the financial institutions s/he uses.

Change is also been driven by a competitive disruption in the financial services industry. Globally, there is an increased number of FinTech players that are creating innovative ways to deliver financial services to customers. While many of these companies are trying to disrupt, many of them are also partnering with traditional financial services companies. Growth in FinTech has been significant. In 2010, there was 1.7 billion dollars invested in FinTech in the United States. By 2015, that number had climbed to 22 billion dollars.

The Great-West Life companies are investing in FinTech trough a joint venture with Portage. Through Portage, Great-West is investing in companies that could deliver a significant return on investment as they succeed. Great-West is learning to adapt its business by working directly with companies that are trying to disrupt them. The objective there is to see how they learn. The organization is also learning from the challenges and failures it sees amongst many FinTech companies. The objective is to improve the business model, and ultimately to improve the value proposition for the customers.

Artificial intelligence and robotics can fundamentally transform ecosystems, including the financial services industry.

It is still early days, Great-West Life is active in piloting these technologies within its businesses. The potential benefits are massive. Process bots have the potential to drive huge efficiency in operations. Chatbots have the potential to deliver customer service in any language, on any platform, at any time. Robo-advisors and omni-channel solutions like Wayfinder have the ability to economically serve the markets that are not well served today. And machine learning can bring incredible analytical power and speed to complex business challenges, including underwriting and risk optimisation for the company's businesses.

However, it is not all easy. Earlier this year, Great-West Life announced a restructuring within the company to reduce business process costs as the company continues to invest in digital, analytical and cybersecurity. And this has people impact. People lost their jobs. The changes associated with AI and robotics also have the potential to dramatically impact the types of employment required going forward. And it won't just be limited to process jobs. An article in Inc. magazine identified that machines could potentially replace lawyers, surgeons and airline pilots. While automation will displace certain types of work, it will also create many technical jobs and free-up the workforce for other growing priorities. One important priority is changing demographics. Consider our western world demographics and the increasing need for service based workforce to meet the needs of an aging population.

While the impact of the change of technologies like AI and robotics may not be as great of industrialization, the speed of change will be far greater. How do we—business, government and academia—work together to create positive economic and social outcomes from this technology-driven change. This can and will come through innovation on many fronts,

including innovation and education, training and retraining to ensure we have the population that can respond to this change, as well as innovation in our tax- and social systems to support this change. Ultimately, this is not a technology challenge. It is a challenge and an opportunity for all of us to work together to shape a positive technology-enabled future for our people.

During the **Q&A** section, the moderator addressed two questions to Paul Mahon. The first question concerned the number of jobs impacted by artificial intelligence and robotics.

Mr Mahon replied that one should rather speak about the number of roles impacted. Jobs being impacted means that there won't be a job for someone; roles impacted means that we just need to change. The way Great-West Life thinks about changing is focussing on roles where automation has a high probability of adoption. But also roles where it takes almost a village to operate a process and that process actually can be overtaken by using for example a process bot.

There is a McKinsey study that looked at 20, 000 processes in the Unites States and they hypothesised that 35 percent of those processes could be automated. More recently, the deputy governor of the Bank of Canada said that they expected 47 percent of jobs in Canada would ultimately been impacted by artificial intelligence and robotics.

We should think about this more of a journey: The journey has to be one of 'How do we change the way how we recruit and develop people? How do we retrain?' Most recently, a Leadership Development Institute has been launched at the University of Manitoba. It was all about 'how do you create leaders that are going to be able to migrate in a technology lead world and a changing world?'

Mr Mahon expected, that over the next 10 years, probably half of the roles at Great-West Life will be impacted in some way by technology and that there will be new and different roles.

The second question was on cybersecurity risks and privacy.

Mr Mahon emphasized that cyber risk is endemic across the world. When going to cyber presentations around the world done by experts, it feels like it is the same expert in every country. This is because every expert is facing the same cyber threats; the cyber threats are coming from the same places and it is organized crime. We talk about cyber risk, but the reality is that these are criminals that are impacting our world.

Cyber is now becoming one of the highest points of investment in Great-West Life, because at the end of the day it goes back to securing the most important thing, which is first of all their customers' security, but it is also their reputation. The company spends time having ethical hackers coming through the organization, and they do tabletop exercises, where the darkest pictures one can possibly imagine are painted.

Cyber risk is taken very seriously at Great-West Life. Advancement in technology are great, but to also advance security is critically important.

As regards to privacy, privacy is very important. It is one of the fundamental freedoms that

individuals have a right to, but there is a balance privacy and risk management. Some of the best models are in Europe and the United States, where you have got government working with telcos, working with technology companies, working with security, and they come together to come up with solutions and they share information. It is information moving quickly; it is the idea that everybody will be as strong as the strongest, not that everybody will be as weak as they are.

The challenge Canada faces is that they don't have that level of collaboration. They have a level of privacy that is availed to people and it limits what the telcos can do to share with financial service companies. It is going to be incumbent on governments and on society to come together in order to become strong as the strongest as we think about security. That may challenge Canada to think about modifying some of its privacy legislation to secure its businesses and to secure the country.

OLIVIA NEAL, Executive Director of Digital Change, Treasury Board of Canada Secretariat, Government of Canada, shared her remarkable experience of digital government and outlined how government can be, what digital means and why it is important, and highlighted three things that the Canadian government is starting to do right now.

Global Leaders

What does digital government really mean in terms of a future vision? People don't tend to think of government as really playing much of a role in being future visionaries in digital change. But government has an important part to play in this world. The Canadian Government delivers services every day to 36 million people; it spends 6 billion dollars a year on technology. If the government is not keeping pace with the change in delivering services that the user is expecting, government starts to become irrelevant.

Olivia Neal, who used to work for the British Government before, explained that the British Government needed to create a fundamental different culture in order to become an excellent deliverer of digital services. Today, the UK is ranked number one by the UN in the world in terms of digital government.

There was an important change in culture in the British Government—which is traditionally a very hierarchical place, a place where people aren't empowered to work in an agile way, to take decisions for their own teams, or to change things themselves without going up lots of layers of bureaucracy. The government wondered how to deliver digital services differently. They stared creating a culture where people were valued not on whether they wore a suite and tie or on how many degrees they had, but on what they had done and how they acted, and having a culture that welcomed different types of skills and different types of people in the government.

The British Government started working in different ways: it started working in the open, it started working more collaboratively, and importantly, it started engaging users of services at every stage through that development. These were very important aspects when moving the UK forward in terms of digital delivery.

The Canadian government has looked at what the UK, the Unites States, countries like Estonia and Denmark and other countries around the world have done, in order to answer

the question how to do this in Canada. The Canadian government recognised that the services provided online to citizens do not meet their expectations—the government must become better in that. This is why the Canadian government is bringing in new people and fresh ideas and started working with people in order to amplify and accelerate that progress.

What does digital mean? There are different definitions of digital, one being: 'applying the culture, processes, business models and technologies of the internet-era to respond to people's raised expectations' (Tom Loosemore).

This definition has two very important parts in it: The first one is that digital is absolutely not about building a website or building an app. It is about an organization working in a really different way; an organization empowering its people, adopting its culture to be welcoming of change, and to be constantly iterating and developing.

The second important part of this is people's raised expectations. The government has to meet the expectations that people have of their government. Governments have to deliver to that standard. And people's expectations will change. Digital government is never going to be done, because people's expectations will continue to change and technology will continue to change.

Delivering effectively in the digital age is not optional. Private sector companies are either digital or they are dead. Governments are monopoly providers of many services. Governments deliver services that people use sometimes in times of great stress, they deliver benefits to very vulnerable people and they receive people's tax returns. Governments deliver to millions of millions of people every single day. Because governments are monopoly providers, sometimes in the past, they thought that people have to use a certain service and that it is up to the citizen to work out how to use a specific difficult form. However, this is not acceptable. A government has the duty, as a monopoly provider of services, to say 'how do we make these services things that people can use, that are quick, straightforward, easy and ideally are delivered in the place where people already are?'

We see that people are loosing faith in the democratic system of government. It is so important that government keeps the pace of people's expectations and delivers services that they expect so that government remains relevant. Delivering services that met people's expectations is not optional!

Three things the government of Canada should start doing now:

1) The first one is procurement. The Canadian Government has to procure differently, and Hon. Scott Brison, who is President of the Treasury Board, is strongly supporting this target.

It will be important to move away from a government awarding very big contracts to single suppliers and asking to deliver something in 10 years time. The Canadian Government needs to start operating its procurement in a much more iterative approach, it needs to start working with a wider range of companies to make the most out of the expertise that is out there. And instead of asking great new tech start-ups to spend months of writing huge amounts of documentation, the government should ask them to build a prototype, because this is what start-ups are good at. This is something the Canadian Government started doing and it just finished a first pilot of a new procurement approach. The government got small start-ups to show them prototypes, and after that the government awarded a contract on a

day to a company. The intention is to build that model out and to keep doing that.

2) The government has to recognise that it doesn't have all the answers. It is not possible, as a government, to sit in an ivory tower, to just come up with a list of requirements and to think they know the solution. There are brilliant people out there everywhere.

3) No matter what type of technology we are talking about, no matter how the world changes, the government has to keep focussing on its users, because that is the only way it would deliver services that meet the users' needs. Government has to be out there, talking to the users from the beginning. It has to actively welcome that change of requirements and deliver things that meet those needs. This is the only way for the government to create a system and services that work for the users.

The first question addressed to Olivia Neal, Government of Canada, during the following Q&A was about her thoughts about implementing a very comprehensive e-government regime on a mandatory basis (such as Denmark)—versus the other way round, where the government provides incentives, motivation among citizens and businesses for entering this system.

Olivia Neal answered that, as far as she knows, Denmark is the only country that has made it absolutely mandatory to use online services unless you get special exemption. The UK took the approach to say they want to build digital services which are so good that people prefer to use them. Because if they build a service that is incredibly simple and straightforward, why would people not use it versus going to an office or writing a letter? In this approach you don't see the digital take-up as immediate increase as the Denmark model would have, but this model really puts emphasis on building the services well.

If the government would just made it mandatory for people to use the services, it would be interesting to know whether that does genuinely reduce cost. Because if you are using a digital service that isn't excellent, people will get stuck and they will immediately pick up the phone and call a call centre. Therefore the call centre's costs rise and in most governments costs of operating call centres are really a large part of running government operation. If you are not looking at how you decrease that additional customer contact, you are not ending up saving any money.

Mrs Neal's preference would be the approach of governments saying that they want to make excellent things, because that keeps pushing governments to deliver and drive better measures of satisfaction. One of the really important things the UK did was to ask 'how to measure people's satisfaction with the services that the government provides?' The UK set up 4 performance measures for digital service: customer satisfaction, costs per transaction, digital take-up and, most importantly, competition rate, i.e., how many people where able to finish the transactional service they started first time without any help? Measuring the completion rate was important to work out where people were getting stuck, where they were dropping off, and whether there were particular elements of a service they didn't understand, so the government could immediately update those and make them easier for people to use.

Another important aspect in the UK was to publish all this information. The government made all of that information public on a performance platform which is open to the public. Governments have be responsible for holding themselves to account. Publishing these

information keeps the pressure on governments to deliver excellent digital services.

A second question was about how does the government encourage risk taking and innovation in public procurement?

Mrs Neal stressed that governments have been very afraid of talking about failure and they have to embrace that. Governments have to recognise that they will fail sometimes and that this is okay—but they have to fail small, they have to fail fast and they have to learn from it and do things differently.

When the Canadian government is looking at different ways of doing procurement, one of the things they are looking at is how to breakdown contracts so that they are not awarding something for an entire 7-year period. How to break that down in order to enable them to ask for an initial discovery piece of work or a couple of potential prototypes in order to award a number of contracts and then see which one is the best. Awarding a small contract that fails in 6 months is much better than awarding a large contract which fails in 10 years time and has just more and more investments. Governments have to start talking about failure and they have to learn from it.

YOSHIO TANAKA, Professor, Tokyo University of Science (TUS), Graduate School of Innovation Studies; Emeritus Councillor, National Institute of Advanced Industrial Science and Technology (AIST), Japan, provided a great talk on means to foster open innovation in the Japanese industry.

Things & Systems

Digital technology changes almost everything in every sector. ICT is very important, but it also bears dangers.

The accelerated globalisation of the economy during the past 10 years has changed any area of business, especially in Japan, such as business models, industrial structure, innovation schemes, the system and human resources. They have to adapt their legacy system to meet new and changing business needs.

The Japanese industry is suffering from declining market shares. In order to stop this trend, it will be necessary to incorporate new business mechanisms.

The Japanese manufacturing industry has to shift away from simple product-based business models with revenues from products. For a long time, Japan's manufacturing industry was characterized by selling existing products with enhanced quality, low cost production and global sales. There was a strong focus on just the QCD (quality, cost and delivery) approach. In the 1960's, Japan provided products, especially electronic consumer products, cars and textile products, in almost every country around the world.

Today, Japan has to change its industry structure from only 'QCD thing' to 'things with systems', including services and ecosystems. The ecosystem loop is necessary to make the system evolve. Japan competes with many countries simply on product development and product development cost. However, it will be necessary to change more than that in a

product and to evolve towards the services and the systems.

Japan's industry has to change from a product-based business model, based on revenue from products to a system design with outcome, providing value to the customer—which is a customer requirement. Quality, cost and delivery is still important, but it is important to also focus on the service with product.

In the current business architecture in Japan, architecture, business design, operation and components of a product are clearly separated layers. It is a very common architecture, especially in the area of PC or car manufacturing and others. The product's components are being assembled from various component manufacturers.

The new business architecture should be an architecture operation where architecture, business design, operation partners and component partners are working together in order to create an open innovation ecosystem. This kind of system is needed to revitalize the Japanese industry.

To take an example from the consumer electronics industry: Japanese companies like Sony, Toshiba, Panasonic, Sanyo, Sharp, Mitsubishi etc. all have almost the same structure. All these companies are offering similar products and compete in Japanese market. They all provide very good products, but they don't make enough profit.

In order to revitalize the Japanese industry, there is a need for open innovation systems. Currently, each industrial sector in Japan, e.g., steel, automotive, electronics, communication, chemical, bio and pharmaceutical, etc., are individual independent layers. In the future, there should be transversal ecosystems linking all these different industries. This kind of system is needed.

However, from a government point of view, it is very easy to control each industrial sector individually, but it is much more difficult to control the interlinked industries. Uber, for instance, is not allowed in Japan due to the specific nature of the company which is rather difficult to define.

The concept of things and systems is simple, but implies a change of business models. The boundaries between technology and service providers are becoming more and more unclear. Actually, a service is just a product. Companies have to change their mindset and incorporate the new business mechanisms of the things and systems concept. The proposition is a business design which promotes the cooperation of the things and systems. This will lead to value creation in the outcome economy, where companies create value not just by selling products and services.

With the objective of revitalizing the Japanese industry, two organizations have been created in April 2014 together with the industry and national research institutions and universities: The Things and Systems Society and the Things and Systems Consortium.

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Q&A

A first question was addressed to **Olivia Neal**, Government of Canada: Her talk about digital government mainly focussed on services, but government is much more than services. One of the things that weren't mentioned is the idea of open government—open data, people participating and making government more transparent. None of this can happen without the digital tools. What is the Canadian Government doing in this area?

Mrs Neal, explained that the Canadian Government is very active in the world of open government. Canada is currently ranked number 2 in the world on the Open Data Barometer. Moreover, the Canadian Government is just to become co-chair of the Open Government Partnership, which is an international group of countries who come together to push that open government forward around the world. That means that Canada will be co-chair next year with Georgia, and then will host the Open Government Partnership the year after. That is a strong indication for the commitment of Canada to open government.

Canada is doing great work in making open data sets available. One of the things the government focuses on, and would like to see going forward, is not stopping making open data sets available, but looking to how this can be taken to the next step: not just making static open data sets available, but to create real-time open APIs in order to really start opening-up that ecosystem to allow people to be offering services and using government's data on a much wider spread.

The next question was addressed to **Gary Shapiro**, Consumer Technology Association: Many people are afraid of what AI might bring. How can governments and the private sector prevent the 'dark side' of artificial intelligence and get people to trust this new technology?

Gary Shapiro answered that it is an interesting dilemma. There is science fiction that discusses a great future and science fiction that talks about a dystopian future, with a lot of robots taking over the world.

However, the real issue is not robots taking over the world, but bad players taking over and using artificial intelligence to try to do damage.

The most effective approach to this question is when government and industry work hand in hand. Either industry regulates itself or there is a co-opted relationship. Mr Shapiro gave an example of both:

CTA represents the major players in the area of personal health devices. These players gathered together and agreed upon a way of handling privacy where it is transparent, in clear language, with the possibility to opt out, they limit restrictions on what they can do with the medical information. That occurred a few years ago and has been extremely successful.

The way to get to the U.S. HDTV standard is another great example: It was a 10- to 15-year project and required a specific goal and literally thousands of engineers working together to build up pieces of that goal. The biggest project can be broken down to small projects, and you can end up with a success if you agree upon a definition of the goals.

With regard to AI, one can relatively quickly agree upon a definition of the goals and that is Isaac Asimov's rule No. 1:'Robots shall do no harm to human beings'. The question is how could you stop someone from programming that.

This will be a process over time, and there will be a lot of discussion and dialogue. The real bad case scenarios are proxy wars being fought out with devices and things like that, in a way which is harmful on a massive basis. It requires people getting together with NGOs and private settings in order to do various scenario planning and figuring out ways to require a certain level of programming to be built in, which doesn't effect the utility of products but which does avoid bad things.

Take one component of this: self-driving cars. What if you are in a non-self-driving car and you try to hit a self-driving car? What happens and how does the car choose between one life and another life? The reality is probably that most licensed drivers never have to make this decision in their entire lives. Certainly with programming you can resolve that decision, based on what are the likelihoods of a person being in this situation, the number of lives involved etc. But there will be bad things that happen along the way, there will be deaths due to self-driving vehicles, there will be deaths due to artificial intelligence and robots. Things will go wrong—however, we can not just stop something really amazing, which will save and transform lives. We have to keep the positives in mind as we, one by one, slowly and methodologically, discus and debate and resolve the negatives. And, just as we are seeing with cybersecurity now, if you build a better mousetrap, you get smarter mice. And there is always a better way that the bad guys will figure it out and we have to deal with that as a society.

Technology and innovation will raise us up as human beings and we have to keep this in mind.

Before closing the session, the moderator, **Jørgen Abild Andersen**, Abild Andersen Consulting, asked each panellist to make a short statement about the most prominent challenge to use the digital economy as a tool to provide more innovation, growth and social prosperity.

Olivia Neal, Government of Canada, considered culture change as the biggest challenge. The Canadian Government has to adapt to a culture where change is going to be constant and is looking for ways to embrace that.

Gary Shapiro, Consumer Technology Association, also opted for change. We as human beings fundamentally resist change. We think everything will be the status quo, we think it will be for the lifetime, from the time we were born. We try to keep the relationships and the parents and the friends, but yet the history of humanity is the history of change for the better, and sometimes it hurts, sometimes it is for the worse. But we have to embrace change and innovation as a basic cultural tenant.

Paul Mahon, Great-West Life, also choose change. Great-West Life operates in an old economy business with millions of customers. Change in terms of how to apply new economy (digital) capabilities in an old economy environment and how those things manifest and work together.

Yoshio Tanaka, Tokyo University of Science, highlighted industrial change as biggest challenge to create the new ecosystems.

The moderator thanked the audience and the panellists and closed the session.

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Session 1

Day 1 – Morning – Plenary Session

Agile Infrastructures
Evolution of Connectivity: The Future of Networks & the Cloud

Overall summary by the moderator

Moderated by Prof. Emer. Jean-Pierre Chamoux, this session combined two lively sub-sessions: a face-to-face discussion between the session chair John Guisti, GSMA and Wladimir Bocquet, Eutelsat, followed by five presentations dealing with the future of digital networks, case studies and worldwide connectivity progress followed.

The face-to-face sub-session touched upon connectivity quick growth over the world. Agreed by both speakers, numbers are impressive: roughly 5 billion people connected to date of which 1.2 billion are reached by 3G coverage albeit leaving some 2.5 billion people unable yet to take full advantage of this extended world coverage.

Both speakers stressed that global standards do incentivise connectivity between people but that Internet of Things will impose a tougher convergence to allow anyone and anything to be connected anywhere, as soon as 5G is implemented.

Besides, spectrum being the main rival resource, it still appears that spectrum is again the major challenge for the next generation of infrastructures and services to develop smoothly over the coming years, a challenge to be faced by the coming ITU World Radio Conference, scheduled for 2019.

Speaking next, Adiel Akplogan, ICANN, stressed the stakes for another basic resource required for the next Internet step forward: extension of the Domain names systems and inclusion of diverse and multiple language spelling to allow a smooth, convenient interconnection between users spelling and naming ASCII and non-ASCII characters which are used over the world (Arabic, Cyrillic, Indian, Thai etc.). A Universal Acceptance Steering Group is working to achieve a universal acceptance of valid domain names, for all languages and spelling, he said.

Three case studies followed:

Tim Nickerson, GreatWest Life, gave an overview on the critical path forward to be carried for convenient, adaptive and friendly cloud services applications, software network development and legacy mainframe services which are still crucial for major corporations even during the 5G roll out, holding great promises. IoT will have to be bound with existing nets and connectivity will hence play a key role during the coming years.

Joel Ogren, NxtVn, a Dutch quickly growing infrastructure company, implementing data centres, gave some hints on the mission and challenges of such an info-services provider: selecting the appropriate spots for such facilities, analysing transborder flows, data privacy and fiscal issues, dealing with cyber and physical security stakes etc.

Prof. Nagaaki Ohyama, Tokyo Institute of Technology, described the original nationwide Japanese e-ID card programme which has already been implemented on a wide scale for healthcare, credit and ticketing applications over the recent years in Japan. He sketched the current project to use this Japanese standardised ID card as a safe, personal and reliable ticketing and ID device for the people expected to attend the coming 2020 Olympics events in Japan.

Jason Olson, AT&T, gave an interesting overview of the scheduled system migration for AT&T network management to shift towards a full software centric network. This process will bring operational costs significantly down and help migrating most consumer applications to a full IP environment.

The Q&A closing session was quite lively and allowed each of the speakers to give practical answers to the many questions raised by the audience.

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JEAN-PIERRE CHAMOUX, Professor Emeritus, Université Paris Descartes, France, moderating, warmly welcomed the attendees and opened this session on agile infrastructures and connectivity.

In order to allow more time for debate, Professor Chamoux skipped his own presentation and directly introduced the panellists.

The moderator reminded the organizational sequence of the session which started with a debate to set the scene and introduce the main topics of the session. This introductory debate was then followed by five presentations and a question and answer section.

WLADIMIR BOCQUET, Director of Spectrum Management & Policy, Eutelsat, France, opened the introductory debate and presented key issues from the perspective of a satellite operator.

Connectivity is one of the keywords of this session.

Eutelsat is offering connectivity and broadcasting all over the world. The company operates more than 40 stationary satellites, mainly across Europe and Middle East and Africa, but also increasingly across Latin-America and the Asia-Pacific region.

Connectivity is significant. We are talking about e-government, about services and how citizens can benefit from this evolution towards a digital world. Connectivity is the first and main prerequisite for this.

More than half of the population is still unconnected. About 80 percent of the population in developed countries is connected. Worldwide, more than 3.9 billion people are unconnected. This is significant and creates a huge digital divide which not only could effect the day-to-day life, but also the long-term way to prepare the future.

A recent ITU analysis (2016) shows that 2.5 billion of the Internet users are coming from developing countries, compared to only 1 billion users from the developed countries. The big race after connectivity in no longer in the developed world but in the developing world. The socio economic benefit of being connected is obvious.

While up to recently connectivity just meant mobile Internet, the satellite industry has a part to play in ensuring connectivity. Satellites are not a substitute of mobile or fibre networks, but there is still a big challenge to reach global worldwide connectivity. While working together with the mobile industry, the satellite industry can be part of the success story, providing backhauling in those areas where fibre is not available due to economic and environmental reasons.

Moreover, the satellite industry supports alternative ways to get connected. WiFi community networking, for instance, represents be a good opportunity to provide a first Internet experience to a number of populations. Eutelsat is working with a number of great providers, especially in Sub-Saharan Africa, to support this. There is no one-solution-fits-all approach to get connectivity. It is the diversity that will create opportunities for everybody and cooperation is key.

Another important aspect to be addressed is 5G. One of the big challenges when moving towards these new generation innovations is the risk to increase the digital divide between different populations. We have seen the evolution from 2G to 3G to 4G and are now moving to a new paradigm having high frequencies to deliver the 5G. There is the possibility to use cell sizes and the economics behind, but one has to be careful not to leave populations and citizens behind in terms of connectivity.

The session's chair, **JOHN GIUSTI, Chief Regulatory Officer, GSMA**, [www.gsma.com], continued the introductory debate on the challenges of the evolution of connectivity.

Discussing this evolution is important, because we do have to reflect where we have been and where we are, as we look to where we are going. In 2016, GSMA operators estimated that there are 5 billion individuals connected to mobile communications worldwide.

The GSMA is the mobile industry association. It represents the interests of nearly 800 of the world's mobile operators as well as a huge number of the broader ecosystem players within the mobile space. The GSMA also produces industry-leading events such as the annual Mobile World Congress in Barcelona.

Increasingly, connectivity is no longer just about telecommunications, it is about all industry verticals and it is also about people and society. This is why this question of connectivity is so important.

5 billion people are connected today. However, there are a number of people that are still not connected. According to the figures of GSMA Intelligence, there are currently 1.2 billion people living in areas with no 3G coverage. But importantly, there are 2.6 billion people who live in areas with 3G coverage and are not using it. As we look at this challenge of connectivity, we don't just need to look at the infrastructure challenge, we need to look at the commercial sustainability of this deployment, but also on the challenges of things like making sure that people understand its use cases, that it is valuable for their lives, that there is relevant content for them, and, of course, that the environment and the affordability is such that they can access it.

As we look back at where we have been, we are building on success: 2G services have been

launched about 25 years ago. 2G really was a game changer in many ways in terms of giving people mobility. And then, eventually, we went to 3G, which started to give us a taste of mobile data and access to mobile Internet. Eventually, getting to 4G in many places and this is where we are really started to see a shift: we got a truly global standard in place and a platform for the development of the platform economy. And now 5G will be more than just transforming. It will be mobile broadband with faster speed and lower latency. It will also be about integrating people and things in the Internet of Things and all the different devices that will ride over these networks. Another important aspect when looking at this connectivity challenge is this shifting dynamic: We talk about people connected and the coverage of populations, which is very important but, we also need increasingly to think about covering all areas where devices or things that we care about as being connected will have access to the kind of connectivity they need.

In terms of thinking about the challenges, some of the topics to be addressed in this session relate to spectrum. It is important to confront this issue of this finite resource—it is a challenge because it is governments that control the access to this resource, and in the case of mobile, historically it is made available through auction processes which are very costly and time consuming. The availability conditions of the spectrum are very important. A sufficient amount of spectrum made available for the future of connectivity will be key, and also the different types of spectrum that can be made available in order to meet the needs of both coverage and capacity as we see the growing use cases developing in the emerging 5G space.

Spectrum is a finite resource: if somebody takes it, somebody else loses it. Sometimes it is possible to gain efficiencies. We saw that with the digital television transition in freeing up spectrum through a more efficient use by broadcasting. But the reality is, as we continue to face these issues of increasing demand for mobile data, we need to look more creatively at opportunities for co-existence, particularly in some of the higher frequency bands that have low-coverage areas and therefore reduced issues of interference.

Moreover, we also shouldn't lose sight of the side of the amount of investment that we require in deploying networks—either to cover the regions where people are not reached today, but also for deploying the networks of the future. Something that often policy makers take as an assumption is that the business case will be there for networks to deploy and invest. It is very important to have a goal around connectivity as a policy maker, that they prioritise the issue of how to incentivise investment and not putting too many burdens that are going to reduce that incentive. We are seeing some of these challenges now, when we look at comparisons between the U.S. approach to telecom networks and the telecom framework of the EU.

Another important aspect is the issue of sustainability. One of the things GSMA and its mobile operator members are very committed to is what they can do to help achieve the UN Sustainable Development Goals. For at least half of these goals, mobile networks will help advance those. But the idea behind them is sustainability. We can talk about connecting and reaching more people, but to be truly successful we need to find innovative ways with mobile and other technologies, so that there is a sustainable business model in place—without them needing to be grants or other subsidies that might be make it less predictable for the future.

WLADIMIR BOCQUET, Director of Spectrum Management & Policy, Eutelsat, France, took

the floor to pursue the debate.

Spectrum is the lifeblood of many industries. It is a scarce resource managed at different levels (the international, the UN, the national and sometimes the regional level) to get access to this resource. Spectrum is an important issue in the discussions between the mobile, satellite and broadcasting industry since decades.

However, there are a number of milestones. The first one was in 2015, when the satellite community received the UN approval of the C-band, which can provide both broadcasting and communications services, to be protected in terms of security for the deployment and the development of satellite services. This has been an essential decision for the satellite community due to the very high investments in this industry sector. The life of a spacecraft is about 15 years once it is in the space and it is important to anticipate that for two reasons: 1) in terms of delivery, it is in the interest of the consumers and the citizens that the satellite operators have the certainty to be able to provide the service during the entire lifespan of a spacecraft; and 2) the operators need to anticipate future deployments and investments.

The next milestone will be in 2019. There is an important spectrum meeting at the UN that takes place every 3 to 4 years, and the next one will be in 2019.

There are a number of questions concerning where and how to deploy 5G. There are several approaches, but moving to the higher frequencies could impact the future of the satellite industry. The satellite industry is very committed to offering global and ubiquitous connectivity. Half of the population still needs to be connected and the satellite industry will be part of the success story to connect everyone. However, in order to be able to do so at a reasonable and fair rate, satellite operators need to have security on this spectrum.

One of the key spectrum bands is the 28 GHz band. The FCC recently issued recommendations on how to use it. However, for the satellite industry, this spectrum band is key. There are a number of projects were this Ka-band will be used to develop the satellite broadband services. There is enough spectrum for everyone. The EU shares this point of view and the Ka-band is not part of the selections of the pre-selected band that will be discussed. The idea is to make sure that the interests of every industry are appropriately considered.

There is a uniqueness of having this Ka-band for the satellite communication, as it allows to provide broadband at a reasonable price and to offer connectivity everywhere and at every time, especially in the context of mobility. Mobility is very important for the connected people. Just take the example of connected cars: How to make sure that wherever you are, you will be connected? If you have some safety issues or another element to be updated or uploaded immediately, you need to be connected. Furthermore, we need connectivity on board of the aircrafts. This is also very important for the population. And, there are more and more requests to have the same type of connectivity when being on the move. Also think of ships and the crews and the Internet of Things.

In terms of the Internet of Things, we are more and more connecting things. There is a strong paradigm shift occurring. Up to now, many regulators and policy makers were focussing on population coverage. This was one of the main key performance indicators when looking at the development and deployment of networks. Now, with the Internet of Things being everywhere, the paradigm about coverage is completely different. We need to cover

everywhere, not only populated areas. Ubiquitous coverage is becoming more and more important. 5G could be a nice opportunity to make sure that we can appropriately complement different communication platforms, including mobile, fixed, broadcasting and satellite, to provide this ubiquitous connectivity and to make sure that we are able to respond to all the future demand and future scenarios that will happen in terms of connectivity.

There is no one-solution-fits-all. We have to think about what we are expecting for the future and about our future needs, where do we want to go and how to make sure that industries can complement each other to provide full ubiquitous coverage.

JOHN GIUSTI, Chief Regulatory Officer, GSMA, took up the issue of complementary usefulness of the various types of networks.

Network operators don't limit themselves to one tool to reach their customers. An example is GCI, a telecommunications corporation operating in Alaska. Alaska is a very highly developed marked but also has unique challenges in reaching indigenous population in very remote areas. GCI has used a range of technological solutions.

If we look at 5G and maritime traffic, we will increasingly see opportunities where the different sectors have to come together. Satellite has long been a player in some aspects of mobile networks; we may see more of that particularly as we try to increase opportunities around backhaul to very rural communities that are otherwise underserved. Moreover, there could be other innovative solutions that the satellite industry is developing. 5G standard is not even finished yet, networks have not been deployed and there is still opportunity here.

There are plenty of opportunities to come together, but one of the main challenges is spectrum. Spectrum is like the last piece of pie in the play—there is only so much and you are going to fight over it. There is this common interest of working together on solutions and business models that will be sustainable, but each industry is also trying to make sure that they have the spectrum resources that they need to deliver services.

The mentioned upcoming World Radiocommunication Conference (WRC) 2019 is an area of work focussing particularly on higher frequency bands, i.e., very small coverage areas inside and high capacity type of uses. There has been previously identified some other spectrum which may provide complementary services, e.g., 600 MHz and the 700 MHz band for some regions for better coverage and of course the C-band.

The role of this international process is very important for all industries. It is through this process that industries get agreement internationally and a common understanding of how the spectrum will be used. That is important beyond just the common understanding, but also the issue of harmonisation and economies of scale. Without economies of scale, people can't afford equipment and if people can't afford equipment, you are not connecting people. Thus, it is very important to get that alignment.

The bands we are using today for 3G were harmonized at what was the World Administrative Radio Conference in 1992. It takes a long time from the time you get these things identified and aligned, and the time you are fully using them. We need to be thinking ahead and we need to think creatively.

Politics are always committed to these negotiations as well. The satellite industry is particularly concerned about the 28 GHz-band and for that reason it doesn't appear on the agenda of the WRC. At the same time, Korea, Japan and the United States are moving forward with it. So how to find a solution where the satellite industry can continue to deliver services and we still can get the benefit of 5G? In this particular case, they may be opportunities around the tuning range between those who will be using 26 GHz and those using 28 GHz. There is a lot of work to do and find creative solutions, but it is becoming more and more difficult.

ADIEL AKPLOGAN, Vice President Technical Engagement, ICANN – Internet Corporation for Assigned Names and Numbers, took the audience to a different aspect of globalisation, away from the physical infrastructure to the more logical infrastructure.

Extension of the TLD in the DNS, how ready are we?

The extension at the Domain Name System (DNS) level is key for accessing the Internet today. As users, we are very familiar with how to access information online: we access the Internet using identifiers based on names. The domain names are a critical part of the way we access the Internet.

All domain names that exist in the public DNS must be globally usable and accepted by online applications. Email addresses that are built from these domains must be accepted. Website addresses must be reachable from everywhere. Linkification has to work automatically.

When looking at statistics ranking countries where people consider that they can't live without the Internet (a personal statement which goes beyond simple access but which shows how important the Internet is for their well-being), one can notice that countries like India or China are among the top 5 ranked countries—countries that haven't English as first language. They don't even use the ASCII format to represent their language. How to cope with that? How to make sure that the globalisation is able to address the needs of those people?

The Domain Name System has been evolving over the past few years, with new TLDs added in order to better reflect people's sense of identity (.club, .networks, .photography, .paris, etc.). There is also a new generation of names, called internationalized domain name (IDN) to better reflect language diversity and allowing to represent non-Latin based scripts, such as Russian, Chinese, Arabic etc.

However, with such rapid evolution (more than 1,000 new TLDs added over the past 3 years to the root zone), many systems do not recognize or appropriately process new domain names, primarily because they may be more than three characters in length or in a non-ASCII format.

In order to address this challenge, in February 2015 the community has set-up a Universal Acceptance Steering Group to promote universal acceptance of all valid domain names and email addresses.

The reason is not just economic, there is a virtuous circle of benefits for everyone: For

Internet users, the Internet should work. No matter where they are coming from, users can use applications and software without any problems. Moreover, the domain names work everywhere and domain and website owners can effectively use their identity. Finally, application and software owners can successfully serve new customers all over the world.

Combining the business generated by new domain names and the opportunities created for application developers to make sure these new TLDs are universally accepted, Analysys Mason, in their recent report for the Universal Acceptance Steering Group, evaluated the business opportunity to USD 9.8 billion.

However, how ready are our systems for this near future which goes beyond the ASCII domain? Does the system recognize and consistently process domain names with more than 3 characters (such as http://golf.club) or email addresses like jo@golf.club? Or a combination of ASCII and non-ASCII domain names, or an email address that is written from right to left, such as in Arabic? What about automatic linkification of these new domain names? These are very important questions to deal with.

To achieve universal acceptance, systems have to be consistently able to accept all valid Internet domain names, as well as to validate, to properly store, to process and to display any type of domain name and email address.

To excel in the long run and to be ready for future global opportunities, organizations need to ensure that their systems work and keep up with the evolution of the naming infrastructure of the Internet – the Domain Name System. Businesses that are Universal Acceptance Ready, set themselves up for global success by supporting their customers using their customers' chosen identities.

TIM NICKERSON, Senior Vice-President and Chief Technology Officer – Shared Enterprise Services, Great-West Life, Canada, [www.greatwestlife.com], delivered a great talk on how the availability of mature cloud services is driving a transformative shift in how information services departments deliver business services.

Agile Infrastructures

The need for increased business capabilities and agility has influenced how information services departments have to provide services to their businesses. This is resulting in a shift from traditional own and operate in-house models to the adoption of agile infrastructure outside.

Great-West Life has a number of internal programmes underway to leverage these opportunities that are being presented by these solutions and services. One example is the company's next generation infrastructure programme which is redefining its data centres through the following: Providing secure and seamless connectivity with cloud capabilities and the establishment of hybrid services; establishing and management of operations across the systems; and reforming the employee connectivity experience with a focus on accessibility and mobility.

There is a shift to substantially increase dependency and criticality of connectivity beyond the walls of the in-house managed data centres. The question raised is whether the evolution of

connectivity is progressing rapidly enough to successfully support the speed in which agile infrastructure is moving and in which business needs to adopt it?

There is a number of shifting global trends:

First, cloud computing. With the sharing of cloud services and the recent residency of such services in Canada, many of the hurdles for adoption have been eliminated. Additionally, vendors are progressively shifting their traditional business models from acquisition-based software to rented software models via cloud services.

Second, shifting network traffic. The availability of complete software suits, online microservices, which are really specific and a specialised service functionality in the cloud, are providing great new opportunities and agility for business.

Third, business mobility: Although it is not new that workforce demographics and their expectations are constantly changing, the ability to work seamlessly onsite or offsite is fundamental to moving forward.

These trends are driving very different connectivity demands than those of the past, and they are requiring innovative connectivity thinking and approaches.

Legacy business applications in place today can not easily nor affordably be modified in alignment with the shifting trends and business needs. Great-West Life has many services that run on mainframe today. However, the applications and business processes they support continue to be critical to the day-to-day business operation.

The use of cloud-based microservices, in conjunction with legacy applications, provides a great opportunity to introduce agility while leading well-established critical business functionality. This hybrid approach introduces a new reliance on connectivity. Applications previously operating on standalone infrastructure, located within the walls of the data centre, are now distributed across cloud services and hence highly depended on external connectivity for availability. The end user device, the shift to cloud applications is proving to be a cost effective approach in dealing with the world of multiple corporate devices, continued device updates and mobility flexibility needs. Connectivity is critical again to end user productivity.

As applications shift towards the cloud hybrid environment, the focus on meeting business expectations can not be lost.

Convenience: The user connectivity experience, on and off the enterprise network, must be of the same quality, must be location independent, must be seamless and must be secure.

Efficiency and security through intelligent infrastructure: Connectivity and agile infrastructure must handle traffic patterns with the highest efficiency and security, without requiring significant pre-configuration for either microservices or end user cloud application traffic. This would drive new cloud brokerage companies and provides opportunities for traditional telecom carriers.

End-to-end manageability: The end set-up and configuration needs to be rapid, error free and policy based. There is no black holes from an end user to service source visibility.

Connectivity-related service failures must be avoided or restored quickly.

There are a number of interesting and promising connectivity efforts underway to underpin agile infrastructure adoption. Many of them are in an embryonic state and do need to move forward. However, just to mention some of the problems they potentially could solve:

Under the banner of supporting connectivity as a utility and bringing intelligence to the network and self-recoverability there is a named data networking. One of the things this would do is get rid of the underlying reliance on IP and IP addressing, which is a hindrance as we try to move forward. With name based addressing it would greatly align with cloud information architectures and microservices.

Time-sensitive networking and intend-based networking: These start to understand the nature of the traffic in real time and how they need to move through the network and how they need to make their way through. There is no need to pre-configure, and when the configuration is wrong to go back and configure it again. It is done in real-time, based on intelligence in the network.

5G networks hold great promise as it is rolled out. It seems to be very cloud aware and cloud ready which is hopeful.

Network function virtualisation is getting rid of the hardware. One of the biggest problems today in the network is the hardware centricity of the network, when the world is really shifting to services—the concept of network microservices.

IoT network bundled with business applications and API developments could enable microservices with common APIs—not only that applications talk to one another, but also that intelligent networks can understand and help rout the content in a better and faster way.

Under the banner of supporting end-to-end manageability, two items have to be mentioned: First, software defined networks: This is what Great-West Life is deploying as part of its NGI network. It allows to move up, as opposed to physically configuring hardware devices, they are now configuring more the software level which will allow for speed as well as some flexibility. Second, network on demand services, which are providing enhanced visibility and management capability into the carrier network. Instead of having the issue and order to the carrier network and wait weeks for services to connect up, this can be done dynamically and end-to-end using the carrier network.

The next couple of years will tell if connectivity standards and capabilities are going to meet the overall needs of agile infrastructure and the business adoption. They can either help or they can hinder.

JOEL OGREN, Board Member, NxtVn, The Netherlands, [nxtvn.com], provided a most interesting insight in the world of data centers.

NxtVn is developer of a global cluster of hyper connected Data Center Parks. Founded in 2014, the company started with one park. Today, NxtVn has six sites and envisages to have 20 parks worldwide by 2020.

NxtVn works with the data centre providers, the cloud providers and the emerging providers to help satisfy their requirements, as they try to build their global enterprises and to move out on a global scale.

The customers of NxtVn report that, in order to build this infrastructure, it takes literally 6 to 12 years to identify the right location, identify the right tax issues, work with the local city and federal governance authorities to address this, buy the right land, find the right networks to connect them and put the whole package together. What seems very easy is an incredible difficult task, and when you handle it one by one, it is challenging and relates to these 6 to 12 years.

The mission of NxtVn is to accelerate that. NxtVn works with its customers to identify locations, to identify the networks—if they are not NxtVn will build them, submarine networks across the oceans, networks around the coasts or terrestrial networks that need to be put in a very short amount of time. All of this requires addressing issues like governance, policy, regulatory issues, and security.

Land is not the number one concern of NxtVn's customers. The number one concern is data privacy and data sobriety. This is a number one issue—before even considering building the networks and putting a new data or cloud infrastructure out there.

The second item is taxes. Taxes are important because on a global scale or an enterprise scale, companies often move their data and their data storage elements, i.e. the content, from one country to another, because power is cheaper there. This is called the sunrise clock effect, because you follow the sunrise clock. When you wake up in the morning, the cost of your power increases, no matter where you are in the world, because you are in the premium timeline for power consumption. Some of the largest data centre companies in the world follow this sun methodology. They move their data from one country to another throughout the period of a day because 70 to 80 percent of the cost of their operations are in power. They follow the sun to reduce their power costs and thereby reduce their operational costs. Of course, this requires large diverse resilient global networks.

The third item is networks. It is not possible to have a data centre or clouds anywhere in the world without a network.

And finally, the last aspect is the land itself. All of these elements have to be discussed, but it is interesting, that those are the most important issues to be addressed all over the world.

Why is the number 17 important today? 17 is the age of young people when they become enabled on a global network infrastructure. They become consumers—consumers of data centres, enterprise applications, email, APIs, apps, they want to become developer etc. This next generation, born in 2000, is now old enough to purchase their own apps, music etc. But the age of 17, the age of consumerism, is being reduced. Today even toddlers have their

own iPads, teaching them from a very young age. All of that data, all of that storage and all those networks—it is up to us to enable them, to further enable them and secure them.

All of the underpinnings of everything mentioned above is addressed by security—both cybersecurity and physical security. We have a responsibility, on a global scale, to protect our enterprise, to protect our networks, to protect the cloud. The cloud is nothing but a bunch of hyper connected data centres. The cloud is also moving. Just a few years ago, when we talked about the movement of our infrastructure elements, we talked about being on the edge. We wanted to push applications and services to the edge. Today we move those apps, those services, closer to the consumer and closer to this young 17 year old kid.

We need to address the physical security today, because physical security of our critical infrastructure becoming more and more important. And we need to engage, we need to talk and we need to solve these problems together.

We are a constantly evolving ecosystem. Let us make the world more secure, more resilient and more divers.

NAGAAKI OHYAMA, Professor Imaging Science and Engineering Laboratory, Tokyo Institute of Technology, Japan, presented the recent international digital ticketing project for the Tokyo Olympics and Paralympics in 2020.

The digital ticket project is a project of the Japanese Government for the Tokyo Olympics and Paralympics in 2020. It is one of the government's activities to promote the e-ID card in Japan and shall allow a more convenient and secure ticketing. In terms of international collaboration, such kind of collaboration could be an important step towards an internationally compatible e-ID.

Current status of e-ID in Japan is an e-ID card, called "My Number Card". It is based on the My Number Act. About 40 million My Number Cards have been issued. The card is free of charge.

Among the current applications under trial, those in the field of healthcare are the most important ones, e.g., a health insurance verification and uploads to the EHR, a lifetime healthcare record. My Number Card can also be used as a credit card for payment. The most recent trial is in the field of digital ticketing, including all processes from reservation to admission.

The card is connected to several applications through a certification number of the personal authentication services.

The Japanese Government is currently experimenting a PKI-based digital ticket covering the totality of steps required, from reservation and payment to reselling and admission. This trial uses PKI, the personal identification is a pseudonym. The advantages compared to conventional ticketing are obvious: fast pass service for e-ID users, prevention of illegal overpriced resale of tickets, and last-minute delivery of tickets.

[A short video explained the use of the My Number Card for digital ticketing]

The video showed a young women using My Number Card for reserving a ticket (the card supports a read and write function on the backside of the smartphone) as she goes to the 7-Eleven convenience store to check the seat or the game that she selected and to pay the ticket. Of course, this could also be done via the Internet. She then checks whether her ticket is valid or not. The process is not totally paperless: the ticket will be printed out because customers prefer to have a printed version in their hands.

It is already official now for Japanese residents. However, the idea is to propose an international collaboration for the Tokyo Olympics and Paralympics in 2020 using JPKI (Japanese Public Key Infrastructure), in order to provide the same convenience and benefits to people form other countries. Thus, Japan is about to propose an international digital ticket project for the Tokyo Olympics and Paralympics to the EU.

From an international standard point of view, PKI is supposed to be compatible, but in practice it is necessary to make a conformance test just like an e-passport. One has also to figure out how many countries in the world propose a personal authentication service based on PKI. The worldwide use of PKI, RSA or ECC will enhance the security level in both the real and the cyberspace.

In summary, the tests of My Number Card have been successfully carried out during the last 3 years in healthcare, as credit card and for digital ticketing. The digital ticketing service for big events, such as the Tokyo Olympics and Paralympics, sports and music festivals is under preparation.

JASON OLSON, Director – International External Affairs, AT&T, USA, [www.att.com], presented AT&T's experience of agile infrastructures.

There is the ongoing project at AT&T to replace all of the company's old analogue network with a software centric network.

AT&T is no longer buying proprietary hardware from Juniper and CISCO, but generic equipment from HP and Dell, and asking Juniper and CISCO to put their software on it in order to deploy instantaneously around the world. There is no need of 300 pieces of unique hardware in the network.

This is the change AT&T is undergoing. The reason for making this migration to software defined networks came about 10 years ago, when AT&T was awarded the exclusive rights to sell the iPhone. Since that moment, traffic on the network has gone up to 250,000 percent.

If AT&T would still be passing packets of data through its network at the cost they were doing in 2007, people's phone bills would be much higher today. This goal of moving to a software centred network—on demand, immediately, scalable very quickly—is to take the cost of megabytes down. There has been an enormous growth since the role of the iPhone and with 5G, IoT, and machine to machine this percentage growth is only going to accelerate. 250,000 percent in 10 years sounds a lot but if we look back in 10 years, this number will be much larger.

AT&T still has obligations to provide POD services, and still has obligations to sell long distance. The company is undertaking a process trying to develop solutions that are exclusively based on PODs, e.g., many of the hearing impaired devices run on PODs. AT&T is undertaking this process to not only built this next generation software centred network, rather to undertaking a process of how to migrate a lot of consumer applications from an analogue to an IP world.

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Q&A

The first question addressed the digital divide. For instance, in Canada, even if the majority of the population is in the larger centre, there are still a lot of small and remote communities. Are there solutions, such as partnerships? How does it happen and where does it begin?

John Giusti, GSMA, stated that ensuring that, no matter where one lives, there is a sort of at least relatively equal opportunity to access and work, do business and study is one of the biggest challenges we face today.

One of the things we have to confront, as we think about the policy enablers to make that happen, is that in order for a service to continue there has to be some kind of system incentive: either it has to be commercially sustainable or a very predicable government investment scheme that would allow the infrastructure to be maintained, to provide the service, but also to innovate over time. Mobile operators always do want more subscribers. They have to find a way to make sure that they are getting some degree of return on that, even if it is a small return.

There are a lot of different factors we have to take into account: One is, when you are looking at mobile networks, that in many countries spectrum is auctioned. Since the advent of 3G in 2007 to today, the average price paid has gone up 250 percent. That affects the investment ability. That means that you could get further, if you were come up with other tools to provide spectrum. For instance, in Sweden they used a mechanism that was more about showing how far you can reach, not how much you are going to pay. There may be some incentives that can be pushed by reducing the cost coming in, but may be increasing certain conditionality on the deployment, whether it is mobile or other infrastructure.

In particularly remote areas, we all have to challenge ourselves and be more creative. The good thing is that the capacity challenge is smaller because the population is smaller. Satellite will be an important component in that, at least in some elements. But there are also other innovative solutions that are being tried. During the natural disasters happening in Peru recently, it just happened that Telefonica and Google's project Loon were involved in some trials in that area and they were able to use that particular service to supplement communication during that time, without much interference or problems.

There is not an easy answer. We need to be realistic, however, and not expect that people will go where is no business case. We have to find a way to either make this business case for them or to find other ways that are sustainable to deploy.

Wladimir Bocquet, Eutelsat, added that we have to think differently and should not stick in the current model. It is not only about spectrum auction and spectrum assets. The way the network is built and how ownership is maintained in the network need at least to be adjusted. The combination and the complimentary of the different platforms to deliver connectivity need to be at the core of the new mindset.

In this sense, the mentioned softwarisation of the network is very important. It enables to independently interconnect different platforms to help reducing the digital divide, as it allows to have fixed networks, together with satellite and mobile, but delivering the same flow of data to the community. This represents a radical change in the way of building the network.

We are in a very critical period. We are using the term of 5G, which means a lot and nothing at the moment. Softwarisation, looking at the ownership of the network and interconnectivities between the different platforms will help to reduce significantly the digital divide.

The second question addressed the issue of interoperability. What about the top leadership and having companies look at how they work together in order to ensure that interoperability takes place?

Joel Ogren, NxtVn, enumerated two specific challenges on a global scale: open access and vendor neutrality.

Referring to the earlier question on the digital divide, this is also one of the challenges in Canada: true open access and true vendor neutrality. That means to those remote communities that want to set up an ISP to take advantage, whether it is satellite connectivity or fibre connectivity, that they have access to that capability, that they can respond and built a small business out there. It is about interoperability, but it starts with a policy that enables open access and vendor neutrality. These issues have to be addressed on a global scale.

The next question regarding privacy issues in the context of the Japanese e-ID card was addressed to Prof. Ohyama.

Nagaaki Ohyama, Tokyo Institute of Technology, underlined the importance of privacy in Japan. Obtaining the My Number Card, or eID card, it is not mandatory. However, Japan wants to use this kind of ID card to identify the cardholder in order to provide better services at lower costs—especially in the field of e-government and healthcare.

The most important aspect is PKI, not the card itself. The card is just the container of a secure device in order to protect the secret key and make sure that it can never be copied by someone else. There are two components: one is the data signature, which includes the name, address, gender and birth date of the cardholder. The other one is a personal authentication, a pseudonym. Nobody can identify whose certificate it is. This protects privacy.

Another question was about how to provide immediate rescue to a network in case of emergency, such as the destruction caused by the recent hurricanes Maria or Irma in the

Virgin Islands and Puerto Rico?

Jason Olson, AT&T, explained that it is a challenge to have those structures especially on an island. The speed with which you can get networks running when they are not harbour-based but cloud-based makes it a lot easier. The more you have in the cloud the better it is.

Wladimir Bocquet, Eutelsat, highlighted the possibility to provide immediate rescue via satellite. After the hurricane in the French Caribbean, Eutelsat, through Télécoms Sans Frontière, provided instant connectivity through satellite. They used solar panels to get the ground sector to be connected. There are some solutions and Eutelsat is also deploying equipment for such kind of events, like natural disasters.

The next question started from the assumption that the main point is not just change, but the speed of change. It is much faster than humans can handle. How to keep up with this speed of change?

Joel Ogren, NxtVn, affirmed this speed of change that is happening inside the infrastructure world, both the telecom, the data centre and the movement to the cloud, the enabilisation of all of these changes.

The speed of technology is at hyperscale today. Applications, been developed in universities, in homes, in smart businesses all around the world, and been put out once they are identified and moved to an enterprise level scale, are being adopted very quickly and require major resources to implement them. One of the biggest challenges is the ability of the global regulatory environment to accept these change and allow us to address these issues. Data sovereignty issues that come along with this global enterprise solution, the tax issues, etc., these things take a long time, and along with the regulatory items, country by country, as you try to build up a global enterprise is very time consuming and does not keep pace with the implementation and the acceleration of technology today.

Adiel Akplogan, ICANN, underlined that coping with change and going forward is complex and difficult. One useful approach could be the multi-stakeholder approach. When complex issues need to be solved, there is a need to gather people from different backgrounds and to have a deep thinking about the problem—not only looking at the problem and reacting immediately, but also looking ahead and trying to find a joint solution to the problem. We used to have a monolithic approach to different issues, now we need to look at them globally. The more people we bring together, the more it will be easy to look at the problem from different angles and being able to react and anticipate where we are going.

Jason Olson, AT&T, added that, from an operator's standpoint, it is a challenge if you deploy this equipment and you deploy these services to get adoption becomes a competitive issue. Thus, AT&T has human factor laboratories that look at how people interact with everybody. They have innovation spaces working on things like connected cars. How to make a connected car work for individuals? How to make medical devices at home work with that technology? It is overwhelming, but part of AT&T's competitive response is to figure out how to use this technology better than the next carrier.

The session's moderator, **Jean-Pierre Chamoux**, Université Paris Descartes, complemented that it is known, not only in physics but also in sociology, that people are

much more sensible to the quickness of the differential change than to change itself, because they are accustomed after a while. Therefore, it is important to ease the differential between ex ante and ex post possibilities. This is a good way to consider not only governing things but also governing people.

Before closing the session, its chair, **John Giusti**, GSMA, wrapped up the session by summarising the main discussion points.

This exchange on connectivity is a particularly important one when we are trying to confront anything digital, which is basically everything today. Maybe the session raised more questions than answers, but this reflects both the complexity of the issues discussed but also the importance and the difficulty in resolving them.

One of the lessons is that it is always good for different stakeholder groups to get together and to hear the issues about the communalities and the differences. It is a good reminder for all of us not to be working in silos as we move forward.

AT&T gave us a good reflection of how they have evolved in terms of a service provider in the changing landscape. It showed the nimbleness that some companies are able to take and adapt into the new environment. We all should be looking to different sectors and figure out how quick we can adapt to the digital space.

The panel opened up an exchange about mobile and wireless networks as the real key enabler to agility. We recognized that finite resource challenge, the spectrum that is used by different types of wireless platforms, be it satellite, mobile or others—and also in both cases the importance of predictability for investment in networks. Without that predictability and certainty companies are not very likely to invest.

The panel also showed that there are some resource challenges beyond spectrum, and domain names is certainly one, and a good reminder that we need to pay attention to all of these important inputs and resources if we are to better reflect globalisation and cultural identity. The question is, even if people are connected, are they truly connected?

There is also a lot of change in terms of how to redefine the way networks and data centres are working, and particularly new opportunities created around cloud-based solutions. But we also heard a lot of the risks coming along with that and the challenges that we need to confront, those around security or data privacy.

As we increase the dependence on this infrastructure, the issue of physical security is very important, whether it is a terrorist target or whether it is a natural disaster. We have to make sure that there is redundancy and resiliency in the infrastructure that people are depending on.

Concerning the issue of disaster responsive networks: GSMA launched the Humanitarian Connectivity Charter in partnership with the UN and vendors and in cooperation with the mobile operators to make sure to have the best plants in place to respond. The GSMA is continuing to work on this challenge and actually has a new partnership with the UK Department for International Development on just this topic. It is definitely of increasing interest for all stakeholders.

Importantly, we also heard the issues around how these new technologies and networks can be better used for secure identity, for instance in the context of the digital ticket. But of course, there is also the competing challenges about the issues of the balance between using data to advance consumer interest and also consumer expectation of privacy.

The chair thanked the panellists and the audience for the active participation and closed the session.

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Keynote Session

Day 1 – Afternoon – Plenary Session

JULIA GLIDDEN, General Manager, Global Government Industry, IBM, USA, [www.ibm.com], provided a thought-provoking and inspiring keynote on digital transformation:

Digital Government Transformation: Toward More Personalised and Accessible Services for All

Some years ago everybody talked bout smart—everything was smart. It was so much that it was nothing in the end. The phrase just became something that companies stuck on everything in order to sound modern.

If we are not careful, we are at risk of making the same mistake in the context of digitization. Many of those working in the world of trying to modernise government, with its rules, compliances, regulations and security etc., just stick digital on it and think it is ok. But if we are not really careful, all we are doing when we use the word 'digital' is sticking lipstick on a pig.

Imagine a world where we embraced the power of the technologies. We should do what now can be done: to deliver services for citizens that are personalized, that are citizen-driven, that are seamlessly blended into our day-to-day lives. Don't think about all the reasons why something can't be done. Understand that simply saying we are going digital or going mobile or putting something in a cloud, is not really digitising.

The world has changed and technology has changed us all. There is Steve Jobs' famous line about his hope that the phone would be an extension of our mind and body and that we wouldn't be able to differentiate between the mobile phones and ourselves. Technology has changed the way we interact, the way we define our relationships with each other, the way we understand efficiency, the way we are able to—or not—be comfortable with each other. Government is no exception.

We are living in a world in which we can interact with governments more easily, more mobilely, more agilely. We can access apps to pay our taxes. But for all of the progress, what have we really done in the last 15 years? We have digitized the status quo: We have taken existing 20th century technologies, processes and administrative ways of looking at the world—processes and administrative ways of looking at the world that evolved in a way to overcome the limitations of time and space as we moved beyond communal village living. It was a means to scale.

We then built our administrative government and societal functions around bureaucracies to enable us to scale, and now we are living in a digital 21st century and we are in that iron cage of bureaucracy—in so many ways limited by those procedures we embraced to scale, at an age in which the ability of the technologies that are coming online are so radically transformational. They hold so much power to have village living in a global community. Often, what is standing in the way is our imagination, our ability to not be locked-in to 'this is the way it has always been' and 'you don't understand' and 'this is government, we just can't' etc.

Take Amazon as an example of how to do things: Amazon started as a bookseller, then they did Kindle and then they went on to sell the world. Their corporate philosophy was never 'no'. If you wanted to say 'no' you needed to justify this no. A 'yes' never needed to be justified.

According to the United Nations E-Government Survey, South Korea has been at the forefront. Their strategy in opening data was to say 'you have to show where in the rules you can't open the data' as opposed to simply saying, 'I can't'. The idea is to transform the mindset. Digital transformation is not as much about technology, it is about the people and process changes. We need to genuinely go beyond simply digitising the status quo. It is important to find ways to help people embracing the 'yes' and the potentials that are at our fingertips.

In the age of disruption, what citizens really want is not to juggle a gazillion more apps. Things definitely have become easier with one-stop-government shops, but the today's digital natives take for granted what we once thought is an advancement.

Juggling a gazillion apps and a gazillion online identities is not what genuine transformation looks like. This does not meet the expectations of our youth. Young people are absolutely brilliant at telling what today and the future is—the problem is, they can't link it to what you need to do as an organization, whether it is a company like IBM going through its own transformation, or government bureaucracy, because they can't imagine how messy and disaggregated the status quo is. They just have grown up with everything on a platform via an open API.

This is an issue. We really do need to start thinking about how to take the power of the technologies that are coming online, wed it with some changes and a 'can-do' attitude to genuinely transform services, and have them be built around people, not the bureaucratic silos that we have inherited.

It's time for Cognitive Government 4.0 which harnesses the power of digital to place people at the centre of everything.

It was evident for some time that the UN needed to go beyond digital and beyond the ultimate stage just being everything digital by default, because it was obvious that we are going to this kind of messy world where it is getting impossible to navigate things even on our phone. Artificial intelligence has the potential to transform.

Internet of Things was a concept we heard about 8 years ago. It is mainstream now. This is great, but what do we have now with the Internet of Things? We got a data tsunami, so much data, nobody knows really what to do with it. We have data coming out of the energy sector, out of the automotive industry, out of the water and environmental industry—but what we

don’t have is any ability, in any kind of scalable way yet, to take that data into actionable insights. Let alone to integrate it across our silos in order to give people what they really need: the service they want, when they want it, where they want it and as they want it.

More data has been generated in the last 2 years than in the history of human kind! And if there is so much, there is nothing. The power of cognitive computing, to take that data that is being generated via IoT and turn it into actionable insights that policy makers can leverage and use to improve services, is transformational. We are at a pivotal point in time.

How to meet the challenge of silos? Take a technology like the blockchain ability to securely create networks of data that are centred not around bureaucracies (whether they are industries or governments), but around the meaning that matters to the citizens in their real lives, and then take cognitive computing and the ability to translate that data into actionable insights. Cognitive computing isn’t a pre-programmed algorithm. It learns—the more you feed the data, the more you interact with the system, the more the data will learn about you and start to deliver services that are more personalised to you. If you use blockchain for security, they are more accessible because they can be delivered to you where you are and not where it is convenient for governments to have you be, whether that is a mobile app or a website.

If we thing about these three technologies in conjunction, we can really imagine a world where services are personalised, they are accessible, seamlessly blended into people’s everyday life and they are citizen-driven (not through co-creation incubators, but due to interaction with the website). Cognitive capabilities enable analysis of vast streams and sources of disparate data, creating actionable insights and learning at speed. They are taking citizen services and programs to a new level to deliver truly transformed public services

The National Disability Insurance Agency (NDIA) partnered with Oscar winning actress Cate Blanchett and IBM in order to create an online virtual assistant who speaks, writes and chats online—an avatar called Nadia for people with disabilities. Every time Nadia would interact with someone with a disability, she learned what that person needed.

The future is much closer than we think. The technologies are certainly there. Cognitive computing, blockchain technologies and the Internet of Things creates a whole new level of possibilities. If we unlock our own imagination, if we take a look at more and more the way we are leading our lives and our children are leading their lives, we can start to imagining a world where services are personalised, accessible and seamlessly blended into day-today lives. And we do that by building what has been already put in place. The mistakes we made during smart cities—thankfully we have learned that lesson. What we really need to do now to truly digitally transform is to build on existing infrastructures, infuse the new, but most importantly, imagine a better world and say ‘yes’ not ‘no’.

ANJA WYDEN GUELPA, Chancellor of State, Republic and Canton of Geneva, the Switzerland, addressed the very specific issue of democracy.

Trust & Confidence

Many analysts and political commentators around the globe are worried of the state of our modern democracies. With the election of Donald Trump as President of the United States and with the Brexit in the United Kingdom, many feel that the foundations, upon which our democracies are based, are shaking. Faith and trust in our democracies are eroding; even worse, support for populists and authoritarian regimes is on the raise.

These remarks rely on intriguing evidence, presented in a scientific report that provoked an important debate among political scientists:

In January, 2017, Roberto Stefan Foa and Yascha Mounk, academics from the University of Melbourne and Harvard, published in the Journal of Democracy an article whose title is “The Signs of Deconsolidation”. Based on analysis of data from the World Values Survey, the two authors observe a progressive erosion in the support to democratic institutions, especially among young citizens. For the promoter of civic engagement of young voters that I am, this assessment is chilling.

In 15 years, the view that democracy is the best form of government among European youth has substantially decreased between 15 to 40 points. The authors explain that, first, Millennials are more disillusioned than the elder ones, and second, Millennials are also more disillusioned with democracy than previous generations at the same age stage. More alarming, the data presented by the two authors tend also to show an increasing faith placed in strong leaders, "who do not have to bother with elections". Although this trend varies strongly between the countries, something is definitely happening. These various indicators, the authors say, are congruent with national studies. This affection with the democratic form of government goes with a wider scepticism towards liberal institutions.

According to the theory of democratic consolidation, once a set of conditions is met, (for example contested elections, freedom of speech, rule of law etc.), the stability of a democratic system is ensured. Both authors conclude that the time when democracies progressively gained in popularity and trust through time is now over and that we are in fact entering a deconsolidation process characterised by growing distrust in democratic institutions and eroding faith in its advantages.

This article provoked a long methodological and scientific debate. The questions that it raises are the following: is this deconsolidation inevitable? What can we do to prevent it? Or, in other words: how can we heal democracy?

Although there seems to be a global trend of growing mistrust, some countries perform extremely well. Switzerland for instance: Democracy is a big deal in Switzerland. Swiss vote 4 times a year, 360 times in a lifetime. Switzerland is not an ultimate model, but it might present some interesting ideas on how we can try to heal our democracies. First, we must reconcile citizens with their democratic institutions by bringing the power back to citizens and start co-creating public services they need.

Democratic apathy is often justified by the citizens themselves by the fact that politics is non

of their concerns, that political debates are not for them—whatever this might mean, and that they do not understand the political institutions and how institutions work.

Civic education is necessary, but it is not enough. In a world of immersion and emotion, institutions need to get closer to citizens. They need to become tangible, they need to be experienced in a physical way. This is why the State Chancellery of Geneva has launched a series of projects and events to promote the interaction between the institutions and the citizens. Not only the citizens visit the House of Parliament, which is a kind of museum, and the House of Government, after specific lessons in class when these are students, but they also play the role of politicians in the very places where the democratic power is exercised. These events are called 'Institutions 3D'. These visits, and especially the role-playing games, are designed for youngsters, but now also for adults, as well as for people with disabilities, because there were parents who wanted to come with their children.

By creating a physical and emotional link between the citizens and the places where our democracy lives, one contributes to reduce the gap between citizens and politics. The success is huge and is such that these experiences have been expanded to the municipalities.

There is also a certain amount of cynicism lurking behind the growing mistrust in the efficiency of our democratic institutions. We hear 'politics does not work', 'nothing changes'… Disillusioned citizens have lost faith in the ability of the public sector to deliver the services they expect. Why would a citizen place faith in the ability of the government if the services that administration provides are ill-designed, inefficient and poor in dealing with their needs?

Co-creation of public services is one answer to bureaucratic inertia. There are many examples showing that the involvement of citizens and direct users of public services contributes to higher performance, better targeting and higher legitimacy of governments. Such initiatives don't have to be revolutionary; they need to be honest and faithful.

Last April, the Genevan Social Services organised a sort of social start-up week-end. During two days, citizens, clients and employees of this organization created and designed new innovative services in the social sector. It was not specially digital, it could be digital or not. It was amazing to see so much enthusiasm and so many ideas generated in such a short period! At the end of the event, a number of projects were selected and they are now analysed to be implemented.

Co-creation and service design will become mainstream in the future. Many countries and local authorities have set specific organizations, within government or not: Nesta in the UK, MindLab in Denmark, São Paulo Aberta in Brazil, or Design Research Lab in Germany are just a few successful examples of the possibility to bring citizens directly in the process of designing the services they need.

One voice, one vote—let's make each vote count.

As we saw, populism is growing in several western countries as the people get more and more disillusioned, with the very leaders they elected. Faced by political and economic uncertainty people with similar views end up in homogeneous groups, sharing the same reality bubble—the famous 'Daily Me' prophesised by MIT guru Nicholas Negroponte in 1995. In this bubble, they no longer confront themselves to other views or question their own

beliefs—easy victims for companies who influence decisions by money and by using filtering, big data, psychology and microtargeting on social media.

Not only are citizens even more the subject to manipulation by algorithms, but with the help of these technologies people are mainly listening to louder echoes of their own voices, as Cass R. Sunstein put it in his last book '#Republic'.

The disappearance of shared experiences, when diverging and competing ideas and interest collide, is a threat to the public debate. Democracy needs a vivid public forum. So how can we bring back the democratic debate in which our different opinions enrich each other? Digital technologies can offer an opportunity for co-creating and act as a platform for the emergence of new ways for citizens to express themselves. Despite their short cuttings they can become powerful enablers of both trust and confidence, provided they are transparent. That is what Geneva is trying to do with e-voting. The authorities have to be transparent and this transparency is an opportunity for citizens to take back what is theirs: political power.

This is why, a couple of years ago, Geneva initiated the process of going open source with its e-voting system—e-voting in the sense of online voting, not voting machines in the polling stations. People can vote remotely, wherever they are, on their PC, tablet or smart phone. Switzerland, and in particular Geneva, is a pioneer in this field. Geneva held the first online vote in the world in January 2003, and almost 15 years later, only 5 other countries have tried their hand on e-voting.

It is a great system—state of the art, one of the best in the world—but having a great system is not enough. People won't trust a system just because you tell them that it is technically great. Since 2010, the source code of Geneva's e-voting system has already been accessible, on request for all citizens using it in Switzerland. The Pirate Party and the University used this possibility and reviewed the code. But Geneva wanted to go further: there is no system built by humans that doesn't involve risk--think about nuclear plants or planes.

In the past, security meant hiding and locking-up a system. Today openness provides security, because defaults and risks are open to scrutiny and can be addressed. Geneva decided to go open source, collaborate with hackers and citizens to show them that it is not someone else's tool or a company's tool, but a collective democratic tool.

It was a bold step. Public servants were scared that the intellectual capital they built would be stolen, politicians were afraid that it will be easier for hackers to access the system. They had to be convinced. Even if it seems counterintuitive, going open source was not only necessary for the sake of transparency but also essential to ensure the system's security. Geneva organised several workshops with hackers, scientists, academia, philosophers, and journalists for the successful opening of the source code. These were moments that built trust between the participants. Public servants didn't act as representatives of the authorities, they discussed at the same eye-level with citizens, without hiding behind their institutional role. In co-creating with the citizens, Geneva realised that transparency was not only the goal, but it was the way to achieve it.

In December 2016, boosted by the confidence that these exchanges gave, Geneva published a first part of its source code on Github. Today, Geneva is the only authority in the world that has an open source online voting system. The interest from the community was remarkable: There were hundreds of hundreds of people who joined the group and some contributions have already been implemented. Last April, the second part of the source code was published and hopefully everyone will help to make the system even better.

Democracy should not depend on private interest of companies. By going open source, Geneva's public system has become a common good. Any community can use it, for free, with only two conditions: They have to be open source themselves, and they have to be willing to share with the community the developments they did on the system. This is a step towards renovation of democracy, greater transparency and empowerment of citizens - provided everyone plays their part.

'We should not assume that democracies will always be able to improvise a solution to whatever challenges they face. There is nothing about democracy that guarantees this will happen' (D. Runciman). In order to fight that deconsolidation process, we appear to be engaged in one-must-not-fail confidence trap. We must act.

Solutions for the renewal of our democracies exists. Books and articles are full of examples and ideas. Some plead for a liquid democracy, in which citizens can delegate their vote to an expert, to a friend, to a trustee. Some rejuvenate the idea of sortition, i.e., the selection of politicians by random draw like the ancient Greeks did, as an alternative of the process of electing political candidates.

The web is full of apps or software civic tags offering new tools to collect, to select or to promote ideas and how to run our communities.

Two weeks ago, Geneva organised for the third time a democracy week around the international day of democracy on September 15, with 60 events during which citizens, experts and politicians engaged in conferences, debates and festive activities. It was, as always, very stimulating and rich. Even in Switzerland, the authorities have to question their democracy in order to keep it vivid and stimulating. We do not lack of ideas, so what are we waiting for?

To heal democracy, we, the public authorities must provide the fullest information and the best tools to engage citizens actively in co-creating our world. I fight for that every single day. As citizens, we have to individually and collectively speak up while staying rational and not let ourselves be blinded by fear or anger. Both political institutions and citizens must have the courage to take their destiny into their hands.

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Session 2

Day 1 – Afternoon – Plenary Session

Safety, Security & Privacy in an Hyperconnected Society & Economy

LEWIS SHADLE, Member of the Board of Directors, NxtVn, USA, [nxtvn.com], chairing, welcomed the participants and opened the session with a few introductory remarks.

The chairman talked about his work as ICT Advisor in Afghanistan in the context of the question of how to incentivise or generate opportunity for greater penetration of IP services into rural areas.

In Afghanistan, they started out with no infrastructure, even in the major cities. However, there was an intend very early on to try to get services out to the rural communities, i.e., 20,000 villages throughout Afghanistan—villages that might be just one family.

The approach taken was extremely successful: From a government perspective, it is important to be very light in regulation—regulation that is incentivising the private sector to take chances, to take risks and to move forward. One of the ways they incentivised the private sector in Afghanistan was by utilizing a kind of universal service funding. There was a 2.5 percent tax on growth receipts of the 5 major carriers. Then, the government got involved directly in using that money to establish auctions, where they would target specific districts throughout Afghanistan, to offset the cost of building capital infrastructure in those villages where you couldn't make any money if you were putting that capital investment in. The capital has been provided to these private sector entities and they built the cell towers, the radio networks and they turned up the 2G and 3G mobile broadband services to these communities.

After 5 years, the country went from 0 percent coverage to 90 percent coverage of 3G services, which means that 90 percent of the population in Afghanistan, i.e., approximately 27 million people, had access to broadband mobile services. The penetration rate is 85 percent—and, as result of that take-up, 80 percent of Afghanistan women either own a cell phone or have access to one.

This is relevant to the question about how to incentivise to get into rural areas: Active participation, light regulation and money that can be used to offset risk and offset the reduced revenues that you get in rural areas.

NxtVn is building a global cluster of hyperconnected data centre parks around the world. The company is laying the platform for what can be defined as the 'cloud of clouds'. The cloud of clouds differs from the cloud that we are presently experiencing. It is an ecosystem of cloud services operators who leverage the presence of each other in this market. NxtVn is doing that by connecting all of its parks together across the globe with things such as dark fiber connectivity on a terrestrial basis and undersea connectivity between continents.

There are some common points with each one of the parks that are an absolute basis of necessity for cloud services operators today and in the future: huge amounts of power. Data centres are some of the largest consumers of power in the world. One of NxtVn's parks is projecting over 365 megawatts of power consumption within the park itself. It is an unbelievable concentration of power, and it takes a lot of coordination with the power companies in the U.S., the Netherlands, Finland, Egypt, and France. It takes a lot of coordination to bring that much power into a single location, because this means sometimes new transmission facilities, new substations etc.—and nobody likes new transmission facilities coming across their backyard. So it takes time as well.

Another aspect of this is the connectivity itself: The next generation of parks, and the next generation of locations for the data centre operators and the cloud service operators, is going to be closed to this aggregation of undersea cables. This is also one of the reasons why NxtVn is identifying the continental coastal edge as their sweet spot of location on a global basis. The continental coastal edge has the advantage of being the nearest point-to-point connection between continents, and sometimes between countries, and therefore the lowest amount of delay, when moving data around the world.

Today, Facebook was the first global operator to experience the phenomenon of follow-the-sun data movement. If you are in Europe, in the morning, and you open up Facebook all of that data is being processed in proximity to you in several data centre locations in Europe. However, at the end of the day, when Europeans go to bed, people start waking up in the U.S. and huge amounts of data are moving across the Atlantic in a very short period of time. And this continues as the sun goes West. It is a challenge, not just for Facebook, but for all of the hyberscale operators in the world. They are moving their processes to where the power is cheaper. They shift data processing because they are consuming when they are processing.

These things are very common to all of NxtVn's parks: large amounts of power, hyperconnectivity and the specific locations at the continental coastal edge.

This has been NxtVn's model form the beginning, but it was validated several years ago by the scientist and author Parag Khanna who wrote the book "Connectography". In Connectography he argues that the world is changing where the centres of power are: from the current centres of power, which is the political power, to the centres of the future of business, commerce and trade.

That has been true in the past: If you look at where original trade occurred, it was always on the continental edge. We called them ports. And they became powerful. And over time, that power moved to political power, which shifted away from continental edges. If you look around the world, most capital cities are not on the continental edge, but somewhere in the centre of the demographic of that that they are governing.

Parag Khanna argues that this is going to change and that now—because of the confluence of some 315+ undersea cable systems around the world that are connected on the coastal edges in aggregation points—they again will become the centres of power. They will again become the centres of business, commerce and trade because they are carrying the most valuably monetized commodity that exists on earth, which is data content.

This particular session addresses a number of items. There are two particular topics the chairman commented about:

In terms of resilient networks, undersea cable systems is an infrastructure that the world uses, but very few people know that it exists. The volume of traffic runs on undersea cables. However, these undersea cable systems, and the network infrastructure on a global basis, were built upon some false premises relative to today's reality:

First, they were built upon the presumption that they would last more than 25 years—both terrestrial infrastructure and the undersea infrastructure.

Second, that they would not be subject to unpredictable events (in contrast to expected disturbances, such as a fish troller or an oil tanker that drags an anchor across the cable). Many of the cable systems we rely upon were build between 1977-2006. None of them had any perception of the impact of cyberattacks that we currently experience. Their control systems, their network operation systems, are open to attack. One day, someone is going to get into those systems and will shut it down—and an entire continent is going to be disrupted.

It already happens on a physical standpoint: A couple of years ago, a cable that went across Egypt was cut. It was cut of the coast of Alexandria. At the same time, one of the cables had been down for maintenance and a third cable had a cut 2 weeks earlier. When that third cable went down, it cut off all communications between the Far East, the Middle East and Western Europe. This was a physical cut, but you could imagine a dedicated complex cyber attack would do the very same thing with much more long-lasting effects.

And third, these networks were not build against a physical dedicated attack. These cable systems are at risk as result of this lack of understanding of what a future thread may pose.

The other point are is the topic of mobile, sensors, IoT and blockchain. To address this in a perspective of scale, today, we globally communicate on an IP-basis about 1.2 zettabytes of traffic around the world. The majority of that, growing at a compound annual growth rate of 47 percent per year, is mobile traffic. That is the impact on current IP traffic globally. Behind this are things such as IoT and M2M, which are estimated to have a growth rate of about 23 percent per year. These numbers come from an annual report of Cisco systems. The point about this is that between 2016 (where that number 1.2 zettabytes was being communicated) to 2021, global IP traffic will grow threefold to 3.3 zettabytes. This is the global traffic that will go through our networks in 2021! Imagine the impact that we have if we don't have a handle on the control of our communications infrastructures from a cyber standpoint and from a physical standpoint.

The moderator, **STEVEN LAFOSSE MARIN, CEO, Dgt4leaders**, France, welcomed the

participants and briefly introduced the objectives of this session.

Dgt4leaders is a mutualised digital platform concept to support co-creation, cultural change and social development.

We are living in a more and more connected world. Societies, economies and people are deploying new technology and concepts at a fascinating pace. But, at the same time, trust and confidence are very important. Safety, security and privacy are key and the objective of this afternoon session is to share the vision of a very distinguished panel on this new smart world.

GULSHAN KISOONA, Manager, IT Security, Risk and Compliance, Air Canada, Canada, [www.aircanada.com], focussed his talk on the challenges the aviation industry is currently facing in terms of cyberthreats, and how the aviation industry addresses these issues.

Cyber Security in the Aviation Industry

Safety has always been of key importance in the airline industry. It has been in the heart of the airline industry since its inception and is most likely not going to change any time soon.

With the increasing use of technology, connected systems and the Internet of Things that bridge the physical and digital world, the dangers of security breach is not limited to data breach any more. Those dangers can extend to equipment malfunction and potentially loss of life. Every day new threats arrive, and the air transport industry, including the airlines, the airports and the aircraft manufacturers, need to be continuously on their guard.

Simply stated, ICT is pervasive across the aviation ecosystem, from designing and developing aircrafts to flight operations, maintenance, communications, navigation and air traffic management. Fact is that the aviation industry is a target for cyberattacks.

As a key foundation of international trade, tourism and investment, aviation is crucial to a global economy. Disruption to this flow can result in significant economic and social disruption. We must now remain vigilant to adversaries who seek to disrupt the global economy by attacking the aviation's infrastructure.

What are the challenges the aviation industry is currently facing in terms of cybersecurity?

The first one is complexity. The aviation industry is a complex business, and the information systems supporting that business are equally complex. As one of the most integrated ICT industries in the world, the global aviation system is a potential target for large scale cyberattacks. There are thousands of thousands of entry points and traditional controls, such as firewalls, IDs etc., are not as effective on their own.

In addition to being complex, a lot of the information systems used in the aviation industry are legacy systems. These systems are outdated and were never designed to combat modern cybercrime. The systems have not benefited from the principles of security by design. This means, controls can not be applied within the systems, but instead need to be applied around these systems, making it harder for controls to achieve the same level of efficiency.

The next challenge is an increased threat landscape. The ways business and technology is being used in the world today is constantly evolving. New technologies bring new opportunities, but they also introduce new threats. With the increasing use of connected mobile devices, cyberculture is growing much faster than cybersecurity. Early on, flight attendants use mobile devices to accept payments on board. Now, passengers can use devices provided by the airlines, they can bring their own devices and connect them to onboard connectivity. Now, with the concept of connected aircrafts, the risk is even higher and the attacker could be almost anyone from activists or criminal organizations, states etc.

Another challenge is the supply chain. Numerous speakers already addressed how the supply chain has impacted the way we do business. This is not different in the airline industry. Sophisticated attackers are willing to use any means necessary to gain access to sensitive data and systems and cause damage.

Third party suppliers and vendors may not necessarily have the same level of control as the host organizations, thus making them easier targets by the cybercriminals. Once breached, attackers can leverage the suppliers access as an ingress point to their ultimate target. The cybersecurity of any organization in the supply chain is only as strong as the weakest member in the supply chain. It is not only the network. It has to be all the control points to the outside world that needs to be protected. Cybersecurity is therefore needed at all the phases of the supply chain since we did not know from where the risk will materialise.

What are the solutions to these challenges?

There is no magic bullet. We need to have a common approach across the globe to address these challenges. First of all, we need to understand that cybersecurity is not just an IT responsibility. More and more organizations now place the oversight of cybersecurity at a board level rather than in IT departments. Cybersecurity is been viewed more as a business risk rather than just an IT risk.

Moreover, it is not a purely technical issue. There are policy and strategic issues that are more important than just the technology—and this is why collaboration is key. It is going to take a common approach across the globe: Involving airplane manufacturers, airports and the airlines to protect the aviation industry against cyberthreats. We have seen it in the past, that information sharing has led to reduction in accidents and this has made the industry safer. We need to build on that so that the same applies to cybersecurity.

DAN SHOEMAKER, Principal Investigator and Senior Research Scientist, University of Detroit Mercy – UDM's Center for Cyber Security and Intelligence Studies, USA, provided an academic view on the issue of cybersecurity and introduced some national U.S. initiatives in this context.

Why I Sleep Like a Baby

Basically, the current state of cybersecurity is like the parable about the six blind men and the elephant "though each was partly right – all were entirely wrong." Everyone thinks (s)he knows what it is, but they don't. It leads to a kind of miscommunication when a lot of people are talking about something they don't necessarily understand or agree on. And the data makes it clear that it's getting worse not better. So, how to change that?

1. A commonly recognized and well-defined body of knowledge.
2. Comprehensive organization-wide risk management.
3. Trustworthy ICT product supply chains.
4. Stop trying to defend everything.

We can't teach it or practice it effectively if we don't know what it is. Thus a comprehensive and commonly accepted body of knowledge is essential. The National Initiative for Cybersecurity Education (NICE) Cybersecurity Workforce Framework is an encouraging first step.

It outlines KSA (knowledge, skills and abilities) requirements for seven highly integrated areas of the field:

1. 1.Secure software/trusted acquisition
2. Secure enterprise technology operations
3. Enterprise network defence
4. Forensics and criminal investigation
5. Threat intelligence analysis
6. Threat intelligence collection and operation
7. Governance and control

Threat identification and categorization and systematic risk analysis and control deployment is a critical cybersecurity function. The six stage Risk Management Framework (NIST-RMF) outlines the standard steps to make the risk management process systematic and sustainable:

1. Risk identification and categorization
2. Control selection
3. Control deployment and implementation
4. Control system performance assessment
5. Control system authorization/acceptance
6. Control system monitoring, and enhancement

It is a process that you adopt in an organization as a whole and then implement and follow as a means of managing risk, because risk basically is a continuous process.

Organizations purchase their ICT products from global sources that can be easily compromised—a supply chain is only as strong as its weakest link. That is why control and

assurance of sourcing in these five areas is critical:

1. Malicious code
2. Counterfeit components
3. Supplier incapability
4. Supply chain breakdowns
5. Exploitable defects in code

NIST 800-161 is a single strategy to uniformly identify, assess, and implement controls up and down a supply chain.

Cybersecurity is dead—perimeter based defences are too expensive to sustain. Cyber-resilience is a brand-new concept that deploys controls for just those things you can't afford to lose:

1. Categorize business assets—you can't secure it if you don't know it exists.
2. Identify everything that threaten it—not just the 'convenient' things.
3. Designate the 'showstoppers'—versus the 'nice to haves'.
4. Ensure reliable protection for each showstopper—develop recovery strategies for the rest.
5. Evolve—cybersecurity is a continuous state, not a function.

EIKAZU NIWANO, Research Professor, Secure Platform Laboratories, NTT Corporation, Japan, addressed the issue of IoT security by applying secure measures which have comprehensive resistant capabilities, such as smart cards.

IoT Security with Trusted Secure Module

There is an increasing number of security threads to the IoT. For instance, it has been shown that malicious remote control is possible by hacking cars, medical equipment, such as insulin pumps or cardiac pacemakers, and that it causes life threatening risks. In 2015, 1.4 million cars have been recalled for being hackable. Moreover, 150,000 IoT devices were hacked and cyberattacks were committed through those devices. This type of threats could possibly cause a critical crisis of the social infrastructure.

We have to keep in mind that the risk will increase exponentially according to the number of IoT devices and ecosystems in the upcoming hyperconnected society.

In order to avoid the problem—especially because an IoT device has a complex and long-term lifecycle—device authenticity with remote IoT device management capabilities (such as secure boot/ 'root of trust', remote firmware application update, remote attestation and management, and device certification, identification, authentication and authorization) is a very important issue to be provided with.

In Japan, some important IoT security related organizations have been created recently. Their charter/guidelines touches upon a security module, called tamper resistant module, secure chip, secure element etc. These organizations are the IoT Acceleration Consortium (October 2016), with more than 3,000 members; the Secure IoT Alliance (February 2017); and the Secure IoT Platform Consortium (April 2017).

Moreover, international standardisation efforts have been started. For example, GlobalPlatform standardised secure chips and studied a general scheme as a root of trust and Trusted Execution Environment (TEE). The Trusted Computing Group has standardised the Trusted Platform Module (TPM) for the IoT. Both organizations are cooperating. Other organizations are the OneM2M and GSMA for remote management of secure module by applying GlobalPlatform schemes etc. Commercial deployments have already been started by applying embedded SIM /embedded UICC, TEE and TPM.

What are the issues to be considered and studied in order to increase trust in the secure module? First, according to required security and trust assurance levels, various types of hardware and software based secure module in hyperconnected ecosystem have to be handled (e.g., hardware oriented measures, such as embedded SIM or TPM, and software oriented measures, such as Secure Container or TEE, have to be deployed).

Second, trust definition, assurance and evaluation for integrated multi-types of secure modules and devices as system have to be studied. In this context, security and trust by design with secure modules have to be taken into account.

Third, we need to consider managing, not only trust as functional reliability, but also social trust as safety. It is assurance on the basis of a chip, device and system profile linked to social aspects in the real society and world.

And finally, standardisation efforts have to be done among existing various types of standardisation organizations for integrated trust assurances as describe above

COLIN WILLIAMS, Director SBL, United-Kingdom, provided a great talk on the origins of the word 'cyber' and the importance of cyber for the survival of human mankind.

Homo Sapiens Cyborgia

Human version 2. Humanity rebooted. Homo Sapiens Cyborgia. Progeny of two proud fathers, Nathan Kline and Manfred Clynes. Born in a paper titled 'Drugs, Space and Cybernetics: Evolution to Cyborgs' presented at the Psychophysiological Aspects of Space Flight Symposium in 1926.

A paper with the purpose of proposing a reengineering of the human form in order to propel humans into space. How to solve the problem of human breathing in space? You engineer out the need to breath. But the real purpose is bigger and bolder. The conquest of evolution, the improvements of human condition.

What are these two guys in the 1960s doing with the word 'cyber'? This word is ours! We invented it! We discovered it! We are not even sure if this thing is real, it might just be the fiction of lazy marketing people, or it is a virtual world where we draw distinctions between the corporeal and the nonexistent. It is the matrix. Or maybe we can see it as a domain where we can fight wars upon… But no!

Cyber has a specific point of genesis. In 1945, Vannevar Bush made a direct intervention into a world of ideas and a world of reality. This man said in his article in 1945, we humans

must conquer and reimagine and redefine our relationship with science and with information or we shall parish. We need to build machines that will augment and supplement human memory and human cognition. Machines that will work in symbiotic relationship with the human mind. Without them, he says, we will parish as a species and as a society.

He imagines a machine that will enable the transcoding of light into the machine, of sound, that you will be able to draw on glass panels and receive information projected from the memory extend connected by a vast network of that machines.

He was part of an intellectual context, of the centre of which was Norbert Wiener. It is to this man we owe the word ‘cyber’, the word ‘cybernetics”. The reality of the construct that we inhabit was invented, consciously by humans for humans. Wiener understood the importance of information in systems. He imagined a world in which systems would exist, bound together by information where no functional distinction of any meaningful form would operate between humans and machines. The meat and the machine will be functionally indivisible systems that will self-regulate, self-adapt and self-govern on the basis of feedback and behaviour.

He took the word from classical antiquity, from the Greeks. A mechanism of getting what you want as a consequence of nudging and sensing and adapting and of evolving. And he borrows it from the ‘Essay on the Philosophy of the Sciences”: The future science of government should be called ‘cybernetics’ (‘la cybernetique’).

Wiener wrote three books on cyber: ‘The Human Use of Human Beings’ (1950) deals with the application of the ideas of cybernetics to society. Wiener, when he talked of systems, understood *all* systems—electrical, mechanical, social, societal and human systems.

Then, by 1964 (‘God & Golem, Inc.: A Comment on Certain Points Where Cybernetics Impinges on Religion’), he starts to get into the area of these machines exhibiting the characteristics of life. Machines that learn.

‘Cybernetics: Or Control and Communication in the Animal and the Machine’, in 1948, was a work of seminal importance, comparable to Rousseau or to Mill. You could not be an intelligent human in 1948 and not have read Wiener’s book. Wiener is at the centre of an academic intellectual firmament which drew a wealth of talent, especially J.C.R. Licklider.

People might never have heard about Licklider, although they live with and use his inventions and his ideas every single day. In 1960, Licklider speaks of the human-computer symbiosis, in which computers and human minds will work together in a mutually transformative way. You can not live one without the other. And then, in 1965, he comes up with the idea of a library of the future. He doesn’t mean bricks and buildings. He means a system that will lift information from its physical form. Licklider says, lift the information from the page, call it transportable information, build pro-cognitive systems that can process the information without human agency. And then you have to connect these things together, so you need something that Licklider called the intergalactic computer network. This was one of the fundamental pillars of the Internet.

And then, in 1968, he says, let us imagine that we take these machines away from just being big calculators or doing big things, and let us imagine that we insert these machines into human creational activity. And in 1968, he talks about face-to-face interaction through the modality of computers, message processing, online interactive communities—today, we call that Facebook. He talks, in 1968, about these computers operating at the level of pure meaning, human thought-machine thought. He talks about a meeting of the future and about online dating agencies—today, we would say 'social networks'. And of course he represents all of this using notations not of engineering or science or technology but biology. He imagines the world of the future in 1968, where you will connect machine-to-machines and you will talk to the other person as though they where there.

He also imagined 'Oliver', the Online Interactive Vicarious Expediter and Responder, which was a computerised personal assistant—just like Siri or Cortana nowadays. He named it after Oliver Selfrighe who was a student of Norbert Wiener.

Cybernetics and cyber as we know it, as we inhabit it, as we exist within it, was a conscious and knowing response to the amplification of societal complexity. Wiener understood that societies amplify incomplexity exponentially and have done since their interception thousands of years ago. Wiener understood that this amplification of complexity, this exponential acceleration of complexity, was essential but it brought problems.

And he understood that that which he called cybernetics, and what we call 'cyber', was a necessary precondition for the survival of humanity. These machines have to exist, they have to augment human consciousness and cognition and they have to be joined up as seamlessly as we possibly can, because if they are not, we are finished. We have transformed society so far, so fast that we can no longer live or exist in the old one. How do we cope with the complexity of speed? We allow ourselves to become augmented. We embrace the augmentation. We accelerate the augmentation.

In 1965, Irving John Good wrote a paper called 'Speculations Concerning the First Ultraintelligent Machine'. It is good to advance the idea of the ultra-intelligent machine. It is the last machine humans will ever make because it will make all the others. The survival of man depends on the early constructions of an ultra-intelligent machine. We either embrace and accelerate this augmentation or we are finished.

Cyber(netics) is a matter of life and death, yours.

SARAH ZHAO, Partner, Faegre Baker Daniels, China, provided a judicial perspective on the current situation in China concerning cybersecurity.

China Cybersecurity Law

Before China's Cybersecurity Law was issued recently, China had not have a comprehensive personal information privacy protection law, even though there were many rules and policies governing different aspects of privacy issues. In 2013, China issued its first set of Personal Data Protection Guidelines. The Guidelines are voluntary, not mandatory. However, things have been changed since the Cybersecurity Law of China became effective in June, 2017.

The Cybersecurity Law mandatorily requires the network service providers in China not only to participate in the protection of the national cybersecurity, but also to protect the privacy of collected personal information. Following the Cybersecurity Law, a series of the implementation rules and guidelines have been issued for more detailed compliance requirements.

The new development and enforcement trend of the Law indicates that China is determined to enforce the Cybersecurity Law diligently and forcefully.

All players are covered by the Law, including domestic and foreign companies doing business in China. When dealing with data, one has to be very careful otherwise there can be penalties, and in case of serious problems, criminal penalties can be imposed and the business licence can be terminated. Moreover, individual employees of the company can be personally be held liable.

Details of the Law

The requirements include having users' true identities, storing data servers locally in China and providing 'technical support' (wiretap access) to the Chinese government during investigations involving national security. Failure to do so may trigger not only monetary fines, but also the termination of one's business license, or even certain criminal penalties.

The law for the first time in China has provided relatively clear language addressing privacy protection for personal information. It has provided specific requirements regarding data collection, use, disclosure, and security and other related issues. Experts of the industry consider the privacy protection aspect as the silver lining of this Cybersecurity Law.

Data collected in China has to be stored on servers located in China. Transferring data to outside the country is not allowed unless there is business necessity. 'Business necessity' is not very clearly defined but normally this means that the operation is big enough to a degree that one has to go through an assessment process requiring governmental approval.

Unlike in the United States and the EU, China does not have a well-established system and history of enforcing the privacy of personal information. However, the country is catching up at a fast speed. The new implementations rules are coming out constantly. Foreign companies shall closely monitor the trend and adopt appropriate compliance programmes accordingly.

MICHAEL NELSON, Public Policy, CloudFlare, USA, provided a most interesting insight from the perspective of a Silicon Valley start-up.

We are at a critical point right now. We have 3 years to get things right, i.e., government policy but also to get the industry to work together to define the next generation of technology, the cloud of things.

If we do it right, we have continued exponential growth in new applications for even more sectors of the economy. If we do it wrong, we are going to stall out and loose the most exciting opportunity that the technology industry has ever had. If we do it right, we are going to have free speech. If we a do it wrong, we will have chilling effects where people are afraid to share information online because of surveillance. If we do it right, we continue to have permissionless innovation. If we do it wrong, governments will decide that this Internet and the cloud is a mature technology—and when you hear the phrase 'mature technology', that means something that needs to be regulated and stopped.

We are changing, things are still moving very fast. Last Wednesday, CloudFlare celebrated its 7th birthday. In 7 years, the company has grown to over 500 people. CloudFlare now manages about 10 percent of all web requests on the Internet. The company provides the security for 6.5 million websites. They are doing it with a cloud-based security service and most of its customers don't pay for that. But the company can't continue to do this if there are phone companies, cable companies and ISPs in certain countries deciding to play the oligopoly game and trying to block the development of cloud services in their country, charging 10-20 times what they would charge in a competitive marketplace.

CloudFlare has 117 data centres around the world. If countries start imposing regulations, the company will loose the trust of its customers and the ability to provide cloud services. And it is not just CloudFlare, it is other cloud services that are providing this new foundation.

The most exciting thing about this cloud foundation is not the computers and the laptops and the cell phones we connect to each other. It is the cloud of things. It is what we get when we have hundreds of billions of things connected together. And we have a choice. There are these critical forces—the things that are driving the changes we will see.

In this area, there are two critical forces: One is regulation, that will slow down and restrict what we will do, and the other is innovation, which will give is greater things to do. One can very quickly plot out four scenarios: The first one is that we have more regulation and it is really bad regulation (focussing on the 100 billion things to be regulated). If they don't write the rules right, everybody ignores them and we end up with the 'cloud of lousy things'.

Second, if people are creative and innovative enough, to find ways to meet the regulations and if the regulations are written well, we will end up with the 'cloud of very expensive things'.

This is exciting but it won't be nearly as exciting as what we could have if we had, third, less regulation and more innovation—which gives us the 'secure cloud of things'.

Fourth, CloudFlare has a service called CloudFlare Orbit that uses the cloud to protect the things—and if we do it all right, we get the best of all possible worlds, the 'cloud of all things', where the cloud itself is providing the security. We don't have to manipulate each individual thing.

We can have various different devices that are protected by the cloud rather than by a $10-dollar software on the device. It is a very exiting world and the government can play a key role by laying out a vision of what the cloud could do.

Some years ago, three very important papers, published in the U.S., provided a vision for the Internet. Everybody in the industry got together, there was a clear vision from the White House, and because of these three papers, the U.S. was 2 or 3 years ahead of everybody else.

It is the complete the opposite now. There is this battle going on between different parts of the industry, and there are a lot of people making a lot of money writing very negative and untrue stories, about how much damage and the Internet and the cloud are doing.

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Q&A

The first question addressed to Michael Nelson was: Is the cloud is dangerous?

Michael Nelson, CloudFlare, stressed that this is some of the myths of the cloud. Some people are saying the cloud is less secure than having all your personal data on a server in the basement of your doctor's office—a server that is maintained once a month by a 17-year-old who gets paid minimum wage. It works better in the cloud.

He was then asked to contrast the two approaches of data privacy laws and the strategy to follow the sun to save money.

Michael Nelson, CloudFlare, explained that data localisation laws, like the ones in Russia, are a very serious threat to the cloud services that several companies are providing. The idea that somehow your data is going to be more secure, if you are Russian, if it is kept in Russia doesn't make sense. There are actually a lot of people in a lot of countries that would rather export their personal data and use a foreign cloud service. But countries like Russia are trying very hard to keep their hands on the servers, and they don't really understand and don't appreciate the benefits the cloud could provide them.

CloudFlare does have a tough issue to deal with and the lawyers are trying very hard to figure out what happens when the FBI in Washington wants to get data from a server that Microsoft runs in Ireland. And the Irish law says that that data can't be handed over to the U.S. without proper Irish Government approval, and the FBI wants the data now. This is one of the biggest issues we have to face in the next 3 years, how do we put these laws together.

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Session 3

Day 1 – Afternoon – Parallel Session

Future Trends in Artificial Intelligence & Data

The chair and moderator of this session, **ANNETTE TRIMBEE, President & Vice-Chancellor, University of Winnipeg,** Canada, [www.uwinnipeg.ca], warmly welcomed the participants and set the scene with some introductory remarks:

The University of Winnipeg was very proud to organize/co-organize the Global Forum conference with the City of Winnipeg, Economic Development Winnipeg and ITEMS International. It was exciting to welcome such a high caliber of attendees from across the globe to Winnipeg. Many staff at the University worked diligently, along with the staff at ITEMS to bring together an outstanding conference. Of particular note was our Dean of Business and Economics, Dr. Sylvie Albert and Sylviane Toporkoff and Sébastian Levy. It was great to see many of our own professors and staff participate over the two days.

Artificial Intelligence and machine learning is poised to explode and touch all aspects of our lives within the next decade. As the leader of an educational institution and as an active partner in the City of Winnipeg's Enterprise Machine Intelligence and Learning Initiative (EMILI), we understand that the world our graduates will inherit is very different than the one we currently live in. We also know our graduates will need to keep adapting to the pace of technological change throughout their lives.

This panel brought together six leaders from a wide variety of backgrounds, including Canada Foundation for Innovation, Citiyzen Data, CGI Federal, Audi of America, Great West Life Assurance Company, and the US Department of Defense. It was evident that the spotlight on Artificial Intelligence (AI) is shining brighter than ever before due to the convergence of technology and data. The applications of AI will range across all industries and sectors and will no doubt have an impact from social, economic, and legal perspectives.

AI is becoming more intelligent, it is learning from past behaviours and adapting accordingly. While there are negative narratives surrounding AI, it was important to be reminded that it is a tool, and all tools can be used for good or bad. We need to have an enabling perspective, it's an opportunity for humanity to use a positive approach with AI to build a better world.

A key question appears to be how we embrace AI while still acknowledging the intrinsic value of humans. Imagination exists within humans and we will continue to evolve alongside the machines. It is an ecosystem of human intuition and experience that combines with data that enables us to make better decisions. We need to embrace data as the fuel for innovation.

There are still many questions that are left to consider to determine the best approach to

embracing AI and the value it can provide. How do we address the skills and regulatory gaps that will exist? Whose responsibility is it to address this? Educational institutions? Employers? Government? Where does research play a role? How do we collectively encourage collaboration to address these societal concerns?

We look forward to continuing our work at the University of Winnipeg through research, education, and taking part in impactful opportunities such as EMILI. We were pleased to have played a role in bringing Global Forum to Winnipeg and seeing the engagement and dialogue that took place over the two days. We know that many conversations and connections that developed will continue beyond the conference.

GUY LEVESQUE, Vice-President, Programs and Performance, Canada Foundation for Innovation, Canada, looked at the topic from the lens of Canada's academic research infrastructure agency.

Innovation.ca view

The Canada Foundation for Innovation (CFI) is a federally funded agency. It has been set up outside of government as an independent corporation to invest and provide Canada's best researchers with the tools, labs, equipment and facilities they need to be internationally competitive and to work with the best researchers in the world.

After 25 years and about $6 billion dollars worth of investments in research infrastructure in Canada's academic post-secondary sector, Artificial Intelligence is an area that speaks a little bit about in terms of investments made by the CFI. The big challenge is to define what research infrastructure investments qualify as AI.

25 years in the making—in reality, when you look at the evolution and how Canada has got to this point today, the strength and the enthusiasm and the spotlight that has been put on AI runs the gamut of publications and of the social media and of the media today. AI has really arrived. Even the Chartered Professional Accountants of Canada summer magazine devoted one third of its pages to AI!

Sitting on the sidelines, making investments in AI research projects, research infrastructure across the country, the job of CFI is to give the tools and technologies to researchers in order to tackle some of the challenges, interesting questions and the discoveries that lead to the innovation that we will be speaking about in terms of predicting and projecting into the future.

AI, the promise and the perils: What happens if we take actions—if we take the right actions, if we take the wrong actions, or if we take no actions? Perils here in the sense of making sure that we are very careful and selective in the things that we do.

The timing is about being here and being now. Why are we here and now? Because the power of data processing, the power of computing, the power of science and science fiction have collided. Is AI an end in itself? Or is it really just a means to an end? We saw that in the early 2000s with nanotechnology, where everything and anything was nanotechnology. It seems that AI is creeping up that path again. Is it all about AI? Or is it really about all of the myriad of applications that AI delivers promise on?

Another point for why are we here is the university's responsibility. Or is it government's

responsibility? Or the industry's responsibility? Who is responsible? Who is in charge and who is going to take the leadership? Who is going to make the right decisions as we go forward to capitalise on all the promise of AI and its applications?

Canada has often used the analogy that a research strategy is like an industrial strategy. Canada did some fantastic things and it is really good at research. The country has done tremendously well over the last 20 years in supporting academic research—but a research strategy is not an industrial strategy. The Canadian Government has understood that and has developed other tools in their toolkit to come up with a parallel or an integrated industrial strategy in complement to the research strategy that was developed over the last 20 years.

And finally, the ecosystem approach really begs for competitive collaboration. At the end of the day, who is the winner? Is it a small start-up, is it a unicorn, is it a university, is it a city, a region, a province, a country or a continent? Those decisions are really critical and will determine where AI ultimately leads a region, a city, a country, a continent and, in fact, globally.

How to built this AI ecosystem? The CFI focussed on two of four infrastructure pillars in terms of conditions to create 'density'. There is a physical infrastructure and a human infrastructure that go together. For 20 years, Canada has done extremely well in providing resources for equipment, facilities and space and the people and services to make those things happen. You take advantage of the physical infrastructure by having the right people.

The second set of pillars around building an AI ecosystem is, once you have in place the people and the tools, you have to have the actions. That is the set of policies/ incentives/ strategies that optimise the use of the physical and human infrastructure that has been built up over the last 20 years. The government has started to act on that. For instance, last week Canada's two largest provinces, Quebec and Ontario, have signed a Memorandum of Understanding to collaborate on AI. The Canadian Government has made significant investments and launched a Pan-Canadian Artificial Intelligence Strategy. Moreover, there are significant investments coming down the pipeline around the so-called Innovation Superclusters Initiative.

And then, finally, the intangible infrastructure is when these things start to creep into the everyday world. It is the culture, the attitude, the values that develop as a result of having the momentum. Intangible infrastructure is really about capitalising on that momentum.

Canada has made really good investments in the first two parts of the pillar. The country has put together a number of action infrastructure items that are going to pay off if they are executed properly. This is going to continue to develop and to build the momentum that the country has. However, it is not a race to the top and it is not a race of one horse. There are a number of countries that are also following very aggressive paths around AI. Part of the question is what exactly is Artificial Intelligence? Canada has had tremendous support on the academic side of things, e.g., over $200 million dollars in AI projects supported by CFI since its inception, and $750 million dollars in academic advanced research computing infrastructure.

All of those AI milestones, such as Chinook, Deep Blue, Deep Mind etc., are now starting to demonstrate that there is a potential strong applicability across a wide variety of fields. In the first 10 years of CFI's existence, almost everything the CFI did in AI was around robotics, optimisation, decision making, vision and imaging. Now, AI is considered as an enabling tool across many disciplines: Aerospace, agriculture, biomedical engineering, space exploration, industrial production, hydrology, manufacturing, social processes, culture and arts, software, telecommunications, transportation, earth exploration, oceanography, energy distribution, civil infrastructure, historical text analysis…

Time to act is now, and acting and non-acting are two scenarios—but acting in a smart, collective and concerted way is really going to give Canada a competitive advantage over the next 5-10 years as the country really tries to seize a portion of this AI world.

HERVE RANNOU, President, Items International & CEO Cityzen Data, France, addressed the issue of time series data processing and explained why this technology will play a major role in the context of big data and AI.

Connection from Big Data to AI

When talking about big data, we have to be aware that there are different types of big data and that people understand them differently. In fact, there are four segments of big data:

The first one, representing 95 percent of the existing IT technology in companies, are data from major companies' databases. This type of data is based on traditional relational databases. People call this big data today even if it is something called business intelligence 25 years ago—and in fact, it is business intelligence. Today, we have more and more data but it is not all about big data. People who are calling this segment of data 'big data' possibly do this for marketing reasons, but it is not related to the development of technology.

The next two segments really concern big data: The second segment is data coming from social networks, documents, videos and here you have a lot of data. Big data in this segment is used for content analytics, e.g., to recognise a song or somebody in a video. This segment really implies big data expertise.

Cityzen Data focuses on the third segment, which is data from sensors. Today, there are many sensors in aircrafts, in the automotive sector, in any area of energy, and the objective of Cityzen Data is to industrialise this segment with a data analytics approach and research.

In this segment, you have time series. In the context of time series, the key data is not content regarding a business or a transaction. The key data is the time. Time series data requires storing and querying an enormous amount of data, coming from various sensors, in time series databases. The data is managed according to time—and this is the big change. Once you consider all the data by the time, you are able to cross a large bunch of different kinds of data.

Today many companies are working with time series, especially the big major digital companies. Cityzen Data has developed a tool where geo time series and all the data are defined by time and location. It is a disruptive architecture for sensor data in which all data are not only defined by time, but by time and location. Whereas data are traditionally stored

in by business applications, Warp10 uses a universal formal referring to time and location, regardless the business specific format.

The connection between big data and AI is not new. There isn't really new technology in AI. Everything regarding the research in AI, such as algorithms etc, has been discovered 20-25 years ago. However, today, big data enables us to analyse the big history of data—not only the big history of data, but a very large number of source data. This is the big change today.

The intention of Cityzen Data is not to carry out a specific project, any kind of lab or company can develop an interesting project in AI. The key issue for tomorrow is how you are going to industrialise this technology in cars, aircrafts, trains, in energy, in any kind of business today. This is the objective of Cityzen Data. There is this evolution from the old world of data management in a company based on business data organization, in which the key word is transaction, towards a new world, in which you can describe everything in a process with elementary events. Finally, everything can be described as a succession of events.

The idea is to have companies transforming IT organization based on business ideas in a traditional system to an organization where everything is considered as an event. And everything in data management can be managed in time series. However, when discussing this issue with traditional companies, they are ready to realise innovative projects by using this kind of technology, but they are not ready to transform their IT system to this new one.

The idea behind this technology is the ability to build up a kind of neutral infrastructure and to make a clear difference between what relies on this data infrastructure and what relies on application, which is obviously the objective (application and service), and how to manage the connection between the two levels, i.e. the time series data infrastructure and the application and service. This is the new challenge we have to face.

GRADY JOHNSON, Senior Solution Architect, CGI Federal, USA, provided a captivating insight in the use of Adaptive Artificial Intelligence.

Adaptive Artificial Intelligence

CGI is a global company, headquartered in Montreal. With approximately 70,000 members worldwide, CGI is a very large company—a herd of unicorns running head first into digital transformation.

You can also look at Adaptive Artificial Intelligence as intelligence augmentation. What is intelligence? How do we lean? How do we learn from our children? How do we learn from our parents? How do we determine where we are going in life and all the different paths we can take?

Machines are learning, they are able from the algorithms which are derived from the human beings, they are able to determine the next path they should take. Sometimes, they come to decision points and they take those paths.

Where do we go or what do we gain from intelligence? Intelligence is all about learning from the past failures and not repeating the mistakes that were made. This is when you talk about adaptive behaviour. It is basically being able to recognise when you have done something

wrong and you adapt, so next time you don't make the same mistake. Machines are able to do that through machine learning. They are able to determine over time different paths that they should take to avoid a mistake they made before.

Another example of learn behaviour is what Google did with their car: They had over 2 million miles that they have used to help train this car to adapt, so that it learns from its mistakes made, before they are going to release it out onto the road. This is adaptive behaviour. Another example is Amazon's Alexa.

When we think about machines that are listening, that are adapting to the things we are doing—why does this matter to us? Because we have to adapt as a society. The human spirit is not going to change. We will keep evolving and designing and building and influencing the technology that comes out. And you can not sit aside and wait for someone to make a decision, you have to embrace it. Or you will get left behind, that is how you become extinct.

There is a lot of false narratives out there around AI because everybody is scared of change. Things are changing and there is a lot of different conversations with world leaders and technology leaders. They are talking about AI is going to take over the world. This is a false narrative. The machines are designed by humans, and the machines are only going to be wicked and only do bad thinks if we programme them or deliver that for them to be doing those things.

One of the worst recent use cases of how people used AI: Someone actually used AI to try to model people's faces to determine what their sexual orientation is. If you don't think that is bad, why would you want to model someone's face to determine his sexual orientation? The creators of the machine are the ones we have to fear, not the machines themselves.

Some of the other use cases are the things that are driving the innovation: For instance, the expediential acceleration of processing power, or recently Apple's new A11 neural network processor which is being able to do augmented reality. There is event correlation. We should make a distinction between adaptive learning and applied problem solving, because applied problem solving is more about determining which path to take from taking a solution that you had in a differing domain and applying it to a new area. The adaptive side is more about looking at what is going on and making the right choices from the data that you have.

Furthermore, there is also natural language processing, such as Alexa, but also chatbots. Recently, they used a chatbot to go back and learn from all the blogs that were posted about sports information during the last 3 years. It was then able to write sports blogs that nobody could tell a machine had written based on all the other sports blogs wrote. This was being used to show the utility that chatbots could actually write language that is understandable and you can't tell the difference between the humans or the machine.

SEBASTIAN STOESSEL, Big Data and Business Intelligence Strategy, Audi of America, USA, [www.audi.com], delivered a presentation of the Audi specific story in the context of big data.

Audi

Audi basically describes big data through three attributes: the variety of data, the volume of data and the velocity of data. The main challenge is to take those inputs and manage them towards fulfilling or achieving Audi's strategy and vision.

Audi was founded by August Horch. The original automobile was created at the beginning of the 20th century in order to compete with the horse. The most recent Audi, the Audi Aicon, was presented at the International Automotive Exhibition (IAA) in 2017. The comparison between both vehicles shows to what extent customer expectations towards a vehicle have changed. It is no longer just a mean for mobility in order to get from A to B. The Audi Aicon is fully electrified, fully autonomous and there is a lot more applications and digital services that are being enabled through the car and the technology.

Digitalisation, digital transformation, AI, machine learning, deep leaning, supervised and unsupervised learning—those are not just concepts and applications that are relevant to the automotive industry but also to all the other sectors we heard about earlier. There are applications within the governments, applications within academia. Today, patients get used to downloading their the medical records in an electronic format. People are used to doing things online: They do banking online to get immediate responses, booking accommodations, renting cars, subscribing to cars etc. Those are all services that are being provided and which educate the customer towards raising the bar for all the participants in the economy of service providers, such as Audi of America.

As a result, Audi has to raise the bar as a company. They can no longer just look singularly on engineering cars, putting them on the track and distributing them through the company's dealer network. They have to understand what is it what the customer really expects from Audi in order to seamlessly integrate into the ecosystem that the customer maintains.

Of course, business intelligence applications have always been used at Audi. They had allow the company to track programmes, the efficiency of possesses, to improve and to measure KPIs, and to visualise data. However, what has never existed before is the ability to connect all the interdependencies of an organization to each other. That is the big promise of big data and digitalisation.

Audi got into big data a couple of years ago when Audi's CIO asked what big data can do for Audi of America? Audi didn't want to jump on the bandwagon of innovation, but wanted to get an answer to the question: What is it that this innovation can do in order to support the expectations of Audi's customers?

At that point, questions raised, for example, from the following observations: Many customers that lease Audis are terminating their leases earlier than indicated in the contracts. Another observation was that there were more and more Audis in the driveways of the neighbourhood of Audi's CEO. Were these just personal observations or are there demographic indicators supporting these hypothesis?

Often, it starts with a simple observation, that then is being translated into a hypothesis. And

what then normally happens, in order to get the answers to those business challenges and make business decisions, is that you proof from the wide experience of a world class CEO, you combine the experience with intuition in order to identity the right decision to take. What Audi has done over the years is to introduce a third element into this chain, which is data. And data for Audi, in combination with experience and intuition, enables better decision making within the organization.

Better decision making can result in a more efficient use of resources, which then translates in higher profitability. But most importantly, it allows to have an improved and optimised relationship with the customers. It allows to really understand how to optimise the relationship in terms of being more relevant in the content discussed with the customer, but also being more relevant from a timing perspective, i.e., when to communicate to the customer. The objective is to be perfectly integrated in the ecosystem of the customer and the brand.

Today there is a fully financed programme across the entire organization including the headquarters Audi AG in Germany. Audi of America is working closely together with the electronic research offices in San Francisco and Silicon Valley, with the Audi IT centre and resources in Virginia. There is a fully formalized approach towards that, based on the identification of the resources that are required and the partnerships that need to be established. The questions are how to collaborate across the globe as a global organization and how to make sure to achieve the global vision that Audi has set as a target?

The mission is to identify new business models for Audi which couldn't be realised in the past. Now the data is available and Audi would like to capitalise on that resource in order to understand how to make best use of it to meet customer expectations.

The path to get there is the journey of an evangelist. Data is the fuel for innovation that propels the organization into the digital age. But data is worth nothing if we don't understand exactly what we are trying to achieve and the vision we try to reach.

For Audi, this translates into a better understanding of the relationship between the customers and the brand, the relationship throughout the vehicle, the relationship with partners and dealers, but also the lifestyle of the customers.

Audi has worked on a number of use cases using AI: For instance, in order to better understand customers' expectations, a loyalty model has been created that allows to optimise the relationship with the customer by being more relevant in the conversation and the interaction with the customers. Another example is the use of text analytics to better process user feedback surveys in order to really elaborate and elevate the organization.

However, AI, machine learning etc. are only tools. The most important part is that it is the human brain that generates the universe of imagination.

PHILIP ARMSTRONG, Executive Vice President & Global Chief Information Officer, Great-West Life, [www.greatwestlife.com], provided a captivating talk on AI and machine learning in the financial services industry.

Canada Convergence Automation, Robotics & AI

In the financial services industry the most profound emerging future trend in AI is the inevitable collision of customer facing, conversational AI technologies with back-office task-oriented robotic process automation technologies. Once these technologies have been effectively linked, then we can design products and support services that think, evolve, adapt and scale without the need of human involvement.

Robotics, automation, AI, machine learning, cloud computing, and big data analytics are redefining our current business models, our social constructs and our world.

Conversational AI technologies are evolving quickly. They are becoming far more sophisticated and more human-like in their characteristics. This started with relatively simply dump chatbots who were easily confused. But today's conversational AI engines can remember and learn from previous conversations. They can understand the meaning and context of words and they can follow and discuss several threads within a conversation simultaneously. An episodic memory will contextualise words, emotions, timelines and events to mimic the human brain. Some can detect your mood from the worlds that you use and alter their responses accordingly.

Conversational AI can be applied across all preferred communication channels; whether that is webchat, text, voice or email. Today's AI engines can analyse words, images or numeric data with ease. Some of the most sophisticated AI engines have lifelike Avatars, they will talk to you in the language of your choice.

These conversational AI technologies are becoming so advanced, so human-like, that we see companies like Google for example, gaining patents for distinct robot personalities. It won't be long before you are unaware that you are talking to a bot. Some countries are toying with the idea that organizations will have to identify upfront that you are not taking to a human.

Great West Lifeco expects to go live with this type of technology in early 2018. The approach will be to gradually introduce the technology into the company's chat channels initially, before extending the platform's capabilities to other channels resulting in extended service hours.

Robotic process automation is an exiting field where bots can be developed to automate the most repetitive of tasks. Great West Lifeco has already introduced this technology within its operational areas. For example, a fist bot that has been deployed handled over 100 process steps, has built-in narrow handling routines, updates dashboards dynamically and contains searchable metadata. It operates at about 5 times faster than its human counterparts and is always available. Great West Lifeco has hundreds of business processes across the company identified that would lend themselves to automation across operations, legal, compliance, marketing, customer services, risk, finance, HR, actuarial and IT areas.

Today's bots, while efficient, are still rudimentary. The leading robotic vendors aspire to raise their bots intelligence by injecting AI capabilities into the bots. When this happens, this will be

the transformative event enabling task bots to think, learn and adapt dynamically.

This transformative opportunity will increase significantly for companies like Great West Lifeco, when conversational AI engines begin to talk with AI infused robotic bots. This will create a real-time fully automated cognitive ecosystem, designed to service Great West Lifeco's customers and advise the company. This method could easily be adapted across many different industries and business models.

Imagine having the ability to design your digital products and services with these capabilities. This will transform the way companies are organised today, are staffed and operated.

Companies are starting to realise how transformative this could be. It was interesting to see the CEO of Credit Suisse, Tidjane Thiam, in July 2017, giving an update on the number of bots deployed, 58, and the number of bots projected, 150 by the end of the year. It is a measure that is clearly instrumental to its operational efficiency targets.

Canada has always led the way in the development of AI and automation, leveraging the ground-braking pioneering work performed in the universities of Alberta, Montreal and Toronto. Where Canadians, such as Richard Sutten, Yoshua Bengio and Jeff Hendon respectively, advanced this field of study. Canada now has the world's most vibrant AI technology community with tech-start-ups flourishing across Edmonton, Winnipeg, Waterloo, Kitchener, Cambridge, Toronto and Montreal. Canadian companies will lead the way once again connecting conversational AI with task-oriented AI infused bots.

We know that access to technical skills within these emerging field will be difficult and very competitive over the next decade. We will experience organizational design impacts as current job definitions between a business and a technology resource will simply disappear.

There will be challenges with the introduction of AI. The reality is that millions of high-skilled educated people around the world between the age of 30-50 have jobs that are easily automated. Government agencies are becoming increasingly concerned as companies seek to use the technology to better serve their customers and remain competitive. The question being contemplated: Will this next wave of AI eradicate more jobs that it creates? What about the social implications? Will local or federal governments resolve to taxing bots or algorithms to replace their lost revenues sources? Are unions going to demand that bots pay union dues?

Great West Lifeco is moving to establish a new Center of Excellence in Winnipeg. It will address sustainable AI and robotics capabilities. This represents a significant investment in the local skills and new roles. We are currently designing and staffing capabilities and job titles that don't even exist in the marketplace today, knowing that they will soon become mainstream. These new capabilities will position Great West Lifeco as an industry leader in AI and robotics and help grow Winnipeg as a hub for emerging technology talent. We are indeed at an exciting fork in the road. Companies that invest wisely to lay the foundations for automation and AI in a sustainable way will emerge from this revolution in much stronger position than their traditional competitors and adequately position themselves to compete with more agile start-ups.

AI will not be remembered by what it can do, but rather by what we do with it.

DON DAVIDSON, Acting Director Cybersecurity Risk Management, Office of the Deputy DOD-CIO for Cybersecurity (CS), US Department of Defense, USA, addressed the issue of cybersecurity risk management and the importance of balancing man-machine roles.

Artificial Intelligence & Cybersecurity

Artificial intelligence and cybersecurity is extremely important to the U.S. government. The Office of Science and Technology Policy published some information in this area last year and the U.S. is heavily investing in AI and machine leaning.

AI changes our life. It is going to change our life probably the same order of magnitude as smart phones or smart homes.

When we think about cybersecurity, we often talk about as an evolutionary approach from information assurance. We talk about protecting the data, confidentiality, integrity, the availability of data and we don't always think about the holistic approach, i.e., how to move the ball forward for the functionality in terms of what we want to accomplish in this arena.

What is AI? The father of AI, John McCarthy, defined AI in 1956 as 'a sub-division of computer science dealing with the development of systems and software capable of acting intelligently, and doing things that would normally be done by people – equally as well, or sometimes better. AI refers to the science and methodology itself, and to the behaviour exhibited by the machines and programs which result from it.'

However, we have evolved since that point in time. We have had several evolutions in growth of AI over the course of time. And there are some aspects that are different based on AI:

Narrow AI is actually just automating tasks that are going to replace human behaviour. General AI is trying to replace a whole section of activity, lots of tasks are grouped together. A Super AI construct is where we create an entire enterprise and we shape the functionality. We are not yet very advanced in that spectrum. The development of general AI is very much in its early stages, but things are evolving.

Artificial intelligence in movies is always portrayed as the bad guy. But it is not a game. It is real and it is a balance between the man and the machine and who is going to own which portions of this enterprise and how do we move forward. All enterprise capabilities are a balance of people, processes and technology working together. AI is rebalancing the collection of data/ big data, the computing power and the human subject matter expertise. We should think less about AI as the technology and more about AI as the balancing of the man and the machine in order to accomplish some mission and move forward.

However, some of the greatest minds of today, including Bill Gates, Stephen Hawking and Elon Musk, have all voiced their concerns on the repercussions AI could bring and how it has the ability of directing itself and getting out of human control.

Where are we today? We are rapidly evolving from an Internet of Everything. Since 2008, there are more devices than humans on the Internet. By 2020, there will be 50 billion devices connected. Imagine the volume of communication that has to take place, considering that those devices are communicating.

We have actually improved our ability to monitor. Advanced cyber attacks often go 99 days undetected. This number went down from 145 in 2015. Each major breach costs over $3.5 million dollars to fix. The total cost to the global economy could reach $500 billion dollars and lost productivity and lost growth could reach $3 trillion dollars.

According to the Microsoft Security Intelligence Report (based on over 600 million computers worldwide), every month, there are 35 billion messages scanned, 600,000 known Spam email addresses tracked and more than 8.5 billion web page scans executed.

Given this volume of security concern, one could assume that the growth of cybersecurity professionals would be enormous. However, in 2016, there was only about 50 percent of the companies that had chief information security officers (CISO). This will grow to 65 percent in 2018, but it still means that about a third of industries don't have a CISO looking at the enterprise that manages risk in that arena.

There are roughly 1 million vacant cybersecurity jobs today in the U.S., and this number is projected to be 3.5 million globally by 2021. We are spending a lot of our human subject matter expertise responding to poor design and bad practices. Those cybersecurity professionals that we do have are trying to fix the ongoing activities.

One of the industries that could benefit most of all from the introduction of AI is cybersecurity. Intelligent machines could implement algorithms designed to identify cyber threats in real time and provide an instantaneous response. Despite that the majority of security firms are already working on a new generation of automated systems, we are still far from creating a truly self-conscious entity. The security community is aware that many problems could not be solved with conventional methods and requests the application of machine-learning algorithms. We need to focus on better designed systems and here AI can help.

We should use AI to inform us about lessons learned of how to better design this system: We need to take this information to do a better architecture and engineering and to reconfigure our enterprises to do a better job to prevent those breaches. And more importantly, one is not going to stop a cybersecurity issue, one just can manage a cybersecurity issue. It is how to remain resilient, how to do mission assurance in the face of cyber adversaries or cyber contested-environment.

The scientist Steve Omohundro wrote a paper that identifies three ways to keep AI safe: 1) To prevent harmful AI systems from being created in the first place. It is desirable that scientist could be able to carefully program intelligence machines with a Hippocratic emphasis ("First, do no harm"). 2) To detect malicious AI early in its life before it acquires too many resources. Monitor the evolution of such systems over the time by measuring the processes implemented by the AI systems and the resources that is continuously consuming. 3) To identify malicious AI after it's already acquired lots of resources. It is essential to maintain the human control over the machine even after the AI systems has already acquired a significant amount of resources.

The lesson learned is not to create conditions of competition for any resources between humans and machines.

Recently, Facebook abandoned an experiment after two AI programmes started chatting to

each other in a strange language mostly incomprehensible to humans. The chatbots were supposed to use the English language to negotiate with each other but they quickly came to create their own language to make things faster. Facebook turned off the machines and they are now studying what the language was and what they were actually doing. They were repeating phrases over and over again. However, the result was a form of deception: one machine was trying to get the other machine to act based on the beginning of the conversation and then they were taking advantage of the reaction of the other machine.

The Hague Centre for Strategic Studies in its recent report (Artificial Intelligence and the Future of Defense, 2017) put together an overview of the competitive market landscape for machine intelligence.

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Q&A

The first question addressed to the panellists was about data privacy with respect to big data and the sharing of information with other organizations to advance AI.

Don Davidson, US Department of Defense, mentioned that Nokia might reissue its stick phone. They are doing this with the idea to suppress geo-location and not to share too much information.

We actually don't realise how much information we give up. For example, most people use Waze in their car. They don't realise that the entire technology is built on tracking their cell phone and the car. It is not identifying a person individually, but the number of cell phones that are moving on the highways are dots combined and smashed together—those not moving are the red lines.

About two years ago, a thesis paper at Stanford has shown that people are using Facebook and geotagged pictures to plan to rob houses. They were casing based on people sharing pictures with geolocations and timestamps, which allowed them to tell when the people are on vacation.

Consumers are starting to understand that they may be over-sharing, also seeing how much industries adapts based on that.

Herve Rannou, Cityzen Data, explained that Cityzen Data had decided to use their own programming language to manage big data. Cityzen Data considered that existing languages have many security holes. Everybody is talking about security but at the same time uses languages which haven't been developed initially for this kind of data. The result is software that can be diverted to other objectives.

Cityzen Data also crosses data from different companies, but they make a clear separation between the producer of the data, the owner of the data and the user of the data. The objective is to cross the data between two different organizations, but the two organizations are not going to share the data. If Cityzen Data crosses the data between X and Y, X is not going to know the data of Y.

One example that requires such processes is mobility. In mobility you have to cross different data. Historically, they used to be managed independently —data for traffic, data for parking, data for weather forecasts. Today, we need to cross this kind of data in a neutral perspective. But there are private companies, e.g., Google, which propose local authorities to get all their data, to cross the data and to get revenues from crossing the data. Google has a vertical approach and they produce interesting results regarding mobility. But it is a serious problem.

The following question was whether there should be any kind of limitations for AI and controls for humans?

Philip Armstrong, Great-West Life, answered that AI technologies advance rapidly and the true AI technologies are not doing statistical inference, they are not weighting results based on percentages, they are not doing image analyses. They are actually starting to do all of those simultaneously and then learn from their experiences. That is moving into another level of AI when the technology can assimilate multiple inputs, make decisions, learn from their decisions, pattern out what their decisions are and then keep evolving.

As we start down that journey and we are very early in that journey, it would be good to have some guide rules, it would also be good to have every decision checked by a human initially or at least a quality control check as that happens. As we get more comfortable with these types of technologies, then we can do less checking. But to start with to let AI make decisions, evolve and adapt their decisions based on their own inferences. It might be advisable to built a human safety net just to know that the technologies are working.

Don Davidson, US Department of Defense, stressed that we are early in the process. It is not about machines replacing the humans. It is about finding the right balance and the roles and responsibilities between men and machines.

It is actually not so much about the machines but the fact that there are bad actors out there. People that are going to try to infect those machines, just like they try to breach your networks today, whether it be criminal elements or nation-state actors for whatever means. An AI system is billions of lines of code and there is a lot of sophistication that goes into all that. There are chances of having someone penetrate that and put something malicious in it.

The next question addressed the possibility of hacking AI systems.

Don Davidson, US Department of Defense, underlined that good guys aren't the only ones playing with AI. Last year at DevCon, they interviewed about 70 really good hackers and they said, if they get the source code, they would be able to break about 90 percent of the systems.

MIT did a study in 2016, and they found out that they don't even need the code. Once they get the AI tools, the machine learning tools, they would be able to break 85 percent of the systems. That is not even with a sophisticated hacker—it is just someone who understands how to use some of the emergent tools in this arena, without the source code, just looking at your data logs.

Philip Armstrong, Great-West Life, emphasised the need for a human safety net. The early

experiments and learning from huge amounts of data is that machines start to form biases and start to act in ways that perhaps we don't want them to act in.

Before closing the session, the moderator, **Annette Trimbee**, University of Winnipeg, asked the panellists to close with some comments about hope and youth and future by answering the question of how to pull youth into this existing field in the right way?

Grady Johnson, CGI Federal, stated that teenage children are more interested in consuming technologies than in being part of the wheel. However, there is a generation behind us that is used to using tools, that is not the innovators of the tools, but at some point in time there is like a paradigm flip in most people that you start becoming more productive.

Sebastian Stoessel, Audi of America, stressed that people tend to over-complexify the world with all the knowledge they have, which leads towards creating the framework and context in which they think things need to happen. It is inspiring to see the world with the eyes of teenagers who are growing up with technology at their hands—technology that theoretically gives them the same power as a large corporate organization that is a global player. We should try to understand their view and use this perspective when drawing regulations. Regulations are very important, but we have to look at those regulations more from an enabling perspective rather than from a limiting perspective.

Mr Stoessel considers technology, innovation, and AI as a main enabler of humanity. It could lead to a world where people are connected to each other, where people communicate with each other, share values and create a better world.

Herve Rannou, Cityzen Data, explained that it is important to give the power to the user to decide what will happen with his own data. However, experience has shown that once users want to access a service and have to answer the question "do you agree that we use your data to do …", the users generally say yes, because they just want to access the service. The consequence of this is a trivialisation of this kind of question, and at the end, all service providers are using the data in the way they want to use it. There is no real answer to the question of how to deal with the governance of data.

Don Davidson, US Department of Defense, pointed to the fact that it is currently the beginning of the cybersecurity awareness month in the U.S. The challenge we have with our youth is very similar to the one we have with our senior leaders. It is the classic yin-yang relationship between the CIO and CISO. The CIO wants everything in IT as fast and as cheap as he can get it and many times trades off sustainability and security to get that fast and cheap. We don't tell the story very well, we have to do a better job of talking about the lifecycle, costs, sustainability and security. It is the same kind of message for our senior leaders as for our kids, because kids think that they are invincible. They think that bad things never would happen to them. They never would get hacked or somebody would steal their identity. It is a general awareness campaign that we all have to take on about the risks.

Philip Armstrong, Great-West Life, emphasised that there is a segment of youth that we do need to pull into this. Universities and schools across Canada and around the world are working very hard to promote technology and the STEM disciplines to girls and young women. We need to see a lot more girls and young women get into this industry. It is a fascinating industry, and some more diversity in this industry would be very welcomed.

Traditional jobs will be displaced by technology, but that is been going on for a long time. New jobs will be created, jobs that we can't even imagine, jobs that we haven't defined and that will come out of nowhere. If you think about how many people are actually making a living out of social media 15 years ago versus how many are making a living now. How many data scientists did we have 15 years ago versus look at the demand for that now. New jobs with new titles, with new growth industries will pop up as a result of all this innovation and these technologies.

Guy Levesque, Canada Foundation for Innovation, shared this optimistic view. The single most important investment over the last 20 years in our universities and colleges and research hospitals has really been the youth that has come out and that has become the new and next generation of leaders. They are the ones that are leading all these start-ups in Waterloo, Saskatchewan, Montreal etc. However, this refers to the youth who is connected, because there is a large segment of the youth population that is still disconnected and outside this circle. But they are hyper connected, they are hyper open, and they have very different attitudes and social norms around sharing and being public. A lot of the challenges that we have lived through and that we have grown up with, the next generation will simply not see them as a challenge. Trying to pull youth into this, we should do well to get out of their way.

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Session 4

Day 1 – Afternoon – Parallel Session

Public Policy & Regulation

The session's chair and moderator, **ANDREW LIPMAN, Chair Media and Technology Practice, Morgan Lewis & Bockius LLP**, USA, welcomed and introduced the panellists.

This panel had a rather different format from some of the other panels of the Global Forum. Over the years, it has evolved to an entirely Q&A and participatory panel.

The session was split in half: The first half was dedicated to a dialogue about the question whether some of the social media edge providers should be subject of more regulation—a difficult discussion because these are some of the premier companies in the world. They brought an enormous amount of technical advance, and they are not typical regulated entities. In fact, much of what they offer is relatively inexpensive, even much of what they offer is free.

The second half of the panel was dedicated to individually tailored questions to the panellists, each of whom brings a tremendous and unique background.

Some people have said the collective global love affaire with the large high-profile social media edge companies may be coming to an end. Public and government sentiment is beginning to tarn, which is both good and in many senses alarming.

Google answers our queries, Facebook keeps us connected, Amazon delivers our shopping needs. But we are seeing these companies increasingly under defensive. These are companies that have collectively a $1.6 trillion dollar market capital, but relatively linear employment for companies that represent such a large share of the NY Stock Exchanges.

Historically, even as recently as last year at the Global Forum, we are talking about these companies as shining examples of innovation because of their extraordinary innovation and ability to advance the future.

Are these companies becoming more vulnerable? We have been seeing a growing evolution from a hands-off approach to now some people are saying that they are too big, too influential, too unmonitored—and we are seeing these concerns from both bookends of the political spectrum, both the left and right.

How do we regulate these companies? These aren't traditional companies and aren't amenable to traditional regulation. The antitrust and trade regulation laws generally don't touch disruptive companies. They are offering cheaper goods and free goods, they are also arguably not offering essential services or a bottleneck, or maybe the services that they are

offering are becoming essential.

In the U.S., the Federal Trade Commission, several years back, looked at regulating at least Google, and stepped back from that. But what we have seen recently, in the last months in the EU, is the EU becoming more aggressive, particularly as to discrimination and self-favouritism, and in that regard famously fining Google $2.7 billion dollars for using its search-engine to allegedly favourite its own shopping ads at the alleged expense of consumers.

We are also seeing these companies proactively make self-policing and voluntary changes, just like Google did by allowing rivals shopping comparison and services to bid for and resell advertising space.

Let us talk about regulation and trust and policy.

The moderator then addressed the question to Gérard Pogorel whether there is a threat of government intervention in the EU that would align the Internet market place and the digital advertising market. And if so, what agencies would be involved and what jurisdiction they have?

GÉRARD POGOREL, Professor of Economics and Management-Emeritus, Telecom ParisTech, France, pointed to the uneasiness many Europeans currently feel when dealing with the position of those large social media providers.

In Europe, people tend to have concerns about three issues: people have issues with content, with behaviours and with the structures. There are many initiatives in this regard originating from different areas in Europe, in addition to the initiatives of the European Commission.

The most pressing issue those days is the issue of content—the issue of what is happening on Facebook, on Google search etc. There are divergent views between the U.S. and the EU on the freedom of speech and the various laws which apply to some kinds of contents in Europe—even if concerns about some events happening during the recent electoral campaign in the U.S. have also raised the level of awareness in the U.S.

A strong initiative has been launched recently by Germany. A new law (Network Enforcement Law, 'NetzDG') has just has come into force in Germany. This new law requires social networks to delete blatantly illegal content (hate speech and other offending content, e.g. anti-constitutional, terrorist, child pornography, etc.) within 24 hours. Fines of up to €50 million euros can be applied under the law if social media platforms fail to comply.

The Italian Communications Regulatory Authority AGCOM, strongly expressed the opinion that platforms should be considered not just as supporting networks, but also as publishers, which entails a responsibility on the content which is carried.

It is a debate which is going on since a few years. It seems actually that social platforms are not only supporting elements, like highways or railways etc., but are now aggregators or organizers of content. This gives them a stronger role as publisher and puts them under the EU law regarding the publication of content.
It seems that there is a trend towards a more proactive attitude and harsher regulation of

content in Europe, given what people consider as the role or responsibility of the social platforms—not only in certain political situations, but considering the role they have played in the circulation of aggressive content and the organization of illegal activities.

There are different legal principles which apply to network platforms, there is no common legal framework. On the one side, there is a reference to illegal content and activities, on the other side there is a reference to competition. It has to be looked at with different principles. It would be dangerous to mix the two.

When we look at competition, there are two approaches to competition, especially in the context of antitrust legal frameworks.

There is the structural approach referring to the fact that some social media providers are too big. They cover billions of people, they hold a 95 percent market-share etc. There are concerns about excessive size and proportion.

And then, there is the behavioural approach to competition, whether you are big or you are not that big, you behave well or you behave badly.

The structural approach had been a little disqualified during the past years. Remember the time when achieving a 40 percent market-share in a given industry was immediately under scrutiny, because people supposed this company is too big and something should be done.

Remember what happened with IBM decades ago. When IBM enjoyed a 40 percent market-share in the computers market, there were immediate discussions of dismembering IBM. But then, technological advances and globalisation completely changed the situation and IBM lost the market-share lead. This was a lesson that was very well learned by the antitrust community. Many people argue that those structural dominant positions don't last forever. At some point of time, something happens. What happened to IBM was the minicomputer, what happened to the minicomputer was the microcomputer, what happened to the microcomputer was the platforms. Things, by themselves, tend to self-regulate and structurally dominant positions don't last forever.

This structural approach has been disqualified, although we are now confronting a situation where we see very high market-shares achieved on certain markets. Of course, people ask whether these companies behave correctly or not, and whether one should go further and adopt stronger measures against market-shares that are too high.

The moderator, **Andrew Lipman**, Morgan Lewis & Bockius LLP, emphasised some of the counterpoints in the U.S., where historically the social media companies claim they are operating like common carriers and aren't responsible for traffic, and where business per se is not necessarily bad unless you got there through some improper means, but also the concern of antitrust acting too quickly. In 1998, MCI WorldCom was seeking to merge with Sprint. This was rejected by the EU and the U.S., because it was to dominant in the long distance market. However, within two years there was no long distance market. Much like IBM, technology often finds a way to cure those issues.

ALICE PEZARD, Attorney at Law and Arbitrator, France, was asked to provide her

perspective on privacy and related fields.

During the last years, the European Court of Justice (ECJ), the highest court in the European Union in matters of European Union law, delivered a lot of rulings against the big media companies and about competition and antitrust.

But there are two other topics for the judges in Europe with regard to these big U.S. companies.

Next year, a new regulation on privacy and the protection of private data will come into force in all the 28 EU Member States (still including the U.K.). This will have a very big impact on third countries, including the U.S. and Canada. In 2015, the European Court of Justice invalidated the EU-US Safe Harbour Privacy Principles. Safe Harbour has then been replaced by the EU-US Privacy Shield Act. The European Commission is now observing the implementation of the Shield Act by the U.S. American authorities. It seems that the discussions are very aggressive and that European authorities disagree with the implementation of the protection of data.

The new European privacy law, the General Data Protection Regulation (GDPR), will apply from 25 May 2018. It will apply to all companies processing and holding the personal data of data subjects residing in the European Union, regardless of the company's location. It is no declaration for the protection of data, it relies on self-regulation. The companies have to have a privacy protection in place, i.e., privacy by design. Self-regulation should ensure that all companies and organizations offering goods or services to EU citizens must comply with the GDPR, even if they are not located in the EU.

The big problem for many non-European companies that manage EU citizens' data is that they will be subject to European sanctions, which are very high. European penalties for non-compliance can reach 4 percent of a company's total global revenues. For companies like Facebook or Google the amount of the fines imposed would be very important.

The most important rules of the GDPR are privacy, consent, and the right to be forgotten. All these rules are coming from a ruling of the ECJ in the case Spain against Google in June 2014. Since then, there are ongoing conflicts between the European authorities and the big U.S. American companies, because the companies are willing to accept the EU rules in Europe, but they don't accept to apply these rules all over the world. However, it is not a question of Europe or not, it is a question of protecting the data of European citizens in Europe and abroad. Nevertheless, currently a European citizen in the U.S. is not protected by these rules. That is the compromise of the new regulation.

There are further rules, e.g., concerning anonymization of all private data and pseudonymization and the right to profile. For instance, if you are an U.S. banker, in Europe it is not very easy to profile your customers without their consent. You have to have the explicit consent of your customers. These rules represent a constraint for all companies.

Another issue in the context of regulating (or not) big social media companies—apart from competition which is the most important one, the European Commission is very strict about antitrust law—is taxes. In the EU, taxes are national issues.

In June this year, the French tax authorities pursued Google for €1.12 billion euros in back

taxes. Google was accused of channelling its French profits through Ireland (Dublin) where the company's European subsidiary and headquarters are based. A court in Paris ruled Google was not liable for tax in France. The French Government appealed the court's decision before the Court of Appeal. The debate is rather aggressive.

The moderator argued that some of the social media companies say that they are global players. Why should they have to be subject to the more rigorous European roles, which in fact would require them to apply those same roles in the U.S., Latin America Asia and elsewhere. What would be the response in the European Commission?

Alice Pezard explained that the EU cooperates on the basis of mutual recognition agreements in order to ensure the appropriate and same protection. There would be no problem if the rules were the same in the U.S. and Europe. However, to some extend the different rules are converging, especially due to the Shield Act. For instance, the principles are the same in the EU and the U.S. regarding the principle of accountability, consent, and even data protection impact assessments.

The moderator concluded that Europeans are forcing the U.S. to be more rigorous than they have been historically.

JURGEN VAN DE KEMENADE, Co-Founder, Board Member & Member Senior Leadership & Strategy Team, NxtVn, The Netherlands, [nxtvn.com], was asked to provide a global perspective on this issue. Is it positive or negative and what is the legal framework?

If you look at antitrust in Europe, you have to look at the competition rules that the Directorate-General for Competition of the European Commission in Brussels. And DG Competition will first and foremost look at Articles 101 and 102 of the Treaty on the Functioning of the European Union in order to asses if an antitrust case can be made—basis of the violation of any of those two articles of the Treaty on the Functioning of the EU.

Member States also have their own ways of attacking competition, but the tools they have are basically coming from Brussels. The Director General for Competition is the arm you will face if the EU wants to make a case against you about antitrust. As already mentioned, the last case was Google.

The Directorate-General for Competition is one of the most active parts of the European Commission, with Margrethe Vestager serving as the European Commissioner for Competition. The most famous one was Neelie Kroes, the Dutch Commissioner who basically put the DG on the map.

With respect to privacy laws, the General Data Protection Regulation (GDPR), which will come into force and effect on 25 May 2018, is what everybody is talking about. It is the most important part of what the EU is going to implement, or rather what the Member States have to follow. The EU adopted the Regulation and a Directive.

The regulation is basically the piece of legislation where everyone looks at and everybody will be subject to as an individual in the normal sense of the word. The directive regulates which information on EU citizens can be made available to other states that are not part of the EU. For instance, the U.S. will ask information to the EU on an individual that might be convicted in a different state. The directive will regulate the flow of the information, if the information can be made available and under which circumstances it can be made available.

Another question to be discussed in the context of platforms like Google, Facebook or Amazon etc. is: Are they responsible for the content they carry and should they be made accountable for that, i.e., knowingly and willingly making that data available ? What about live streaming? For instance, Facebook Live, launched a few months ago, is live video streaming. What about somebody who is live streaming a murder? And unfortunately, these people exist. What do you do as Facebook?

NxtVn is operating 20 data centre ecosystems around the world and the moderator assumed that NxtVn is putting them in places where there is a significant investment. If there is too much intrusive over-regulation in a particular country or region, will that impact the amount that the social media companies will invest in those regions? And therefore even have an impact on where you would prioritise and select your data centre ecosystems?

Jurgen van de Kemenade affirmed this and added that, if you look at the decision making tree of any of these companies, the two most important questions they will ask are: What about privacy laws? What about taxation?

The moderator evoked that AT&T has long been regulated and to some extend has pointed out, at least in the U.S., some of the anomalies where companies are unregulated, social media companies providing somewhat comfortable services. This came up especially in privacy, where prior FCC, under democratic chairman Tom Wheeler, wanted more intrusive privacy regulation of broadband Internet providers.

The question addressed to Jason Olson was: What do you think is the proper role of governments on the competition side to regulate these social media companies and what impact would that have on relaxing or harmonizing the roles of some of the incumbents?

JASON OLSON, Director – International External Affairs, AT&T, USA, [www.att.com], explained that if you look at this from a consumer standpoint and you are thinking about data, it is very hard to understand for a consumer: AT&T has this rule, edge providers have that rule, and Facebook has another rule. Consumers just wanted their data protected, and they want to know what people are doing with it. It is very complicated and even people working in this industry don't always know the nuances of who has what, what can they do with it, and why would one be opt-out, or why would one be opt-in.

Somebody who wants to compete in advertising space and other areas wants to have the same rules as his competitors have. When a company wants to compete for advertising dollars on Facebook or Google, it is hard to do this if they are opt-out.

From a consumer standpoint, it is important to have consistent rules. From a competition standpoint, it is important to be able to compete on a level playing field.

It is a little messy right now. AT&T would be great to have rewrite not only the Telecom Act but also other relevant acts, to figure out—if you put the consumer at the centre of this question—what should all the laws be?

Jason Olson then was asked whether there is a problem, at least in the U.S. and probably also in Europe, where companies are siloed, i.e., in cable companies, telco companies, social media companies etc., and subject to very different regulations because of their background and experience—whereas they are increasingly converging and providing substitutable types of services?

Jason Olson affirmed this. People have different ways to communicate with people, whether it is WhatsApp, Messenger, iTunes app etc. There are FCC regulations that apply to some services, but they don't apply to other peoples' services.

One should look at this holistically from end-to-end, not just depending on whether there is fibre in the ground or spectrum brought.

CHRISTOPHER MONDINI, Vice President, Stakeholder Engagement, North America and Global Business, ICANN – Internet Corporation for Assigned Names and Numbers, was asked about the appropriate direction that governments should be taking in terms of these social media companies. Are governments going too far trying to regulate that, or have governments been to compliant and passive in terms of not regulating them?

ICANN is looking at a completely different layer of the Internet, which is very much focussed on the underlying, independently operated tens of thousands of network switcher interconnected by a common addressing system. It is ICANN's role to implement and make available these addresses, protocols and standards that make the Internet look like one global network.

ICANN also gathers stakeholders to innovate the future of this connectivity, e.g., domain names in different alphabets and security improvements to the resilience of the Internet. All these big global social media companies, many big European companies, companies from Asia, India, network companies, they are all at the table. One of the most valuable things that they bring to the policy making table at ICANN—and ICANN policy is about Internet Protocol policies, not public policy—is that they have a global perspective.

Despite what may be appearing in the headlines in North America now, or even despite the very intensive debate in Europe over data etc., these companies are still very much focussed on connecting the next billion people. Moreover, their platforms are allowing all kinds of really innovative and socially beneficial activities, whether it is the delivery of mobile health services in East Africa or helping South Asian farmers decide whether to go to market, because they can learn the prices of their goods. It is almost an impossible task to have a global assessment of the total human value that has been given to us by these companies versus some of the concerns that we might have for citizens in different parts of the world.

ICANN is trying to give governments the role of having an advisory voice which they bring to the table in a unanimous way, so that the innovation is not constricted by debates between different political ideologies. In general, this is a more equal meeting of different stakeholders, not just government and business, but also civil society, consumers and technical experts, to co-solve some of these problems.

One provocative question: We soon will have the first trillion dollar market capital company and we seem to be beyond looking at this from an antitrust viewpoint. With regards to the recent reactions from Brussels, whether it is the share of tax or the proceeds from a 4 percent fine, we have to consider the following example of a 16-year old in Toulouse who is on Facebook: Is he more loyal and exited and getting more benefit in his life out of his Facebook everyday or out of the European Commission? Should those proceeds stay with the company that is giving him services, making a lot of shareholders very wealthy, and innovating? Or should it go to his elected, multiple layers away officials and will they be looking out making his life better over the next decade?

In terms of global Internet policy and ICANN's role, the moderator followed up with the question: Is global Internet policy converging or is it diverging?

Christopher Mondini stated that there has been a very interesting period at ICANN. The Global Stakeholder Engagement Team was built up over the last three years because ICANN realised that, even though there were some governments that had a very strong opinion about how a multi-stakeholder model should or shouldn't be allowed to work, there are many stakeholders around the word that just didn't know what ICANN was.

The difference that can be noticed in North America in particular, where the Internet was born and where the technologists were innovating, those who grew up at the same time had that sort of iterative process seeing innovations popping up one after the other. They had a very good 15 years of seeing the technology developed and then seeing the benefits it was giving. And also there was still much of this sense of wondering how to connect the world and how to connect everybody in the technology. If you are sitting in Brussels or Moscow, Beijing or Ankara, the Internet and its applications arrived all at the same time. People didn't really see the built up of all the great stuff.

Whether you are seeing it as enabler of rapacious big companies or as enabler of colour revolutions, you really look at the application layer of what is happening on the Internet and seek to control that. Whereas just into recent years, the U.S. was much more 'let's keep it open, let's keep it connected and let' continue to connect and explain to people'—which is very much the ICANN point of view.

STUART BROTMAN, Howard Distinguished Endowed Professor of Media Management and Law and Beaman Professor of Communication and Information, University of Tennessee, Knoxville, USA, was asked whether we are at the right point now in terms of regulating these Internet companies. What sort of paradigm, from an intellectual and academic standpoint, they should be subject to?

To some extend these questions have to be discussed with respect to the new U.S. administration. Some of that relates to the fact that some key positions are not filled and until those positions are filled, we will not understand philosophically where some of the people are coming from.

For instance, the Federal Trade Commission (FTC) which has a substantial oversight in the area of privacy is now headed by an Acting FTC Chair, Maureen K. Ohlhausen, and it remains unclear whether she will be appointed on a permanent basis. In fact, with each passing day it remains more certain that she will probably not be appointed as the permanent chair and that a new chairman will come in.

There are currently only two (of five) Commissioners in place in the FTC. The U.S. doesn't have much of a policy making apparatus at the Commission. Once there will be a new permanent chair of the FTC, one can say more about where the Trump administration wants to see some of the privacy aspects played out.

On the FCC (Federal Communications Commission) side, there is a permanent chairman who has been appointed who will be reconfirmed. Ajit Varadaraj Pai was a commissioner, was elevated to the chairmanship and reconfirmed for an extended period as chairman by the U.S. Senate. Pai has the strong conviction that the FCC don't has much of a role to play in the area privacy and that the FTC is the agency that should have more authority in this area. Again, it depends on who the new head of the FTC with regard to whether the Commission will pick up that mantle. Thus, in terms of privacy it is 'to be determined'.

There are few things that are quite clear: In content regulation, the United States clearly is anchored in the First Amendment of the Federal Constitution. It is difficult to see any social media content regulation in terms of regulating hate speech or racism and many of the things that Europe is more sensitive to. Moreover, Europe has a greater legal ability to regulate these things, because it is not bound by the Constitution.

In terms of the general philosophy of the Trump administration, it is an 'America First' philosophy. And as you implement an 'America First' philosophy, there may be tensions and potentially real conflicts with some of the proposed approaches such as regulating American companies with extraterritorial regulation in terms of treating them as if they were not American companies. That may raise some serious issues in trade policy.

There is something that happened in the past couple of weeks in the U.S. It didn't receive a lot of attention, but sometimes organization or reorganization has a major policy impact. The Office of Trade and Manufacturing Policy—which is a trade council in the White House—has been subsumed and will be reporting now, not to the President, but to the National Economic Council. The National Economic Council is really focussing on areas like job creation, to the extend that some of these issues can be calculated in terms of whether or not any of the impact would affect America's job creation by American social media companies. One could expect that they will be substantial and thus could expect rather aggressive counterattacks

by the U.S. in the trade area.

With regard to the fact that at least Google and some of the other social media companies are engaging in self-regulation initiatives, the moderator wondered whether those will be successful, either in Europe or the United States.

Stuart Brotman stated that this again is to be determined. Basically self-regulation typically comes as a prophylactic method for preventing regulation from being imposed. If there is not going to be a lot of pressure in the United States, you will probably see less self-regulation. We will see some selected, for instance what is going on now with Facebook. We probably will have some legislation dealing with political advertising and social medias mandate to essentially allow consumers to understand who is paying for particular political ads. But in terms of self-regulation as an instinct, this is not really where social media companies are coming from. When push comes to shove, they will take a step-by-step approach but culturally they are not really organized to do appropriate self-regulation.

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During the second part of the session, the Moderator asked each of the panellists a specific question corresponding to each panellist's core expertise.

There is one issue which has been discussed for years at this panel of the Global Forum: the open Internet and network neutrality. We see that swing back and forth depending on which political party is in office. But through all that period, AT&T has consistently said that it is for an open Internet and that, at least in the US, the FCC can ensure this without reclassifying Internet broadband service as a telecommunication service. What are AT&T's concerns about reclassifying broadband as a telecommunication service?

Jason Olson, AT&T, explained that AT&T once was the monopoly carrier having both the local facilities, the transmission facilities, and the AT&T long lines. The U.S. administration created these rules under Title II of the Communications Act, which is basically a formal monopoly regulation. The government has to look at everything you are doing, because there is only one carrier. That is not true with the Internet, it is not true with ISPs. The reasons for which these laws have been created don't exist anymore. There is no longer one single provider providing the service.

With respect to the regulatory overhang, or the unintended consequences of regulating something to heavily, AT&T argues that if you regulate it more, you get less of it. This is the exact opposite of what we want in this time. Governments should take a light regulatory touch, they have the ability to police companies like AT&T without regulating them as a common carrier. Moreover, the uncertainty that these regulations create puts investment at risk.

Over-regulation has a depressing impact on capital expenditures and took a greater risk on investments. But this issue never seems to go away and it will be forever debated. The Telecom Act was written in 1906. Let's write up a new set of rules for the new age.

Christopher Mondini, ICANN, was then asked about the role of governments and regulators

in the ICANN model and what happens when ICANN policies conflict with national regulations.

Governments and regulators and other law enforcement entities from around the world sit in the ICANN Governmental Advisory Committee. They can opine (from a public policy perspective) on any domain name or addressing or protocol innovation, but they opine in a consensus way. For example, in the context of the domain name extensions, they could argue: If there is .medicine or .insurance, maybe there should be consumer protections around these new domain names. That is in the sort of proactive way making policy.

To take the examples of domain names: Someone buys a website from an Internet registrar, who in turn registers the buyer's name in an Internet registry, and all of these entities will have contracts on how they will interact with ICANN. Those contracts say that the contract should not violate or be in contrast with local law. However, sometimes there are conflicts of law and that requires opening up a policy making process within ICANN, which again has all the stakeholder categories at the table, governments, business, technical people, civil society etc., to see how the contract might be adjusted.

For instance, the GDPR in Europe has presented a really interesting test case where a policy, that is seeking to protect people at the application layer of the platforms, is having an unintended consequence on this technical layer of interoperability of the Internet. There is a system which is called WHOIS, which is used to identify who has registered domain names. The purpose of that accessible database is not a commercial one, it is for interoperability and interconnectivity and being able to keep the Internet working. There is a very interesting discussion going on right now, and ICANN's role is to try to facilitate awareness about this. It is not so much a conflict, it is the unintended consequence so that the privacy authorities and others can consider whether it is a different case than what they had intended to implement.

ICANN is very much limited to interoperability and the technical assets. But there are so many questions from privacy to net neutrality to others. It sounds crazy but it does work: If you could have a table like this and a good selection of private sector actors from a lot of countries, a good selection of public sector actors and civil society, academics and technologists, start with a white piece of paper and go around and ask: 'What do we want to get out of this discussion about how data should be treated? What are our competing equities? Let us start designing what would work for all of us.' It might take a few years to get to that—global consensus is difficult, but it is usually stronger for the process.

Particularly in the Trump administration and after Brexit, trade policy, maybe for the first time in decades, is going to become a more important part of telecommunication policy. **Stuart Brotman**, University of Tennessee, was asked about his opinion in terms of the expected outcomes, as some of these new trade agreements are being renegotiated?

Multilateral approaches with multiple players might be the best. Philosophically, the U.S. has a new administration and is no longer going to engage primarily in a multilateral trade environment. In January, the United States announced to withdraw from the Trans-Pacific Partnership, which has been negotiated over many years and which the previous administration had committed to. There is now the beginning of renegotiations around NAFTA. Philosophically, what the Trump administration has signalled, is that there is going to be no longer a multilateral approach to trade, but essentially a bilateral approach. Obviously,

with existing agreements like NAFTA you need to have a multilateral approach.

The interesting point here is whether or not some of these telecom issues can receive the attention, focus and resolution in a bilateral environment that they could receive in a multilateral environment. It is much more difficult to negotiate bilateral agreements, and do that in a series of agreements, as opposed to have these larger trade agreements, even though they are complex and difficult, if you can get these people around the table and untimely come to a consensus. As we saw in TPP you can have that sort of durable agreements. It is going to be a tougher road in trade negotiation because it is going to be in a bilateral environment rather than multilateral.

Critical infrastructure is an issue for many administrations around the world. The moderator wondered whether digital infrastructures should or should not be recognized globally as part of critical infrastructure. Social media companies, such as Google or Facebook, are now the catalysts for major submarine cable systems.

Jurgen van de Kemenade, NxtVn, explained that the cloud is basically a bunch of interconnected data centres that are handling all of the traffic that is produced. These data centres are interconnected, mainly also by submarine cables. Submarine cables are highly vulnerable and this is an issue that should be addressed. In fact, it has been addressed, both by the Obama and the Trump administration. Executive Order 13636 on 'Improving Critical Infrastructure Cybersecurity' was signed by former President Obama almost 5 years ago. And that Executive Order was augmented by the Executive Order 13800 on 'Strengthening the Cybersecurity of Federal Networks and Critical Infrastructure' last year.

However, we need something more than an Executive Order from the U.S. President. The issue is highly underestimated in the European Union. There is no legislation at all, at least at the level of the European Commission, which is close to the Executive Orders in the U.S. This issue needs more attention. If there is a cable cut, and there have been examples of cable cuts in the past, a whole continent, or even several continents, are whipped out in terms of connectivity. This is a high risk.

Submarine cables land in cable landing stations. Most of these cable landing stations are not even very highly secured. The German cable landing station in Rostock, for instance, which carries all the traffic coming into Germany from the Nordic countries, is almost not secured. You could imagine some bad guy using kerosene and setting the whole landing station on fire.

NxtVn is fully aware that this is an area requiring highest attention. Therefore NxtVn parks come with highly secured, military grade infrastructure, i.e., highly protected cable landing stations. About 99 percent of the traffic is carried by cables. These cables are the backbone of our economy, our safety and our health.

Furthermore, these cables, this physical infrastructure, are the backbone of the Internet. If you ask the carriers whether they are willing to build these submarine infrastructures by themselves, the answer is no—because there is no money to be made there. These cables are highly expensive and the big content players, like Google, Microsoft, Facebook, Amazon or Apple, need this connectivity. Hence, they build these systems themselves, e.g., the Marea cable or the BRUSA cable. This is also something that needs to be addressed,

because if these companies are building these infrastructures for themselves, what does this mean for the rest?

The question addressed to **Alice Pezard**, Attorney at Law and Arbitrator, was to provide some of the cutting edge privacy issues in Europe.

Mrs. Pezard pointed out that, while preparing the GDPR, the EU is also preparing a European-wide electronic identification, the eID. As of next year, every European citizen will have a digital identity. Comparable to the Japanese ticketing eID, this identity will be used for various aspects, such as health, passports, payment etc. It is a lifelong identity.

It will be a biometric eID card, which will also be used for payment. The This digital card is created to reinforce privacy protection. At the same time, this single eID card also facilitates controls by the government. It is a question of compromise.

The user will be the owner of this card, and more importantly the owner of the data which are on the card. Data ownership is a hot topic in Europe. Who is the owner of his/her data? It is not very easy to answer because even if the citizen are the users of the data, it is not sure that they are really the owners of their data. According to European law, it is not possible to sell the data. We can sell our house, our books but it will be impossible to sell our data. In fact, data is a common good. All this is questioned yet and every question is linked to the protection of the personal life.

Another question is the transfer of the data. There is a principle called portability, i.e., a pharmaceutical laboratory will send the data of a patient to another laboratory. Of course the laboratory is not the owner of the data. This is a question of portability and the principle of portability allows a data owner to control his/her data. All the 28 data controllers in Europe are currently writing the national guidelines for the users.

Gérard Pogorel, Telecom ParisTech, was asked to elaborate on open Internet and network neutrality in Europe.

The network neutrality debate is generally a badly defined debate. There is confusion between the notion of open Internet and network neutrality. Those are two different things. Open Internet is the access to a network and the provision of services to access the network. The rhetoric of net neutrality is politically brilliant, but it is just a slogan.

15 years ago, there was a saying that the Internet should be free. Free and neutral are politically-charged words, but behind those words they had billions at stake. The net neutrality debate has actually pitted one against the other very important actors: the actors which provide and invest heavily in the network and the actors which heavily use network. In this context it is important to remember that Google or Facebook are not the biggest users. The biggest users are video service providers, they count for about 70-75 percent of the content carried in the network.

The bottom line is: Who pays? Ideally speaking, it should be neutral and free, but in the end, who pays? The notion that some actors are not committed to pay for the network is just not sustainable.

In Europe, the notion of net neutrality has been proposed in the European Electronic Communications Code by the EC as a political trick. What the Commission actually wanted was a roaming across networks in Europe. And roaming was not popular with the telecom operators and the EU Member State. Today, we can use our mobile phones without having to fear roaming charges. The European Commission introduced net neutrality to achieve roaming and at the same time to accommodate the request of the Member States, because this is politically popular.

However, the debate will be redefined with 5G. More than 50 percent of the Internet access goes through mobile devices. The next generation of mobile networks will be highly complex, highly diversified networks with elements from 4G, evolved 4G to 4.5G technology plus some new elements. The job of the telecom operators will be to handle those very complex bits and pieces of network and to put the traffic through the most appropriate pieces of the network—and of course, they will do this in a way that is compatible with the level of investments they have to make.

Not only the net neutrality debate has been poorly defined, but it will be redefined in the very close future.

The moderator agreed that 5G will be an extremely important infection point and redefine the product market in many different ways. He thanked the panellists and closed the session.

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Gala Dinner

Day 1 – evening

DR. SYLVIE ALBERT, Dean of the Faculty of Business and Economics, University of Winnipeg, Canada.

The Power of Networks and Technology

I would like to say a few words about the Power of Network and Technology through the lens of my own personal journey.

I started my journey out of pure self-interest in the early 90s– trying to attract an MBA program to Timmins, Ontario where the nearest university, Laurentian, was a 4 hours drive away. I was told that this would only occur if we could avoid professors travelling back and forth and if we could bring sufficient number of students to fill a classroom. After a year or so of investigating and gathering partners, we received a half Million dollars of support from the Province of Ontario to establish the first video conference network. This financial support allowed us to provide elearning across 3 small communities through Northern College and Laurentian University; and eHealth between the Timmins District Hospital and the Ottawa Heart Institute. Anytime you try to innovate it takes risk-taking leaders and a lot of patience to change systems. For example, doctors could not get paid for online health consultations because there were no policies or processes in place, and the funding was controlled by a third party – the Ontario Medical Association – who had no incentive to subdivide what they already considered to be an inadequate size pie. Getting involved in elearning meant working with unions, getting professors and students on board. Even the technology was a risk – we paid $80,000 per end for equipment, a service that Skype provides for free today. But still, it was an investment and a worthwhile undertaking that sprouted many other digital projects and brought benefits to northern Ontario. This is the power of networks and technology.

This week we welcomed Dr. Jane Goodall at the University of Winnipeg, you probably know that she is recognized for her work in building more resilient communities surrounding the forests that harbor her beloved chimpanzees. Her message of hope reminded me of the importance of the work of every single individual trying to make a difference. Our efforts here are not so different, it is not about the WOW factor of technology, it is about building sustainable communities that bring opportunities while decreasing our environmental footprint. It is fraught with challenges but if we don't do it, who will?

The videoconference network experience brought me to sit on two funding bodies in the province of Ontario that supported ICT innovation, and I was fortunate to join Dr. John Jung and his team in New York to lead a small group of jurists and develop criteria to evaluate applications for recognition as 'intelligent communities'. This is where I met Dr. Sylviane Toporkoff who was running a digitalization program in Issy-les-Moulineaux. Issy was a front runner on digital topics, among the first to showcase online payments for parking, WiFi for

outdoor farmers markets, and cameras in kindergartens to connect parents with their children. Issy at the time had two times more jobs than residents, mostly in the ICT sector. Il faut le faire n'est-ce pas? Since that time, the power of technology and network has grown even further and cities are leading the way in solving challenges thanks to the imagination of private sector and researchers. This triple helix of government, business, and academia is key.

In the late 90s, I had opened a management-consulting firm and was helping communities across Canada to develop partnerships to solve digitalization problems. Often it meant starting with infrastructure, building fibre rings so that what we called the MUSH sector (municipalities, colleges & universities, schools, and hospitals) could access much higher speeds at the same level of budget. We had a payback of less than 2 years on a local fibre build. We could afford more if we co-built and brought telecommunication companies to the table. Only after making available a good broadband infrastructure could we afford to talk about life changing and economic-building applications – these are inextricably linked.

I ended up a researcher and an activist on this topic because it fascinated me how much we could accomplish if we only used the power of networking in communities. We need to take down silos, to dare to dream on how technologies could decrease challenges and create new opportunities, to plan now so we are not left behind, to consider how we ensure that we do not grow the digital divide. If we are not careful, the growth and exodus toward our larger cities will exacerbate a host of problems – in traffic, in increased carbon emissions, in reduced quality of life. There are so many more solutions today that could help us deal with these problems - such as in using more extensively our ability to telework; or moving more of our health systems to mobile delivery and self-care; or in using and building what we need within our own regions; or in creating the kinds of inflection points in traditional industries such as those we will see with automated transportation and artificial intelligence.

I sincerely hope that this Forum is a step forward to building more networks of leaders and activists like you that will dare to collaborate and innovate so that we can take advantage of the best opportunities that this digital revolution can bring to communities. The dialogue now needs to move from concept to action with people in this room hopefully as its principal instigators. For this reason, the Canadian Steering Committee of this Forum whose names are on the back of your program, would like to invite anyone who is interested in continuing this important discussion in a virtual environment to join a post-forum action group. Our very talented coordinator of this Forum, Ms. Carter Cousineau, will take the business cards or the names of anyone who wants to join us. She will be at the door on your way out tonight. I encourage you to help us change policy and move forward with digitalization.

Thank you.

Please allow me to recognize a few individuals who have worked very hard in support of this Forum, and I would ask them to stand and be recognized:

Carter Cousineau, is the Director of Development and Operations in the Faculty of Business & Economics at the University of Winnipeg. I am sure that most of you have received countless emails and calls from her to ensure that this Forum would attract the best and brightest as well as unfold seamlessly. I am very grateful to have such an impressive individual as part of my staff and a rising star.
The staff within my Faculty and the University who have supported this Forum in so many

ways – from accounting to media. I would ask all of those in attendance who have played a role to stand and be recognized.

The Canadian Steering Committee who was instrumental in identifying Canadians that needed to be here, who contacted sponsors, linked the co-chairs (Sylviane & Sebastien) to countless stakeholders. Your involvement was critical in developing this new network of Canadian expertise on digitalization. Please stand my friends

- Greg Dandevich from Economic Development Winnipeg
- Darren Fast from the University of Manitoba
- Kathy Knight from the ICT Association of Manitoba
- Doug McCartney from the Government of Manitoba
- Lorne Pelletier from the Government of Canada
- Eric Courcelle from the Winnipeg World Trade Centre
- Jason Fuith from the City of Winnipeg
- John Jung from ICF Canada
- And our special advisor, Kevin Fitzgibbons from NSERC, one of Canada's main Research Councils

Now it is my pleasure to introduce Olin Wethington, Chairman of Wethington International, an investment & business advisory firm specializing in emerging and Asian markets. Mr. Wethington has held numerous high level positions in the US Government including in Treasury, Economic Policy, and International Affairs and he was the Chairman of AIG companies in China. Currently Mr. Wethington is leading a group working on international security policy at the Atlantic Council. Welcome and thank you for agreeing to provide your perspectives today.

OLIN L. WETHINGTON, Board of Trustees, Freedom House, USA.

Thank you. I feel very privileged to be here this evening—in this wonderful place, the Canadian Museum for Human Rights—which has an essential mission in promoting respect for human rights and democratic principles around the world. To paraphrase an American President, Ronald Reagan, respect for fundamental human rights and freedom are not the sole prerogative of a chosen few, but rather the universal right of all God's children. These ideals must apply to all nations; a mission this Museum holds dear. I also wish to congratulate the Global Forum for holding its Gala dinner at the Canadian Museum for Human Rights and for introducing human rights and freedom on the internet into this conference's discussion.

This conversation is timely because support for democracy and internet freedom is on the decline globally—a trend with huge negative ramifications for public expression, human rights and democratic process around the world. In my view, human rights and liberal democracy are today under intensive and sustained attack by modern authoritarian government—and also some elements within liberal democracies. This is not a concern simply of journalists and their on-ground defenders. Rather, it should be a concern of users, like you and me, entrepreneurs, students and academics, business people, ordinary citizens—who in many countries live with the harsh reality that the tools of internet socialization and communications are being taken away or limited by government, and that the content of news and postings on the net is increasingly subject to censorship.

I am on the Executive Committee of the Board of Trustees of an organization based in Washington, DC—Freedom House--that shares the values of this Museum here in Winnipeg. Freedom House is an independent, non-profit organization dedicated to the expansion of freedom and democracy around the world. Freedom House does not identify with either major American political party.

Freedom House was founded in late 1941 by Wendell Willkie and Eleanor Roosevelt to mobilize support of private citizens for American involvement in the fight against Nazi Germany and to counter the then influential, isolationist tendencies in the United States. Today, Freedom House is working in dozens of countries, some difficult environments, to support human rights defenders, independent media and free expression.

However, you may best know Freedom House for its democracy research. In 1972 Freedom House launched the first of a kind report to measure the state of freedom throughout the world. It is called Freedom in the World. We also publish Freedom of the Press and Freedom on the Net. These three flagship publications are internationally recognized as the gold standard in the rating of freedom and democracy. They are funded privately, not by governments.

Freedom on the Net Report:

The core findings of the report Freedom in the World over the past decade are very disturbing. They show a steady decline in freedom that affects practically every region globally, including Europe and the United States. I should point out that Canada ranks as one of the best performers on our freedom scale—among the 195 countries that Freedom House measures.

However, I wish just for a few minutes to highlight Freedom of the Net—as it connects more closely to the theme of this Global Forum. The last Freedom of the Net report was in November 2016. The next report will be in November 14, 2017; I hope you will look for it.

Freedom on the Net is a comprehensive study of internet freedom in 65 diverse countries around the globe, covering 88 percent of the world's internet users. It tracks improvements and declines in government policies and practices each year.

The central conclusion of the 2016 report is that internet freedom has declined for the previous six consecutive years (I expect the 2017 publication to be released this November to document the seventh consecutive year of decline in internet freedom.). As to the global population of internet users, more people globally live in countries rated "Not Free", than "Free".

We have seen a relentless drive by authoritarian governments on freedom on the internet. At their most ambitious—as in Russia and China—political leadership has set forth a goal of refashioning the internet from an institution that enhances personal and political freedom to something that reinforces the power of the repressive state.

As to the individual country ratings: the worst actors are China, Syria, Iran and Ethiopia. (North Korea is not rated, because of the difficulty of on-ground observation.) China, the country with the most internet users, is the worst abuser of internet freedom.

Key Areas of Recent Government Repression on the Net:

Very quickly, I would like to highlight several noteworthy recent trends in government repression on the NET. Maybe some of the sessions of this Global Forum will discuss them. More governments than ever before, as a means of halting the rapid dissemination of information, are cracking down on the use of social media and communication apps—important tools for holding governments accountable. We see new restrictions on instant messaging apps and internet-based calls. WhatsApp is blocked more than any other tool. Facebook users are arrested for posting political, social or religious content in approximately 30 countries, and in some countries Facebook use is blocked altogether. Police in roughly 40 countries have arrested individuals for their political activities on social media.

And, social media users face unprecedented penalties.

Governments are censoring more diverse content; the list of forbidden topics grows.

Government measures purportedly for national security reasons frequently threaten free speech and privacy. There is app blocking aimed at stifling protests and expressions of dissent. New encryption features also trigger blocking. Moreover, there is pressure to enable backdoor access to encrypted communications. I recognize legitimate national security considerations that need balancing, but governments too often use broad anti-terrorism laws to prosecute users for simply writing about democracy, religion or human rights. Russia and China's anti-terrorism law requires all organizers of date on-line to provide to authorities the tools to decrypt any information they transmit.

Repression on the Net Reflects Broader Methods of Modern Authoritarians:

The 21st century has been marked by a resurgence of authoritarian rule; modern authoritarians prove resilient despite economic fragility and occasional popular resistance. They utilize refined and nuanced strategies, the exploitation of openness in societies, and the spread of illiberal policies in democratic countries themselves. Faith in democracy and respect for human rights, even in the West, is weakening.

Concluding Comments: The Way Forward

So, in closing, I leave you with a challenge and an appeal: to make the case anew for the core principles of liberal democracy and respect for human rights. Let us together take the time, and seek to explain more persuasively why democracy matters and what actions are needed to reinvigorate support for democracy. Let us be vigilant against encroachment by government on the free movement of data and communications on the net and against over-regulation and efforts that constrain innovation. For many citizens, the web has become a primary means of social interaction and expression. I hope during our dinner tonight we will raise a glass to freedom of expression and respect for universal human rights. Thank you and I hope you will read the 2017 Freedom on the Net—again, to be released on November 14.

Bon appétit!

BRUNO BURNICHON, Honorary Consul of France.

Bonsoir à toutes et à tous. Good evening everyone. Welcome to the wonderful city of Winnipeg.

I would like to express my delight in being here this evening and to thank the organisers for this opportunity to say a few words to you. Thank you Madame President, Dr Sylviane Toporkoff, for inviting me. I am greatly honoured. This is an opportunity to praise the activity of your think-tank.

Items International is based in Paris, as all of you know, and has an international influence around the world. The French embassy, along with our new ambassadrice to Canada, Mme Kareen Rispal, are eager to support this success story and I am here to offer you France's congratulations.

Digitalization and the will of shaping the future is a strategic issue for the new government of my country. At the time of his election, the current President of the Republic of France, Mr Emmanuel Macron, stated on the first page of his manifesto that the digital revolution is changing our ways of producing, consuming and living together. You share that conviction and you prove that these words are more and more relevant every day.

You are discussing very technical issues during this Forum and I must confess that I do not understand all of them… cloud computing is a mystery to me!

However, I know on the other hand that healthcare is taking a giant step thanks to digitalization and it will evolve very quickly in the future. Faced with such developments, which bear a tremendous hope but also threats, it is fundamental to reflect and debate. This is why you also discuss the issues that are very important to me—namely safety, security and privacy. Cybersecurity is vital for all.

Innovation, of which digitalization is one of the main components, is one of the major partnerships of collaboration between France and Canada. French universities produce excellent computer engineers. Today, Canada appears to be the pioneer country in artificial intelligence. The exchange between France and Canada on digitalization can only continue to strengthen.

Links with Canada and France are naturally strong. Winnipeg, because of its diverse history of global influences, has learned to accept diversity. France remains the country that attaches great importance to such values. Together let's try to make the digital revolution happen for the good of the humanity. I believe that your debates are an element that will enable us to do so.

I whish you a great success during your Forum and a great stay in Winnipeg.

Thank you.

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Keynote Opening Session

Day 2 – Morning – Plenary Session

The **chair and moderator** of this opening session, **JAY E. GILLETTE, Professor Emeritus of Information and Communication Sciences, Center for Information and Communication Sciences, Ball State University**, USA, welcomed the delegates and briefly presented the organization of the session to ensure its smooth running.

DYLAN JONES, Deputy Minister of Western Economic Diversification, Canada, welcomed the participants on behalf of the Canadian Government and shared some of the key questions currently being discussed inside government on the topic of digitization. His talk took into consideration yesterday's discussions on cybersecurity, the anxiety that government would overrespond to the thread, the discussions around digital infrastructure and the extent to which broadband connectivity really is connectivity to the modern world, and also on the opportunities inherent in artificial intelligence and big data.

The general orientation towards digitization within the Canadian Government is positive. Digitization is seen largely as an opportunity.

But the Government is also conscious of its duty of care. The industrial revolution, for instance, produced dramatic improvements in the human condition in material comfort, but it also came along with exploitation, environmental degradation and a number of other significant downsides. If we would do it all over again, we would probably do it differently. Part of the obligation in government is not to admire the process of digitization, but to look ahead and ask 'how can we do this well?'.

There are three main questions:

First, how to get Canadians to own the change, to be digital actors—not just be passively affected by the change? This is really about how the citizens and firms approach digitization.

Second, how to ensure that the benefits are broadly distributed amongst the citizens? This is the digital divide question and how to avoid it.

Third, and less obvious, how to improve government services? How to do government's do business better by taking advantage of the tools that are available?

To step briefly into each of them:

In terms of owning the change, a critical question is how to better connect the academic research assets with firm behaviour in the private sector. Canada has one of the best research establishments in the world, which is in part driven by the county's liberalness and openness to talent globally. But this isn't fully utilised by the private sector firms. Building that

supply chain is a key government preoccupation. The Canadian Government has just launched a 1 billion dollar Innovation Superclusters Initiative designed to create more industry-led innovation. So far, it looks like there is a large pent-up demand for clusters work for bringing industry and innovation actors together.

Obviously, digital skills is another key aspect.

Another one is regulation and standards. For instance, Ontario has been very quick to create a licensing regime for self-driving vehicles. It is important to get ahead on a regulatory side and become a jurisdiction of choice for people to experiment it.

However, there are two trickier parts of this: It may not actually be rational in some sectors to be a first adopter—it is often better to be a fast follower than a first adopter in terms of new technology. So, there is an appropriate government role in de-risking. There are two parts of that: one is regulatory, the other one is financial. On the regulatory side it is easy to say, if you create conditions of certainty quickly, you should move fast and get ahead in your regulatory models. But when we are talking about technologies that we don't fully understand and whose social impacts we don't fully understand, you don't want to be in a position where you lock in your approach to protecting the public in advance. How to create certainty but also maintain public protection? That is part of de-risking.

And then, on the financial side, what is the role of government? Where is it appropriate to share financial risks?

As AI develops, we have a very powerful predictive capacity; the critical input is data. But the question about who owns this data and how peoples' personal information is protected is a legitimate concern. Striking that balance is a delicate policy question.

On the issue of inclusivity, the biggest improvement in Canada's economy happened after the Second World War. The reason was very simple: women entered the economy in a big way. It has long been a secret of success in Canada to fully utilise all of the skills of all members of its society. The secret sauce of economic success is to support people building their full potential and then making use of it.

There are inclusivity issues, specifically related to digitization, where Canada is doing quite well relative to others in terms of women's involvement in science technology and engineering. However, there still is a significant gap and closing that gap will be very important.

Economic growth and economic change create tremendous opportunities for social mobility. In environments that change, someone who is in the bottom income could get to the top. All of this change creates lots of opportunities in our society for people to move, but there are differential levels.

For example, there are real challenges in terms of improving the education quality for indigenous citizens. Canada has a large indigenous population. They are young and represent huge economic opportunities. Here again, one should take a positive approach: As Canada rebuilds and strengthens indigenous education, Canada leapfrogs the baseline public education system and figures out a way to do digital education in an indigenous context that is actually better than the norm. All of these are opportunities.

This issue of inclusion is very important, e.g., rural versus urban. There is an assumption that urban environments will lead on digitization—but is this really true? One of the most obvious places for the early adoption of big data solutions is agriculture. There are lots of opportunities in rural Canada for early movement on digital as soon as the infrastructure is got right.

If you want to have a highly risk tolerant society, you can not have a society of people who mess up then starve to death—you cannot have a society where the jeopardy is so high. This is the reason why most entrepreneurs are young: When you are young, you have nothing to lose. When you grow older, you accumulate stuff and obligations and you become less comfortable with risk. The ability to be compassionate, to be caring, to be thoughtful, to have an appropriate support even in cases of failure is quite important to building a stronger, more risk-tolerant society.

The third area mentioned was reform in the public sector. There are lots of opportunities, lots of rethinking to do on how government works. One area is challenge funding, where the problems are put out to the public that drives innovation, i.e., crowdsourcing. Transparency itself is inherently valuable. Just think about the mass amount of health data the government owns. It can be put out there in an aggregated format. Who knows all the positive ways people can use that data? And then, of course, government procurement. The Canadian Government is the biggest employer in the country. As it starts procuring more innovation, that builds an ecosystem that also supports private industry.

To wrap up, Deputy Minister Jones gave the key questions back to the audience: How do we own the change? How do we ensure that everyone is included in the change and benefits from it? How does government reform itself?

SAMIA MELHEM, Chair, Digital Development Group Information and Communication Technologies Sector Unit, World Bank Group, gave an insight in what the World Bank Group is doing in the space of digital development, and more specifically digital government. Her talk addressed digitalisation and its implication on how we live, what governments provide, how they reform themselves and how they have the citizens participate in this transformational effort.

Transport & ICT Global Practice

The World Bank lends money to governments of developing countries. It lends money in every possible sector, e.g., agriculture, health, education and technology. In general, especially for the poorer countries, the World Bank Group through its International Development Association (IDA) provides zero-interest loans repayable over a horizon of 30 years. Heavily indebted poor countries may even be exonerated from payment.

Together with the loan, the World Bank provides free advisory and technical assistance and supports its clients in implementing the objectives for which they borrowed the money. Typically, these projects cover a period of 5-6 years.

As technology has evolved, the digital government projects financed by the Transport and ICT Group of the World Bank evolved too. With these new tendencies—i.e., the Internet of Things, big data, sensors everywhere, social media, the rapid transformation of storage and

the availability of cloud—the way governments have been rethinking their digital government around the world has changed. In particular in countries that are less privileged in terms of financing, connectivity etc. There are revolutionary changes in how projects are designed today versus how they were designed 10 years ago.

The World Bank's clients are typically ministries of technology, but more and more often ministries of economy. Today, people are considering digital not as a specific sector but as a cross-cutting force that is pushing the digital economy and creating new sources of growth and new opportunities.

However, the world is still not very well connected. Often the question is not even about the last mile—it is about the last thousand miles, as some countries have vast areas that are not connected and not enough demand today for justifying huge investments in infrastructure.

Access to fast Internet is reserved to the lucky few; more than half the world does not have access to it. The Internet remains unavailable, inaccessible and unaffordable to a majority of the world's population.

There is this intricate link between connectivity, services and digitization. One does not happen without the other, and many studies demonstrated that broadband has an impact on economic growth. It is a whole business sector by itself, many people are living from it, and it has created a lot more demand for any sort of services and content as can be seen by the telecoms operators' share of national GDP's and of the global economy.

What are the new rules and principles of digital government? There is digital by default, and openness and security by design—which is quite a challenge: how to publish and open up code as much as possible without jeopardizing security, anonymity etc.?

Another point is the aspect of data-driven, not document-driven transformation, and transformational by design. During the first 10 years of digital government, people tended to automate and digitise things as is. Today, the transformational aspect, the rethinking of procedures, especially in administrations that have had a traditional approach to bureaucracy, is happening. There is a lot of demand coming from innovators from within, saying 'form X or Y no longer needs to be done this way or no longer needs to exist. Let us really rethink how we offer services'.

In terms of projects financed by the Transport and ICT Group of the World Bank, there is an increased demand for digital government—and especially whole-of-government digital platforms. The World Bank Group prefers this approach of shared services to a siloed approach which is not sustainable. Moreover, there are also a lot of applications, such as smart cities or in agriculture projects, precision farming using IoT, digital health etc. There is a new type of portfolio and demand by the World Bank's clients; especially as these clients are more informed or are from a younger generation.

The new trends in infrastructure represent a real challenge for the World Bank: It is important to always stay on the cutting edge in order to design a sustainable project to be implemented over 5 years. It is important to have from the beginning, at the design stage, the foresight to not recommend something that will become obsolete very soon. Moreover, the World Bank has to help its clients build their own skills and ownership so that once the financing of the World Bank is done, there is ownership and sustainability.

Digital government is a complex ecosystem. One element of successful digital development, which is at the same time the longest and the most painful, is the ability to change legislation. Often, the legislation applied by the World Bank's clients dates from 1900 or even before, and changing that to the digital age is very challenging. Thus, the World Bank has put together a set of good practices looking at model laws implemented around the world that can be reused for the World Bank's clients.

The World Bank tries to help governments building a digital platform to be shared among all the agencies. This is very difficult because governments are not used to share data amongst different ministries. Sometimes they even have to send a fax from ministry X to ministry Y to share data on a daily basis. This is not sustainable.

The digital economy requires digital skills. But how to empower citizens and policy makers with both the skills needed to have vision and foresight and also to implement? It might be necessary to rethink how computer science programmes are delivered; how they can be changed. Computer science, as a rather mature science, is still taught in the same way as in the 80s. In order to be inclusive and attract young women, it will be necessary to rethink how to offer that, and to help retrain and improve the existing teachers' skills.

Another important aspect, which is a basis of all these projects, is identification. For most of the World Bank's clients this is a huge problem. More than 1.1 billion people around the world have no documents for a legal ID. So, how to think about digital payment or digital services without even having an ID or birth certificate?

In conclusion, what are the lessons learnt? Ownership, the rethinking of government processes, and making them really user-centred with high user participation are key. Partnerships are also very important. All successful projects have private honest result-oriented sector partners, implementing the solution and assisting the governments.

WALID EL ABED, Founder & CEO, Global Data Excellence (GDE), Switzerland, introduced the software system Data Excellence Management System "DEMS" created by GDE, with the vision to elevate data to excellence empowering a data-driven society governed by value for perpetual excellence.

Data Excellence Science - Automate Business Excellence Management and "Govern by Value"

Data excellence science optimises artificial intelligence for business excellence automation and the human-computer dialogue.

Today, the discipline of data excellence is taught at many universities, such as the Fribourg University of Law, at the CNAM (Centre National des Arts et Métiers) or the Paris Dauphine University in France. It is the science of the dialogue between humans and machines.

The digital world is extremely complex. The Digital Enterprise 4.0 seen by the ISO community visualises all these complex interactions that people actually have in this new digital world. Given this complexity, the question raises whether there is a way of doing things the old way, with old technology.

The creation of a new society requires to think differently. The question is: are we ready for this? In fact, no one is ready, but do we have a choice? Yes, we have the choice to either jump stupidly or to govern by value.

We are all seeking for value, but what is the meaning of value? In linguistics, value is a polysemy, i.e., a word that has multiple meanings. Value has only two: the one and its opposite. The first meaning is what we can measure (e.g., money, energy), the other meaning is what we can not measure (e.g., humanity, human rights, policies, rules)—and since the beginning of the world these two meanings walk aside. Both meanings always were separated and we have never linked them together. This is what is causing today's complexity.

So, how to link these two meanings together? Through data. It is a huge opportunity that will enable us to finally link these two meanings together and to govern by value.

There are many solutions. We are trying to create the future in analysing the past or the present: Big data analytics, IBM Watson, many technologies are existing in artificial intelligence enabling us to understand the world and trying to project the future for us.

But, what if the world we created is not the world of happiness; i.e., that the rules we will discover out of the existing data will not lead us to happiness, simply because the data of happiness didn't exist before? We need to acknowledge and to accept that future trends do not necessarily follow past trends. If we need to create a new world, it is with new rules and with new data—we need to act like an octopus. We need to move from the web logic, the spider logic, to the octopus logic.

An octopus has 8 brains linked to a huge brain which is the polariser, the head. The octopus lived its digital revolution millions of years before us. We should not connect data together, we should connect smartness together. Connecting smartness means that the data must be managed at the source, otherwise we will not be able to integrate all this data.

If we are integrating this data in multiple places to create data lakes etc., we are creating symmetries of things: As soon as the data moves from the source, the lifecycle of the source continues while this new thing that we have created is completely decoupled from the lifecycle of the source. It is a common illusion that we can create a data lake and then maximise the value of data. This is not possible.

If we want to create a new future, data must be managed at the source—but, who owns the data? This is the question of data ownership. The source of the data must own its data and has to be responsible for it. It is a negotiation to connect people and to do contracts in order to make them sharing their data. Why should people provide their data? Because you can be transparent in the value creation process and can negotiate value for them, so they can share their data on demand. This is the new world—it is connecting smartness.

Imagine a world with this super machine that will save humanity. It is time to reconcile humans and machines to work together. Machines are part of our society and there is no way of survival, or for the creation of a new society of excellence governed by value, without the machine, because this complexity will go beyond our imagination. We won't be able to manage those data tsunamis that are hitting the world.

During the biblical flood, Noah built a boat to help, otherwise no one would have survived. So, this is the machine that will enable humans and the computers to work together towards collaboration and the creation of a new digital society.

"So long as men can breathe or eyes can see / So long lives this, and this gives life to thee." Even Shakespeare imagined the eternity machine four centuries ago. However, the issue here is not imaging the machine but creating it—together.

The **chair and moderator**, **JAY E. GILLETTE, Professor Emeritus of Information and Communication Sciences, Center for Information and Communication Sciences, Ball State University**, USA, addressed the topic of:

Survive and Thrive with Irresistible Force:
Evolve the Knowledge We Need for the Digital Era

To put this in the context of our era: "a knowledge society driven by an information economy." But, what was the old way? We had a feudal society driven by an agrarian economy. That was supplanted by a mercantile society driven by an industrial economy. That is now being supplanted rapidly by a knowledge society driven by an information economy. So, agriculture disappeared when the industrial revolution hit? Not at all! It just became industrialised. And industry would disappear from the information economy? Not at all, it will become informationised—and agriculture will become even more informationised. Agriculture is currently one of the most advanced sectors in using information.

The chair proposed the following keynote panel task statement, in the sense summarising the topics the panel addressed:

A person's world is defined by what they know. Hence, coordinated programs of education are traditionally the engines for social change. The digital age is infinitely fast-moving. Its citizen is inundated by daily floods of information and hazards lurk everywhere in cyberspace. The challenge is to ensure sufficient digital literacy to enable the world's citizens to make informed choices about things that are critical to their well-being. That task requires innovative ideas, and concepts to underwrite global education, training and awareness/ consciousness requirements.

To put this in today's context, one could say it's now the information renaissance. Information renaissance is this knowledge society driven by an information economy—a challenging innovation, yet not unprecedented in human history. The world has seen this before: it is like the information explosion of the European Renaissance. In that renaissance there also has been an explosion of ideas from technology, especially printing and publishing.

But, how do we succeed as a person in this renaissance time, to become a renaissance man or woman, like Leonardo da Vinci and Vittoria Colonna in the earlier European Renaissance?

Become a " T-person" (a person that is built like the letter T)—a person that is both broadly comprehensive (T-crossbar) and deeply competent (T-base) in one complete person. Breadth of comprehension has always been the goal of liberal arts education, and depth of competence was always the goal of professional education. Know something about everything and everything about something—this is the T-person of today. Breadth informs adaptability, especially in changing times. Depth informs utility, that is the competence that allows us to add value to our societies (find a need and fill it). This combination defines a renaissance person, the type that our era requires to succeed and prosper.

Renaissance times are always clashes of paradigms, because the new paradigm meets and competes with the old paradigm. The new paradigm gives us all this rapid, great human progress, but at the same time, a clash of paradigms generates major social conflict. The renaissance or reformation, which is a progress paradigm, always generates counterreformation and even the Inquisition, supporting the current or even older status-quo paradigms. The old paradigm often uses the techniques of progress to counter the new paradigm.

This results in a period of upheaval and change, from the top of the society to the bottom of the society, and from the bottom of the society to the top of the society. At the end of the story, there is an irresistible force that always wins, yet the immovable object always alters its vectors.

The speaker showed a picture of the Grand Canyon, to illustrate the irresistable force (the Colorado River), moving inevitably to the sea, being twisted and turned by the earth itself as an immovable object.

A humorous story of a faulty way to respond to the situation was this: the Interior Secretary James Watt once was on a Grand Canyon raft trip for VIPs. His response: "The first day was spectacular.... The second day started to get a little tedious, but the third day I wanted bigger motors to move that raft out. On the fourth day we were praying for helicopters and they came.''

However, on our evolutionary journey through this information renaissance period, there are

no helicopters coming to rescue us; there is no Deus ex Machina, as in old theatre drama. Yet, let us adapt for our journey some important whitewater rafting lessons: stay with the boat (this is your organization or firm); always wear your PFD or life-jacket (this is your family and your friends, keep them close to you, they will help keep you afloat); and hold onto your paddle even if your boat overturns (that is your work, which you will need again when the boat is righted; without it, you are of no use for the boat).

Survive and thrive, flow with the irresistible force of human evolution (through your own irresistable goal), even through hardship and resistance of the immovable object. Your vectors will change by objective conditions, but always go onward.

Evolve with changing conditions to reach your irresistible goal. Your vectors will change by objective conditions, yet go "Onward!" At the end of the story, the irresistible force always wins; humans as Homo Sapiens will survive and thrive through the inevitable evolution of their knowledge.

The chair then opened the floor to questions and comments.

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Q&A

The question addressed to **Dylan Jones**, Deputy Minister of Western Economic Diversification, was 'how to tap high potential?'

Deputy Minister Jones stressed that the first task is actually identifying potential. That is external to you and very difficult. Many of the great industrial successes have been built on identifying value that other people didn't see. This is a kind of external observation skill.

The second is internal. It is seeing a path to creating that value or tapping that potential on. A lot of these things are about confidence. A hundred people may have seen that potential external value and not acted on it. Similarly, out of the people who did see it, many of them, for whatever reason couldn't figure out how they could actually meet that need. This is an internal confidence issue—some of that comes from core skills and some of that is just a culture.

There are risks associated with technologies. The second question concerned the fact that cyber exploitation may lead to physical harm. What is the government doing to make sure to check that out so we don't have to wait for citizens to die before government takes action?

Deputy Minister Jones explained that there was a trend towards self-regulation. This is less en vogue today, there has been a bit of a pull-back. Government operates under transparency rules. The government has these two competing disciplines: one is the protection of privacy, the other one is transparency. And it struggles in reconciling those. Potentially a lack of transparency was a fundamental failing of how government approached self-regulation.

Samia Melhem, World Bank Group, added that a lot of this has to do with capabilities within

governments in terms of imagining and envisioning the consequences. Let us say, technology is this irresistible force described earlier. It knows no morals, it is indifferent, it will just magnify everything. Governments have a role to play in order to make it conducive for development and to prevent all the negative side-effects. Governments have a big role to play and they have to partner with everyone—starting with the most influential and big companies that everybody is using for software.

The next question referred to the statement of **Walid El Abed,** Global Data Excellence, that the data is already here or there with us to create a new society, but we may need to think in new ways. How do we get people to think in new ways when they are frightened of the new paradigms?

Dr. el Abed stated that the data that exist will not necessarily help us create the new future. If we want to create the future, we need to start in the future, i.e., it is the alpha before the omega. We have to start with the omega—the final destination we would like to create, the image of the new society that we would like to create, and then use our intelligence to go there. This can help us in aligning our path with the technology. We have to know our goal in order to get there.

Walid el Abed, Global Data Excellence, was then asked to comment the statement that data has to be managed at the source but also at the end, because otherwise it is not working.

Dr. el Abed stressed that the final end, where the data has to be managed and be smart, is the Internet of Things. In some years, there will be so-called data aggregators. They will enable to service this data from the source towards the context of data usage. Because data without context has no sense. In order to make sense out of data, one needs to understand the context of usage—and the context of usage is not at the source but at the destination. This is why the best way to know the data that is required is to get it at the source. Everyone knows best about his or her own person and therefore can provide the most up to date data concerning the own person.

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Session 5

Day 2 – Morning – Parallel Session

Innovation for Society

JEREMY MILLARD, Senior Consultant, Danish Technological Institute, Denmark, moderating, opened the session and welcomed the panellists.

'Innovation for society'—What else is innovation for? Why do we need to add that question? It is important to ask this question as we go through the different presentations, how that pans out. For example, social innovation is always seen in contrast to technological innovation or business innovation. However, all innovations should be for society.

The session's chair, **RANDY ZADRA, Director, Government and International Relations; Senior Advisor Eureka Clusters, National Research Council of Canada (NRC)**, Canada, welcomed the audience and put the session into context.

Innovating Innovation

How do we innovate differently?

The Internet changes everything. Big data, AI, etc. would not be possible without the Internet. Even 20 years ago, we lived in a tribal approach to innovation. This means that different groups innovated together as a group, but really didn't share the information because it wasn't easy or possible to do so. Research breakthroughs were slow, because they were often paper-based, people had to go to conferences, travel far distances etc.

In 1998, when Bell was involved in building out the infrastructure for the global Internet, the fibre optics, the satellites etc., there were 40 countries that did not have public Internet access. That is not such a long time ago. Think about how far we have gone. The single biggest revolution is that we moved to get people online.

Today we are living in an interconnected world—interconnected like neurons in our brain. There is information all over the place. There are a lot of connections to various pieces of information that exist.

Today, we have 9 million developers who work with APIs, meaning connecting someone's solution to someone else's bigger set of data. We have big data, we have zettabytes, we have great new possibilities in many sectors, such as health or agriculture. That is driven, first, by ubiquitous connectivity and secondly, by the low cost of storage. These are the two biggest things that are driving this kind of system.

Geoffrey E. Hinton from the University of Toronto has been working on neuronal networks for

20 years, which is patterned after the neurons in a brain and which strings together lots of data to make predictive analytics using that data. If you are looking at patterns using a technique called back-propagation, invented by Prof. Hinton, you can detect patterns in health conditions, in agricultural soil conditions, etc. All of this is driven by lots of users providing lots of data.

In order to provide an academic context into who has been writing on innovation for society:

Henry Chesbrough at Berkley talked about 'external technology insourcing'. Enterprises, companies, NGOs don't generate all the information themselves. They can go outside, get it and use it productively. He wrote a number of books on open innovation

Former MIT's Eric von Hippel talked about user centred open source—opening things up in order to have a more productive use of information for society. He wrote the book 'Democratizing Innovation'.

And more recently, Karim R. Lhakanin, Business School at Harvard, wrote 'Revolutionizing Innovation', a book on crowd sourcing and how important it can be for social and societal innovation.

Everyone uses Wikipedia. This data is generated by 135,000 editors, checking each other. Wikipedia is a great example for the use of big data for societal benefit. Reddit is another one.

Some of the questions the session will address: Will a more open innovation model improve outcomes for society? What are some examples of digital/internet adoption which has spurred innovation in various sectors? What are the skills required to innovate effectively today? What will the next 5 years look like in your sector?

The session's moderator, **Jeremy Millard**, Danish Technological Institute, added that social innovation is a great example of open innovation. It is getting people do it for themselves. It is empowering people in communities, in cities and in towns, and even within families to have the ability, the capability, the resources, the knowledge and the networks to innovate.

Innovation is not just about change, it is about purposeful change—change by people, by organizations and businesses to achieve a beneficial end. It is about changing things in the way we want change to happen. However, we have to have a vision—even if it changes over time. We need to know where we want to go, what sorts of economic needs, environmental needs we want to impact, and then we can innovate using all the resources that we have available.

TED HEWITT, President, Social Sciences and Humanities Research Council of Canada, Canada, addressed the question of why we do innovation.

The 'why' of innovation is not something we usually talk about when we talk about innovation. We usually look at lists and countries' rankings in terms of innovation, rather than the financial payoff, prosperity and so much more.

Canada's current government is on track in understanding this. Innovation is front and centre in Canada, among current national priorities. With every federal budget there are greater investments in what is come to be known as the country's Innovation Agenda. Now, with new initiatives like the Strategic Innovation Fund, the Innovation Superclusters, the Global Skills Strategy, the Smart Cities Challenge, the Pan-Canadian Artificial Intelligence Strategy, Canada is ready to be placed in a competitive position in the global innovation race.

However, at the same time, there is a strong focus in government on the 'why' of innovation, and the 'why' for Canada is increasingly about prosperity and inclusion and diversity. Why? In order to create the kind of society Canadians deserve, the kind of society Canadians want if they are to avoid many of the pitfalls that now can be seen in so many other parts of the world.

Already in Canada, one can see some of the momentum. A couple of weeks ago, Facebook announced that they are going to open a new Artificial Intelligence Lab in Montreal. It will be the company's first AI Lab in Canada and only the second outside the U.S. They choose Montreal for the strong Canadian technology ecosystem. The social network's AI lab will help create jobs and economic growth and will help Canada retain and recruit high quality talent.

AI and disruptive technology is feared by many as disruptive, as a tidal wave that is going to replace jobs. A report by Forrester, the U.S. based market research and business advising company, made headlines recently with its prediction that by 2021, 6 percent of the jobs in the U.S. will have been taken over by robots using AI powered systems. Often, those who want us to prepare for these types of technological ecosystem changes make the case for additional investments in technology itself, but that doesn't represent the whole picture.

Human skills and knowledge are what will ultimately help us to successfully adapt to disruptive technology. We need to invest in people, people with the skills to assess and convey, not just the benefits but also the risks that come with any given piece of technology. Technology is neutral, but it has implications. It is how and whether to use technology—and how to mitigate and deal with some of the effects of that use—which will be the critical questions for all of us in the future. How to turn technology to our advantage, because we know it can well go the other way.

A good example of this more people-centred approach is provided by the work of Dr. Teresa Heffernan, Saint Mary's University in Canada. Dr. Heffernan is working to expose some of the possible dangers of AI. She found that algorithms often have the same gender and the same biases as their human developers. While some of these might be fairly easy to spot by reasonable users, more settled biases can lead to influencing how governments use big data to make decisions.

User experience (UX) is a whole other field whose research is imperative when it comes to considering the experiences that consumers have when interacting with a digital platform. UX research removes assumptions from the design process using data to inform design. This sounds like a no-brainer, but the savings in time and money that can be realised by such an approach are very real. As a result, highly skilled UX researchers, with backgrounds in social sciences, particularly, see an increasing demand for their knowledge, for instance in data analysis and particularly research design. These research skills can help us understand more thoroughly and quickly the economic, social, environmental, legal and ethical aspects of a disruptive technology.

Using more technology won't guarantee economic sustainability. If we had all the technology we would ever need, would that solve our problems? We know that this is not true.

However, maximising the level of creativity, adaptability, foresight and human understanding associated with the development and use of that technology will have that benefit. Moreover, cognitive and group skills, like communications, reasoning, sharing of experiences, problem solving and leadership, are increasingly being recognized as the keys to business growth and quality of life. And it is not just all about the risks associated with technologies, but opportunities as well. Steve Jobs, founder of Apple, once described himself as living at the intersection of the social sciences and humanities and technology. He knew that the success of an enterprise and of a society itself depends on understanding change to both of these perspectives. Society thrives when its members start to understand how social sciences and humanities and technology work hand in glove to solve some of the world's biggest challenges.

In Canada, geocoded data, social media and open data initiatives are offering access to an abundance of data about various immigration-related topics, including international students, temporary work permit holders, refugee settlement patterns, and so many more. Digital return projects, meanwhile, are aiming to repay trade in Indigenous cultural heritage gathered through postcolonial methods.

But, for all of this synergy between technology and social innovation to work effectively, to help raise society to greater heights and move it past obstacles, the technology needs to be usable and to be used. Social sciences and humanities researchers provide the insight that makes adoption, and in particular the early adoption, possible.

The Social Sciences and Humanities Research Council (SSHRC) just concluded a report summarizing findings from a recent competition where researchers addressed the question: How can emerging technologies be leveraged to benefit Canadians? The findings reveal that while emerging technologies have incredible potential for improving quality of life for Canadians, significant gaps remain when it comes to accessibility, privacy, education and other areas. For example, community-centred development, ownership and management of digital tools and infrastructures can provide indigenous communities with more independent control when technological resources are developed and used for language and cultural revitalisation and other community needs. Identifying the potential opportunities and risks, and working to address them through policy change, regulation and additional research will lead to positive impacts for societies both in Canada and around the world.

And at the heart of this process—in fact, at the heart of innovation itself—is collaboration, particularly multidisciplinary collaboration and at an international level. Society today, as a whole, faces serious international issues associated with climate change, increased migration, inequality, faltering economies, food and water securities, cyber insecurity. The UN predicts that the proportion of the world's population living in cities is expected to grow from 54 to 66 percent, by 2050.

In October 2016, Canada and other countries committed to the UN Urban Agenda, a global standard for building environmentally sustainable prosper cities and centres of cultural and social well-being. The time has come to deliver on this commitment and to address the issues with innovative solutions. International collaboration across disciplines is paramount for meeting the needs of a 21st Century World and for supporting research cooperation across borders. Knowledge mobilisation, open data, open innovation are all vehicles which promote this kind of collaborative innovation.

SSHRC looks to promote collaboration through programming, through funding opportunities like its Partnerships, Partnership development and Engage initiatives. SSHRC also invests considerable efforts in special initiatives, such as the Trans-Atlantic Platform, a collaboration involving 17 key humanities and social science funders from the Americas and Europe. The Trans-Atlantic Platform helps grow networks within the social sciences and the humanities, connect these communities with other disciplines, support research and promote a culture of digital scholarship in social sciences and humanities.

Increasing transatlantic collaboration in social sciences and humanities means broadening the bridges that connect research and removing the barriers that block international research projects from taking place. Enclosing technology is certainly crucial to future economic success, but the true innovation we seek, requiring holistic human efforts, helps individuals and communities use the next big thing to find solutions to global challenges, and help all members of societies realise their potential. After all, we can talk about social innovation, but the fact is that all innovation is social and inherently social endeavour.

CHARLES LEMOINE, Senior Project Analyst, CSA – Canadian Space Agency, Canada, shared an ongoing initiative at CSA, which is intended to increase the amount of innovation that results from CSA space projects.

Space Projects and Open Data as Innovation Drivers

[A short introductory video provided an overview of some of those CSA projects]

Space projects are usually innovative by virtue of their state-of-the-art designs, the novel technologies they involve or the type of benefits they bring to society. Typically, most of the innovation would happen during the design and manufacturing phases of such projects, and to a lesser degree during the operational and post-operational phases. For instance, in the case of an earth observation satellite or a space exploration instrument, once the system is launched and starts operating and generating some data, that data would typically end up in the hands of a limited number of users, whether they be clients or scientists. Another limitation is that space systems are limited in their lifespan due to the harshness of the space environment. As a consequence to those two limitations, the data lifecycle under the classical paradigm for space projects has been somewhat limited in time.

In 2014, the Canadian Government released the Directive on Open Government mandating organizations like CSA to start opening their datasets. The idea was to reach a broader audience with those datasets, in order to foster more innovation through the development of applications, through additional or new services, as input to education, etc. Through the application of this Directive, CSA is extending the data lifecycle after the completion of projects for more downstream innovation.

Open data is defined as structured data that is machine-readable, free and that can be used without restrictions, which includes for commercial use. This becomes even more interesting when considering a Finnish paper which examined 40,000 architectural and engineering firms in 15 countries, from 2000-2007, both in countries that had an open data policy and countries that didn't. That study revealed a correlation between open data and firm growth. It further revealed that: 1) such growth happens within a year of a government switching to an open data philosophy, and 2) this growth is further increased in the second year following that switch. In that sense, it is not surprising that more or less 75 countries are part of the UN Open Government Partnership.

CSA has a dedicated team working on implementing an open data approach and opening CSA's datasets. CSA has about 15 datasets published on the Government's open data portal and more are coming. For instance, CSA has a backlog of previous space missions that the organization has to address. That backlog represents an estimate of 200 potential additional datasets that should eventually end up on that portal.

A few examples of datasets produced from CSA earth observation and space exploration projects, published on that public portal are: RADARSAT-2 – Mosaic of Canada, Far Ultraviolet Spectroscopic Explorer (FUSE) Satellite Data, Alouette-I Data on the ionosphere. There is also a series of applications that were produced from various datasets of Federal Government open datasets on that portal.

During the annual 48-hour Hackathon in 2014, 900 Canadians developed over 100 applications using open data from various Canadian government organizations. Such applications can in turn provide significant value added to a society. For instance, some existing examples include: applications that might help somebody start a new life in Canada by providing access to various services and information, by providing timely secure information to travellers, or by providing a simple interface for Canadians, so they can have a voice into the development of their neighbourhood and also by reporting information about air quality.

CSA is working hard to release more datasets in order to generate more innovation resulting from CSA space projects and to push innovation one step further.

One of the big challenges public agencies face is the change of management practices coming along with opening their data. The moderator wondered how CSA has addressed this issue?

Mr. Lemoine explained that CSA has a change management Centre of excellence which accompanies teams in the planning and execution of various types of changes in the

organization. In the case of open data, consultation rounds and meets were organized by the Open Data team, in order to introduce the Directive (e.g. requirements), address any apprehensions, and explain why opening the data could have very positive impacts. Furthermore, there was executive-level leadership by the CIO to steer the initiative at a strategic level. Moreover, simple tools and checklists have been developed and pilot projects initiated to validate the approach CSA tried to implement. CSA is also updating its project management governance to reflect the need to incorporate open data considerations in the early planning stages of projects, in order to be in a proactive mode rather than in a reactive one.

STEVEN A. MACLAIRD, Senior Vice President, Government & Industry Strategy, OMG – Object Management Group, USA, presented how the OMG is building standards and some of the programmes the organization is associated with.

Object Management Group

The mission of the Object Management Group (OMG) is to develop technology standards that provide real-world value for dozens of vertical industries. OMG is dedicated to bringing together its international membership of end users, vendors, government agencies, universities and research institutions to develop and revise these standards as technologies change throughout the years.

OMG has developed a number of standards. The group considers its standards being a success when users apply them without knowing them. An example is the Common Object Request Broker Architecture (CORBA) standard, defined by OMG in the 80s/90s, which is today widely used.

OMG brings together government, industry and academia to come up with standards. The organization is known for being able to do standards faster than most of the other organizations in the world. OMG is an international community, meeting 4 times a year. OMG also founded the following three organizations:

The Cloud Standards Customer Council (600 members) setting policies and procedures and writing White Papers to help operating the cloud.

The Industrial Internet Consortium deals with the industrial side of the IoT. OMG believes in building test beds before taking a product to market. Together with government, industry and academia solutions are tested to figure out how these solutions work, where the bugs are and to fix those bugs.

The Consortium for IT Software Quality (CISQ) has identified 5 areas in which software has to be measured before it is taken to the cloud.

ARTS (Association for Retail Technology Standards) is a new addition to the OMG group. It was a part of the National Retail Federation, but they handed it over to the OMG. ARTS looks at the international suite of standards to manage commercial retail sells, to reduce time-to-market cost, and develops and implements application standards exclusively to the retail industry around the world. 71 percent of retailers who deployed ARTS standards saved 20 percent or more in development and integration time and cost.

There have been three revolutions: The first being the Industrial Revolution in the 70s. In the 80s and 90s, we turned to the Internet Revolution, and we are now entering the Industrial Internet Revolution. Depending on who you talk to, there is a lot of opportunities and money in that market.

Innovation has impacted most areas of our life. In the 1960s through the 90s and early 2000s, when an airplane came down, we looked at the engine with our eyeballs and went through a checklist to measure jet performance. In 2015, jet performance data is still downloaded by hand but using an USB stick. In 2017, jet performance data is downloaded wirelessly on the fly and we are able, based upon the environment, to change the performance characteristics of that engine to make that plane fly more efficiently. There are a lot of things that we used to do in society and computers can do that for us.

As you go through that cycle of the industrial Internet in terms of intelligence flows, data location and data ownership, you have to look at this not from a national but from a global perspective. This causes the need for standards and raises issues like data residency challenges and how to manage them, architecture and security, what are the best practices and what are the cybersecurity issue you have to deal with. OMG addresses all of these issues.

The global GDP is $70 trillion dollars. OMG has broken it down into developing and advanced economies. The Industrial Internet opportunity amounts to $32.3 trillion dollars representing 46 percent of the GDP today. There are enormous opportunities out there.

To connect industry and Internet innovation through strategies, OMG is looking at decision cycles, and Artificial Intelligence creates that problem. If you divide your sectors in business solutions, marketing, security, technology and test beds and cross it with the different verticals you have to deal with, you have to ask yourself: What are the company desires? What is your strategy and is it the right strategy? What are the security requirements (firewalls, frequency hopping etc.)? What are the key technology drivers? OMG has looked at those and has then identified the top test beds by sector.

OMG defines standards for the future. The group suggests to industry and government to use standard-based requirements to lower their risk so that they can focus on the right areas of concern when they are dealing with the cybersecurity and getting information pass to other people.

The moderator then mentioned the challenge of linking new technology to legacy technology.

Steven A. MacLaird provided the example of an Irish county that took the old technology in their ambulances and tied it to a new technology, the cell phones, by using the Internet capability. When an ambulance shows up to your doorstep, they know someone is been hurt. The 911-operators will ask for the cell phone number of the individual involved. They take that cell phone number, tie it to the individual's medical records and instantaneously know, not only who the individual is, but also his/her entire medical background, including the treating physicians.

JOEL SEMENIUK, Laudato Si' Challenge Mentor; Imaginet Cofounder, Global Microsoft Regional Director, Fresco Capitol Impact Partner, Horizon Three Founder & Executive Director, Canada, discussed how to use technology to make things better.

Horizons of Innovation

According to McKinsey's 3 Horizon Model, there are three different types of innovations:

Horizon 1-type of innovation is optimizing existing products for existing customers. It is a kind of 'keeping the lights on' innovation. However, it is still innovation as innovation is about change for the better.

Horizon 2-type of innovation is expanding from existing business into new-to-the-company business. It is a kind of 'let's try something new, but not too crazy' innovation.

Horizon 3-type of innovation is developing breakthroughs and inventing things for markets that don't exist yet. This is transformational innovation, where the projects are recreating brand-new markets by doing something that the world has never seen before.

Each type of innovations has its place. Horizon 1-type of innovation really does focus on exploiting and expanding existing markets with your existing solutions, but doing this commandingly better over time. Horizon 2 is about adopting new-to-company markets and also new-to-company solutions. They are not world-new solutions, but they are new to the organization. Many people are calling this type of innovation imitation. It is the Horizon 3-type of innovation, which opens brand-new markets with new-to-world solutions.

Most of the existing established organizations do a fairly good job at Horizon 1- or Horizon 2-type of innovation projects. They spend the majority of their time working on Horizon 1 projects, which is good to keep their business alive, and they spend a little bit of time on Horizon 2 projects.

We also know that, if we don't change our business and if we keep on doing the same thing over and over again, we will start to atrophy over time. And this cycle time is getting shorter and shorter. The companies who were doing extraordinary were the ones who are also doing Horizon 3 projects at the same time. They weren't the ones saying 'someday we are going to be innovative' or 'someday we are going to rethink our business'—and 'someday' never came, because they were so caught up meeting the growth target, meeting the revenue target, doing dividends etc. It turns out that this is the most important model that most organizations need to adopt today. How to innovate innovation? There is a pattern to it—and a bit of secret to it as well.

If you think about Horizon 2 and the projects that we are work on there, it is really about turning something new to the organization. This eventually will become part of their core business and we will see a disruption. We also see that eventually the Horizon 3 projects will become mature and transition to Horizon 2 projects. But what we want is a continual wave of this to keep this transition alive, to keep us focussing on continual and incremental change.

This is a recognition to how these existing organizations keep on reinventing themselves. They are doing it before anyone else can. They are disrupting themselves, before someone else can disrupt them. Amazon is a frequently used example in this context: Who would have

thought that, when Amazon started their company, they went from selling books online to doing stores and disrupting the way that people do grocery shopping in the future. This is a recognition that these companies always have this secret project, these secret opportunities that they are exploring to think about how they can disrupt their own business.

However, there is also a big problem. There is this periodic table. And with all that new technology that is being stuck on it all the time, the reality is that we don't know how this all comes together, we don't know how this is going to impact our business. Therefore, we have to think a little bit like scientists, when it comes to looking at how technology impacts our business.

Maybe, we should take this a step further and say that we also need to work like start-ups, in the way we need to think about innovation. Start-ups actually have a mechanism that spurs innovation—it is 'no money and no time', no pressure, no diamonds.

When we think about innovating innovation, we should imagine these innovation ideas being a seed. We have to plant that seed and nurture it properly. Experience has shown that we need to do this in a particular way. First of all, we need to focus on sustainability—not sustainability in general, but human sustainability. Recognizing the fact that innovation is not a technology problem, it is not a process problem, it is a human problem. We need to think about that, and how we have to embrace new forms of working and working together and a brand-new paradigm to stimulate this type of growth within our teams. We need to embrace diversity of all forms, cultural diversity, gender diversity, age diversity, background diversity. There are a plethora of studies showing that the greater the diversity, the greater the impact on innovation in the shortest amount of time. When you work inside a silo, you don't get that diversity.

Especially for Horizon 3-type projects, we also have to embrace that the goal is not outcomes but rapid learning. The goal when experimenting in Horizon 3-type technologies is to learn as fast as possible—which by the way means running experiments, and which also means failure.

We also need to focus on community and collaboration, making sure that these seeds have all the access to the technology they need. And finally, this is not going to happen by accident. Innovation must be curated. You need to be fairly deliberate in terms of how you orchestrate all those types of horizons across your organization, independent of what type of organization you are.

JURGEN VAN DE KEMENADE, Co-Founder, Board Member, & Member Senior Leadership & Strategy Team, NxtVn, the Netherlands, [nxtvn.com], brought the audience back to the foundations of innovation.

The sharing of information and ideas is the basic cornerstone of innovation. For decades the Silk Route stretched from Europe into Asia into India into the Far East and the Middle East. It connected all these people together, basically creating the ecosystem to share ideas, goods, products with each other and therefore creating the basis of innovation—even if innovation was very slow at that period of time. Everybody understood that the Silk Route was important and therefore, people built forts around these routes, they had soldiers and garrisons to protect the Silk Route from any disruption. People understood how important it was for their economy.

Today, the Silk Route is superseded by the Internet. The Internet is basically a bunch of submarine cables, a terrestrial route system, a couple of interfaces, and more importantly, a set of data centres. The Internet thrives and the motor of the Internet are the data centres. However, if we look at the Internet as it is today and especially the submarine cable systems, we don't see any forts, we don't see any soldiers protecting this critical asset. And we know that the world has not become a better or safer place. Shouldn't we look at this critical infrastructure that is driving our innovation globally, that is the heart and the backbone of our existence?

NxtVn has very early on realised that the attention for that digital infrastructure is not recognized in the right way. We should recognize this infrastructure as being a critical infrastructure, i.e., we should protect our new Silk Route the same way as we did it hundreds of years ago.

One of the countries that are at the forefront of this is the U.S.A. The Obama administration issued the Executive Order 13636 on 'Improving Critical Infrastructure Cybersecurity' which recognises digital infrastructure as being critical infrastructure. The Trump Administration then augmented that Executive Order with Executive Order 13800 on 'Strengthening the Cybersecurity of Federal Networks and Critical Infrastructure'. The foundations have been laid for recognising our digital infrastructure as critical infrastructure. Unfortunately, in terms of recognising digital infrastructure as critical, Europe is lagging behind. The Executive Orders are just the basis for further implementation.

The cable landing stations, which are the landfall points of the submarine cable systems, are not very well protected. An example is the cable landing station in Rostock, Germany, which is the heart of the Internet system for the whole of Europe. There is no protection. Somebody could go there, spill some kerosene and put it on fire—and the lights in Europe go off.

Some years ago, there has been a cable cut off the coast of Egypt and the whole of the Middle East and Asia-Pacific was literally in the dark. There was no more exchange of information possible. Things like this happen and it is a very important issue to address.

Data centres are very important. Everybody immediately thinks at the big cloud players, such as Google, Microsoft, Facebook, Amazon and Apple, but data centres are playing a more and more critical role in our daily lives.

At the CES 2016 in Las Vegas, the CEO of Ford announced that Ford was moving from a car

manufacturer to a mobility company and that future cars would run about 65-70 percent on digital components. When being asked how Ford is going to solve the problem that these digital components will run somewhere in a data centre, the CEO answered that Ford's IT department will do that.

No, the IT department will not do that. This infrastructure has to be built. NxtVn is building this infrastructure. The company is building data centre parks based on the following concept: NxtVn is carrier neutral, open access, multi-tenant and the company is a big advocate of net neutrality. This concept enables innovation and guarantees the flow of information.

Another important issue is that these submarine cable systems, which in the past were built by incumbents and carriers, are no longer built by incumbents and carriers. There is no economic drive to do that. So, who is building these systems? It is a consortia of the big cloud players, Google, Microsoft, Facebook and Amazon, that are building these critical infrastructure components. But first and foremost, they build this infrastructure for themselves. So what does that leave for the rest of the world? Shouldn't governments step in and look at these critical infrastructure components, this guarantee of further innovation?

We have to address these issues of protection of critical infrastructure, building of critical infrastructure networks, and in particular the submarine cable systems. It can not be left to a handful of big players that are going to dominate the world. Information flow should be free and guaranteed for everybody.

BERT VAN DEN BERG, Acting Vice President, Research Partnerships, NSERC-Natural Sciences and Engineering Research Council of Canada, Canada, explored the questions around how innovation is evolving.

Innovating Innovation

To put my remarks in context, NSERC is $1.1 billion dollars of funding for research in natural sciences and engineering. $350 million dollars of these funds go to partner grants where researchers work with a company (or sometimes a public organization) to help link research ideas to use. It is a virtuous circle. All funding goes to universities and colleges. I would like to look at some themes related to the evolving nature of innovation, particular as influenced by information technology.

Time was that innovation was very much a cottage industry. People could find a problem, solve the problem and the scope of the solution was local, the impact didn't have the potential to scale. We have seen the industrialisation of the innovation system. Scale has come to innovation, and scale has come to research. There are now large organizations, like the universities and colleges, large companies, like General Electric, through Thomas Edison, that industrialised the process of innovation, captured a lot of the value, exported many more ideas, developed solutions that had a wide scope.

The Internet further has changed that. Social evolution is also an important factor. We now have ideas coming from many places. Skills, and also the needs, are broadened. The challenge facing us is that we still have the industrial innovation system, but we have a broader context, that has many more actors and is somewhat more chaotic.

That is a general theme that is addressed by all sorts of actors. NSERC is used to funding of universities and colleges and trusts the institution who manages the fund. However, when you have actors that are in small or even no organizations, how to fund them? Since interesting ideas or talent are there, how to engage this broader audience? This is a challenge for NSERC and other research funding agencies.

There is also the question of technology versus opportunity. There are a lot of people chasing what is probably a few promising markets. Let's take the example of drones, there are some people that are at the stage of demonstrating interesting ideas on paper, others that are demonstrating them in reality, and others have ongoing production and are trying to conquer the market. From the perspective of resource efficiency this is not an ideal process. You want the variety in order to make sure you get the best idea to put forward, but there really is a large amount of chaos. This emphasises the importance for innovators to strongly understand the opportunity. Innovation policy knows that, but there is also the question about skills.

The key impact of NSERC's funding, and perhaps of other agencies funding, is the talent that is trained, rather than breakthrough innovations. Our resources help realize talent and knowledge that support innovating organizations. With a view to creating more effective talent, how can funding agencies encourage the training of people who have a focus both on the opportunity and the technology? Otherwise people will be inventing perhaps the wrong solution or a solution that already exists. That is an increasing problem and the Internet doesn't necessarily solve that.

An important question that also relates to this is marketplaces. Innovation ecosystems need effective marketplaces for the exchange of ideas and skills and services. Historically Original Equipment Manufacturers (OEMs) in large markets build their own value chains, with from companies that provide various components and systems. The speed of innovation, the convergence of technologies and markets is disrupting this structured approach. Other actors that were peripheral to the value chains are becoming more important to the success of innovators – academic researchers, contract research organizations, single or small firms. The question for innovating organizations that seek to bring products/services to major markets is how to capitalize on these actors. Open innovation is a step towards that, but is still largely owned by the major corporations. It is not a very neutral space yet.

The internet is an important enabler of this interaction, however, we are increasingly seeing interventions of state and private actors in the space, who are not necessarily constructive in their interactions. We are seeing the potential for weaponising various social platforms. This reduces trust and effectiveness of internet-enabled fora.

Another challenge to consider when seeking to "innovate innovation" relates to technical complexity. It (the internet) offers a world of possibilities to us as users, and offers a world of possibilities to innovators. However behind it is a quite a complex and dynamic infrastructure. The required skill set to navigate that, to identify opportunities, to be able to parse what is promising is a significant barrier to innovators.

Beyond the internet, in reaction to the pace of change, there is an increasing drive to not a multi year-credential, but something that is more punctual. For a funding agency, building most of its funding based on multi-year graduates student cycles, micro-crendentials are an

interesting challenge.

One of the characteristics rapid and open innovation is that we end up with incomplete innovation. The cell phone you have emerges to you in one condition. You start adding apps that improves, you start adding histories, you start updating it and, at the end, perhaps it becomes less performing. This is an interesting context. Who owns that problem?

Finally, as a signal of the need to innovate innovation, we have seen the behemoths of industry are struggling to control their markets. How do they mobilise themselves and adopt approaches to compete? And for people, there is the increasing emphasis on data and interaction skills. More and more, there will be an emphasis on these skills, so that the people, whether they are individual or organizations, are more effective in their implementation and use of innovations.

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Q&A

The question of potential measures put in place to evaluate whether the open datasets led to innovation was addressed to **Charles Lemoine**, Canadian Space Agency.

Mr. Lemoine, stated that the Open Data Team at CSA is working on implementing a system enabling this. CSA does no longer just focus on the output of a project, i.e., launching a satellite. Today, the organization is also worrying about what happens after an operation is over. CSA is actually developing a tracking mechanism to track outcomes and to see where the data ended up. But also compiling this in order to see whether or not CSA achieved a broader distribution and created benefits to society through more innovation after the project lifecycle. It will also be a way to tie those post-project benefits to whatever was put in the initial project business case. Using business cases in government or at CSA is something very new. CSA used to do projects because they seemed to be a good idea and because there were technology maps to follow. Today, CSA is focussing on real business needs and is doing business cases. In those business cases CSA has to identify the specific outcomes the organization wants to realise once the project is over. CSA is currently developing a way to track those outcomes.

The session's chair, **Randy Zadra**, National Research Council of Canada, addressed some closing remarks to the audience.

The panellists discussed some of the aspects that could be improved to enable more and better innovation. Innovation really has to be for the users, and the social aspect of what a technology does is usually important. And then, there is a whole bunch of issues, from standards to having the data more open, and more secure and having the Silk Route for the world, not just for a few.

One of the key aspects of innovation is the ability to iterate. You don't always get it right the first time. Big companies are traditionally very bad at doing that. But now most of the large companies around the world are setting up safe incubation labs where people can go in and play. Hopefully this would yield some good results. It is still in the early stages. Before that,

the large labs, like Bell Labs and even Phillips in the Netherlands, until recently were really fenced out and it was all about what is happing inside the corporation. The recognition of the social aspects and users has been elevated because we can create better solutions. And having a safe place to do that and having the ability to change, if necessary, and failing perhaps first, is important. This is why universities are great place to do that. They are safe places to fail and try again.

With including the citizens in very many aspects and the ubiquity of access, even though we do need to secure it, we are going to see faster and more quicker innovation. Thinking about it strategically in terms of a Horizon 3-type of approach definitely helps. At the end of the day, if you are a company and you want to be funded by a venture capital company, you better be at Horizon 3, because they are not interested in a kind of iterative innovation.

Before closing, **Jeremy Millard**, Danish Technological Institute, moderating, wrapped up the session in a few words:

All innovation is social, all innovation is incomplete, failure is good, but you have to fail small and early.

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Intelligent Cities, Regions & Communities

HUGO KERSCHOT, Founder & Managing Director, Is- Practice, Belgium, moderating, opened the session and briefly introduced the panellists.

The session's chair, **JOHN JUNG**, **Chairman & Co-Founder, ICF – Intelligent Community Forum**, USA, set the scene by providing an insight in the Intelligent Community movement and the subtle but important difference between smart communities and intelligent communities.

Developing Intelligent Cities & Regions for Sustainable Growth

The ICF has used the smart city concept over two decades ago and held the first smart cities gathering (Smart '95) 22 years ago in Toronto. Over those years there have been 160 cities qualified as intelligent communities. Winnipeg, for example, is one of the top seven intelligent communities. Many communities have worked very hard to meet the criteria of the Intelligent Community movement.

There are 160 qualified cities all around the world, but there are actually thousands of smart cities. Most of them have been self-identified as smart cities, some of them have basically bought the smart city in a box. They put a little bit of technology in the ground or the air, maybe put some sensors out and they are gathering some data, maybe they have put some of that data together to inform their politicians and their budget chiefs to be able to create very effective budgets, make their smart city a very cost effective and maybe even a very efficient city. But that doesn't make them an intelligent community. In fact, you have to be a smart city to become an intelligent community.

It takes a smart city to become an intelligent community, but there is something missing. ICF, years ago, realised you have to use the technology, you have to enable it to do good things for your community. The smart city is all about creating a city that works—make it efficient, cost-effective, maybe take the data and create really good informed decisions, maybe it is predictive and help your city to become a really good working city, but it doesn't necessarily make it a better city. And this is the essence this session wants to talk about: How to create a better city—not just a city that works better.

The ICF talks about taking it to the next level. You have this fantastic smart infrastructure—what are you doing with it? Creating knowledge work, attracting that human capital, and the hardest thing is to retain it. You better create a really wonderful city for those people who want to stay there and raise families and for those kids to want to stay in that community. That is the biggest challenge that cities have.

We need to look at creating opportunities for jobs and growth; the creation of an ecosystem that allows and encourages innovation and creativity to take place, where you have that opportunity then to be prosperous and share that prosperity with others. This is a key ingredient. People have talked about digital democracy around the world. We stopped talking about digital democracy, we now call it digital inclusion. It has to be an inclusive society that shares and learns how to cooperate and collaborate. We also talk about things related to opportunities for taking that and sharing it with the environment, with people who now how to use it, to develop resiliency plans, and then work with the citizens to become an opportunity for sharing that, but also to receive from those citizens their points of view.

ICF would like to go the next step now and figure out ways how people can begin to share, to create the most liveable cities in the world with limited resources. There are better ways to share limited resources and make it available for people and to enable other cities to learn from each other and to share the solutions. We all have common challenges and if we share those solutions, we might be able to do better with our limited resources.

Some of these are really big issues today: Look at what is happening in Huston, Florida or Puerto Rico. Resiliency plans are very important and when we have the kinds of solutions to common challenges, we need to figure out ways to share those.

There are benefits to sharing. Examples are the cities of Eindhoven, Leuven and Aachen forming a triangle that works together to share the information, but also to share commercial opportunities. You have the same in the Ontario Tech Corridor, where for 15 years the cities of Ottawa, Waterloo and Toronto have gone around the world and promoted foreign direct investment and have used very limited resources to their better ends. Right now, across Canada there are 11 cities, including Winnipeg, that work to attract foreign direct investment and they share the resources to be able to do that.

CATHERINE WARREN, President & Board Director, Centre for Digital Media; Founder & President, FanTrust, Canada, delivered a captivating presentation of a fascinating city.

Vancouver:
From Entertainment to Place Making

Vancouver is a young city. A city built on unseeded First Nations land, build around a resource economy of fish, of forests and of precious metals, at the end of a railway line, between mountains and the Pacific Ocean. Vancouver is a place were you can snowboard and scuba dive in the same day, where black bears still roam in your yards and where you can see whales from the downtown office towers.

In terms of identity, Vancouverites are attached to their identity as a progressive city, the home of Greenpeace, the birthplace of the Occupy movement, and as inclusive—inclusive, welcoming to people from all over the world. From these two pillars of their identity, the progressive and the inclusive, Vancouverites have also built a digital media capital. From its ranking among the world's most liveable cities to its top universities and the relative freedoms, the city has become a draw for innovators and collaborators. Not only is it critical to retain this talent, but it is time to transform this city that has brought people together: from the virtual world of entertainment and media technologies to the real world, towards a more ideal world in the years to come—from virtual to real to ideal.

Digital change in not easy. Without a progressive mindset and without diversity of people and ideas and cultures, digital change is not something that you make, it is something that happens to you. Vancouver is a digital home for entertainment, the shiny front-end of digital media, from video games to youtube networks, from movies to virtual reality. Vancouver is ranked as the number one cluster for visual effects and for animation and among the top for game development. Vancouverites have taken something profound, their values as citizens and the spirit of the city and turned it into something fancy: entertainment for the world. But now it is time to go to the next level and to turn the digital media skills back on Vancouver and ask: how to use digital media for place making?

The Centre for Digital Media has just been celebrating its 10th anniversary. Over the years, the Centre for Digital Media has transformed an underdeveloped industrial area in Vancouver into a thriving digital hub. Today, more than 5,000 people live, work and study within the Centre for Digital Media, which includes game studios, start-ups, art galleries, housing and a digital media graduate programme.

This year's students, fifty-fifty men and women, come from 20 countries. Vancouver's Centre for Digital Media is also home to a new virtual reality lab which was launched by indigenous women entrepreneurs. In many aboriginal communities the matriarchs are the knowledge holders, the are the cultural leaders and the storytellers, part of a continuum of thousands of generations of people who bring the story. So, it only makes sense that indigenous women take to virtual reality and this VR lab's goal is to serve First Nations by contributing to healthy and productive societies using technology and indigenous contexts and building new tools for aboriginal people. They have also done something interesting by producing VR experiences for indigenous tourism to represent Canada through a female First Nations lens. This is digital leading real world change.

Elsewhere in Vancouver award-winning documentary filmmakers are using an iconic bridge as a massive overhead screen to project the migration of Pacific salmon. Nightly, audiences can witness this silver sockeye as it turns to crimson and return to their fresh water birthplace to spawn. This is a natural cycle that nourishes the land, the animals, the water and the people, but which faces growing threats from human intervention. And when you get to see something that normally is hidden underwater and is now displayed skywards, larger than live, it gives you a new frame of reference for understanding nature's vulnerability, our fellow creatures and our place in the world. This is digital media for biophilia.

The company GSM, neighbour of the Centre for Digital Media, has scanned Vancouver from the air and ground to produce the most detailed 3D city model ever created. These kinds of interactive 3D experiences and graphical landscapes give urban planners a new way to detail possible futures. When you are immersed in the immediate and the critical impact of rising sea levels, you can better imagine ways to shake up the status quo and to build for sustainability. It is not the data that has the power to transform, it is the visualisation and the reaction. This is digital media for change making.

Of course, Vancouver also faces criticism. It is an expensive city, a city where neighbourhoods are empty because owners live elsewhere. So, how to make sure to create a district that is vibrant around the clock with student housing, tech hubs and pubs, that is workable and welcoming? This is something the graduate students of the Centre for Digital Media want to help answer. Working with the Center's real estate development partner PCI,

they created an app that lets urban planners task these mixed-use activities for a growing campus. There are drag and drop icons, such as arts & culture, retail, light industrial, and users can mix and match the use with time in order to build a district of light and of life and of action. This is digital media for community building.

Ultimately, one could say that Vancouver is going through a classic digital business evolution, moving from a content service model to original intellectual property. While Vancouver succeeded in packaging digital entertainment for global audiences, Vancouverites are now also making digital things to shape their own place in the world.

WAYNE KELLY, RPLC Project Coordinator, Brandon University, Canada, addressed the issue of rural Canada to give a sense what digital rural looks like.

Understanding digital rural

Sometime in the future, we might talk about smart rural and intelligent rural. Right now, we are still before that. We are still trying to figure out what does it mean to address things like digital divide or digital inclusion in the rural context. There is a lot of academic literature on developing countries, but there is not very much literature on digital rural in developed countries or OECD countries.

One of the things we have to understand is that rural is diverse and it is essential to Canada. One of the preconceptions is that rural is dying. There are parts of rural Canada that are definitely declining, but overall rural Canada is growing. It is growing 1-2 percent per year—less than the 5 percent that urban centres are growing—but rural is definitely thriving in a lot of places, especially within 100 kilometres of cities. One of the challenges for rural communities in Canada, and elsewhere in the developed world, is that, when rural communities do really well, they actually grow so much they become cities. Thus, the successful rural becomes urban. Supporting the remaining rural areas is an ongoing challenge.

In Canada rural is like the ATM for urban centres. Just think about power, food, water or even things like tourism or camping. Those are all located in rural areas and all enjoyed by urban residents. That is something we need to consider in terms of how important rural is to us as a society. How important is it that we make sure that they are included and that we do address the digital divide?

Another aspect is that rural is diverse. This is the case across the world. There are many different types of rural. Just compare Hamiota in Western Manitoba, Churchill on the west shore of Hudson Bay and Clear Lake Beach with its sandy beaches—all very different rural areas in Manitoba.

One of the challenges in rural is that you do have these great examples of innovation right next door to struggling with very basic infrastructure, not even being able to access emails. And it is not just the infrastructure, it is also the skills. These are things that we need to address in rural communities. In terms of digital inclusion and the people, we need both in rural areas, the infrastructure and the people to keep up.

Hamiota is another example of innovation. They have decided to take upon themselves. A town of 1,225 people invested in their own fibre broadband because the market forces weren't delivering good enough quality infrastructure to their small community. This is part of their economic development strategy. Hamiota had to go out and create their own secret source so that they can be included in our digital economy.

Where do we go from here? In a couple of years we will talk about intelligent rural. One of the things we have to do is to invest now. And we have to support the local solutions. Just like there are different cities, Vancouver is not like Winnipeg is not like Ghent, Hamiota is not like Churchill is not like an East Coast fishing village. There is many different rural, they all have different digital states right now, and they all have different ways that digital technologies will help them meet their goals. Support and intervention in terms of providing infrastructure and training needs to be driven from the ground up and needs to work with these communities and with these rural regions.

The Brandon University is doing some research in understanding how rural communities are using broadband and digital technologies. They developed a framework to understand both the infrastructure access, skills and use compared to how rural communities actually are using it to promote different parts of their community.

ROB MCCANN, Founder and President of Clearcable Networks; Owner & Operator, Hamilton Technology Centre, Canada, presented Hamilton's journey towards an intelligent community.

Hamilton – ICF Smart21 2016

Hamilton has a population of about 500,000 inhabitants living in the shadow of Canada's largest city, Toronto. Hamilton is an ICF Smart21 recognised community. It is one of Canada's 32 intelligent communities, but they are not without challenges. On the good side, Hamilton is a multi-modal facility and is located in a great place in the province to be able to reach many people with airplanes, trains, boats, and highways. Because of that apex, it was historically a place of great manufacturing and steel making. But in the 80s and 90s, as that began to diminish, the city fell into disrepair and much of the infrastructure, everything from the water, the roads, and the urban planning became aged, tired, and in need of refresh.

It wasn't until about 10 years ago that a grassroots' movement started to turn this city around. Because there was ample empty space and low rent space available, artists started to show up. They created galleries and areas where people gathered and began to form communities and work with each other. That attracted local investors—people who lived in the city, who believed in the city, and started to make investments in the community. Now, Hamilton is on a journey from being a traditional manufacturing economy to a digital economy.

But in doing that, people realised that there were some significant gaps and the biggest gap is the availability of broadband. While it is difficult to get broadband in rural cities, it is also sometimes difficult to have the substantial infrastructure that is necessary to be able to run all of the IoT-type applications, in a city of relatively large size like Hamilton.

Broadband is the start of the Intelligent Community cycle because with broadband one can get the knowledge workforce and innovation, quality and sustainability. Without broadband Hamilton wouldn't be able to become that digital community. In order to address that, the Mayor, Fred Eisenberger, actively took a role in creating the Mayor's Intelligent Community Task Force that would look at all facets of the City and fill in the gaps. There was a conscious effort to build innovation parks, the local university McMaster Innovation Park, and the international Fraunhofer Institute, as well as two more local and smaller scale innovation hubs, the Innovation Factory and the Hamilton Technology Centre.

The Mayor managed to bring all of these actors together in order to build the 'digital plumbing', i.e., to figure out how to connect all of these things and places together. It turned out that Hamilton is very blessed with several service providers: the largest service provider in the country, Rogers Cable, services the area as well as the number 5 cable operator Cogeco Cable, the largest telephone company Bell Canada and several other local start-up ISPs—all building infrastructure.

In order to figure that out, Hamilton had to engage the local university to study the existing networks and to get an inventory. Once it was known where the networks were, Hamilton was able to figure out where the networks were not. The city was also able to get the service providers to work together on a common infrastructure in order to derisk them and help encourage them to build in those places that they didn't want to build because the return wasn't high enough. Hamilton also established a municipality owned telecom that can fill in the gaps that couldn't simply get elsewhere.

Out of that lesson, the city has learned a few things that are important to take away for other cities: First, it is important to measure broadband deployment and address gaps. Once you managed to figure out where the gaps are, you want to start building, but in order to build you have to devise better municipal policies, processes, and work flows to support the deployment of broadband. In a city like Hamilton, with so many service providers, there are an increasing number of building permit requests coming into the city—such that the administration can't handle the requests to actually get more fibre or assets built into the ground. Building that work-flow is important. But also being able to have civil infrastructure standards that are friendly to would-be investors, entrepreneurs and service providers. It is very tricky if you are creating a set of rules that make it difficult for networks to be built. It is also important to work on inter-governmental and regional networks of people and technology. For Hamilton, it was very successful not only to work on a municipal level but also the provincial and the federal level. But then also to look to the neighbours, the surrounding cities and towns, to be able to connect each other together, not just technology-wise but people-wise. The business community was a really great resource to help build that broadband network. Also, it is important to promote both public infrastructure and direct competition. A great way to do that is to have a network that is established and open, allowing any other service providers to take access from that network and deliver services to end customers. And finally, leverage the educational institutions that are nearby.

Today, Hamilton is on a path to grow. In this year alone, there has been more than $1 billion dollars in new building permits and we expect the population to continue to increase.

SEHL MELLOULI, Full Professor, Department of Information System, University of Laval, Canada, shared some most interesting research results of the University of Laval in Quebec City.

From Intelligent Cities to Intelligent Communities

How we can go from intelligent cities to intelligent communities? Developed in 2012, the Smart Cities Integrative Framework is the result of a research project that was funded by the Social Sciences and Humanities Research Council of Canada with the participation of different cities around the world (Quebec, New York, Philadelphia, Seattle, Mexico City, Shanghai and Macao). The underlying question was: What is a smart city? The project partners met with officials of the participating cities to understand their perception of a smart city and to come up with this framework.

One aspect of this Smart Cities Integrative Framework is of particular interest: people and communities. We need to have people at the heart of a smart city. The question is how to make people and communities build or to contribute to a smart city? One of the issues behind people and communities is how to build an interaction between citizens and decision makers? This leads us to the concept of electronic citizen participation, which is not a new concept at all. How to use technology to leverage interaction between citizen and decision makers?

In 2013, Quebec City decided to change the garbage collection schedule. Instead of collecting the garbage once a week, the city decided to pick it up once in 2 weeks. As the citizens opposed this plan, the mayor posted a video on the city's Facebook page. There were about 600 messages from citizens reacting to the post.

The messages then have been collected by the university. As the City Government wasn't able to analyse this data, this was done by the university. This analysis revealed that it is not possible for Quebec City to apply one unique model for garbage collection to the entire city. There are disparities and concerns depending on the parts of the city people resides. The situation is different for the citizens living 10 km away from downtown and those living in the downtown, due to the architecture, due to streets, tourist centres etc.

At the end, the mayor decided to come back to the 'once a week' model and the citizens were calmed. However, this wasn't really the right decision. It was a good decision because the citizens do no complain, but it was not the optimum decision to take.

The challenge is still to find means to bring this data to decision makers. How to build new tools to inform decision makers about what people are saying?

The idea behind two different papers elaborated with PhD students at the University of Laval, was to better understand a citizens participation process, based on a literature review, in order to come up with a decision making process. However, in a first step one needs to engage people and needs to understand what people are saying.

With this regard, 3 research projects were carried out at the University of Laval:

The first one was funded by the Canadian Internet Registration Authority (CIRA) in the last year. The project wars realised in cooperation with votepour.ca, an NGO in Quebec City. votepour.ca is a platform where citizens can express themselves on different issues in the city. One of the discussed issues concerned the rebuilding of a public place in Quebec City and about 1,000 messages from citizens expressing their opinion have been collected. In order to analyse what people were saying and provide decision makers with this information rapidly, the University of Laval used existing natural language processing techniques, by adding some fresh ideas from the students. The outcome of the analyse showed that social reasons were most important for the citizens, followed by cultural and urbanism reasons, safety, economic and civic reasons. The success rate was about 85 percent and this research work has recently been accepted for publication.

The second project concerned the issue of Sustainable Development Goals and was about helping cities to learn from what people are saying in the Twittersphere. This is a huge amount of data and between March to June 2017 200,000 tweets on Sustainable Development Goals have been analysed chronologically. One interesting outcome is that the matters change each month. The research team is currently writing a research paper and investigating on more data to understand the reason for these changes from month to month.

The third project concerned a Tunisian Facebook page managed by the NGO Winou Etrottoir. It is about all the issues cities are facing. 96,000 people are posting images, videos and texts. The project started identifying what people were taking about and their main topics and issues of concern.

The next step in this research will be the creation of visualization tools as argument tools by integrating geo-location data and the contextualisation of data. A paper about the context in citizen participation has been submitted to ICeGOV2018. How to identify the context and how the context can help better understand what citizens are saying? Another work in this context is the creation of a common language to which all participants, technical and non-technical, can relate.

The Smart Cities and Smart Governments Research-Practice Consortium is a robust global research community that focuses on innovations in technology, management and policy that change the fabric of the world's cities. Through purposeful networking and connected research, the Consortium members come together to share ideas, new knowledge, and research and practice innovations in the interest of increasing opportunity for all those who live in and work in these cities. The SCSGRP Consortium is based at the Center for Technology in Government, University at Albany, State University of New York.

KARL-FILIP COENEGRACHTS, Chief Strategy Officer, City of Gent; President of the Executive Committee of Eurocities, Belgium, presented a 'city of people' where citizens, businesses and knowledge institutions together with the city administration are acting as city makers to co-create their smart city of the future.

Smart (wise) City of People

Ghent is a smart city considering itself as a 'city of people'. Ghent is an old city, founded in the 9th century. It is also a very dense city which in the 14th century was the second largest city in Western Europe after Paris. There is a lot of history in the city, and a lot of infrastructure that dates from this medieval period.

Ghent is a 'pocket sized metropolis', combining the intimacy of a small city with the openness of a metropolis. The city has 258,119 inhabitants (600,000 inhabitants in metropolitan area), and brings together 161 different nationalities. With 74,500 students studying at Ghent's universities and schools of higher education, Ghent is also a young city.

The first city was founded 10,000 years ago in the Middle East. The city is the default in human society—the default of humans living together. City-states existed even before empires or nation-states. Today, more than 50 percent of the human population is living in cities. However, this is not really true: If you look at Belgium, for instance, 97 percent of the country is urbanised. We speak about urban regions. If you would ask 97 percent of the people living in Belgium if they live in cities, over 50 percent would say 'no' because they are living in a rural area. Urban regions and urban populations are not equal with people living in cities.

There is a multitude of definitions of smart cities and various concepts. However, there is no one-size-fits-all definition. Ghent is not Hamilton or Antwerp or Brussels or New York.

The City of Ghent considers itself as being in a constant beta version. The city reinvents itself in different stages of its life. It actually reinvents itself each day, because there are a lot of societal changes and of what people want. In consequence, the city has to reinvent itself constantly.

'Smart city' means that we need solutions for complex problems of today and tomorrow with (un)explored possibilities of new technology over existing infrastructure.

Robert Moses built New York as it is today. He was the man who had the top-down vision and is actually the father of the plans for most North American cities. However, a lot of infrastructure and a lot of buildings, but something is missing.

As Jane Jacobs, an American-Canadian urban visionary, put it: 'Cities have the capability of providing something for everybody, only because, and only when, they are created by everybody'. This idea of Jane Jacobs is the idea applied in Ghent.

For the City of Ghent, the most important building block of the city of the future, or a smart city, is the smart citizen. Ghent created a very simple recipe for the city of the future, containing the following 4 ingredients:

The first one is to create a strategy, not a smart city strategy, but one single strategy based

on the future of the city. And this future needs to be defined. This is what has been done in Ghent: Ghent created a mission with regard to how the city would like to see itself evolve over the next 30-40 years—even if this vision will adapt due to societal changes.

This long-term vision has been translated into nine local priorities for the legislative period of 6 years. And most importantly, it is not a top-down government strategy. Ghent co-created this strategy, not only with the citizens but also with entrepreneurs, civil society, professional organizations etc.

Data and technology are two further ingredients of the city of the future. When Ghent started its first real smart city projects, the city looked at the technology as being the goal. But very soon they realised that there might be no use for all that in Ghent. Hence, the city government turned it around and looked at it from a citizen's perspective: What are their objectives? What are the problems to be tackled in the city? What do people want?

Citadel on the Move was one of the first EU open data projects. For Ghent it was all about demystifying the concept of open data. What is open data for people, for citizens? How can they work with that and use it in their daily life? In 2010, Ghent held its first Hackathon and had its first open data portal, always focussing on how to use the data available together with the citizens, entrepreneurs etc.

Data is a very important concept in the city of the future. Data is the basis for wisdom. Wisdom is on top of the data pyramid. Without a good combination of qualitative data to get information and a combination of information to acquire knowledge, which requires a human being, it is not possible to create a vision.

Ghent has realised its first IoT projects even before the term IoT was being used. Flanders is a very dense region, comprising the cities of Antwerp, Brussels and Ghent. When looking at an IoT-map of Flanders (showing the IoT devices, the sensors, the cameras etc.), one can see a difference between the cities: There are very little IoT devices in Ghent. For the most part, we don't know who is capturing all the data with these devices, nor what is being done with it, nor how it is being used.

Ghent is very concerned about how all this data is going to be used. The city adopted the idea of the MyData concept. The Scandinavian MyData concept is the ability to allow one to take control of their data, make it open to be used when they want to. It gives control of the data back to the owners of the data.

Data is the basis for decision making. Ghent also uses Unity game engines with its 3D open data model to play games with politicians, with entrepreneurs, with citizens, and to encourage them to take decisions.

For instance, a 3D game has been proposed in order to see what would be the best place to plant terraces on a square. This has been done together with the restaurant owners on the square. And it worked. They did it themselves with the city administrations and even citizens.

This small project evolved into a very big '3D-Citygame Ghent', which was launched a couple of weeks ago within the city's open 3D city model. Everybody can add games that form the basis for decision making on one hand and fun on the other hand. Even kids are making their own 3D SketchUp and integrate them in this 3D model. It is really a city-wide 3D open game.

Another question the city addresses is what to do with all the big data? Big data is also something that can be used in decision making. Ghent is part of the PoliVisu project, which has the goal to improve the traditional public policy making cycle through the use of big data.

Technology should not always be high-tech. In 2013, the citizens of Ghent have been asked what they consider as a smart project for Ghent. They came up with urban agriculture, a sharing website of tools and all other kinds of fine projects. It is not about technology for people, it is about what can be done with this technology and the objectives of that technology.

The fourth ingredient of the recipe is working together. Ghent has left the Triple Helix innovation model and even the Quadruple Helix innovation model. The city is working with a Quadruple Helix city making model. Government, academics, industries and citizens need to work together in order to permanently co-create the vision, the city-making, and to realise the objectives of the city's strategy. It is very important that the citizen is not a user in this model, but an actor.

What is the role of the government? The role of the governments differs everywhere all over the world. In Europe, governments, and especially local governments, are rather strong levels of government. It is their goal to consolidate the vision of the future of the city, to facilitate the eco-system, i.e., to bring together all the actors of the Quadruple Helix, and to connect the dots.

The city of Ghent is using a concept that is based on living lab methodology lab to tackle societal challenges that are local priorities—they made a 'societal challenges city making lab' out of it.

HUGO KERSCHOT, Founder & Managing Director, Is- Practice, Belgium, put emphasis on the infrastructure of a smart city and briefly introduced two EU research projects.

bIoTope, IoT open innovation ecosystem for connected smart objects

The recently completed project Open Transport Net (OTN) turns open geospatial data into insights and easy-to-read, visually appealing maps. Meanwhile, a small company has been created to continue working on the results.

Among the advanced visualisations which have been developed within OTN is an advanced heatmap tool to analyse and generate insights from big data. For example, a dataset of more than 30,000 accidents in the Birmingham area visualised in a heatmap form. The same has been realised for Belgium.

It is possible to put an extra layer on that map, for instance white dots indicating schools, in order to identify hotspots next to schools. Such picture speaks a hundred times more than the 100 pages of reports and statistics that our politicians usually receive.

The Belgium Federal Police published traffic accidents with the tool developed within the OTN project, and all of a sudden people in Ghent started discussing a certain number of crossroads characterized by a difficult traffic situation.

The same has been done, even a bit more complicated, in Pilsen in the Czech Republic. What the City of Pilzen did was based on their static traffic model. Citizens can use a time slider to see how the traffic evolves throughout the day.

A lot of those intelligent objects in the cities, such as counting of traffic, traffic light controls etc. are all closed legacy embedded systems. The next step in Pilsen is to integrate the real traffic data in this kind of visualisation, so that the traffic is not only based on a mathematical model but on real-time data. The next step then will be to use it in any smart city environment.

Two years ago, the prestige object of smart cities was to have smart lighting. However, this generally remained a siloed system instead of being an integral part of the city's overall smart infrastructure.

The objective of the bIoTope project is to create a system-of-systems and to create a new standard. Thus, bIoTope will provide a platform that enables companies to easily create new IoT systems and to rapidly harness available information using advanced systems-of-systems capabilities for connected smart objects—with minimal investment.

Full advantage is taken of recent IoT standards, notably the O-MI (Open Messaging Interface) and O-DF (Open Data Format) standards, while an 'Everything as a Service' design enables rapid development of new IoT systems and reduced development costs. The Aalto University of Helsinki is working with the Open Group on these two standards that claim to create for the IoT an equivalent to the HTTP concept which created the worldwide web during the last decades.

The use of an open messaging interface and an open data format shall overcome all the silos of the cloud platforms and incumbent systems. To a certain extend, it will be the glue between the communication protocols and another very important element in the real integration of the smart city, which is the semantics of our vocabulary.

With BMW being one of the bIoTope project partners, the project would like to enable communication between cars and the city. Once a car enters a city, it communicates with the city infrastructure. For instance, the car knows where the parking places are, where the parking places for disabled persons are, where the traffic jams are etc. The car is communicating with the city.

This should be the real smart city of tomorrow. Leaving aside all the human aspects, there is still a lot of 'digital plumbing' to do in the infrastructure concept in order to enable all these objects to communicate with each other.

ALAN SHARK, Executive Director & CEO, PTI – Public Technology Institute, USA, delivered a great talk on the evolution of AI, robots and smarter communities.

Beyond Intelligent & Smart Technology: It's Still About People

In terms of elements of what a smart community is, cities, counties or townships are like cakes: Every cake is different and everyone has different ingredients, but some of the basic elements are similar.

The Public Technology Institute has defined the following 9 smart city factors: Smart transportation, smarter digital infrastructure (digitization), citizen engagement and digital citizen services, smart and big data, data visualisation, public safety, healthcare services, leadership, vision and citizen satisfaction as measured (i.e., what good is all this unless we have the citizens being aware and proud of being part of this?).

The Intelligent Community Forum took a different approach as they use the word 'intelligent' as opposed to 'smart'. ICF defines the following set of intelligent community indicators: Broadband, knowledge workforce, innovation, digital inclusion, and advocacy. However, they are very similar to the ones defined by PTI.

The world 'smart' might no longer be appropriate, because 'smart' implies stagnation.

Today, we are looking at something that is a little alarming in the context of people: it is the future of work. The rise of machines and robots. The idea of disruption. According to statistics, robots will take 50 percent of our jobs by 2050, and outperform humans at almost anything. That is scary and has all sorts of challenges for societies that are striving to build these smart or intelligent communities. How are they going to pay for this when there are less people working and paying taxes? How to make people happy and how to define self-worth that is today tied to what we wear, where we work and the titles on our business cards?

It is worth looking at the website willrobotstakemyjob.com: With a probability of automation of 1.5 percent, chief executives come out pretty well. They are, from a robot's point of view, totally safe. But what about janitorial staff? In this case, there is a 66 percent automation risk, except maids and housecleaning. Robots are watching.

It is amazing to see how humans and robots, little cars with wheels that go up and expand to pick something of a shelf, coexist together in the Amazon facilities. A lot of people think of robots as human-like. Humans are so self-centric. We are the species who believed that the entire universe evolved around us, not the sun. We also believed the world is flat. Humans have a very limited horizon and our history is rather poor when we put things in perspective. And we have occupied this planet for a very short amount of time.

Robots won't get away. They are already here: Robots are greeters in public buildings; they are policing (predictive crime analytics); bomb detection robots that are going where no men would go; there are all sorts of IoE monitoring devices; video surveillance monitoring systems; anticipatory engagement; there is voice interaction (Siri, Cortana, Alexa and further to come); chatbots and others.

We have confused two things that are very interrelated: We have confused Artificial Intelligence with robotics. But they do go arm in arm in some cases. When we look at where we are, we are at the infancy of AI. If you look at the learning curve of where AI may be taking us, this might be frightful.

Right now we are masters in AI, of cognitive learning. We are just absorbing every bit of data base information that we can, and we can interpret some of this data. The question then becomes: Where do we go from here? And the answer is, ultimately, machine learning is taking us to another hide—and the hide is artificial consciousness. This is a new territory where machines can have machine consciousness, i.e., they are writing their own programmes to solve problems. They are already writing their own languages.

At some point in time, they are going to get impatient with us, because they don't need holidays, they don't have to join a union, they don't take week-ends off and humans are terrible sometimes in making decisions. As we programme our imperfections into all this language and reasoning, it is just a matter of time when machines are getting impatient.

When looking at all of this: Do public managers have the necessary skills to manage what we are, especially when it comes to making these smart or intelligent communities? Do we have the leadership to govern beyond 'silos of enlightenment'? Do we have the vision to see beyond the current departmental and agency structure? Do we have the legal authority to make meaningful transitions and changes? Do we possess high emotional intelligence? Integrates technology/people requirements and needs? Do we have the willingness to take risks?

There is a technology development gap which is in the professions. When it comes to colleges and universities, they do lack practical focus and they rely too much on theoretical research and old case studies. And there is too little focus on contemporary leadership – especially technology leadership. Of course, research by nature is to look at what is and to quantify and calculate—and there is an absolute role for that. The professional development programmes too much focus on topics and silos and lack a 'big picture focus'.

We have to come up with better ways of certification. We don't want to necessarily just certify our cities and our counties, we want to be able to certify people to keep up. That is why PTI has come up with a lot of certifications on technology leadership, digital service delivery, recognizing the individuals who go on to be the practitioners and help is us in this new brave world.

In the end it is all about safety, well-being, digital and human connectedness. We will see who wins.

MICHAEL LEGARY, Chief Innovation Officer, City of Winnipeg, Canada, provided a snapshot of what the city of Winnipeg has undertaken to become an intelligent community.

Intelligent Community - Culture Enablement

There are numerous things we need to do in our communities. It is not just technology, it is not just people. It is the integration of both. It comes down to the systemisation of it. It is things like resiliency, city capacity and planning and management, using public engagement to formalise those requirements the citizens are giving us. But also using data to remove the emotion. It is systems.

The Open Group does data standards but also enterprise architecture standards. What comes down to the fluff of what innovation and what smart cities have been for the last 15-30 years. It is becoming more refined, to a point where we can have certifications, where we can have designations, where we can have academic research applied in very specific ways.

A CIO of Winnipeg has to take all the smart sensors and get them in the ground and in the air and integrate them. However, the city is collaborating with partners to do this. The problem of putting sensors in the ground is to get the radio waves and other types of frequencies down there. Winnipeg has a partnership with a local set of community members, business and non-profit, to come up with some composite-based manhole covers to get those signals into the sewers for a reasonable price. It is not about taking academic research and applying it and spending million of dollars for doing this. It is about building these local innovations quickly and efficiently.

Innovation drives the economic development of the city and the city has to have a community to do that with. Winnipeg developed high skilled communities. There is this concept of ideas (inspiration, development, enablement, access, sustainment). Capacity should not just be built within the municipality or within the province or state or in the country, we need to build this community where inspiration is around us. Develop communities of interest within the municipalities, within the provinces to make sure that everybody is working together. We can't have an urban location that is desirable without the right world complements to it. It is that balance that we need to have. Enablement, it is community enablement but also the decision-making engagement to create opportunities for ideas to grow. Access needs to happen not just locally but truly globally, to identify and foster great ideas to success. And, last but not least, sustainment, to provide iterative learning processes and improving business models. How we look at intelligent communities, using smart systems, the way we enhance our decision making, our planning and implementation processes inside our businesses and communities, it is all to enable sustainment to grow this over time.

The Innovation Alley in Winnipeg's West Exchange District is where the city took those concepts and applied it. What came out of it is a community that has gone from an empty warehouse to a community of innovators, entrepreneurs and artists. Tons of different small and medium businesses started to shape into a culture of innovation. Winnipeg has created a whole number of outputs from this maker space that was created. It is formed into an innovation hub, not just for Winnipeg but for the province. There were thousands of outcomes, be it technically or from a corporate development perspective and new revenues. The economy and the relationship are key. Private industries have been doing it and the community was being challenged to engage itself.

In terms of getting intelligent communities up and running, some of Winnipeg's lessons learnt: Access to capital and access to customers. Winnipeg is about 6 hours away from any larger population, so access to customers means something entirely different than, for instance, for the city of Ghent. Winnipeggers have to fly to other geographical locations. Physically, if they want to meet with someone, the cost is quite high. At the same time, isolation made Winnipeggers exceptional at online businesses. They know very well how to integrate with those remote communities via the Internet, because for most of them this is the only way to scale. Learning from that lesson, the city has been trying to take those lessons learnt through the community, through education, link them to how to create growth in the medium enterprises and the larger community, and dealing with everything with an economic development lens.

The intelligent community really understands what citizen prosperity is and economic prosperity is. The argument that Winnipeg has applied locally regarding economic development is just like any good business: if cash flow is good, you can invest in innovation, you can invest in your employees, and you can invest and grow. In urban planning, making sure that you have the right economic development focus allows you the opportunities to not just innovate internally but engage as communities in an inspiring way. At the end, it comes down to this 'idea' concept.

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Q&A

The first question addressed the issue of investments required to build the necessary infrastructure.

Rob McCann, Hamilton Technology Centre, explained that from the Hamilton experience, the city itself didn't have to make the investments in the technology or the infrastructure. Hamilton discovered that, by getting all of the stakeholders together, the institutions, the citizens, the business community, much of it was already happening, but it was happening in isolation. And by bringing them together, it was possible to connect those bits and pieces. It is really about the human capital, the investment from the city perspective of getting everyone in the room at the same time.

The next question concerned the policies and challenges related to climate change and the impact on the environment in the context of intelligent communities.

Michael Legary, City of Winnipeg, emphasised that as municipality, a lot of those challenges, the policies and the decision-making regarding those policies, exist at different level governments—federal, provincial, state or international. In the last 2 years, Winnipeg has gone from this smart city to an intelligent city. The city is understanding those high level problems and, especially in Manitoba, this engagement, provincially, regarding if we do not look at the carbon footprint tax, how it triggers issues at the local level regarding where do the employment and manufacturing lands exist in the city of Winnipeg? How to change the transportation roads to make sure the supply chain for diesel trucks are shorter? It requires those layers of government and thinking. Winnipeg is just becoming self-aware to this multi-disciplinary challenge the city is facing.

Karl-Filip Coenegrachts, City of Ghent, added that this is actually the basis of Ghent's strategy. The 9 priorities presented earlier are on climate change, mobility, security etc. These 9 priorities are underpinned by a lot of data and indicators that have been collected over the last 20 years, with projections on the future, on a 10, 20 and even 40-year basis. On climate change, for instance, the city made 12 models of different scenarios on how to evolve within the city in order to avoid the most drastic effects of climate change. Being a 'low country', Belgium is at danger of flooding within the next 10 years. Those 12 scenarios have been developed, a choice has been made, and climate lines have been created, together with the urban stakeholders, to tackle the effects of that scenario. In terms of mobility for instance, the centre of Ghent is car free. A new circulation, mobility and parking plan has been implemented this year. This was very courageous, because one of the basic principles was to ban the car out of the city. One could think that a lot of people in the city would oppose that because they could no longer reach their jobs, stores etc., but it was the result of a very long process where the city worked with all the urban stakeholders in order to get the best possible multi-modal solutions in terms of mobility. This was very interesting, because you are not only working on the direct modes of transportation, you are also working on everything that goes with it, such as tele-working, making people aware of health issues etc.

Alan Shark, PTI, stressed that these things are happening, they are just not happening fast enough. The bigger challenge is that the training and development of the infrastructure folks aren't there. We are still in a siloed mode with our cities and counties. We need to get more interdisciplinary kind of training and development so that people can see the bigger picture. That is the exciting promise of intelligent and smarter cities. It is having this new consciousness of 'how we manage' and 'how we govern'. We need the ability to sit above these silos.

The last question addressed to Michael Legary, Winnipeg, was how to measure the effectiveness what has been done?

Michael Legary, City of Winnipeg, explained that from a matrix standpoint, Winnipeg is using the performance measurement framework TOGAF, the Open Group Architecture Framework. This framework for enterprise architecture has some KPI layering techniques that allow to look at things like citizens prosperity or economic prosperity, and to break that down into measurable indicators. That works well for administrations, i.e., for how to govern transit or other city services, but it didn't work very well for the partners doing quality or social outcomes. On that front, a lot has been trying to agree upon indicators that are improved by those actions, such as quality performance of the programmes or the activities that have been done together—but then using data to show how social situations have been improved, e.g., a declining crime rate etc. It really has been an awareness exercise with the partners of the city.

With respect to the data pyramid mentioned earlier, the persons on the top of the pyramid, the ones trying to make that decision, they have all the data in the world they could ever look at. It is only they who know which part is important. And the challenge in a community setting is who is at the top? And hopefully it is not one person. It is really defining that community of who are the 5, 10, 15, 25 organizations today and tomorrow that are there.

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Session 7

Day 2 – Morning – Parallel Session

Digitalization in Healthcare

The chair and moderator of this session**, MARIANE CIMINO, CEO, Hoa-Ora**, France, welcomed the participants and set the scene for the following presentations by introducing an example of a new smart pathway.

Better Coordination of Health and Social Services for Fragile Persons at Home

Hoa-Ora means health or life companion in Maori/ Tahitian. This name has been chosen because Tahiti and French Polynesia are examples of a peaceful and benevolent culture, where people care for each other, especially with regard to elderly persons.

Hoa-Ora, a new service provider, has been set up to help fragile populations stay at home with all the commodities and services they need, including e-health and e-well-being services.

The aging population is a major societal challenge all around the world. OECD figures show that, between 2000 to 2050, the number of elderly people (over 60 years old) will double. By 2050, they will represent 22 percent of the world's population. This implies many people with disabilities and diseases.

With regard to their social conditions, 80-90 percent of the people want to live better and longer at home, instead of being placed in specialised institutions.

However, there is a dilemma to solve: it is the dilemma between revenues and costs of these specialised establishments. According to the International Labor Organization, half of the retired people don't receive any pension. At the same time, the costs for retirement homes are very high. 5-7 percent of the over 65-years-old are in institutions (hospitals, elderly homes, living facilities etc.). The costs are equivalent to 1.5 times the annual GDP per capita (e.g., €44,000 euros per person in France).

Most families can't afford financing the loss of autonomy of a family member. 5-17 percent of the population are using care services. The costs amount to 10-50 percent of the per capita income. This means that only 1 out of 10 French citizen is able to finance the dependence of his/her parents.

However, there is a second dilemma: The helpers and caretakers (family members, volunteers, professionals) have very bad conditions of living, due to the fact that they are helping somebody else. 48 percent of the caregivers report chronic illness. And even worse,

one third of the caregivers die before the person they are caring for. Furthermore, these helping people are often working men or women and have to give up their work in order to care for a family member. And these family members are often far away. In France, the average distance between the helping and the helped person is 226 km. 75 percent of caregivers feel stressed or overworked.

The ecosystem is very complex and fragmented. There are a lot of SMEs, start-ups, initiatives and associations providing services or products to help elderly or fragile people, but this is done in silos. The people who are providing equipment for elderly people are not connecting with the health professionals, and health professionals are not connecting with the social workers. Even the proximity resources (veterinaries of the pets, the plumber, hairdressers etc.) are not connected to all the social services around the person.

There is also a lot of criticism with regard to the quality of the overall service provided. Today, there are various labels or certifications of quality, but the landscape is diverse and fragmented. There are labels for specific aspects of a service (habitats, equipment, specific care services etc.), but there is no global one certificating that the overall service provided to an elderly or fragile person is of good quality.

Some examples of the barriers to good aging at home, i.e., aging at the place a person has chosen and the kind of service the person has chosen:

With regard to public authorities: A heavy financial burden, low quality control and the complexity and fragmentation of financial aids.

With regard to service providers: Inadequacy between training and needs, difficult quality control, small and unprofitable actors, and difficulties in the coordination between providers.

With regard to the seniors: The complexity and illegibility of aids, managing the multiplicity of stakeholders, and the amount of the remaining costs.

With regard to the families: Guilt, cohabitation with service providers, financial participation, stress and absenteeism at work.

It is very complex and difficult to organise and control the services, there is a real lack of coordination between the different silos. The need for better coordination is obvious. There is a need for a coordinator to organise these different services for elderly persons on a unique interface. Currently, there are 20 different phone numbers to ask for different services.

It is not a question of technology, even if we need high tech IT-systems to provide accurate and ergonomic services at the right moment. It is more a question of innovation in the social condition of people. We need to centre our services around the usage and the user experience. We need one interlocutor for the different services for elderly, and we need to concentrate our energy on a rapid and emphatic solution for the user.

This is the emergence of a new smart pathway. We have no choice—there is this societal challenge with respect to elderly people and we need to put the most emphatic services around them. It is also a way to conciliate humanity and business because this will provide a lot of local employment.

EYAL BLOCH, Cofounder & Co-director, Institute Education for Sustainability & Social

Change, Israel & **PHILIPPE SCHEIMANN**, **Co-Founder & CTO, TOPGlobal.org**, Israel, took the audience on a fascinating journey to Kenya.

Improve Health in Developing Countries
From Foreign Aid to Self Aid

As one of the UN seniors once said: 'Technology makes us smarter but not wiser'. TOP (Technology Of Peace) tries to make a healthy link between humanity and technology. TOP is a digital and offline platform sharing challenges and sustainable solutions related to poverty and hunger in a network connecting individuals and communities of doers and proven leaders across the globe.

One example is the project of creating clean drinking water from bio-sand water filters: Students at the Joel Omino Secondary school in Kisumu in Kenya were suffering from water born diseases caused by drinking unsafe water from contaminated ponds in the school and at home. This affected their learning in school and regular duties as well as faced with huge medical bills.

The students were trained on how to make and maintain bio-sand water filters. They were then able to pass this knowledge and skill to the community.

Students and members of the community are now able to attend school and their regular duties with less or no disruption caused by water born diseases and at the same time access safe drinking water at a cheaper cost and less or zero medical bill.

Nutrition, water and food security are the basics of health. TOP didn't need to invest money in teaching the people how to solve their problem. TOP just provided the inspiration and the training and, later on, disseminated the success, because such simple solutions can help so many people.

TOP is basically looking at connecting both, the past and the future, in a healthy way by Tapping the peoples' Own Potential.

Another example comes from the 'Connectedness and Leadership' course of TOP Kenya, that started in February 2017 and finished in July 2017. This course was given to young professionals on how to use technologies in various fields, such as agriculture. Each of the participants received a kit including a Raspberry PI3 subcomputer (costs $35 dollars) and electronic devices, learnt principles of education for sustainable development and built green-walls..

One of the participants connected a humidity sensor to the ground to create an irrigation system. The young man lives in the area of tea plantations. Tea plantations are beautiful, but the people are starving because there is no food for the people. This young man then built green-walls. He used local materials and some soil and started to grow organic plants in order to sell food. He also created a presentation on how to build a green wall so that others can also start doing the same.

In order to create change, you need to create a new leadership. TOP connected 6 NGOs that are working with the people on the spot. RODI Kenya, for instance, is working on prisoner rehabilitation by teaching them to practice organic agriculture so that they can use it and teach when they are back in their community.

TOP Global and TOP Kenya, which is made of these 6 NGOs, annually organise 'Connectedness and Leadership' courses for young people in the age of 20-30 years affiliated to the 6 TOP Kenya founding members. It is a 5-day workshop on technology and other subjects (such as permaculture and ICT) and a graduation 4 months later.

After the 5 days of training, the participants are sent back to their communities in order to come back with solutions. After 4 months, in order to graduate, the participants then present their solutions to challenges that can be spread all over the country.

In 2017, one of the presented solutions has been the green wall. Another one was about the process to turn plastic into usable material such as oil. The young person came back with a prototype of upcycling plastic.

The feedback of the participants is great. The mindset of these people moved from being a victim to becoming an active user, or 'prosumer'.

TOP brings the spirit of innovation. Solutions can be very simple. The bio-sand filter, for instance, is a very simple solution but only few people knew about it. Actually, the President of Kenya, H.E. Uhuru Kenyatta, visited the Joel Omino Secondary school to learn more about this solution—and he even tasted the water.

Last year, James Aggrey Otieno, who ran the project at the Joel Omino Secondary school, presented his work to the UN General Assembly. He is now implementing the principles of TOP and Education for Sustainable Development in schools.

Youth don't want to get into agriculture, but if you go and give them a Raspberry PI subcomputer, they become permatech (permacuture and ICT) experts. This is something that is very valuable.

Today, our main challenge is to raise the awareness that sharing is key. People are making great things, but often they don't share it.

Video clip: Kenya we have a chance to wake up

RYAN C.N. D'ARCY, Professor and Surrey Memorial Hospital Foundation BC Leadership Chair in Multimodal Technologies for Healthcare Innovation Faculty of Applied Sciences, Simon Fraser University, Canada, gave a number of amazing examples of innovation in the world of brain and healthcare.

Digital Health NeuroTechnology

One in three individuals over the course of their lifetime will have something bad happen to their brain—dementia, stroke, Parkinson's, multiple sclerosis, brain injury, depression and other mental health related things.

The market size around brain tech is really something that is of relevance. If you are hospitalised right now, the amount of technology that you face in any developed country hasn't changed that much since the 1980s. The way the brain is treated and evaluated is relying on technology advances that are largely unchanged. This is particularly a problem when you have major conditions, but the opportunity in that is that with digital health and digital neurotechnologies it is really going to change around prevention, ways to monitor and diagnose etc.

Healthcare is generally not an area that embraces and runs towards innovation, for the very fact that healthcare training is highly risk averse—do what you always do, follow procedures and don't change things because otherwise patients could die.

Do you know how your brain is today? Do you know if your brain performance is as good today as it was yesterday or the day before that? If you have had a coffee break, will this make you have a higher performance? What happens in case of a concussion? If your are getting older and your memory starts to slip—is that dementia?

The application 'Brain Power Score' is available for free from the Apple tunes. It will take you two minutes to get your brain power score, which will tell you how your brain performance is. This small technical innovation allows you to answer that very important question of 'how is your brain today"?

'Brain Vital Signs' is a consumer product meant to give you an objective physiological, using your brain waves, yardstick for brain function. But here is an even bigger gap in the healthcare system. If you go into your doctors office, or even at home, you can find out your vital signs; Fitbit would tell you that. You can find out about your pulse rate, your blood pressure, but what about brain vital signs? Do they exist? They do, but only since the last 5 years when this problem has been addressed.

Can you believe that there is no such thing as a 'one-twenty over eighty' for your brain? Do you think that we would have anywhere near the problems of brain care, if we knew what your baseline was?

Everybody has brain vital signs. Brain activities with potential have been studied for over 7 years. They can be turned into a 'one-twenty over eighty' for the brain and used in all sorts of examples to help improve care.

The Mayo Clinic uses brain vital signs for concussion in ice hockey. A radar plot is a profile of your brain vital sign activity. The profile is good if it looks like a hexagon. It should have the 6 sides all symmetric. When it becomes a triangular of shape, it is a profile of concussion. Your brain vital signs responses got bigger and delayed and as a function of that, the shape changes to a triangle. After the player recovered, it goes back to a hexagon.

It is possible to track this in players who are retired. When players start to show really bad looking triangles, it is time to retire. It is possible to track this in all the players that haven't had a concussion and in pre- and pause season, they still show concussive impacts. But the good news is that brain technology now that can help accelerate the return back to normal.

This didn't exist 5 years ago. Now health systems across North America, and expanding out of North America, are adopting this to answer that basic question: shouldn't there be brain vital signs?

These are all examples of wrestling the healthcare system into innovation, which is not easy.

Pilots are trained on flight simulators, which is rather reassuring for the passengers of a flight. In surgery that wasn't the case. And in brain surgery, it was definitely not the case.

The National Research Council of Canada developed a neurosurgery simulator called NeuroVR (formerly known as NeuroTouch). The National Research Council launched a massive country-wide initiative to change the problem and to have virtual reality rehearsals for complex brain surgeries prior to performing the actual surgery.

The first virtual reality rehearsal was realised in the context of removing a patient's brain tumour. The rehearsal was done the night before the operation. The virtual reality neurosurgical simulator showed the patient's brain and all key areas of concern. It was possible to identify all the critical areas, take the tumour out—it was even possible to feel in virtual reality what the tumour felt like, extract it safely, and then actually do it for real.

Today, surgery simulation with PeriopSim allows training on an iPad while you are on the route to the operating room.

Captain Trevor Greene, victim of a Taliban attack in Afghanistan, was hit in the head with an axe. The axe knocked out all his abilities to walk. General belief was that an adult's brain doesn't change—what you got, you got. Nevertheless, Captain Greene has recovered his ability to walk. A robotic exoskeleton is helping him to walk and currently a whole array of technology is used to help him to walk further and further. His brain is rewiring and advanced medical imaging shows the increase of his ability to walk, his motor activity.

If you should have something bad happen to your brain, it isn't fixed—you can change it and technology is probably one of the key and core areas to do that.

In neurotechnology, the way you interact with your brain with sensors and technology is changing very rapidly and it will change your world.

JOE JARZOMBEK, Global Manager, Software Supply Chain Solutions, Synopsys, USA, addressed the issue of software supply chain management to both enable and control the digitalization of healthcare today, in particular within medical devices.

Enabling Cybersecurity Assurance for Network-Connectable Medical Devices

With regards to technological advances in network-connectable medical devices and systems, today's devices are connected wirelessly to patients and other devices. Data is now obtained from devices, is stored in the cloud and can be used everywhere. Devices include software and databases of health information. Care is now available to patients in the palm of their hand through applications. And, health data can now be accessed anywhere on earth. This is innovation and helps us evolve. However, it is also creating challenges.

Sloppy manufacturing 'hygiene' is compromising the privacy, safety and security of those who are using it. IoT risks provide vectors for exploitation of privacy and financial data, and these IoT risks are ranging from virtual harm to physical harm.

We are seeing that medical devices and heath data systems provide hackers with vital information. There is a lack of timely software updates/patches and compromised devices infecting other systems and exposing patients to increased risks attributable to cyber exploitation. And the uptake of this is even more dramatic and is not always publicly reported.

Connected medical devices are the end-points, there is a one stop treasure-trove of data that is available—both in the devices and the medical systems and the databases. The cost of a data breach is going up, and there is loss of reputation of those healthcare providers. Moreover, cyber exploitation is now leading to physical harm.

The publicly available report 'Medical Device Security: An Industry Under Attack and Unprepared to Defend', sponsored by Synopsys, has been published in May this year. In this report, the Ponemon Institute reveals the following risks to medical devices and why clinicians and patients are at risk: Medical devices are very difficult to secure, as there is a lack of people that have the fundamental skills of focussing on security of the medical devices. Moreover, accountability for medical device security is lacking and mobile devices usage is affecting security posture in healthcare. Medical device security practices are not the most effective and testing of medical devices rarely occurs—they test for functionality, but not for safety, security or privacy of those devices.

Another question asked in the report was: How likely is an attack on one or more medical devices built or in use by your organization? 67 percent of the device manufacturers believe that an attack is likely. 56 percent of the device users believe that that an attack is likely. In fact, patients have already suffered adverse events and attacks. 38 percent of respondents are aware of inappropriate therapy or treatment delivered to the patient because of an insecure medical device. 37 percent confirmed that attackers have taken control of medical devices.

If you look at the number of records that are breached by industry, it turns out that—if you look at all industries, including the financial industry and government—the number one

source is healthcare records. Healthcare is the number one target because you get the most money in the black market from selling healthcare information. The second one is in the area of government. Imagine government is controlling healthcare: you create a target-rich environment. And many of the innovations that we have, such as electronic healthcare records, which is now mandatory, are actually further complicating this because people are not securing it.

Pacemakers are just one example of hackable network-connectable medical devices. Barnaby Jack already demonstrated some years ago that it is possible to hack a pacemaker while it is in a person. It is possible to change the input that is going into that person, e.g., reading and writing to the memory of the device or changing the voltage.

It is a supply chain issue. There is an increased risk from the supply chain due to weaknesses and vulnerabilities in these products. And these wireless and Internet connected devices are what is complicating that.

It is about who is making the risk decisions. Is it the consumer? It turns out that most consumers have no clue that this is happening. It turns out that most clinicians have no idea about what that is. It is the healthcare providers and the medical devices.

Software is buggy and people who are hacking it are taking advantage of that. So, the question is: Why aren't people testing devices for these things that are actually happening?

Synopsys is helping people to become better informed consumers. The company provides 'Procurement Language for Supply Chain Cyber Assurance', which is freely available for download.

The Mayo Clinic is one of the organizations using it. It is a perfect example where you enter in different discussions with your suppliers. Mayo Clinic is very interested in innovation in healthcare and they are dealing with a lot of innovative companies providing these devices. Unfortunately, because many of these are small companies, security is not their primary concern. Mayo Clinic is using Synopsys' tools and procurement language to work with these suppliers in order to make them securing the devices. Consequently, all healthcare providers get the benefit of that, because they are reselling to others than just the Mayo Clinic.

Synopsys also works with Underwriters Laboratories (UL) to develop programmes for independent testing and certification of medical devices. The UL Cybersecurity Assurance Program is looking at network-connectable devices. Synopsis started with industrial control systems and medical devices, because that is where consumers are most at risk. There are solutions, but you have to be aware of that.

There are tools and services that can be used today, that can help governments and industries in establishing certification and testing of medical devices. They help healthcare services testing medical devices and assist manufactures to implementing those best practices so that they can secure these medical devices.

JOSH PAYNE, Executive Director, Sales & Enterprise Solutions, Powerland, Canada, [http://powerland.ca/] approached the topic through the lens of an IT integrator and discussed some of the security concerns to bringing the digitalization of healthcare, and the opportunity that it represents, into real life.

Digitization within Healthcare

Some of the today's trends: Acquisition and sustainment models are typically broken currently. They are not funded properly relative to how utilizations consume half of their IT service delivery, i.e., how they are trying to consume clinical systems.

Technology refreshes and product obsolescence curves, i.e., how quickly items go end-of-life, are unrealistic with the pace of change that organizations can undergo themselves in terms of people, processes and policies.

Each new innovation area in healthcare was exciting—AI, robotics, data, VR, the wearables, IoT. But these all create unrealistic IT-demands on the organization, both from the funding and in some cases the actual technology that is going to be available and in a place.

By 2020, the amount of data created will be greater than 50 zettabytes, yet the capacity of today's Internet is 2.5 zettabytes.

Demographic shift is not often discussed in IT contexts. It means that greater healthcare demand is put on the system, as the aging boomers in North America now hit the peak of health requirements of the system.

Today's IT vendors are typically part of the problem. That legacy incentive models around revenue streams do not align with bringing the most current and best models for solutions to market. We should review the existing revenue models that we have in order to provide a new model for healthcare organizations.

Citizen trust disappears in the system availability for healthcare delivery, because citizens no longer see improvement in healthcare outcomes even though they are funding it in greater amounts.

Organizations, both private and public healthcare institutions, can't continue as before. Economic funding, service delivery and acquisition models, i.e., the way we buy our solutions, must change in order to leverage the power of digitalization.

Tough situations will only become tougher eventually leading to the conversation to say: What do we turn off and what do we stop providing? Ask yourself: Are vendors part of the problem or part of the solution? Do their models align with the healthcare outcomes you are trying to drive in your organization, whether it is private or public?

Given some of these challenges, we have to look at the potential value of hyperscale clouds, in terms of large scale global data centre providers and large scale cloud application platform vendors. It is really a new twist. Mainframe computing, back in the 50s and 60s, moved to edge computing in the 80s and 90s, and now the IT sector has moved to a collaborative sort of hybrid model between distributed and centralised IT computing and resources.

What limits us today is not necessarily new technology and new ideas, but the people,

process and technologies. The transitional revolutionary approach suggests that moving to a hybrid cloud model leveraging cloud IT would make sense in order to leverage some of the advantages that digitalization and new opportunities present. Change management therefore has to be a key focus of executive teams in healthcare institutions to deliver digitization to help move the organization forward—it is the people, not the technology.

However, the answer has significant air gaps. Fundamentally, the market is not addressing the conversational customers at the same level. By nature, they are solving in isolation, but the solution they desire is not necessarily delivering to how IT is required to software and hardware, it is not necessarily in sync with how it is connected both from WAN and LAN architectures, and it is not relevant necessarily to cloud platforms.

The problem of market size involves monetization. The cloud is highly disruptive to most existing incentive and conversation models for on-premise IT, which is an ecosystem that has been built for the last 15 years. The challenge is practically an economic challenge.

Modern partners must bridge these gaps and properly package service offerings of existing technological capabilities, and bring it back to healthcare organizations in an economically consumable fashion, that is patient-centric and focussed on outcomes. And they can't do it alone.

Part of this is going to deal with the hybrid cloud, especially in public institutions. Organizations in Canada, and the globe, currently are unable to ensure data sovereignty by leveraging existing Internet transit methods when accessing public cloud offerings. There is this example of a public institution in Vancouver, trying to leverage the public cloud which is only based in Toronto, and which, without knowing it, is breaking some of their own regulations and laws.

This data sovereignty issue is typically not discussed and is typically ignored. It is not brought forward to health organizations as viable. And yet, it absolutely is today.

There is pressure that current executives are facing around the content management of data, data sovereignty and new laws on 'where to put the data', 'how to manage the data' and envisaging some negligible penalties if people improperly control and manage the data.

For instance, in Canada, the public cloud access resides in Toronto, both for a redundant carrier and a redundant path to the cloud. Questions to be asked are: How to connect? How are solution options provided? What are the architectural decisions for where the actual risks exist?

Part of this vision, and the approach that needs to be understood, is that there is a democratisation of IT services. By trying to take advantage of the promise of digitalization, we need to decouple and move to a software-defined everywhere.

We already heard about the advantages of software-defined networking and examples of typically heavily bureaucratic and conservative industries that are leveraging software-defined. Nothing should be sacrosanct and unquestionable at this stage, even within healthcare in terms of the clinical applications and the modes of delivering business. Saying it is too big and too expensive is no longer an issue, is no longer a reason to not make the change.

It is important to work with organizations that can partner with some of the clinical applications and digitalization opportunities that exist to understand the WAN and LAN implications and to take a 'crawl, walk, run' approach to manage change within the organization. This presents new opportunities and challenges around security and governance, but it also provides opportunities for business optimisation and cloud cost management (going from one cloud to the next), and eventually move to a fully outsourced situation.

With digitalization within the healthcare space, we have to be ready to serve the change. The wave is coming. Healthcare is not going to go away in terms of the funding models and it is not going to be disrupted and removed. The patient-centric solution approach, focussed on outcomes delivered in a modern consumptive model, leverages appropriate hyper scale IT operations, where appropriate, and will send us generally in the right direction. It provides a roadmap of how to get there and leverage the opportunity that digitalization represents.

MICHELE THONNET, eHealth European & International Affairs Executive, Ministry of Solidarities and Health, France, addressed the challenge of international cooperation to bring forward digital healthcare.

Digitalisation Healthcare: A National Strategy

In order to have digitalisation in healthcare, you need to know where to do it. You need to set up a goal, a vision, clear objectives and you need to know whether you want to utilise digital health or not and for what purpose.

There is this a need for a strategy, but this strategy has to evolve—and this is the difficulty for ministries, civil servants etc., because usually the implementation doesn't go fast enough for them. We have to have different business models, but we also have to be flexible in order to make it happen.

Infrastructure represents the basis for digital healthcare. It should be organized by public authorities, to be used by the care providers' management systems in order to have products with both private or public elements. The goal is to offer services, both public and private, to patients and citizens. However, there are so many legacy applications in the various countries, not only in Europe, that it is very difficult.

We need a health strategy which is based upon health needs and demands. But it is not sufficient to just claim 'users first', because there are multiple users: There are patients, there are citizens and there are health professionals. We have to go beyond patients and health professionals. We need to co-construct a health strategy based on agreed health objectives, and we have to be able to iterate if needed.

For this reason, France adopted a law on the modernisation of the French health system at the beginning of last year. One very important enabling element is the eID. It is important to unambiguously and uniquely identify a patient—all those great applications are worthless if they are not for the right patient or if you are not able to identify the patient. Over 1 billion individuals globally don't even have an identity document. It is one of the first things to do, and it is not just healthcare oriented.

We speak about security, privacy etc., but if we only stick to the healthcare system, we will never succeed. eID is one element of that, infrastructure is another. We have to work together, not only within a sector, but within a variety of sectors.

We have to act within these three layers infrastructure, care providers' management systems and public and private services. One important element is providing incentives in these different layers, but also to set up a kind of new governance. Although this is not an easy task, because it has to evolve and everyone has his own organization.

We need to work together, especially in Europe, even if the legislation across the EU is very different. In order to foster cooperation, a kind of brainstorming has been set up. It came out that we all have the same challenges and the same problems. The e-Health Committee of the EU also tried to adapt the ISO standards for interoperability, in order to make healthcare being part of that and enable the different countries, companies and authorities to work together.

How to handle this European dimension and work with 28 different EU countries? A kind of large scale experimentation has been set up, in which not only industry, SMEs, people, health professionals and patients participate, but also the authorities—not to regulate, but to be part of it and to either develop or deploy the new rules and principles to be simplified.

It is the first time since many years, that the EU agreed upon the fact that there is a need for a European committee of representative health authorities to work on common priorities and to move closer together.

Take, for instance, the example of medical devices: France has set up rules in order to ensure that a device doesn't harm the patient and to be sure that a medical is secure. However, this doesn't mean anything if there are different rules in the European countries and in the U.S. and Canada. We need a code of conduct for the industry and also a voluntary guideline, as they are already in place in France and in Europe, in order to have the same set of rules for medical devices everywhere in the world. This also avoids barriers for SMEs to sell their products internationally.

The current four priorities of the EU regarding digital healthcare are empowering people, the innovative use of health data, enhancing continuity of care, and overcoming implementation challenges.

In order to deal with these challenges, the European e-Health Committee agreed upon a governance not only between authorities, but between all stakeholders, trying get some kind of agreement at least twice a year and iterating questions such as: Is the performance ok? Does it harm the patient or not? Do we need legislation? Is there too much legislation?

However, it is not only about having a good governance. The common principle is 'think globally and act locally'—but does locally mean? The village, the city or the regional level? But the most important aspect of 'think and act' is to be able to connect to each other and to be able to decide together on a common pathway.

PAUL WORMELI, Executive Director Emeritus, Integrated Justice Information Systems Institute, USA, addressed the burning issue of making sure that data can be trusted.

Creating Trusted Data

Data has become a far more important asset in addressing the intelligent pathways that we are building. This is certainly true in the healthcare world, just like the idea that data has to be trusted or the fact that we are building these mountains of data. And this curve is exponential: In the next three years, the amount of global data generated will double what it is this year. There is no end in sight to this exponential curve, which has a very strong impact on how we deal with this data, especially in the face of the fact that we are recognizing on a global basis that there is a new continuum of care.

It is not only the healthcare providers and the various disciplines within healthcare that have to share data. It is all of the supporting organizations that are focussed on community and neighbourhood wellness and the wellness of our citizens, whether it is public safety, public health or the healthcare community itself or human services. That new focus on community wellness means that these individual agencies have to share data with each other and build to this knowledge and wisdom. In order to do that, the data has to be trusted.

Research has shown that the longevity of the citizens is not determined by the quality of their healthcare, it is determined by the social determinants of health. The U.S. Institute of Medicine has determined that there are 12 parameters of the social determinants of health that are more important. This data needs to be submitted and transmitted and trusted as it moves from organization to organization.

We really have come to the conclusion that there is a new axiom here. It is that knowledge sharing at the heart of everything we can do to improve individual and community wellness. We have to find the balance between trusting the data that is out there, developing the privacy policies that are applied across all of the disciplines involved, making the data standards that need to be developed on a global basis, and providing that interoperability across systems all under the umbrella of data governance.

There is no better example of the need to do this than the opiate crisis in the U.S. Last year, there have been 65,000 overdosed deaths from this terrible crisis. It is a U.S. national emergency requiring a multi-agency response, but the data resides in all kinds of different silos, from the medical community to the law enforcement, and there needs to be a coordinated response strategy, which means data needs to be collected and trusted across of this.

There are 4 major pillars in developing the trust in data: 1) The importance of a system of governance to affect the policies and privacy and access rules and principles of data sharing and trusting data. 2) The ability to manage the identity of the users, so people can be assured that whoever gets to see the data has the right and authorisation to do so. 3) We have to base this on standards for information exchanges, so the data is interpretable and the meaning can be commonly viewed across these various disciplines. 4) We have to create the access rules that are needed to make secure privacy and use your privileges in common across these agencies.

The U.S. is trying to build a national interoperability consortium that is a kind of a network of

networks. The idea is to try to bring together the disciplines of public health, public safety, healthcare and social services in order to figure out ways to share this data and to trust this data across the disciplines that are so engaged.

Trusted data is the way to make it possible for people to make informed decisions and for that knowledge to turn into wisdom.

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Session 8

Day 2 – Morning – Parallel Session

Industry 4.0

The chair and moderator of this session, **GÉRARD POGOREL, Professor of Economics and Management-Emeritus, Telecom ParisTech**, France, welcomed the audience and briefly presented the panellists.

Industry 4.0 stays at the intersection of the continuous technological progress of industries and the grow of pervasive networks all around the world.

It is a very critical issue for all industries. But it is also a critical issue for the tele-communication industries, in particular network operators, because one of the challenges of the next generation of networks, 5.0 mobile technologies, is the inclusion of industries in the provision of tailor-made services. It is not just about more sophisticated smartphones, it is also about being able to provide the requested services to all kinds of industries.

We are at a very critical junction for telecom operators, for all kinds of Internet Service Providers and for the industry itself.

NAMIR ANANI, President & CEO, ICTC – Information and Communications Technology Council, Canada, addressed the current and future transformation of the industry in this particular context.

Industry 4.0 is becoming the new frontiers for manufacturing. It is becoming the essence of any high performing economy. It is the competitive advantage that creates that environment. It is enhancing yield productivity and many other facets.

What is important about Industry 4.0, or the data-driven manufacturing, is the fact that there are several transformative technologies that are dramatically changing the shape of this environment.

One is Artificial Intelligence. Some years ago, the manufacturing industry used programmable logic controllers and programmable computers with the aim of programming the manufacturing site to do a specific task. Then, the machine learning came along. It learns any faults of the system and adjusts automatically to try to enhance that process. And then, there is deep learning, which really resembles the brain of the human being in terms of doing predictive analysis and determining what actions to take in manufacturing to address the future.

All of this relays a lot on data. Maybe we should talk about smart data instead of big data,

because data has become the new oil for industries.

According to Cisco, there will be 50 billion devices connected by 2020. There are 15 billion devices around the world at the moment, but not the majority are connected, despite the fact that sensor prices are getting lower, processing is getting much faster and broadband capability is becoming much more affordable. But there is very little connectivity due to some standard issues that has to be looked at.

Industry 4.0, specifically from the IoT environment, is blurring the lines between the physical, the virtual and also the biological world. The synthetic biology is now coming into the design of genetic circuitry that will look at low power from the sun and others and be able to inform manufacturing in terms of states (one, zero, etc.) to entice different actions within the manufacturing processes.

We heard about autonomous vehicles and autonomous robots. Clearly autonomous vehicles are part of the design of that system. They make all of this happen, and the virtual and augmented reality as well, in terms of the design and concepts.

Another important technology is blockchain. Blockchain, as much as we talked about virtual and augmented reality and AI, is very much an enabler for all the transactions that are going to take place. It is a cross-industry enabler, not only from the supply side, but the manufacturing and right to the enablement of the payments and the intelligent retail. All parts of this ecosystem of manufacturing that we need to start addressing.

Another technology is 5G, 5th generation mobile. When you talk about manufacturing of the future or Industry 4.0, you are going to need autonomous cars that be are able to shift raw materials from one spot to another. Actually, what drives autonomous cars, and the only thing that would make them workable as autonomous cars, is 5th generation mobile. What makes 5G an incredible technology is that a close to zero latency is possible. 5G is going to be an incredible enabler.

Furthermore, high-performance computing needs to be democratised, because the capability of predictability or predictive manufacturing is going to be enhanced at a whole new level with the use of high-performance computing.

Industry 4.0 is becoming a global enabler. It is really not only about manufacturing within one geographical location or country. The whole idea is that with the connectivity of the devices around the world, you are able to federate your manufacturing where there is low-cost of labour, best economic assets to buy and to manufacture. This raises the question of how to operate in this environment of global trade? If you are going to ship your manufacturing or your raw material and maintain your IP in one country, and ship it to another country to be refabricated and manufactured and then send it back, you don't want to be caught in the tariffs issues. Obviously, open trade is going to be an important dimension.

Intellectual Property is also an issue. If you manufacture in a country, will you retain that IP or does the IP belong to the country where the manufacturing is going to be?

Industry 4.0 is no longer about manufacturing. It is about enabling a value chain from the raw material right to the consumers. With the rise of connected products, there are more and more products that, through RFID tags etc., know about failure rates and mean time between failures and inform the manufacturing plants of the future to be able to adjust that manufacturing and to make more robust products. That whole ecosystem, from the raw material to the consumers, is taken from just the manufacturing to a whole value chain that has to be looked at.

Moreover, those smart and connected products are not just able to send information about failure rates but they are also going to send information by the consumer's usage. Hence, sending back details to the manufacturing side and saying: how do I invent the next product that doesn't exist now to meet consumer demands? That is what is called Industry 5.0, because it is taken from just manufacturing of equipment or products to create of manufacturing to meet consumer needs of the future.

We are in living in an interesting environment in terms of federated manufacturing across the planet. Never before have we got a chance to be able to outsource some of the manufacturing to some developing countries. Since we are going to require a lot of raw material development and others, before it hits our shores and then value added and manufactured and sold, maybe we start thinking of how do we close that loop and enable potential prosperities to other countries around the world using the concept of Industry 4.0.

Last year, there were indications of a refragmentation of the world industry, whereas this year international trade is again increasing. Namir Anani was asked about his view concerning this matter.

Mr. Anani emphasised that all depends on how we play it as countries. It depends on the protectionism level that is coming to play here. 3D-printing and small scale manufacturing is also taking place. We have a potential to take it to whole global capabilities by enticing global trade and global expansions from sourcing the raw materials right to consumers from around the globe. However, this can only be enabled by opening trade to a whole new level, because the moment tariffs come into the pictures is going to stop that capability of global manufacturing.

ALAN ELIAS, Senior Manager Global Public Policy; Member eBay Public Policy Lab, USA, [www.ebay.com], presented the findings of the eBay Small Online Business Growth Report 2017, an extensive survey on the impact of technologies on international trade of eBay's commercial sellers.

Industry 4.0 & eBay

eBay looks at its commercial sellers, which are sellers that do $10,000 dollars in sales per year or more.

Before getting into the new model of trade that is really empowering small and micro-businesses to connect with sellers around the world, let us look at the traditional model of trade in globalisation, that has really dominated the landscape since the industrial revolution, and probably even before that. It is a model dominated by large—it is large companies, large factories, large containerships, large volumes. Under this model, the only way for a micro- or small business to reach global customers is through global value chains, i.e., a kind of supplying a component part to a larger product, that is then shipped around the world and then small businesses consider their part through that. This is also the model around which global trade institutions and infrastructure where established. It make sense when to engage in global trade you have to be big simply because of the cost.

However, an entirely new model of trade has emerged in recent years and this has been studied very closely at eBay. It is based on very small enterprises and became possible because technology, and specifically platforms, have dramatically reduced the cost of distance. According to eBay's estimates, the cost of distance is 6 times lower for international transactions over the online marketplace compared to the traditional market. eBay refers to this model of trade as the Global Empowerment Network. It is running parallel to the traditional model of trade, i.e., the global value chains. It is largely packet-based and a powerful vehicle for connecting the unconnected.

There are 4 key overlapping elements to the Global Empowerment Network: The first is connectivity to the global Internet at low cost and without gatekeepers. The second is global platform-based marketplaces, like eBay. The third is global payment services, e.g., PayPal. The fourth is efficient, modern and 'connected' package-level logistics and delivery services. This can be country postal services, UPS etc. These four elements are overlapping.

With regard to impact, eBay's research has shown that small is not necessarily the new big, but micro is the new global. There are three findings related to the impact on independent micro- and small businesses.

First, the online platform model for commerce is really enabling enterprises, no matter what size—they can be one person in their home operating a business to a multimillion dollar company with 500 employees—to extend their reach from their locality or region to an unprecedented geographical area. This is an 180 degree change in the way trade is occurring. And most importantly, it is not a phenomenon on the margins.

Second, the technology-enabled platform commercial model creates growth opportunities at the firm level across regions and in countries at different levels of development. It is not something we are just seeing in advanced economies, but all over the world.

And third, the economic activity of the micro-, small and medium-sized enterprises (MSME)

across the platform is not only reflective of a more inclusive model of commerce, but it is also resulting in MSME growth and dynamism that exceeds that found in the traditional economy.

In July, eBay released its annual Small Online Business Growth Report 2017. It examines eBay commercial sellers, i.e., sellers that do $10,000 dollars annual sales or more, in 18 countries across 6 continents.

Among the full 18 country data set, slightly more than half had 100 percent export rates—meaning that every eBay commercial seller in that country was an exporter. In every country, the rate of exporting by eBay commercial sellers exceeds the rate of traditional businesses. In more than three-quarters of the countries reviewed, more than 50 percent of these commercial sellers sold to consumers on 4 or more continents. This is an important step, because it is not just exporting to the neighbours, it is exporting all around the world. We are really talking about a global reach by a micro-enterprise. Finally, in all 18 countries examined, both advanced and developing countries, the sellers reached the $10,000 dollars in sales from 2011-2015. Sellers that hit $10,000 dollars annual sales experienced a growth rate in sales that outpaced their home countries economic growth rate.

A crucial element provided by the Global Empowerment Network, i.e., access to Internet, access to platforms and payment services and logistics, it really enables trust. The average person would just not buying goods directly from merchants and countries all around the world. It's human nature: There was no way knowing if you are going receive it. There was no way of knowing whether your payments are going through. Today, you have email, Skype, Facebook and others to contact a seller, you have reviews left by other customers in all these different countries, you have electronic payment systems. You have all these things that create a kind of a trust network. People feel very comfortable going online, putting in their credit card, using PayPal to buy goods from all over the world directly from that merchant. This is a major change and something that is going to expand in the years ahead.

The moderator wondered whether eBay's ambition is to provide the wide-ranging platform for international trade even more than it does today?

Alan Elias stressed that the core element of eBay are people and empowering people, as these new technologies emerge, making it easier for a buyer to connect with the seller. eBay is a global company with buyers and sellers all over the world in 170 countries. There are billion items for selling on the platform every day. It is very important to empower those businesses on the platform, to have that global reach and to be able to reach those customers and expand their businesses beyond the limits of the local economy.

JEREMY MILLARD, Senior Consultant, Danish Technological Institute, Denmark, shared his thoughts on manufacturing evolving from centralized mass production to localised mass customisation.

Shift to Distributed Manufacturing, Mass Customisation and the Future of Work

We have a productivity and growth problem. The rate of increase in productivity has gone dramatically down since the 80s. We aren't producing the goods and value in society which we need for the next generation to have a higher standard of living comoared to the previous one. This is the first time in history that this seems to be happening. It is an immense societal issue.

Most productivity increases in the past have been related to the different industrial revolutions. There was steam, electricity, electronics and ICT, and now we are at the beginning of the fourth industrial revolution. We are merging the digital with the physical and the biological.

Industry 4.0 is probably poised to be the most important we have had so far, also in terms of creating value and increasing sustainable growth. The transformation is actually seeing ICT not just as that sort of digital online stand-alone technology, but considers ICT as a general-purpose technology. It underlies all other technologies. All technologies rely on ICT now, whether they are online or offline. This is really important. It is not just about doing online things, it is about manufacturing, such as digital manufacturing, additive manufacturing, such as 3D-printing etc. We are talking about ICT underpinning everything in digital economies. This is one of the biggest game-changers.

Some of the main technologies which are being used in this context are advanced robots, additive manufacturing, horizontal and vertical integration, augmented and virtual reality, the cloud and cyber security, simulation, the industrial Internet, and big data and analytics.

The assumptions the current big centralised manufacturing companies have, when mass producing goods and services, are that people around the world basically want the same thing. Car factories in Japan or in Germany are assuming that people would buy the cars they make. They are manufacturing products before people buy them. With distributed manufacturing we are able to have lots of local manufacturing centres, really close to the market, getting away from long rigid supply chains, and instead supporting local markets, local jobs and local growth—while still being connected.

This is a really important move forward. It is a massive macroeconomic shift from mass production, as we have had in the past, to mass customisation. Basically, manufacturers in the future don't need to produce products before someone asks for and pays for it.

For example, I have heard that Toyota is currently experimenting the idea that you can go on Toyota's website, personally design the car that you want and then pay for it. But then, the car is not made in Japan and shipped to you. You get an algorithm. You can go to your local advanced 3D-print shop, get the components printed out and assembled by robots. This is still largely in the future, but now perfectly feasible and highly likely. Think of the environmental implications of that. Think of the local stores, the local economy and the local communities building up around that.

FabLabs (fabrication laboratories) and the maker's movement are both bottom-up concepts, often community-led, university-led, social entrepreneurship-led, but also small businesses-led. It is also linking very much with big manufacturing. In the Netherlands or in Denmark, people now have 3D-printed buildings. What we are seeing now, is not just the idea of a FabLab, but a Fab City or a Fab Location.

Fab City has been started in Barcelona, and there are about 20 cities around the world involved in this. It is a vision—the vision is that in future locations, especially cities, are where you manufacture and make products. You do not any longer need to ship tons of cars and refrigerators etc. around the world. What you do trade internationally is data, and obviously people, as well as raw materials to some extend, but the idea is that physical stuff should be produced locally. This makes a lot of sense and is good for the local economies, as well as the environment.

This idea of mass customisation is extremely important. You are customising for a particular customer on a mass scale. Joe Pine once said 'people don't want choice – they want exactly what they want'. Given that often people don't know what they really want, you have to have a dialogue with them. But the idea is that nothing is produced physically unless the customer wants it and pays the money upfront.

The idea of the Fab City is that data exchange takes place on an international scale, or even a national scale, and you fabricate locally in the city or in the locality. For example, the maker movement is getting bigger but it needs to link in with manufacturing on a larger scale. It typically uses so-called local feedstocks (local plastic, local metals, local materials of all kinds). The circular economy idea is critical here, in the sense of reusing resources based on the idea that any asset which is unused is wasted. We are talking about physical assets, but we are also talking about people. If you reintegrate manufacturing locally, in cities, many of the people there who have lost their jobs, they become an asset in human resource terms. Leaving them un- or under-employed wastes assets and is un-economic, not to mention the huge personal and social damage being done

Jeremy Millard explained that Fab Cities are recycling local materials (local feedstock), but of course that is never going to be a 100 percent and it is never going to be everything. In any case, this is early days—we have to think in the long-term. Cities are at the 'sweet spot', cities are big enough to have power, resources and money, but small enough to be close to their local populations.

MICHAËL STANKOSKY, Research Professor, George Washington University, USA, addressed the challenge of orchestrating complex systems.

Industry 4.0

To set things in context, Prof. Stankosky gave a brief overview on his professional career around complex systems, starting in the Air-Ground Team of the U.S. Marine Corps trying to connect together the U.S. Marine Corps aviation assets, fighters, helicopters, transport, the Air Force, the Navy, the army helicopters, the army missiles. How to make this into an orchestra?

In the 1970s, the University of Southern California was the first university to create a degree in Systems Engineering and Systems Management. Prior to that, there was no academic degree, no research about how to take complex systems and stitch them together, to make an orchestra.

He later joined the CAC Corporation, which was a systems development and integration corporation. No matter whether it was health, transportation, space, socionography, the task was system engineering and integration.

Everybody is talking about things like 'transformation by design', 'architectural framework' 'integration across silos'. Complex systems—how to manage them? How to engineer them?

The Industry 4.0 is a very complex system with a lot of moving parts. Clearly, they have been enabled by technology, such as advanced analytics, which is a critical part.

The most significant invention in the world, the Internet, has been done by one single person, Sir Timothy John Berners-Lee. The Internet is the plumbing. The Web is what we use every day, it is the stuff that makes the Industry 4.0 go. Without Berners-Lee the Industry 4.0 and all of is implications, and they are significant, would not be possible.

We need to integrate across silos. How to do this? The challenge is not just technology—this is the rather easy part. When you talk about the Internet of Things, which has to go not only in one organization but across global enterprises: How do you communicate? How do you lead? What is the strategy? How to tie all this together and for what purpose? How to make people agree on the economic outcome or the processes involved? There are solutions to this, but it is very difficult, one has to be humble and thoughtful, and to some extend, rely on miracles.

To give an example of skills, at CAC, there were 2,000 vacancies for system engineers. There weren't enough people able to take the holistic approach required. We need conductors, that type of skills to make that happen.

Take the example of an orchestra: The work of the maestro is done before the orchestra is playing for the audience. The maestro makes sure to bring all the instruments, by hearing, by sound, he plays with them all, and once everyone got their part, he is no longer needed.

This is what the industry 4.0 has to do. You need a maestro to go to the small parts, the small components. And he creates the score.

The question arose how to translate the example of the maestro and the orchestra to the world of management?

Prof. Stankosky emphasized that it is about the choice of people, the training of people and then they play the music/ do their work.

He has established the first U.S. Masters, Graduate Certificate, and Doctoral programs in Knowledge Management, and people wondered why should one manage knowledge (which, by the way, 'only' produces 80 percent of our GDP). Everything we have is our knowledge and we even don't know how to value or to measure it. We need leadership in management. Leadership is attribute-driven, management is function. We need the people who understand orchestras and instruments and play them themselves, and then know how to synchronize all of these instruments. And we need people who work across cultural domains to make sure that everybody is singing on the same sheet of music. Say what you mean and mean what you say to make sure that everybody is on the same page.

NITYA KARMAKAR, Professor, Australian Catholic University, North Sydney, Australia, addressed the issue of cross-cultural barriers in global supply chains.

Emerging Issues Challenges in Managing Global Supply Chains

We talk a lot about technology, but we don't think much about the human effect. We want money, we want global business. We are living in a globalised society, but cultural barriers are still an important challenge in the global supply chain.

When McDonald wanted to enter the Indian market, there was a problem. McDonald's brand is Hamburger, but India is a very conservative country. 70 percent of Indians are almost vegetarian. Moreover, Indian Hindus don't each beef and Indian Muslims don't eat pork. This left chicken and mutton, the ingredient of McDonald's flagship Burger in India, the 'Maharaja Mac'. McDonald had to adapt to the Indian culture and they did, which is very positive from the business point of view.

In a global economy we need to have an efficient supply chain, we have software like SAP, Oracle etc., but there are other issues, such as cultural barriers, that can not be addressed by software. In many countries it is very difficult to do business if you don't know the local culture, the language and if you act without a certain sensitivity.

A supply chain is the coordinated flow of materials, information, money, and services from raw material suppliers, through factories and warehouses, to the end customers. Supply chain management plans, organizes, and optimises the various activities performed along the supply chain in order to maintain partnerships and processes, providing an operational advantage.

There is more and more global businesses or globalisation due to global market forces, technological forces, global cost forces, political and economic forces, and well trained global workforce.

Cultural barriers to global supply chains are language, beliefs, or customs. All of them play a

big role in global business and strongly affect negotiation and communication.

Why do cultural barriers affect global business? From the standpoint of global management, culture is perhaps best thought of as addressing three questions: Who are we? How do we live? And how do we approach work? These three questions focus attention on individuals, environments, and work norms and values, and the answers to these questions allow us to draw some inferential conclusions about work and society and how managers in general should behave as they work across cultures.

Among the most important risks along the line of global supply chains are cultural risks (e.g., number of languages, trust) , political (e.g., government instability, laws and regulations), virtual (e.g., number of countries, time zones) and regional (e.g., safety issues, climate).

Potential risk sources and their characteristics are related to natural disasters, geopolitical risks, epidemics, terrorist attacks, volatile fuel prices, currency fluctuations, port delays, market changes, supplier's performance), forecasting accuracy, and execution problems.

There are ways to mitigate this global risks. It can be addressed by speculative strategies, hedge strategies and flexibility in terms of strategies, investing in redundancy, increasing velocity in sensing and responding, and the creation of an adaptive supply chain community.

A long time ago, Robert J. House, University of Pennsylvania, USA, said 'As economic borders come down, cultural barriers will most likely go up and present new challenges and opportunities for business.'

Global supply chain challenges can be overcome by a clear understanding of cultural sensitivity. But also by addressing cultural issues with mutual respect—which is very important and is something that has to be learnt—and by learning to deal with the unknown. And last but not least, you need a good risk management strategy.

To conclude, you need a deep involvement in global supply chain issues and work as a reliable partner. It is important to establish good risk mitigation strategies while dealing with each international partner country. Companies should treat themselves as global citizens with universal products which are now a reality and hire talented employees worldwide. We have to establish global relationship based on trust.

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Q&A

The first question was addressed to **Nitya Karmakar**, Australian Catholic University, on how to overcome the cultural and language barriers (apart from translations) in a comparably consistent area like Europe?

Prof. Karmakar stressed that emotional intelligence and social intelligence are very important factors to overcome cultural barriers. These are important skills for doing business with other countries. We talk about AI and robots replacing humans etc., but this is not possible because we need somebody who understand our emotions.

The following question was about China and whether the country will be ahead or behind in terms of the Industry 5.0?

Namir Anani, ICTC – Information and Communications Technology Council, emphasised that we know at a high level that the whole movement is to go from Industry 4.0 to Industry 5.0 and that is with the advent of the collaborative robots. It is actually the return of the human in the manufacturing process. Their ability is this coexisting between humans and robots to work together. China is investing heavily in the collaborative robots to do this. Industry 4.0 is to manufacture specific products, no matter how fast is something. It is when you get into the creative manufacturing you are going to reinject this into the process. It is a whole new dimension, a whole new world.

If you are looking at the 5 countries that are adopting collaborative robots, the U.S., Germany, South Korea, Japan, but the largest is China. China is positioning to have the first-mover advantage in that world.

Alan Elias, eBay, was asked to elaborate on challenges, initiatives and policies in the discussed context.

Mr. Elias stressed that the main challenge for micro- and small businesses trying to export is that the framework of the global trading system really was not designed for this new Internet enabled platform-based trade. It was designed for big containerships and big ports. A lot of the barriers that we see are really related to the basic elements of the transactions; it is accessing the Internet and platforms, receiving payments, sending a package, that package being received and processed efficiently and then delivered.

When you think about access to the Internet, a lot of that is just a question of infrastructure, especially in developing countries. When we talk about paying it is the same thing. You need banks and you need identification for people to get into these systems.

With regard to logistics, eBay sees a lot of these micro- and small businesses on their platform using national postal systems. These systems were designed over 100 years ago to deliver high volumes of paper letters, not to deliver millions of packages per year. Certainly it is promising that they are recognising this and are starting to evolve, but it is really having governments understand that these postal systems need to be interoperable, they need to have tracking, they need to have a lot of the things that consumers have to be accustomed to

through a lot of the private carriers.

The important aspect is having governments recognise that this new model of trade has emerged. It is valuable, it is an development tool and it is connecting the unconnected. It is allowing people, regardless their location and size, to trade on a global scale and see their businesses grow.

Jeremy Millard, Danish Technological Institute, addressed the issue of jobs and the future of work in the Industry 4.0.

Massive job losses always happened. The last time it was a disaster for millions of people. We should have learnt some lessons by that. Maybe we should go back to the idea and look at what technology does best and look at what people do best and merge the two. Even if technology is changing over time, it is a fluid interface. Technology is great at huge data, doing routine work etc. But also AI now is doing things that aren't necessarily routine. But people have the broad competences as well as a few of the verticals. At the moment the algorithms and machines don't have that. Look at the computers that just beat humans in Go or in Chess. That is all they can do, even if maybe this would change in the future.

In the book 'Machine, Platform, Crowd', MIT's Andrew McAfee and Erik Brynjolfsson have shown with huge numbers of examples that, when machines do stuff alone it is good, when people do stuff alone is good, when they work together it is fantastic—in terms of efficiency, value creation, but also quality of work and quality of life. We need to move there. And we can do it if we are smart. It is a political thing.

Michaël Stankosky, George Washington University, was asked to add a few words on challenges, initiatives and policies.

Prof. Stankosky referred to his first experiences in dealing with knowledge management, when the first Chief Knowledge Officer claimed that knowledge management is all about people, processes and technology, but people being the most important. The question is: Can we really say this? If Air Canada looses their technology system, they don't fly.

We don't know how to think collectively. They are all important, they are all critical, but we don't know how to stitch them together—how to stitch processes, strategies, management, culture. We are good at one or two areas. We live in a connected world and we don't know how to connect. We don't teach it, we don't experience it.

The biggest silo system is the university. Most innovation happens at the boundaries, the convergence of disciplines. The same goes for this era of the IoT, and the Industry 4.0, 5.0 or 20.0. Until we learn how to stitch it together like an orchestra, we muddle through. However, we do this quite well.

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Digital Agri-Business Ecosystem

The session's chairman and moderator, **DANNY BLAIR, Director of Science, Prairie Climate Centre, University of Winnipeg**, Canada, [www.uwinnipeg.ca], welcomed the participants and set the scene with a few introductory remarks.

Agri-Business Introduction

We have heard about the new paradigm, the transformation of society, the transformation of industry. Certainly not exempt from this evolution is the agricultural sector. The Ag sector is at the frontlines of the transformation that is happening to the use of information in so many aspects.

It is remarkable what has happened to agriculture over the last 50 years, and certainly in the last 2 years. It is truly transformational. The revolution is not just changing the farm operations, i.e., the way the seed is put in the ground and the crops come of the fields, but also changes in the farm operation in total, the management services, the marketing, the transportation network, the entire supply chain, the retail sector, and even the lifestyle of farming is changing. Every aspect of production and delivery of food around the world is changing as a result of the availability of information.

The digital revolution represents opportunities for the democratisation of information, and the democratisation of technology. The democratisation of data is important in order to put data in people's hands so they can use it.

Climate change comes up in many different contexts. It is frustrating that climate change isn't as embedded in our minds and actions as it needs to be. The climate change is happening rapidly and it is going to continue for decades to come. The average temperature of the planet is moving upwards rapidly.

The Prairie Climate Centre is trying to democratise the information about climate change so that people can respond to it properly, so that they can understand and act upon it, be motivated by it and develop solutions towards it. A new tool at the Prairie Climate Centre that is going to be released in January 2018, is the national atlas of climate change for Canada. There is already an atlas about climate change in the prairies at climateatlas.ca, but thinking ahead, climateatlas.ca was chosen because the idea was to make a national atlas of Canada.

People from all across Canada—from the Canadian High Arctic to the West Coast to the

Atlantic and the prairies—can click essentially in their own backyard and the atlas will show them, in a way that they can understand, what it is that climate change is expected to do to them. That hopefully will motivate and inspire Canadians to change their ways to the better and to find solutions to those things that can be prevented.

We are very much in the realm of trying to use the Internet and the online resources and high quality data and information, curated at an appropriate level, to get people to understand and act upon climate change.

This is all about the kind of things this session addresses: using information to transform the way we operate to make a better world, hopefully.

The challenge is—or what the Prairie Climate Centre hopes to happen—is that people will change their choices about energy, the kind and the amount of energy they use, production methods in agriculture, the distribution strategies, the consumer preferences are changing as a result of all of this, local and global food security is involved in this. There are so many aspects of transformation in the agriculture sector and climate change is just one of them.

MITCH REZANSOFF, Integrated Solutions Manager, ENNS Brothers, Canada, demonstrated how agriculture production is witnessing the alignment of equipment, technology, science and big data. The convergence has resulted in a dramatic increase in precision technology solutions and adoption worldwide.

Mitch Rezansoff made the presentation on behalf of Ray Bouchard, president and CEO of Enns Brothers, who unfortunately could not be present due to another engagement as chair of the board of the Enterprise Machine Intelligence and Learning Initiative (EMLI), a CEO-led not-for-profit organization, combining Canada's strengths in agriculture and artificial intelligence and machine learning. The EMLI board has established a bold vision for the future, to create the most advanced agricultural economy in the world through the embedding of Artificial Intelligence and Machine Learning into new and existing business lines.

Enns Brothers Ltd. is a farm equipment dealer located in the Province of Manitoba.

The Rules of Agriculture are Changing

[A short video was shown illustrating today's digital capabilities of the Ag sector]

The John Deere video viewed was developed 5 years ago and represents 90 percent of the digital capabilities of 2017. The only technology not accessed by farm managers today is holographic displays and keyboards.

The other key component of the video is farmer managers are spending less and less time operating equipment and more time acting as CEO, CFO, CIO. Quality of life with the next generation of farmer is becoming a critical requirement. They are not prepared to work 16 hours days, they will be involved with their children's education and extracurricular activities, grower associations and community. Another trend occurring, increased interest of daughters going to agriculture college with the intent of coming back to the farm operation. Expressing, 15-20 years from now I will be the farm operations manager.
What is critical to achieve this business leadership role is real time monitoring of equipment,

environment, markets, inputs and logistics. Reliance on trusted advisors and outside labour. Just in time customer services. The common link to all variables is data.

The development and adoption of advanced agriculture technologies at farm gate is relatively current. It was not until 2011-2012 the convergence of equipment, technology and science allowed for real time data collection and transmission.

Yet in this short period only 5 to 10 percent of growers worldwide are leveraging all tools and gleaning insights from all aspects of their operation.

In less than 10 years this number will probably approach 90 percent. Farmers adopt technology and trusted advisor recommendations if the return is transparent and near immediate.

Integration of technology and advanced analytics will lead to increased and optimised agriculture productivity while increasing responsible environmental practices and transparency.

When evaluating production agriculture landscape don't narrow focus on traditional agronomy and equipment. Look at all touch points and opportunities throughout the value change. Status of the entire life cycle currently or capabilities of participating in digital agri business ecosystem.

These tools and engagement will finally allow the agriculture industry to provide unprecedented degree of accuracy as it relates to enhanced value-added processing and traceability that consumers are demanding.

The agriculture industry (recognizing self-govern or be legislated) had the foresight 15 years ago to come together as an industry to develop standards, 1st with ISO Standards relating to machine performance sensor wiring, monitoring machine performance, also connectivity across multiple brands called ISOBus. 2nd AgGateway. AgGateway, not for profit, association representing the entire value chain. Farm Associations, Processors, Equipment, Crop Protection and Nutrition, Distribution and Logistics. A total of 230 companies are participating to implement data collection, transmission and aggregation standards. The results of the AgGateway initiative will truly allow Big Data aggregation from multiple sources to occur.

At the same time not forcing growers to decide on single company proprietary data format decisions.

One thing we know is that ag tech or technology enabled innovation is advancing exponentially.

How the digital agriculture business ecosystem will change agriculture production is difficult to define. We do know disruptive innovation will occur faster every year.

All agriculture stakeholders require a data and digital agribusiness ecosystem leveraged strategy.

The longer you wait, the farther behind you will be.

LOUIS LONGCHAMPS, PhD, Research Scientist in Precision Horticulture, St-Jean-sur-Richelieu R&D Centre, Agriculture and Agri-Food Canada, provided an insight in the role public organizations have to play in the emergence of a big data exploitation cycle in agriculture.

Big Data: Role of Public Organizations for a Proper Use of Agricultural Data

Why are we talking about big data in agriculture?

The answer to this question lays at the convergence of two large trends. The first trend is that farming is getting more and more complex with multiple parameters to be considered such as weather, market trends, soil fertility, pest management, farm labour, water and so on. And in this highly complex environment, farmers need to overcome the tri-fold challenge consisting of (1) producing enough nutritious food for increasing demographics, (2) farming in a sustainable way, and (3) being profitable. The second trend is the advent of information and communication technologies in agriculture. The first trend calls for more data and the second trend generates more data. But at the heart of this context befalls a more profound problem which is the knowledge gap existing in agriculture. For example, there is no way to tell what is the outcome of cutting N fertilizer by a quarter on important outcomes such as yield, net return, GHG emissions or groundwater pollution. While in other industries this would not be acceptable, agriculture is an industry that has to cope with the wide variability that is intrinsic to the natural environment. There is an inverse relationship between the knowledge that we have about a system and the resources required to exploit it. Therefore, the less we know about a system, the more we need to exhaust its resources. The knowledge gap in agriculture has thus led to the current global agricultural crisis. It is believed that Big Data can increase knowledge in agriculture and help bridge this gap.

What is the Role of Public Organizations for a Proper Use of Agricultural Data?

In order to tap into the power of Big Data in agriculture, a cycle needs to take shape where data is generated, rendered accessible to data scientists, processed (from data to knowledge) and knowledge been redistributed to farms for decision making, where data is generated. The key to the self-sustainability of this cycle is to create and demonstrate value in Big Data. Once value is there, stakeholders will have interest to feed, use and thus sustain this cycle. In my opinion, public organizations have a role to play in assisting stakeholder in the value seeking process (e.g. fund research, start-ups, early adoption,…). Public organizations should also make sure that a workforce that can manage, analyse and manipulate large datasets is being trained. The question of standardisation is debatable (i.e. Industry or government should set the standards?). However, there is a need to maintain standards to ensure that agricultural datasets follow “FAIR”—Findable, Accessible, Interoperable, and Reusable—principles.

In summary, public organizations may not need to act as service providers in the exploitation of Big Data, but they have a role to play in the emergence of a Big Data exploitation cycle that will help farmers meet the expectations of 21st century agricultural businesses.

MAURICE MOLONEY, Executive Director & CEO, GIFS – Global Institute for Food Security, Canada, provided an excellent overview on how advanced the agricultural sector has become in the area of agri-tech research.

Agri-Tech and Big Data & Video

Things are moving remarkably rapidly and one can see this in a lot of ways. Canada is at the forefront of much of the research that is going on in this area.

Research councils have put over $100 million dollars into a digital AgriTech research over the last 2-3 years with the Canada First Research Excellence Fund (CFREF). With that kind of investment, there are number of big questions that we are beginning to look at. Just to mention three of them:

The first big area is in research and developing techniques around research data with the potential for improving plant and animal breeding—particularly linking phenotyping to digital genotyping. There are massive DNA databases, which are entirely digital and searchable and you can look for patterns etc. But phenotyping databases, the mapping of traits, is by no means digital at this point. If you think about how a breeder functions, the breeder's eye needs to be digitised, otherwise it is an analogue to digital activity. Yet, the important thing in breeding is to find out which genes, and which variants of genes, contribute to yield.

A second area is agronomic data, which will increase the efficiency in agricultural production.

And the third one is in the food supply itself, both from a regulatory point of view and the point of view of customer requirements. There is an enormous opportunity for big data and analytics to interpose themselves.

Coming back to the idea of phenotyping or classifying traits—and this could be plants or animals: We already turn traits into mathematical signatures: Every time you pass a border control, they take a photo of you and search your facial recognition pattern. That is turned into a digital signature. There are about 80 points on a human face that are taken, and then the spatial distances between all those points are assembled into a matrix. There are a series of like faces, which are generally called "eigenfaces" (facial archetypes), and as a result of being able to parse the human face mathematically, it takes about 2 seconds for the passport control officer to know that it is you.

This kind of image recognition has advanced, but we need now to build 'eigenplants' or even 'eigenanimals' in order to be able to do similar image recognition. This is where it gets complicated and this is the subject of a lot of research.

Plants are more complex than a human face. We need to be able to look at these plants, look at the variations and turn those into mathematical databases that can be searched. If we could do this, then we could do machine-to-machine interrogation between the traits and the genes and begin to discover all the genes that contribute to yield, to stress tolerance, to disease resistance etc. in a plant. This is a very significant challenge.

In real crop plants, we do have models where we look at the different developmental stages, e.g., with corn, in order to then detect subtle differences in the phenotypes or traits which are useful for the plant breeder. However, this can not be done simply by photographs, some kind of matrix and regression analysis because the images are more complex. For example, leaves will overlap over leaves, flowers will pop up at different times, etc. Thus, we need to use AI techniques, deep learning techniques, in order for the software to detect what is actually in the picture. There is a lot of work going on on using these deep learning techniques in order to teach the software how to read these images. If we can read these images better, then we can begin to place those to a data base and do this genome to phenome interrogation.

It is very much at the research stage and it is a big challenge for image analysis. Eventually, what we will hope to do, is to turn the breeder's eye into something that is much more powerful than it is currently in the field.

When we move into the field, again there is a level of complexity, because we now have to look at genotype by environment, which we can't control, by management, which we do control. And we need to obtain a lot of data with samples about which we know something, particularly of which we know a lot about the genome, in order to be able to follow those.

There are all kinds of image acquisition technologies. Research uses a lot of drones to collect information of field trials. Although you can get a whole field of information of about 30 metres you can still see individual plants, and those individual plants, on a GPS level, are +/- 1 centimetre. For example, we would know if something was out of place: it was probably a weed rather than the crop plant.

Eventually, image analysis in real time will distinguish between weeds and plants and one will have new ways of removing weeds by very targeted applications of herbicides for example.

The purpose of field based data acquisition is to take enough data from flyovers with drones to be able to distinguish differences in these genotypes—as they respond to the environment in order to figure out which of these genotypes is going to perform well under drown conditions etc. Things that are really critical to farmer use.

A phenomobile is a close-in means of screening field plots. These machines can do hyperspectral imaging, which is augmented reality beyond what a plant reader can see. A spectrophotometrie of leaves can reveal the nutrient status of plants in vivo, such as potassium, natrium, phosphor or even zinc content.

Imagine the kind of data that can be obtained and understand with this genotype to environment to management strategy.

Finally, big data is impinging on the entire food chain. The food supply chain is extremely complicated and it is open to a lot of problems.

There was this horsemeat scandal some years ago in the UK. It was basically data tempering at a very early stage of the supply chain that allowed this adulteration to take place. In fact, it is very wide spread, and depending on who you read, these are double digit billion dollar problems around the world. Food fraud, in many ways, has basically been taken over as another form of revenue for organized crime. It is found with vegetable oils, with pastries and flowers—pretty much anything that is an ingredient in the food chain.

Most of these things are not really well monitored and yet the consumer is asking a question: What am I eating? Where did it come from? Who handled it? When was it harvested? Etc. There is going to be a great need in the future to be able to deliver some kind of easy to access data to consumers and to regulators to ensure that what we are selling is what is labelled on the tin.

In a typical supply chain, we start out with primary production in the field, rudimentary processing to much more advanced processing for end product package goods; there is a wholesaler that handles these and the retail site. All of these are subject to handovers and therefore potential changes that do need to be monitored.

Today, through sensors—through cheap technologies—and through biological analytical work it is possible to follow these things. This is where there are opportunities for blockchain disperse ledger type approaches in order to ensure that what we see at the end of that supply chain can actually be worked through and monitored.

There is enormous opportunities for companies in this space to work. The food and agri chain is traditionally not being called a very high margin business, but we will find more and more, as we move towards 9.6 billion people on the planet, it is going to get significantly higher margin.

PASCAL POITEVIN, Digital Strategy Consultant, ITG, France, elaborated on the transformation of the agriculture sector and particularly on the use of big data in this specific sector.

The Role of Public Organizations for a Proper Use of Agricultural Data

Between 1980 and 2010, agriculture has computerised the accounting and financial management, as well as the decision support and management of the production at the farm.

In parallel, agriculture has implemented a major national information system based on data collected on the fields. Local or regional databases serve as advisor for farmers, the national database serves as a guide for public policies, statistics and research. This large national information system manages food and animals' traceability, the genetic improvement of animals and provides measurement of the environmental footprint of agriculture.

Since 2010, one can observe a massive deployment of electronic sensors on robots in agriculture. The electronics are embedded in many material equipments, buildings, and even animals. Dairy farms, cereal farms, vineyards and greenhouses are the most important users.

The same developments can be observed in the agrifood companies. Digital agriculture transformation has an extremely important impact on agriculture and one can see first effects.

Large multinational companies with expertise in digital technologies are now interested in agriculture. This is new. Facing the challenges of our time concerning food supply, food security, environment and sanitary conditions, they provide innovative solutions. These actors invest significant resources to access agricultural data and develop alliances with companies such as agricultural tractors manufactures.

Many start-ups become interested in agriculture. They deliver solutions that are often original and not provided by traditional companies.

In France, for example, it is now possible to produce your strawberries in a container on the roof of your residence or in your garden. This kind of solution embeds a lot of technology, including artificial intelligence components. All these developments disrupt historic models and modify the relationship between the actors. Farmers exchange more data with their suppliers and they have a more diversified range of services. The consumers have access to more information about the products they are buying and can more easily buy from the producer of their choice.

Another point is that agriculture is no longer restricted to rural areas, but it is also developed in smart cities.

We no longer speak of agriculture in the singular but of agricultures in the plural. The development of the use of digital services in agriculture requires that certain important conditions have to be fulfilled: Access to the Internet, setting up of big data platforms, training of skills, and research.

About networks: Even if agriculture also develops in urban areas, the large majority remains

in rural areas. These spaces are places of life, where we find schools, health centres, craftsmen, industries, tourists etc. A countryside without digital access is a space without future. Let's face it, no one wants to visit the countryside for holidays if there is no Internet or mobile access. The farmers are in the same situation and increasingly need to be in constant contact with their environment and remote services. The deployment of the network infrastructure is an essential element in the development of the rural territories and they do not operate as in cities. The involvement of local and regional authorities is crucial when defining and verifying the quality of networks in these areas.

About platforms: Today, data is mainly hosted in relational databases on enterprise servers. The result is a wide dispersion of the data and a great difficulty to organise the sharing. The implementation of big data platforms is crucial but their implementation is complex. The obstacles are not only technical or financial, they are mostly related to mentalities and behaviours. This requires a lot of work on trust issues.

About skills: Companies, that are experts in digital technologies, have no particular skills or knowledge in agriculture. On the other hand, farmers or agronomists are not prepared to the use of technology. It is very important to organise common training courses, that allow both sides to be trained in order to better work together. In France, new training courses have been launched combining both technological and agricultural profiles. These courses are designed for young engineers and academic talents interested in promoting the project of digital agriculture.

About research: For a long time, due to the lack of efficient data, research had to work with samples, in order to then extrapolate the results to an entire population. Many research projects start with searching the sample data. Today, with the development of sensors on robots etc., agricultural research has a considerable amount of data to work on. However, accessing this data represents a major challenge for researchers. How to collect and access data which is managed by private companies or not through an open data model and at what price?

The French Agricultural Technical Institutes, specialised in agricultural R&D, have organised themselves against the lack of access to data. They have created a platform to accommodate the maximum amount of agricultural data offering a high level of confidence and the condition to use this data. Moreover, APIs have been developed to enable stakeholders, including researchers, to access data.

In conclusion, it is still a pioneering era which opens up the possibility of crossing data that has never been crossed before. This crossing will necessarily produce new results, and it will be at the origin of services that are increasingly innovative and useful to humanity.

PHILIPPE SCHEIMANN, Co-Founder & CTO, TOPGlobal.org, Israel representing **EMMAUEL SIMIYU, Co-Founder & CEO, GOIP GROUP**, Kenya, gave a concrete example of how technology can support solving hunger problems in Africa.

Digital Agriculture Extension Services Support System

[The presentation started with a short welcoming video message from Emmauel Simiyu]

80 percent of the food consumed in the developing world are originating from 500 million small scaled farmers.

There is a need to double the agricultural output just to meet the food requirements for this burgeoning population. Family farms constitute over 98 percent of all farms, and work on 53 percent of the agricultural land. One major problem small scale farmers are facing is access to information.

However, mobile penetration in Africa in 2016 was about 46 percent. Kenya is very innovative in terms of technology. As there weren't fixed phone lines, Kenya skipped the fixed-line technology and moved straight to mobile technology. Therefore, the idea is to use mobile technology and permaculture to start solving hunger problems in Africa. This can be done by setting up a Digital Agriculture Extension Services Support System (DAESS) for sustainable growth of the African agriculture sector—a kind of e-platform providing support for farmers.

The DAESS model works as an agri-accelerator and development centre. Mobile extension services, comparable to a call centre, provide support and training via the mobile phone. This is done by professionals working at the collaborating NGOs and having considerable experience in permaculture. It is also possible to provide agri-teleconference trainings for farmers via mobile phones. DAESS also provides agri-products telemarketing supporting the marketing of the products and promotes agri-innovation.

The components of DAESS are the followings:

1) A contact centre which can be used to support farmers, can be used as an early detection and warning system and for the telemarketing of agricultural products.

2) A Tele-training Centre to develop farmer capacity by connecting multiple farmers to a trainer via audio-conferencing.

3) An Africa Farmer Information Management System in order to generate and manage big data collected from farmers, extension workers and agriculture research institutions. The data will be used to drive innovation, research and development.

4) A knowledge base as a content hub of information regarding agriculture in Africa.

5) A Makers Room developing technical solutions for permaculture and thereby spurring innovations and new business opportunities. PermaTech solutions are developed by entrepreneurs and inventors from the accelerator. Kenya is a highly innovative country and a country of start-ups. There are amazing solutions coming out of this Maker Room.

DAESS is a kind of an ecosystem, a social business enterprise: There are technology implementation partners, there are NGOs providing knowledge and government agencies providing support. Further partners of the DAESS ecosystem are farmers, agriculture research institutions, extension agents and financial partners.

ALI KONE, COO & Co-Founder, Coders4Africa Inc, USA, presented a collaborative research project using cutting edge technology applying and co-designing IoT and big data to improve the working conditions in the rural ecosystem of Sub-Saharan Africa.

Affordable Technologies to Empower Rural Economies

WAZIUP (the Open Innovation Platform for IoT-Big Data in Sub-Saharan Africa) is the product of a partnership between a European consortium and African partners. The goal is to create an innovative big data platform in IoT to support rural economies, and even urban economies, in Africa.

The knowledge gap is a big issue. WAZIUP researches ways to propose new ways of making data accessible in order to enable entrepreneurs and organizations to create applications to support their communities.

There are various types of applications possible. Based on surveys, a few applications have been selected as use cases.

For instance, there is a big problem with cattle rustling in many African countries. It is difficult to find solutions for this, even more as it had to be a good and cheap solution. A first approach was to use a management systems with RFID tags. WAZIUP now uses beacon collars to track the animals. The WAZIUP platform enables the farmers to monitor real-time the cattle situation in order to have viable solution to prevent a theft.

Another application is traffic management as Google Traffic doesn't work very well in Africa.

Potential applications of the WAZIUP platform are agriculture, weather, cattle firm, fish farming, logistic and storage, traffic and transportation, urban agriculture, or air quality. The WAZIUP platform has been set up in order to develop applications in these specific domains.

WAZIUP also organizes a number of hackatons to support innovation and make people contribute their ideas of what could be done within the WAZIUP project. There are a number of hackaton IOT applications using the platform: One is the mentioned application using a simple beacon collar to prevent cattle rustling.

Another application is for fish farming: Farmers weren't able to know how much food they should feed. The WAZIUP platform enables people to connect a network of sensors to monitor the fish ponds in real time, measuring water temperature, quality, oxygen levels etc. This will improve the current farm management process by giving farmers the ability to monitor their ponds remotely and in a near real-time way.

Another two applications are experimented in Togo. One is for garbage management to increase recycling, and another one to do composting. The idea is to transform areas with a lot of garbage in the city in farmland (gardens). Sensors to measure the soil moisture are put in these gardens in order to figure out when the garden can be plated. The soil moisture sensors communicate via the WAZIUP platform.

Another interesting idea, which unfortunately didn't work, concerned chicken farms. As there are many chicken farms in Africa and many people couldn't tell the weight of their chickens and when they had to feed. The idea was to set up a system with a weight sensor and also measuring the level of water in the food. Each time the chicken would go to the eating place, the measures could be taken.

Other applications is a chicken incubator and a garbage collection system with sensors. This garbage collection system was given to every resident in the community. The sensors measure whether the garbage is full or not and alerts the organization that will pick it up. Moreover, the residents get points according to how much recycling they are doing and are rewarded.

The WAZIUP platform uses a lot of sensors. The project mainly uses LoRa technology. Telecommunication is also possible via regular GSM, but this is expensive. WAZIUP provides a possibility, especially in rural areas, to communicate over a long distance at a very low cost. LoRa gateways are set up in strategic locations and the sensors communicate within the LoRa gateway. This gateway is self-made using Raspberry Pi and Arduino. It is all do-it-yourself. WAZIUP trains people to create such a gateway and to install it.

WAZIUP is a platform running on the cloud. The gateway communicates with the cloud and collects all of the data. Now applications can be developed to use data from that cloud.

An example is the smart village model in Saint Louis, Senegal. WAZIUP has set up a LoRa gateway at the university, in one of the highest locations, and then there are some strategic points the project wants to experiment with. The idea is to create a kind of smart village model with a central system that collects all of the data. For instance, you can have some sensor network within—it could be for e-health at the hospital, for farms, etc. It is a test bed that is piloted right now and creates test cases for future entrepreneurs

The WAZIUP project realises a lot of research and provides training for developers to develop and to use the technology. The project also does a lot of prototyping and is collaborating with NGOs and governmental agencies in order to see how to make the best use out of the project. But in the first place, WAZIUP talks to the end users in order to see what they need and how WAZIUP can be used to solve their problems.

The biggest issue is affordability. The solution has to make sense to the users and they have to be able to afford it.

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Q&A

The first question addressed the issue of affordability of technology.

Ali Kone, Coders4Africa Inc, confirmed that affordability has been the issue from the beginning of the WAZIUP project. In order to make the technology affordable it is based on open source technology already available. WAZIUP is not trying to invent something complicated.

Technologies like Arduino or Raspberry are very affordable today. It is possible to build a LoRa gateway for less than €50 euros—even for €25 euros. Arduinos can be purchased for less than €2 euros. Those Technologies are relatively affordable compared to before.

WAZIUP has created a weather station, entirely built of open source parts, for €150 euros.

The other part of the equation is having partners that have a strategic interest in getting some of these things out there because the value is not just on the production level. They can help subsidise some of these products and an effort to make it more affordable.

Philippe Scheimann, TOPGlobal.org, added that items of affordability first start with no-tech solutions. There are all kind of solutions that people can do on their own without any technology. This could be distributing a couple of rabbits to families and then they start to eat meat, and then slowly it gets to what was said above.

In terms of corruption, money is a problem. If there is money, there might be corruption. The key here, is to work with local organizations, NGOs, that have been going through training in terms of education for sustainable development and they are developing their own solutions. It is not that they are waiting for the European community's money, they are making their own solutions, so that corruption really doesn't exist and the system is transparent.

Another question, addressed to Prof. Moloney, came from the Canadian Space Agency (CSN) wondering whether CSN's space-based platform for hyperspectral imaging is something that could be useful for the work of GIFS.

Maurice Moloney, GIFS, affirmed the usefulness of satellites for hyperspectral imaging. In general, satellite images are used more to get aggregate data for entire fields. In most individual fields there is just one variety growing in them. But one can get good information about individual varieties that way. The quality of course of the spectrum that is amounted in satellites is extremely high. The close-up imaging that GIFS does tends to be for individual block trials, so one can distinguish subtle changes between genotypes. If you have got thousand different genotypes in the field, then each block might be 3x5m and they would look at individual genotypes. There is a plethora of very useful data from satellite imagery and more and more is coming available.

Louis Longchamps, St-Jean-sur-Richelieu R&D Centre, reported his experience from crop management. Satellite imagery can inform about the concentration in chlorophyll in nearly each pixel. It allows to see that something is going on, but you can't tell if it is a fungus etc. The best way to use satellites imageries is as a guide. You get the image and then you guide the agronomist in the field.

Another question addressed the issue that, from a technology perspective, the cast of high precision RTK (Real Time Kinematics) might be a barrier to further deployment, particularly at broad scale deployment.

Mitch Rezansoff, ENNS Brothers, explained that, with regards to RTK signals, there is an infrastructure cost that has to either be purchased by the farmers or the farmers have to subscribe to access the infrastructure. Compared to the equipment cost it is substantially lower. RTK is going to give you the most accurate guidance for farmers looking for sub 2 cm levels of accuracy. It is usually with row cops, corn, vegetables. The signals coming from satellite or similar signals for guidance will be a lot less accurate, but in a lot of instances acceptable. It really comes down to what is the revenue opportunity for having better RTK guidance signals and so relate it to the high value crops and make it part of the cost production.

Louis Longchamps, St-Jean-sur-Richelieu R&D Centre, added that RTK is an algorithm which has been protected for a long time to keep the market price high. But among all the open source technologies that are emerging right now, there is also a system called Reach, considerably less expensive and able to reach the same resolution.

The next question addressed the issue of food waste, for instance food that is discarded because it is not cosmetically the way people want it to be.

Maurice Moloney, GIFS, pointed to an issue that is probably widely misunderstood in the biotechnology sector in terms of insecticide resistant and herbicide resistant plants: the first product that was ever launched was a shelf life product, the Flavr Savr tomatoes from Calgene, and that was purposely to reduce waste in tomatoes—particularly where tomatoes were transported long distances and would degrade over time. But it also worked very well for shelf life in individual peoples' houses that the tomatoes lasted longer. It is well beyond time to go back and have a look at some of those technologies, because there are many areas in which we could avoid spoilage or prolong shelf life. If you look in sub-Saharan Africa, there is still a massive problem because probably between 40-50 percent of the corn that is harvested, in technical terms in North America or Europe would be spoiled because of aflatoxin. There are numerous ways in which one can treat that: There is aflasafe technology that is now being used, but also even using insect resistance genes. This does actually dramatically reduce aspergillus flavus infections because they are transmitted by insects.

It is still a big area for work, but with the advent of various types of sensors we will now have the potential for chemical sensors, essentially artificial noses that can pick up very small amounts of emissions from crops that have been harvested but are under that kind of risk. It is a very important area and would probably account for somewhere between 20-30 percent of the total food problems that we have.

Ali Kone, Coders4Africa Inc, stressed that, in certain farm rich countries, food is just rotting away. Mali or Guinea, for instance, have a lot of mangos and they transport mangos by truck to other countries. Half of the production is wasted. This is also one of the problems addressed by WAZIUP: How to bring the food to the target population faster?

The other problem is the industry. Some countries have the crops but there is no significant transformation industry—or there are regulation problems. Countries just cannot export to certain areas.

Philippe Scheimann, TOPGlobal.org, reported from a project realised in Kenya to fight waste. They started using the rest of the mangos or avocados to make natural cosmetics. Another positive effect was that it created jobs for women. All of the potential waste of mangos or avocados or medical plants represent an important ingredient to develop natural cosmetics. There is a whole industry for this.

Let's do with what we have. There are a lot of resources.

Mitch Rezansoff, ENNS Brothers, explained that with more and more farmers starting to track and log and record their activities, every operation across an oak or canola field is being documented and geo-referenced. They have the ability to provide social evidence. More and more manufactures, food processors and consumers are making the request: "I want to know how this was produced. Prove that this was sustainably produced. What is your carbon footprint? What is your impact on the environment?" It has already started.

90 percent of the Quaker oats that is used in breakfast cereals for North America are coming out of the Province of Manitoba and southern Saskatchewan. They looked at a strategy of making the claim 'organic oats' in their breakfast cereals. They changed their strategy to look at 'sustainably produced' and are now putting within their contracts for oat production 'show me the social evidence of growing oats'. Most farmers would engage and endorse 'I will show you social evidence'. They are not afraid of it.

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Session 10

Day 2 – Afternoon – Parallel Session

Women in Digital Services

Success trends for raising female profiles and accomplishment rates across information technology digital services practices

The chair and moderator of this session, **LISA ZELLERS, Director Agile Enablement Group, CGI Federal Emerging Technologies Group**, USA, welcomed the participants and briefly introduced the panellists.

This session was about how to make current and future endeavours to increase female profiles and accomplishment rates across information technology digital services practices more successful. The objective was to influence action: What can people do in their companies, in their spare time, in professional development of others and mentoring to help raise women's profiles and to help close the gender gap?

The chair then provided some examples of female successes in digital services and IT:

In the 1940s, Betty Jennings and Frances Bilas were 2 of 6 women who programmed the ENIAC (Electronic Numerical Integrator And Computer).

In the 1950s, Rear Admiral (Commodore) Grace Hopper was one of the first programmers of the Harvard Mark I calculator and UNIVAC. She developed the first compiler for a computer programming language. Her work at the Conference on Data Systems Languages (CODASYL) led to the creation of COBOL

In the 70s and 80s, Frances Allen was a pioneer in the field of optimising compilers. Her seminal work in parallelization and code optimisation made here honoured as the first female recipient of the Turing Award, 2006.

The audience had 1 minute group time to come up with examples of successful women of today. A sampling of strong female leaders identified and reference pages for them is included below:

Suggestion	Prominent Role	Reference
Anne Altman	IBM	https://washingtontechnology.com/blogs/editors-notebook/2016/01/ibm-altman-retires.aspx
Teresa Carlson	Amazon / MS	https://en.wikipedia.org/wiki/Teresa_Carlson
Michelle Zatlyn	Toshiba / Cloudflare	http://entrepreneur.wiki/Michelle_Zatlyn
Marissa Mayer	Yahoo	https://en.wikipedia.org/wiki/Marissa_Mayer

Megan Smith	USG CTO / Google	https://en.wikipedia.org/wiki/Megan_Smith
Michelle Thaller	FCC	https://en.wikipedia.org/wiki/Michelle_Fowler
Karen Evans	USG CIO	https://en.wikipedia.org/wiki/Karen_S._Evans
Meg Whitman	HPE	https://en.wikipedia.org/wiki/Meg_Whitman
Sheryl Sandberg	Facebook	https://en.wikipedia.org/wiki/Sheryl_Sandberg
Dr. Phyllis Schneck	DHS Cyber	https://www.cyberscoop.com/phyllis-schneck-promontory/
Mary Meeker	USA Inc	https://en.wikipedia.org/wiki/Mary_Meeker
Anja Wyden Guelpa	Chancellor of State, Switzerland	https://fr.wikipedia.org/wiki/Anja_Wyden_Guelpa
Janet Yellen	Chair of US Federal Reserve	https://en.wikipedia.org/wiki/Janet_Yellen

Some additional examples presented from the panel included:

Laura Weidman Powers is one of the tech industry's strongest advocates for diversity. With CODE2040, she supports young black and Latino engineers, working to ensure they are proportionally represented in the field. Weidman Powers also served in the Obama White House as a senior policy advisor to the chief technology officer.

Reshma Saujani founded Girls Who Code, the powerhouse non-profit that has helped to make coding education, and its gender gap, more visible.

Tracy Chou is an engineer and alumna of Pinterest and Quora. She also helped spur tech companies to disclose diversity statistics through a Github project that collected numbers on women in engineering. Today, most major tech companies publicly share diversity information about their workforces—and Chou's repository played a big part in that.

Secretary of the Air Force Heather Wilson's 35 years of experience are a testament to how women lead in national security: She was a director on the National Security Council under President George H.W. Bush. She served in Congress on the Intelligence and the Armed Services committees. She was an Air Force officer and graduated from the service academy.

When looking at the statistics surrounding the reality of today's industry, one can see that in contrast with medicine, law, physical sciences—which seem to have a steady curve—the percentage of women in computer science is declining since the 80s.

There is a sampling of theories around these statistics: For instance, programming at first was considered clerical work but was quickly be discovered to be hard and became a male stereotype activity like maths. There are theories around the perception that tech and engineering is about machines and cables and men working together. There are theories about the marketing of personal computers in the 80s that specifically targeted boys. There are stereotypes that women are less competent, evidenced by statistics that show as men move into a field, salaries go up (statistics also show as women move into a field, salaries go down). There is also a pervasive belief that innate ability or brilliance is required to succeed.

There are other theories saying that we are raising boys to be brave and take risks, but girls to be perfect (by avoiding failure and risks); which then makes them less likely to pursue fields that require iterative development like programming. There are other theories about family duty and maternity leave, and the list of theories goes on and on.

But what about the 10-15 percent of women that are working in the field currently? There is a couple of studies for review:

In the 'Subtle Gender Bias' study, identical resumes were sent to male and female professors, who were asked to rate the people on competence, hireability, mentoring and salary. When the resume had a woman's name at the top, both male and female professors rated them lower on all of these measures. This bias, combined with the belief that innate talent is the main requirement for success, explains the gender disparity.

There is a study around gender bias in open-source, even if there is a bit controversy around this: For this study, researchers looked at more than 3 million pull requests from approximately 330,000 GitHub users, of whom about 21,000 were women. The researchers found that 78.7 percent of women's pull requests were accepted, compared to 74.6 percent for men. Programmers who could easily be identified as women based on their names or profile pictures had lower pull request acceptance rates (58 percent) than users who could be identified as men (61 percent). But woman programmers who had gender neutral profiles had higher acceptance rates (70 percent) than any other group, including men with gender neutral profiles (65 percent).

Even in 2017, there are example after example in the news and recent studies that prove women are at a disadvantage: There is the Google Manifest-bro by James Damore and the White House decision to stop the equal pay rule. In EU, 2.7 million people work in the ICT sector, but only 20 percent are women. The U.S. recognizes a 21 percent pay gap between genders. Companies like Google, Microsoft, Oracle and SAP are still composed of about one-third women to two-thirds men. And even in this Global Forum only 22 percent of the panellists and speakers were women.

Why do we care? We care because some of us are women. Because some of us have female children and want them to succeed. But also because digital service (IT) jobs are highly paid, provide financial independence and have high impact on society. Women are potentially missing out on a large portion of the workforce and diverse teams deliver better results and better access to different client groups.
By 2020, Girls Who Code estimates there will be an estimated 1.4 million computing-related jobs in the U.S. alone, and women will likely only fill 3 percent of those.

What is success? In general, seeking and maintaining a balance of women in all digital services fields, at all levels, including leadership and decision-making roles, as well as equal pay for equal work. There are other things that will come once women get more representation in this field, such as paid maternity and paternity leave and benefits such as healthcare and flexible work schedules, but also not tolerating gender-based discrimination or sexual harassment in the workplace.

The panellists presented a 3 prong approach to encourage the education and exposure of women in the IT field: The first prong is school age. By levering the playing field when

females are young through access to education, ICT and STEM programmes, you don't create a male versus female disparity at a young age. And second, you also need to look at adults that are currently not in the digital services fields. By promoting underprivileged areas, women's education, skills development and/or career programmes, you give the opportunity for women who aren't trained or don't know IT skills to change jobs later in their career. And third, for women already in the IT field, you have to provide them on-the-job support, networks and mentoring which creates a feedback loop. Once you see successful mothers, aunts, or female role models providing entire younger generations a new norm and a model to follow, you create this feedback loop to school age girls to want to succeed in the same areas.

The following presentations went through each prong, starting with the first one 'School Age'.

CGI runs STEM Camps in six U.S. cities and recruit elementary, middle and high-school students for programmes that will introduce basic IT concepts and skills in sessions led by local mentors and CGI professionals. The programme addresses a critical industry challenge: the lack of STEM professionals, particularly those from diverse communities, who are needed to help build an IT workforce for the digital age.

Developed in partnership with local organizations, CGI STEM Camps are funded and supported by CGI's Dream Connectors global initiative, which engages CGI professionals and resources for programmes with community impact around the world. During the day-long camps, students will be introduced to software coding, computer hardware and other important IT skills.

MARTA ARSOVSKA-TOMOVSKA, Former Minister of Information Society & Administration of the Republic of Macedonia; Digital Transformation Strategist & Business Development Consultant, Macedonia, gave an insight in what Macedonia has done in this regard.

During the past 20 years, unemployment rates in Macedonia were extremely high. Therefore, job creation was a top priority for the Macedonian Government. After the fall of Yugoslavia in 1991 and the process of privatisation, many factories closed. In 1995, Macedonia had an unemployment rate of about 40 percent, the highest unemployment rate ever.

Since then, a series of reforms have been made, and this year the unemployment rate dropped to about 22 percent, which, of course, is still rather high.

ICT has been identified as one of the most relevant sectors for job creation. Why ICT? Even if the term STEM (science, technology, engineering and maths) hasn't been created at that time, teaching STEM related disciplines has been integral part of the Macedonian education system for children at a very young age. Disciplines like mathematics, physics and science are mandatory for all students in elementary and secondary schools since a long time. Another reason for choosing ICT as one of the more perspective professions in Macedonia for job creation was that many Macedonians speak English, because English has also been a mandatory subject in the Macedonian education system for many years.

Macedonia has become one of the most favourable ICT outsourcing destinations in Europe. According to recent statistics, every third day an ICT company is created in Macedonia. The

country offers very good conditions for ICT.
Early STEM education is recognized as a top national priority. Technology and engineering have not really been integral part of the curriculum of education before. However, 8 years ago, Macedonia launched the project one computer per child, i.e., each child in primary and secondary schools got their own computer. Since 8 years now, informatics as a mandatory subject from K7 to K12. Since 2 years, 'working with computers and programming basics' is mandatory subject for K3 graders (8 years old) and above. It is all about algorithm thinking and logical reasoning.

With the introduction of this programme, the country started using educational software and games (DigiMile, ScratchJR, Daisy The Dinosaur, Greenfoot, Alice etc.) with the aim to understand algorithms, algorithm thinking, logical reasoning, to create and debug simple programs, computer animations etc.

As result of these policies, the number of enrolled students at ICT faculties is increasing by 10 percent per year since 2011. In 2017, FINKI is a faculty with the highest number of enrolled students, out of which 33 percent are female. This is a real improvement, as Macedonia started with 20 percent of all enrolled students being female. And very importantly, 40 percent of the graduate students are female, which shows that they have a better success ratio when advancing in their studies.

There is a long way to achieve a full gender balance, but Macedonia are heading in the right direction.

TAMARA SHOEMAKER, Director University of Detroit Mercy – UDM's Center for Cyber Security & Intel Studies; Operations Manager for CISSE (Colloquium for Information System Security Education), USA, talked about the CyberPatriot K-12 programme.

The US was falling behind in STEM education. The CyberPatriot K-12 programme has been initiated by the Air Force Association to inspire K-12 students toward careers in cybersecurity or other STEM disciplines.

The programme is in its 10th year now and it is organised to be easily implemented. It started as a national programme, but now has gone global. There generally is a $205 dollars fee per competing team, which is also very easy to implement compared to many other much more expensive programmes. 'All girl teams' play for free.

Children spontaneously seek competition with their peers. These programmes seek to inspire students to study science, technology, engineering and math to help to fill the gap in our workforce.

In 2016, there were more than 4,000 CyberPatriot teams competing in the U.S., thereof 192 all girl teams. There have been 80 teams competing in the CyberCenturion in the U.K. and 58 teams competing in CyberTitan in Canada.

Hopefully, the programme will be brought to other areas as well. That basically takes having some people who are stakeholders and people who are champions for the area, so they can get the awareness out. The programme sells itself once people are made aware of it, because it is so easy.

Young children within the CyberPatriot programme are playing simple games to raise awareness in cybersecurity. The children don't even know that they are leaning, they think they are playing games. But what they are really leaning is cyber awareness. It is also taking fears away and making children aware that this discipline might be really interesting for them.

It is in the middle school and high school, where students actually start competing. The competition puts teams in the position of newly hired IT professionals tasked with managing the network of a small company. It is a protective competition (5 rounds, 3 levels of play) unlike some of the other competitions which are more attack-oriented. Competition within the CyberPatriot programme is all protective.

It is all virtual. Thus, it is not necessary to take kids on a bus and go anywhere. It happens over a week-end and the team gets to choose what 6-hour period they are going to do this.

Another important aspect is the mentoring. From the beginning, there have been more mentors than teams, all helping to produce a more diverse pool of people in the career pipeline and aware users. The coaches are not on their own. There are professional mentors for each team, tutorials, practice games, Microsoft OS, Linus OS and Cisco tools as well as 'best practices'. Professional mentors provide the opportunity to bring females and males, people of diverse backgrounds in, as professionals, and show the students what their carrier path might look like.

A summer camp started in 2014 and over 9,000 students have participated. Over 5,400 Grade School kits have been sent out reaching an estimated 54,000 students. Most STEM education programmes draw 12 percent of females, while CyberPatriot draws 23 percent female competitors.

Since 2010 young women have been playing video/computer games at an equal rate as men. These competitions offer role models, encouraging collaboration and providing opportunities for student-directed project-based learning using critical thinking and other cutting-edge pedagogies to engage girls and improves learning outcomes.

BETH BELL, Vice President & Partner, Canadian Public Sector Leader, IBM Global Business Services, Canada, presented IBM programmes in the area of bridging the digital divide, and expanding the pipeline and reinventing education.

IBM is very committed to diversity. In 1899, IBM hired its first female employees and its first black employee. In 1943, IBM has its first female Vice-President. The today's CEO of IBM is female. In 1953, 10 years before the Civil Rights Act, IBM had the first Equal Opportunity Letter.

Diversity of people, advancement of women and all diversity groups, is a very big focus from the top-down from the IBM organization.

It is really important to get to young girls, give them positive examples of female role models, and really start to talk to them in this grade 7-9 area, where perhaps their self-esteem is not always high. They are starting to care more about what young men think about them. Often these young girls don't want to appear too smart, because they think young men are not

attracted by smart women.

In the late 1999, IBM started the Women in Technology Programs, which was really fuelled by IBM women going into the community and doing programmes in schools for girls in grade 7-9 to change perceptions of IT jobs and encourage them to maintain their studies in math and science. Many of them dropped those and when they come out of school, they don't have the appropriate entry level skills to get into the feeder schools for companies like IBM, like CGI and many other organizations, i.e., engineering, computer science, and even some of the MIS (Management Information Systems) faculties.

These programmes take place in the school year and in summer camps. All programmes are staffed by IBM women volunteers with educational and professional backgrounds in technology. The programme has been carried out all across the U.S. and Canada. In Canada, in the 90s and the 2000s, the programme didn't have enough women to support the programme and reach desired impact. So many competitors of IBM joined the programme and over a 5-year period, the programme was done jointly for about 6,000 young girls.

IBM has also adapted this programme for Aboriginal youth, both female and male, and put it in a package so that it could be self-delivered wherever the students were, without relying on an IBM facilitator.

IBM also partners with Girls Who Code which has one focused mission: Close the gender gap in technology. With over 10,000 alumna, the organization recruits girls from sixth to twelfth grade for after school clubs and summer programmes to learn coding and become familiar with what opportunities exist for women in technology.

Launched in 2011, IBM has an organization that is attached to but separate to the company, called P-TECH (Pathways in Technology Early College High School). It is a grade 9-14 programme preparing youth, particularly low-income students of colour, many of whom are the first generation in their families to go to college, to move beyond high school, earn a college degree, and enter the workforce with skills that employers value.

It allow the students to do 2 years of college and high-school in technical disciplines over this grade 9-14 timeframe. The students finish the programme with a 2-year college degree and an entry level to, if they want, take a 4 year degree. Importantly, each school is sponsored by 1-3 organizations, and those organizations provide summer jobs for the students in the programme, they provide mentors for the full term of the programme and they provide jobs when they graduate.

Today, there are over 65 schools in the U.S. and it is not just IBM supporting these schools. The programme has completely be opened up in order to increase the impact

The audience had 2 minutes of group time to come up with similar programmes or questions.

The question of equal access and accessibility came up:

Marta Arsovska-Tomovska, Former Minister of Information Society & Administration of the Republic of Macedonia, explained that the Macedonian Government provided grounds for young people, no matter whether they are boys or girls. The objective was to make them think about having a career in the ICT sector, because ICT is considered as one of the industries that will help the country overcome the difficult economic situation. The focus was put on all children. However, this initiative contributed to increasing the interest of girls.

There were also specialized initiatives, like 'Girls in ICT': ICT teachers, professors and business women of Macedonian ICT companies visited schools, even in the remote areas, and gave lectures about ICT as an industry and as a profession. Then, those girls between the age of 10-12 were taken to IT-companies and spent one working day in these companies to ask questions and get an impression of the whole spectrum of ICT-related professions.

Tamara Shoemaker, UDM's Center for Cyber Security & Intel Studies; CISSE, stressed that if there is an issue with connectivity, the CyberPatriot organizers make sure that people get to play. There is also the possibility that industry partners donate their 'old' computers, which then are repurposed for the schools. Experience has shown that the professionals in ICT are amazing with respect to volunteering, mentoring and bringing in equipment.

Moreover, the city of Ghent has a lot of free computer rooms spread around the city. Volunteers in these vacant rooms help people to use these computers.

Ghent is also doing a project with parents. Instead of working with role models, which the girls might not know, the idea is to teach the mothers the help the girls in ICT.

Lisa Zellers, CGI, moderating, summarized some of the potential success factors:

Learning to code through games has had success. However, some people think 'gaming' is less interesting to girls, so should we consider offering education activities that they could find interesting? Career choices away from IT often happen in high school, so be sure programmes engage at high school. Focus on a wide array of IT-related fields like design (not just coding). Engage parents and teachers, they 'do' influence career choices. 74 percent of teens that considered engineering did so only after being explained the economic benefits and impact they can have on the world. Raise girls to be brave, strong, have grit and are fuelled by failure! And, create young role models through the 'Digital girl of the year' initiative.

The following presentations concerned the second prong 'Adults Not Currently in Digital Services Fields'.

KATHY KNIGHT, CEO, ICTAM – Information & Communication Technologies Association of Manitoba, Canada, demonstrated that there are some great programmes for youth happening in Manitoba.

ICTAM is the Information and Communication Technologies Association of Manitoba. ICTAM represents the ICT industry in Manitoba, which has approximately 650 firms employing over 70,000 people. The current unemployment rate for ICT in the province is less than 3 percent, which means statistically that the sector is fully employed. The population of Manitoba is comprised of 51 percent women, and in Canada, the national average for employment of women in technology roles is around 27 percent. In Manitoba that number drops dramatically to 11.1 percent.

Meanwhile, there are Manitoba firms that are anticipating 49 percent growth in employment by the end of this year. This translates into 15,000 additional full time positions, which many will go unfilled. If you want to take it from the investment point of view, in ICT talent is capital and innovation eats talent for breakfast. Here we have a demand and a largely untapped supply of talent.

When asking where the women are in Canada's ICT industry, there are a number of factors that come into play. But underline all of those factors is culture. Three reasons why we are not seeing as many women participating in ICT:

1) The most popular way of recruitment currently is through personal networks and internal referrals. These are the most common used recruitment channels. Therefore, when you are in a male dominated industry, it stands that the referrals will largely come from a male dominated network. This limits the number of women that are actually getting into the pipeline.

2) Critical determinant in a woman's choice to enter, remain and progress within the digital economy is having women role models, especially in leadership positions and women who can act as mentors and guide the next generation of professionals and leaders. For women in the tech workforce there are often few role models. It is not just that the role models have to be in the C-suite, it is throughout the continuum of your organization.

3) Despite all the good things that are going on, the bro culture is real and it has been for some time. Ellen Pao, activist in Silicon Valley, published a book called 'Reset: My Fight for Inclusion and Lasting Change'. It is worth reading. "When we feel like we're being locked out of the clubhouse at work because of our gender or color or some other difference, often it's because we are," Pao writes.

However, we need to balance the stories. We have to acknowledge the elephant in the room, but we also have to make sure that people don't become anaesthetized to that message.

With the demand for tech professionals increasing, we also have this huge opportunity to take advantage of a significant asset in our workforce, which is women. And by changing the attitudes in workplace culture, we can do a lot to attract more women to STEM.

With regard to the media, there is a need to balance the attention between the 'sometimes it is hard to be a women' stories and successful stories of women in STEM. Interestingly, there are quite a few women in senior positions that are ready and willing about being role models and being mentors, but the gap is often relative to the women who are coming up. There isn't that level of participation.

Some of the events that ICTAM has done over the past year are things like speed mentoring (a social mentoring event). Later this month, ICTAM is beginning a 6-week after school programme for girls. It is giving girls a taste of a lot of different opportunities, from coding to robotics to gaming etc. ICTAM also will host panel discussions featuring its own female leaders demonstrating every day that the glass ceiling is breakable.

These are all small steps, but the only way to progress is to begin as you mean to go on and just get started. Efforts like these will pave the way to change.

On behalf of Tammy Heller, Vice President, Global Human Resources Centers of Expertise, CGI, **Lisa Zellers**, CGI, added that CGI also regularly supports the non-profit The Women's Center.

The Women's Center provides mental health counseling, support and education to people of all ages, to build resiliency, navigate life's challenges and opportunities, find healing and wellness, and develop new skills and goals for life. Their events to educate adults are currently in digital services fields: They have an annual leadership conference. Women's Center offers workshops on interview and networking skills. They provide resume development courses, federal job application support and re-entering the workforce support.

Beth Bell, IBM, explained that IBM deals with the issue of bringing women back to IT by partnering with the following programmes:

There is a programme called Tech Re-Entry, which is run by a collaboration between the Society of Women Engineers and iRelaunch, which are return-to-work experts. They have partnered to make rejoining the tech industry easier for skilled employees who have been out of the workforce.

There is another programme IBM partners with, which is the ReBoot Accelerator for Women. It is an 8-week programme designed to give women the skills, connections, and confidence to re-enter the workforce.

Lisa Zellers, CGI, summarized the potential success factors identified to help re-entry of changing career fields:

It includes partnering with and engaging companies and non-profit organization dedicated to closing the gender gap in technology, but also college recruitment programmes targeting women. A Harvard Business Review study found that 'five years after a company implements a college recruitment program targeting female employees, the share of […] women in its management rises by about 10 percent on average.'

The following presentations concerned the third prong 'Women Already in the IT field":

MARTINE DELANNOY, Chief Foresight Officer of Digipolis, the IT organisation of the cities of Ghent and Antwerp, Belgium, addressed the question whether the future is female.

Digipolis is in charge of the ICT in Ghent and Antwerp and all the local non-profit and governmental organizations in these two cities. Digipolis is responsible for everything from hardware over software to all the ICT developments in these two cities.

The European legislative context changed in 1973. Since that time it focuses on equal opportunities for both genders. Government organizations played a big role by trying to lead by example both at the political level and within the governmental level, and setting up well paid jobs in the governmental sector—jobs that are paid based on education and on years of experience. Candidates are evaluated through a whole examination process to ensure as much fairness as possible. For instance, the city of Ghent has about 500 fulltime employees, comprised of 49 percent women and 51 percent men. At a political level, they even go further. When they are setting up political lists, they actually have female-male or male-female going through the whole list.

However, due to financial issues it remains difficult to find and retain qualified ICT experts. Large efforts have been undertaken to make a governmental set-up as interesting as possible.

Digipolis is trying to implement a good work-life balance: The employees are working time and place independently, i.e., they can use teleworking and working from home, flexible hours etc. The employees get a series of objectives to reach and they decide when they are working on these projects and where they are working on these projects. There is a lot of flexibility.

According to statistics, the success rates of girls entering ICT fields in universities are slightly higher than those of their male counterparts. However, it is difficult to convince girls to enter into these sectors.

With this regard many projects have been set up in Ghent (Digipolis is often involved), such as coder workshops, STEM education in the schools, e-inclusion projects, female role models and mind-machine projects (projects in the schools to have youngsters think up machines, that will then be developed), but also the use of media to eliminate stereotypes. But there is still some way to go to encourage more girls to pursue ICT further.

The focus of how ICT is seen should be broadened to also include the societal values of ICT. ICT is never done for the sake of ICT, it is done to reach a certain change. And we also have to listen to those choosing, and those not choosing, this field and base ourselves on this information to test, adopt and roll out new initiatives. Moreover, we have to share the best practices and failures to learn from each other, because sometimes a solution may not work in one place, but once it is slightly adapted it may perfectly fit for another place. This broadening of the focus from the technical aspects to the social aspects might make the field more interesting to certain groups.

Beth Bell, IBM, outlined the IBM findings with regard to pulling women within an organization and focussing on the advancement of women that are already in your organizations:

The first point is if you don't focus on the number of women advancing in your organization, the number will not change and it will probably decrease. You have to have some sort of measurement system—it is not a quota system, because we are looking for the advancement of qualified talented women. But we do know that, when you set objectives, you typically get results.

The second point would be to encourage people in leadership positions: Whatever is appropriate for your organization and for your culture, if you are hiring for a leadership role and you get a slate of all man, turn it back. It is the one cultural thing every leader could do and say, this is not a diverse slate of people—please give me a diverse slate of people. That sends a very clear message and if you ask your directors and managers to do that too, they start to figure out that there is a need to have enough women in the organization to fulfil this new cultural mandate.

Apart from that, IBM sets up networking groups for different diversity groups within IBM, women being one of them, so that they have an opportunity not only to network in their own diversity group but also do recruiting at universities, because people want to work for people who are like them, and also engaging with IBM's clients.

Moreover, especially with regard to preparing women for the executive level, IBM does some very targeted programmes, such as the Building Relationships and Influence programme. This is an award-winning, highly experiential, global leadership programme for women with executive potential. The three day, face-to-face session helps increase the number of women in executive roles and the retention rates of high potential women.

Lisa Zellers, CGI, emphasized that CGI has Women's Forums in all the major business units. In their India business units, multiple diversity and support programmes are aimed at creating a single community of CGI women in India through the sharing of ideas and knowledge. Since 2012, support programmes range from local and personal, to professional and global.

In the US federal business unit, it started as a grass-roots movement committed to organic growth through educational opportunities, networking and mentorship for women across the company. A three event pilot in 2016 has morphed into a community that now boasts an email distribution of 350 members and 5 events annually, spanning from general communication education, to building a career at CGI, to speed networking activities.

The youngest group is in CGI's commercial business unit in the U.S., but has already launched a series of mentorship programmes and offline women empowerment videos that cater to their women members.

Tamara Shoemaker, UDM's Center for Cyber Security & Intel Studies; CISSE, presented two examples to show that concentrating on women initiatives sometimes may not help.

Deloitte drops their workplace diversity programme. 'After 24 years, WIN, the women's initiative at Deloitte, will end. Over the next 18 months the company will also phase out Globe, which supports gay employees, and groups focused solely on veterans or minority employees. In their place will be so-called inclusion councils that bring together a variety of viewpoints to work on diversity issues.' Deloitte felt that the diversity programme was doing a disservice, and that it was an inclusion programme that they want to do. They felt that this is the way they can incorporate their C-levels into the discussion.

In 2016, Joris Lammers and Anne Gast (University of Cologne, Germany) published a paper entitled 'Stressing the advantages of female leadership can place women at a disadvantage': 'Women are still underrepresented in management and men hold the majority of higher positions. Nonetheless, one often-heard claim in popular media is that female people-centered leadership skills (empathy, communication, etc.) are a better match for the business world – especially in the future... Four studies show that such claims paradoxically maintain gender inequality, by undermining support for affirmative action to reduce female underrepresentation in leadership. Where earlier research shows that positive stereotypes can hurt women by suggesting that they are unqualified for leadership, the current findings show that even positive stereotypes that claim that women are particularly well qualified for leadership can hurt women in their chances for gaining leadership positions. Although it is good to highlight the advantages of female leadership, exaggerated and sensationalist claims contribute to a perpetuation of gender inequality.'

The general question to be discussed is: Are we making it worse by bringing it up? Are these diversity programmes counterproductive? Some women might feel uncomfortable in those kind of events because they don't like feeling like a victim or an outsider.

Lisa Zellers, CGI, moderating, summarized some of the potential success factors of supporting women already in IT industry: bringing "real life" examples of successful women in IT to set the "new norm" in their activities; and promoting female role models and engaging them as mentors (It's much easier for girls to imagine a career in STEM subjects if they see successful examples).

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END

CONTACT

CONFERENCE DOCUMENTATION

All conference documentation, including programme, presentations and slides, speakers' profiles, participant's testimonials, photos and related information on the Global Forum 2017 are made available for download on the website of ITEMS International

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HAVE A QUESTION OR COMMENT?

Please do not hesitate to contact ITEMS International if you need any help to get in touch with the participants of the Global Forum/ Shaping the Future.

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Your feedback is important to us and we would be pleased to receive your comments on this year's Global Forum as well as suggestions for the next year's Global Forum.

The team of ITEMS International will be pleased to answer any question and to provide you with more information about the 2018 edition of the Global Forum.

Please make sure to check our website regularly for updates.

ACRONYMS & ABBREVIATIONS

Ag	Agriculture
AI	Artificial Intelligence
API	Application Programming Interface
ARTS	Association for Retail Technology Standards
ASCII	American Standard Code for Information Interchange
°C	degrees Celsius
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CFI	The Canada Foundation for Innovation
CFREF	Canada First Research Excellence Fund
CIRA	Canadian Internet Registration Authority
CISO	Chief Information Security Officer
CISQ	Consortium for IT Software Quality
CIO	Chief Information Officer
CNAM	Centre National des Arts et Métiers
CODASYL	Conference on Data Systems Languages
CORBA	Common Object Request Broker Architecture
CTO	Chief Technical Officer
DAESS	Digital Agriculture Extension Services Support System
DDS	Data Distribution Service
DG	Directorate General
DNA	Deoxyribonucleic Acid
DNS	Domain Name System
EC	European Commission
ECC	Elliptic-Curve-Cryptography
ECJ	European Court of Justice
EHR	Electronic Health Record
EMEA	Europe, Middle East and Africa
EMLI	Enterprise Machine Intelligence and Learning Initiative
ENIAC	Electronic Numerical Integrator And Computer
e.g.	for example (exempli gratia)
°F	degrees Fahrenheit
FCC	Federal Communications Commission
FTC	Federal Trade Commission
GDP	Gross Domestic Product
GDPR	General Data Protection Regulation
GHG	Greenhouse Gases
GHz	Gigahertz
GSM	Global System for Mobile Communications
GSMA	GSM Association
G7	Group of 7

HDTV	High Definition Television
HR	Human Resources
HTTP	Hypertext Transfer Protocol
ICANN	Internet Corporation for Assigned Names and Numbers
ICT	Information and Communication Technologies
ID	Identification
IDN	Internationalized Domain Name
IoT	Internet of Things
IP	Internet Protocol
IP	Intellectual Property
ISO	International Organization of Standardization
ISP	Internet Service Provider
IT	Information Technology
ITU	International Telecommunication Union
JPKI	Japanese Public Key Infrastructure
KSA	Knowledge, Skills and Abilities
LoRa	Long Range
MBA	Master of Business Administration
MHz	Megahertz
MIS	Management Information Systems
MSME	Micro-, Small and Medium-sized Enterprises
M2M	machine to machine
NAFTA	North American Free Trade Agreement
NGI	Next Generation Internet
NGO	Non-Governmental Organization
NICE	National Initiative for Cybersecurity Education
NIST	National Institute of Standards and Technology
NIST-RMF	NIST Risk Management Framework
O-DF	Open Data Format
OECD	Organization for Economic Co-operation and Development
OEM	Original Equipment Manufacturer
OMG	Object Management Group
O-MI	Open Messaging Interface
PKI	Public Key Infrastructure
POD	Portable-on-demand
QCD	Quality, Cost and Delivery
Q&A	Questions and Answers
R&D	Research and Development
RFID	Radio Frequency Identification
RSA	Rivest-Shamir-Adleman-system
RTK	Real Time Kinematics
SME	Small and Medium-sized Enterprise
STEM	science, technology, engineering, and mathematics
TCG	Trusted Computing Group
TEE	Trusted Execution Environment
TLD	Top-Level Domain
TPM	Trusted Platform Module
TPP	Trans-Pacific Partnership

UICC	Universal Integrated Circuit Card
UK	United Kingdom
UN	United Nations
UNIVAC	UNIVersal Automatic Computer
US	United States
USA	United States of America
USB	Universal Serial Bus
USD	US Dollar
UX	User eXperience
WiFi	Wireless local area network
WRC	World Radiocommunication Conference
VR	Virtual Reality
3D	3-dimendional
2g	Second Generation
3G	Third Generation
4G	Fourth Generation
5G	Fifth Generation

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