Dealing with Data Dilemmas

Towards a human-centered systems approach to data and digital technology development

Report

United Nations World Data Forum
Satellite Event in Macau
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Acknowledgements

Table of Contents

Executive summary

Humans have not only become the most influential species on planet earth, but also the best-informed species of all time. The **great data and digital technology dilemma** is that we humans have never had more data, knowledge and digital technologies available than today and yet are struggling with turning data into collective knowledge, learning and collective action to address the common global challenges and targets we have set ourselves.

Global data growth is mind-boggling. The volume of data in the world today (mid 2023) is estimated[1] to be around 130 zettabytes and 2.5 quintillion bytes of data are being generated every day. While data-driven knowledge generation and decision making have become a serious option and opportunity in science and policy making, at the same time, the fields are rapidly changing by becoming more diverse, post-normal and transdisciplinary. The transformation of science and policy is post-paradigmatic and marked by a diversification of ideas.[2]

In that increasingly complex data and digital technology environment, experts and stakeholders from all urban sectors came together to discuss challenges and opportunities in the following fields:

Data dilemmas and health
Some of the most important and powerful data are those that are collected about the human condition, more specifically, data about human health and wellbeing. Health related data can be lifesaving, preventing the spread of disease, identifying risks to wellbeing, and supporting the best possible medical interventions. The sheer volume of data collected and the potential to use this data in unintended or unwanted ways is of critical concern and were discussed in the panel session on 'data and health'. In order to meet health data dilemmas, data must be collected by those who can use it for the broader social good, privacy and security issues must be addressed, transparency and agency created among citizens.

Regulatory dilemmas with data and digital technologies
Legal dilemmas frequently occur with digital technologies and AI. This requires greater consistency and coherence between different legal regimes. Disruptive technologies are of global character but are addressed locally. Their effects are often overestimated in the short-term and underestimated in the long-term. Therefore, there is a need to apply existing laws to all kinds of disruptive technologies but also for new future-proof laws and regulations, to get the timing of their implementation right and to take a multi-level governance approach.

Data policy for addressing data dilemmas in crisis situations
Data dilemmas in crisis situations requires robust data policies, accurate, trustworthy and timely data. Investments into data-infrastructures need to be made and ways to collaborate with stakeholders found. Data integrity and accuracy is essential for maintaining trust in science and policy. Three data dilemmas were identified: 1) In public health emergencies there is a trade-off between access and use of data while at the same time respecting and

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[1] https://www.statista.com/statistics/871513/worldwide-data-created/
[2] Meckling, J., Allan, B.B. The evolution of ideas in global climate policy. Nat. Clim. Chang. 10, 434–438 (2020). https://doi.org/10.1038/s41558-020-0739-7

protecting privacy. 2) In crisis situations, data need to be interoperable and promote wellbeing, which requires stakeholders to work together across sectors and disciplines. 3) There is a digital data access gap between stakeholders. This risks creating power imbalances and creating inequalities. All these dilemmas can be addressed with UNESCO's Recommendations for Open Science and other ethical frameworks.

Datafied Macau

The 'datafied Macau' session looked at the delemmas related to the datafication of all aspects of urban life. The key takeaway from the dialogue session was the importance of digital literacy in the accelerated digitalization of the urban environment. Simultaneously, social scientists and computer scientist need to strive for more collaboration in understanding the complex urban sensorium. Macao is a fruitful experimental place for exploring the impacts of datafication, however, the data generated should be treated respectfully and responsibly by government authorities and commercial entities.

Data dilemmas in AI applications

Academia and industry can significantly benefit from the use of AI. AI technologies can bridge educational infrastructure gaps by making educational tools and resources more accessible, providing access to vocational training, entrepreneurial resources, healthcare and many other information. Data scarcity is actually an issue for AI, which requires stakeholders and companies to work together under common ethical policies. In this roundtable session, panellists agreed that AI would not replace humans in the near future, but instead will allow humans to focus on more complex and strategic endeavors and dedicate their time and expertise to tasks that require uniquely human skills such as empathy, critical thinking, and creativity. By adopting ethical practices and leveraging the strengths of both AI and human intelligence, the future of AI applications can bring about positive outcomes and address complex challenges.

Data dilemmas in public services, communication and GIS

Leveraging geospatial information and digital applications has a vast potential to improve the quality and delivery of evidence-based decision-making for critical sectors. AI and IoT play a significant role in climate change mitigation and public health policies through real time monitoring, automation, and connectivity which will be applicable to efficient traffic control and energy management of the building sector. Digitalisation and smart controls can reduce emissions from buildings by 350 Mt CO_2 by 2050 although we also need to account for the increased carbon footprint from the ICT sector itself. Partnerships to address data dilemmas in public services, communication, and GIS are critical. Essential is also a neutral platform for collaborations with private sector partners, while recognizing the challenges of working with the private sector. There is a need for a bottom-up approach to make geospatial information understandable to citizens and for capacity building, particularly among young practitioners and scholars.

The need for a human-centred design approach

In recent years, as more people strive to ensure that data is used in a way that benefits humanity and the planet, Human-Centered Design (HCD) has gained traction as a useful set of tools to solve the major data challenges in sustainable development. Human-centered design (HCD) is an approach to problem-solving that puts an emphasis on humans and their

lived experiences in a specific context when designing strategy and process. This philosophy holds that a successful solution or service offering is only as good as its ability to address an identified need of those it intends to help. HCD emphasises user feedback and iteration in the design process. It is essential to use a human-centered design approach when tackling the major data challenges in sustainable development. Doing so ensures that data is used in an ethical and accurate way, and that projects are designed in a way that takes into account the needs and rights of the people that they are intended to help.

Building trust by computational collective intelligence

Collective intelligence and citizen science offer opportunities for more inclusive and effective decision-making and scientific research. However, these approaches also raise important questions about trust, accountability, and the role of citizens in shaping these processes. By continuing to explore and refine these approaches, a more collaborative and responsive approach to urban governance and scientific research can be taken. There is a growing recognition of the importance of including citizens in the co-design process, to ensure that AI models reflect the values, needs, and priorities of the communities they are designed to serve.

Digital entrepreneurs

The discussion in this session was about the transformations in the digital entrepreneurial ecosystem, key concerns for the users and entrepreneurs in a rapidly changing environment, and the role of regulations in the digital ecosystem. Panel members agreed that AI, Blockchain, Cloud and Big Data have transformed how businesses start and run. With increasingly easy access to data, the competitive advantages of companies with access to big data is reduced and with more open access, the strength of a business comes not from data ownership but from excellence in data mining and analytics. Data analytics and cyber security become important. Cross-border digital access remains difficult and therefore an opportunity for businesses which can solve data access across borders. Digital entrepreneurs today require digital skills like computing, data mining, knowledge of trends and but also of cross-border laws.

Cross-border data transfer

This panel focused on the question of how to overcome issues of data transfer and privacy protection, and the possibility of building a third-party platform to facilitate Macau-Hengqin data transfer. Due to differences in legal, political, and economic systems, cross-border data transmission not only relates to technical architecture, but also involves legal, economic, and sovereign issues. Blockchain can be used for secure personal data transmission between Guangdong and Macau, such as converting Macau Health Code into the Yuekang Code.
Technical solutions can be used to address some issues (such as network bandwidth), but it also requires financing and building a task force that connects governmental agencies across boarders to promote a universal internet architecture. A multi-party artificial intelligence auditing module could have important implications for Macau SAR because its unique role in connecting China to the rest of world. Apart from individual data, group data could be a great resource and asset for enterprises to generate benefits. The Guangdong-Macao cross-border data verification platform is an example.

Data gender gaps

Why is important to introduce gender perspective when building a sustainable future; what gaps do we face in gender data; and how to address gender data gaps. Those where the questions addressed in this roundtable session. Gender data can increase the visibility of women and girls' in unpaid care and domestic work; they can provide evidence for addressing domestic violence against women; they can help identify vulnerable groups and inform gender-responsive policies; and they can help designing and implementing gender-sensitive programmes and delivering public services. Incomplete gender data are still widespread and pose difficulties in responding, e.g., to a pandemic, like COVID. Governmental and non-governmental bodies should strengthen mutual collaboration in providing technical support for improving data quality and availability. It was agreed that it is necessary to conduct comprehensive surveys to understand women and ageing women's specific needs before designing policies and developing gender-related programmes.

Data youth and young scientists

As data has grown to be a new type of "resource" globally, this session aims to examine how data could impact and facilitate the personal development of youth and young scientist. The discussion was about data accessibility challenges and how data collaboration can foster the future development of youth and young scientists in Macau. For example, data in Macau is inaccessible in areas such as healthcare, nanomaterials, and education. Training in basic science literacy and science communication is important to improve the dialogue about access to data and data sharing. Data policies need to be in place and respected. Networks for free data sharing are encouraged.

Foreword

Jingbo Huang, Director, UNU Macau

It all happened at the right time, with the best people, and for the most important topics. We discussed data, in all possible senses in relation to science, society, individual security and collective intelligence, in Macau SAR., on 25 April 2023, during the United Nations World Data Forum Macau Satellite Event, and we are happy to present you now the result from it with this report.

This event was hosted by our United Nations University Institute in Macau (UNU Macau), with great support from all our most respected partners from various sectors. We want to express our gratitude to Macau SAR government, to the universities that participated, to our sister UN agencies who showed great support, and most importantly, to all the brilliant speakers, panellists and audience who have been essential to making this event happen.

Among the over 90 active participants of the event (speakers and panellists), 40% of them came from Macau, 35% were from mainland China, including the fast-developing Greater Bay Area, and 25% from the global network of UNU Macau. The United Nations University Rector and Under-Secretary-General of the United Nations Prof. Tshilidzi Marwala honored us with his visit, gave a keynote speech and spent some days in Macau for meeting with officials and with our researchers. Dr. Walter Gehr from the Austrian Federal Ministry for European and International Affairs delivered a plenary keynote speech on Digital Humanism. Top-notch studies and international practices on a variety of issues – Data and Health, Regulation and Application of Artificial Intelligence, Data and Urbanisation, Cross Border Data Transfer, Gender, Youth, Disaster Risk Reduction and Human-Centered Design – where generously shared or openly discussed and debated within 12 parallel sessions during the day.

Since its establishment in 2017, the United Nations World Data Forum has become the most important international collaboration platform in this field, aiming to spur data innovation, nurture partnerships, mobilize high-level political and financial support for data, and build a pathway to better data for sustainable development. With the theme "**Dealing with data**

Dilemmas: **Towards a human-centred systems approach to data and digital technology development**", it was the first time a satellite event was organised in this way and I am glad to say that the 2023 UN World Data Forum Macau Satellite Event turned out to be a great success. I am glad to read the result of it, summarized in the format of this report.

Introduction

The United Nations World Data Forum (UNWDF)

From the UNWDF website[3]: The aim of the annual UN World Data Forum is to spur data innovation, nurture partnerships, mobilize high-level political and financial support for data, and build a pathway to better data for sustainable development. Since January 2017, the Forum's community has grown from 2,000 people who attended the first and second Forum in Cape Town, South Africa and Dubai, United Arab Emirates to active list of over 20,000 interested stakeholders. This growth in interest was due to the more open and accessible Forums held virtually in 2020 and as a hybrid format in Bern, Switzerland in 2021 and the establishment of a regular webinar series to maintain interest and focus between Forums. The stakeholder community represents a diverse range of governments, civil society, the private sector, donor and philanthropic bodies, international and regional agencies, the geospatial community, the media, academia, and professional bodies.

Every UN World Data Forum has resulted in the release of an outcome document to chart the progress of discussions around data and statistics and express the ambitions of the stakeholder community. The Cape Town Global Action Plan (CTGAP) was launched at the first UN World Data Forum on where to focus statistical and data capacity development efforts to establish the full range of reporting and monitoring needed to measure progress towards the Sustainable Development Goals by 2030. The CTGAP was followed by the Dubai Declaration (2018) calling for an innovative funding mechanism to support the implementation of the CTGAP; and more recently the Global data community's response to Covid-19 (2020) and Bern Data Compact for the Decade of Action on the Sustainable Development Goals (2021) on how official statistics and National Statistical Offices (NSOs) position themselves during Covid-19 and then in the wider data ecosystem generally.

The United Nations World Data Forum 2023 in Hangzhou

The Fourth UN World Data Forum 2023 was scheduled to take place in Hangzhou, China, in 24-27 April 2023. The 2023 edition of the Forum aimed at promoting four main thematic areas, which contain the critical issues and pressing actions identified by the global data and statistics community, to serve as a "rallying call" for programme proposals with practical solutions and hands-on experiences on these issues.
The four thematic areas are:

- Innovation and partnerships for better and more inclusive data;
- Maximizing the use and value of data for better decision making;
- Building trust and ethics in data; and
- Emerging trends and partnerships to develop the data ecosystem.

The Fourth UN World Data Forum will be hosted by the Chinese National Bureau of Statistics, with support from the Statistics Division of the UN Department of Economic and Social Affairs (DESA), under the guidance of the UN Statistical Commission and the High-level Group for Partnership, Coordination and Capacity-Building for Statistics for the 2030 Agenda for Sustainable Development (HLG-PCCB).

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[3] https://unstats.un.org/unsd/undataforum/about/

The UN World Data Forum Satellite Event in Macau 2023

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Dealing with Data Dilemmas and taking a human-centered systems approach to data and digital technologies is a contribution to the UN Global Digital Compact and the UN Summit of the Future in September 2024. "Dealing with Data Dilemmas" was a full-day event with 12 parallel session roundtable dialogues being held as a satellite event of the UN World Data Forum in Macau, SAR China on 25th of April 2023. The event aimed to discuss data and digital technology dilemmas and how taking a human-centred systems approach can help solve these for an "for an open, free and secure digital future".[4]

The topic of the UN World Data Forum's Satellite Event in Macau is specifically aligned to the UN Secretary's report "Our Common Future" and the main themes of the World Data Forum:
- Innovation and partnerships for better and more inclusive data
- Maximizing the use and value of data for better decision making
- Building trust and ethics in data
- Emerging trends and partnerships to develop the data ecosystem.

The satellite event also aimed at strengthening the profile, visibility and networks of the UNU Institute in Macau and abroad and to engage stakeholders from science, business, and policy with its new strategic mission to promote a human-centered systems approach to data and digital technologies. The event assembled around 150 participants who exchanged their knowledge, experiences and advanced thinking on the following two questions:

1) What are the data and digital technology dilemmas which have emerged in the context of the UN Secretary General's situation analysis of being at an inflection point in human development?
2) What does it mean to take a human-centered systems approach and how can such approach lead to a breakthrough towards sustainable development?

Conflicts between preventing harm and promoting health, wellbeing and human security through the use of data and digital technologies have resulted in dilemmas in the following fields, each which were discussed in roundtable dialogues at the event: Health, Regulation of AI, Application of AI, Crisis and disaster situations, Datafication of Macau, Human-centred design, Cross-border data transfer, GIS applications, Entrepreneurship, Computational intelligence, Gender, Youth and young scientists.

Dilemmas are situations in which there are two or more options, choosing each of which can have negative consequences. If, according to the Secretary General's report Our Common Agenda[5], we perceive ourselves as being at an inflection point where a choice needs to be made between 'breakthrough' or 'breakdown', we are facing such dilemmas at global and local scales.

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[4] https://www.un.org/techenvoy/global-digital-compact
[5] https://www.un.org/en/content/common-agenda-report/

Dilemmas in the context of data and digital technologies unfold as follows. Data and digital technology development create new opportunities for people's voices to be heard and their needs to be recognized. In all areas of life, human and non-human, data and digital technologies can accelerate the learning process, e.g. by collecting sensor data in urban environments and from people, responding to them and thereby reducing air pollution or adopting healthy behaviours. Participatory modelling facilitated by digital technologies has the potential to be more inclusive, strengthen democratic decision-making processes or enable a science, which engages citizens by facilitating deliberations and communication and creating opportunities for better governance.

On the other hand, data can be used in exploitative ways to identify and change opinions. Data in social media can be manipulated for personal or political gain; misinformation and disinformation can spread, reinforcing beliefs based on false facts making the truth hard to find or even irrelevant. Youth are suffering from adverse cyber-psychological health impacts from inadequate internet use and advances in AI are threatening human freedoms and augmenting these trends. More data can be, but not always is better. To put data and digital technologies to the best use for people and the environments they live in, numerous dilemmas need to be identified and overcome.

Sometimes dilemmas take the form of positive feedback loops. On the one hand there are efficiency gains to be expected from further growth, and to achieve that growth we need innovation. That efficiency-driven growth can be achieved especially with support of data and digital technologies, like AI. That choice is the preferred choice for most businesses, which are facing sunk costs, need to reduce risks and therefore stick to a business-as-usual strategy. That strategy can surely be innovative. The ideas of Industry 4.0, and e-Government, for example, are attempts to digitize the manufacturing sector and public administrations of governments. Many advantages are associated with "datafying cities", as discussed for the city of Macau in one of the sessions of this event.

However, as long as governments and businesses do not change the underlying institutional frameworks, i.e., the framework of rules, laws and regulations, including the social contract between people and their governments, efficiency gains can lead to increasing systemic risks and collapse, like we have repeatedly seen in the financial sector, in the digital currency sector, or a potential collapse of the cloud computing infrastructure. Such collapses are 'natural' in the lifecycle of complex systems. When complexity is built up, efficiency gains are made and when those complex systems become too costly to maintain they devolve, as Joseph Tainter[6] explains.

That would neither be a sustainable option, nor one that is based on the knowledge we have about the behaviour of complex systems. Societies can escape the complexity trap. That however requires us to understand each of the four industrial revolutions as an innovation treadmill where we continue to jump from one treadmill to another[7], escaping the Malthusian

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[6] Tainter, J.A. 1988. The Collapse of Complex Societies. New York, NY: Cambridge University.
[7] As pictured by Geoffrey West in his 2017 book "Scale: the universal laws of growth, innovation, sustainability, and the pace of life in organisms, cities, economies, and companies".

trap[8] and each time going faster and faster – a behaviour that cannot be sustained without our economy and society having a collective heart attack[9].

On the other hand, societies, cities and countries are at different stages of complexity development and innovations are required not only for a breakthrough but for building basic infrastructure and providing essential services, like housing, water, food, employment. Innovations are also required for paradigm-shifting solutions, which allow people to choose a more human-scale and human paced life, beneficial for health and wellbeing, the economy, and the planet.

A breakthrough is also needed for global collective action which is difficult to achieve if some countries are struggling to provide basic goods and services. Nevertheless, in a big world on a small planet[10], many of the development issues we are facing today can only be solved together as one global community of life. The crossing of the planetary boundaries[11] is a symptom of another development dilemma: on the development trajectory we have crossed limits beyond which development can no longer be considered as healthy[12].

In 2022, the *Lancet* Commission on pollution and health[13] reported that pollution remains responsible for approximately 9 million deaths per year. They observed an increase of deaths attributable to ambient air pollution and toxic chemical pollution and found that deaths from these modern pollution risk factors are the unintended consequence of industrialisation and urbanisation, which have risen by 7% since 2015 and by over 66% since 2000. There are more developments which can be considered 'unhealthy':

1) According to the World Health Organisation (WHO), 2.8 million people die each year in high, middle and low-income countries, due to being overweight or obese. And most of the world's populations live in cities, where overweight and obesity kill more people than underweight.
2) The WHO also estimates that in 2019, 99% of the global population breathed air that exceeds WHO guidelines limits for pollutants. 6.7 million premature deaths are associated to ambient and household air pollution.
3) Although due to improved access to health services in cities, urban mortality rates are decreasing and lower than in rural areas, noncommunicable diseases (NCDs) kill 41 million people each year worldwide, equivalent to 71% of all deaths globally and they kill 15 million people prematurely before reaching the age of 70 every year.

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[8] Thomas Malthus, in his 1798 book "An Essay on the Principle of Population" predicted that exponential population growth would outgrow food supply, causing famine, disease and war.
[9] IR 4.0 is not a scientific revolution, see: https://cs.unu.edu/news/news/blog-ir-4-0-is-not-a-scientific-revolution-a-paradigm-shift-in-the-making.html
[10] Rockström, J., & Klum, M. (2015). Big world, small planet: abundance within planetary boundaries. New Haven, CT ; London, Yale University Press
[11] Rockström, J., Steffen, W., Noone, K. *et al.* A safe operating space for humanity. *Nature* **461**, 472–475 (2009). https://doi.org/10.1038/461472a
[12] https://www.nature.com/articles/s41586-023-06083-8
[13] https://doi.org/10.1016/S2542-5196(22)00090-0

A breakthrough requires institutional changes which reflect humanity's changing values. Human values change with changing environments, also with the form in which they are able to capture energy from their environments. Ian Morris, argues, that as societies developed from hunter-gatherers to farmers to fossil fuel societies, they were able to capture more energy per capita, became progressively less tolerant of interpersonal violence but more tolerant of various forms of hierarchy and inequality (economic, political, gender)[14]. If energy capture, increasing complexity, increasing inequality, increasing systemic risks, and weakening multilateralism are causally linked, we need to find ways to put energy and effort into strengthening institutions that enable global collective action.

Today we are also at an economic threshold point, beyond which, e.g., the value of a forest can no longer only be measured only by the value of the wood it provides. We can no longer afford to waste the entire set of life-support functions of a forest or ocean ecosystem, just because it is convenient to capture the monetary value of wood or fish and externalise all other costs to nature and society. "We stand on the mountain of development and for the first time, mother Earth is sending invoices back" as it was stated in a UN General Assembly meeting GA/11373, already in 2013.

Institutional change needs to reflect those changing values by changing economic incentives. Institutional change also needs to be able to accelerate learning cycles[15], in order to match the data and knowledge we have about environmental changes and provide incentives that enable actions for the future. In that context we also need to change the ways in which we measure progress.

A human-centred systems approach towards sustainable data and digital technology development is an attempt to address these dilemmas. It aims at developing and applying digital technologies for the good of humans, but not at any cost, especially not at the costs of declining ecological, environmental and social systems. It also aims at new ways of cooperating and scaling up collective action for the global commons.

As discussed in one of the dialogue sessions of the event, human-centred design can be applied to all situations in which people are part of co-creating solutions to problems or dilemma, which they are facing, also in science, e.g. by applying participatory methods. Rutarasiri makes the business case for taking a human-centered design approach and says that it "*means leading with people's wants, needs and behaviour; developing a deep understanding of tasks, work flow, culture, environments and technology; and ensuring users are involved throughout the design process.*"[16] "*Human-centered design means believing that all problems, even the seemingly intractable ones like poverty, gender equality, and clean water, are solvable. Moreover, it means believing that the people who face those problems every day are the ones who hold the key to their answer. [It] offers problem solvers of any stripe a chance to design with communities, to deeply understand the people they're looking to serve, to dream up scores of ideas, and to create innovative new solutions rooted in people's actual needs.*"[17]

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[14] See a commentary from the Great Transition Initiative by Brent Ranalli 2016.
[15] Transitions towards systemic sustainability in the Anthropocene, see:
https://www.undrr.org/publication/transitions-towards-systemic-sustainability-anthropocene
[16] Making the business case for Human-Centered Design
[17] Yale New Haven Teachers Institute. Human-Centered Design of Biotechnology.

The complex challenges we are confronted with, require us to yet go further than this human-centred design approach. People do not always know which environmental or behavioural factors have detrimental effects on their health. What is experienced or considered convenient, useful, practical, or beautiful must not always be healthy. Just because consensus has been achieved, decisions can be bad if they are not based on data and evidence. To know better, we need to consult both, people, and data. Science and education need to fill that knowledge gap. But further still, the complex challenges we are confronted with, the very notion of what it means to be human on earth, changes. Therefore, Yang and Shan have called for a new humanism and global governance.[18]

The global challenges[19] we are facing today, put the idea of humanism[20] to the test, as the challenges themselves mirror the flipside of a one-sided and mainly economically driven globalization which was made possible by the original ideas of humanism. Chenyang Li[21] therefore argues, that in today's world, "humanity is already placed at the centre, for better or for worse." As Hans d'Orville[22] put it: "the new humanism approach goes beyond the level of the nation state in seeking to unite the process of globalization with its complex and sometimes contradictory manifestations — and to strive for the realization of eco-civilization. [...] humanism today needs to be perceived as a collective effort that holds governments, civil society, the private sector and human individuals equally responsible to realize its values."

Already in 2011 UNESCO declared[23] that the purpose of a new humanism "is to create a climate of empathy, belonging and understanding, along with the idea that progress with respect to human rights is never definite and requires a constant effort of adaptation to the challenges of modernity." "This understanding of the new humanism emphasizes a common humanity beyond particular cultural traditions, with the goal toward building "a single human community", as Chenyang Li (ibid) argues. A new humanism therefore needs to reflect people's response to the challenges of the Anthropocene. Extreme anthropocentric views that perceive nature only for its instrumental values, are out-dated, just as extreme biocentric views are.

Based in those thoughts, efforts are being made to promote the idea of Digital Humanism at the Technical University of Vienna, as outlined by Walter Gehr in his keynote speech at the Satellite Event in Macau. Digital Humanism is a response to the challenges, dilemmas and threats created by the rapid digital development, which can undermine human rights, human

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[18] Yang, L. and Shan, W. (Eds) 2019. New Humanism and Global Governance, Singapore: World Scientific Publishing

[19] E.g., climate change, inequality, pollution, biodiversity loss, social conflicts and risks, shrinking cultural diversity.

[20] Humanism originated during the era of Enlightment and was a moral rationale for fundamental questions relating to humanity and human nature, which were perceived to facilitate humanity's progress in science, knowledge and technology. It evolved into a movement of creative liberation which enabled the acceleration of progress, material growth, human emancipation, independence and social justice based on peace, justice, democracy and human rights.

[21] Chapter 2 in: Yang, L. and Shan, W. (Eds.) 2019. New Humanism and Global Governance, Singapore: World Scientific Publishing

[22] Former Assistant Director-General for Strategic Planning, UNESCO.

[23] A New Humanism for the 21st Century, Accessed May 30, 2023 at:
https://unesdoc.unesco.org/ark:/48223/pf0000189775

health and threaten democratic institutions, increase extremism through social media, create filter bubbles, automate decision-making, invade privacy, and spread digital surveillance. While Digital Humanism is in large human-centred, it must see itself as part of the broader idea of a New Humanism as outlined by UNESCO 2011 (ibid).

A systems approach views humans as part of complex social, ecological, and technological systems in which their actions, often unintended or untraceable, have consequences for human and environmental health. Development within the boundaries of the earth system requires systems thinking to understand the interconnectedness of social, ecological, and technological systems. Identifying planetary boundaries requires the recognition of our limits to growth and the need to seek alternative development pathways. Taking a systems approach also enables us to see the connections between data, knowledge and actions people take. Digital technologies can help to accelerate learning cycles by reducing the time and costs of finding solutions.

That is what a human-centred systems approach to data and digital technologies is about and it is our response to the collective problem-solving process initiated by the UN Secretary General's 2022 report "Our Common Agenda"[24]. All participants of this satellite event engaged in a learning process, exchanged thoughts, experiences, ideas and solutions, which made the event itself human-centred and systemic. The outcomes are summarized in this publication and they are meant as a contribution to the UN's Global digital Compact and the UN Summit of the Future 2024.

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[24] https://www.un.org/en/common-agenda

Keynote 1

Tshilidzi Marwala, Rector, United Nations University

Good morning, ladies, gentlemen, excellencies.

We are in midst of an age of accelerating technological development, with rapid advancements in big data, digitalization, and artificial intelligence.

These changes offer incredible opportunities, but also risks that must be addressed.

5.16 billion people have access to the internet, equivalent to 64.4 percent of the world's population.

This number grows every year, with research showing that on any day in the last 5 years, there were on average 640,000 people online for the first time.

- However, these growth rates have begun to decline, and many parts of the world face significant challenges:
  Internet connectivity is not equally available. There are countries where almost nothing has changed since 1990.
- In the very poorest countries – including Eritrea, Somalia, Guinea-Bissau, the Central African Republic, Niger, and Madagascar – fewer than 5% of people are online.
- Around one-third of the world's population remain unconnected to the Internet. Most of these people are in Southern and Eastern Asia, and in Africa.

Advancements in digital technology development have been truly incredible. In healthcare, for example, the achievements of digital technologies allowing for advanced medical diagnostics, faster drug developments, and improved healthcare delivery.

These powerful opportunities also carry significant risks. In order to ensure safe—and fair—access to digital technologies the **global community** must rally around a **common strategy.**

The United Nations has already kickstarted the process for a common strategy for the benefit of all. In 2018, the UN Secretary-General convened a *High-level Panel on Digital Cooperation* to advance proposals to strengthen cooperation in the digital space.

In 2019 the Panel completed the report. It includes five sets of recommendations on how the international community work together to optimize the use of digital technologies and mitigate the risks:

- Build an inclusive digital economy and society.
- Develop human and institutional capacity.
- Protect human rights and human agency.
- Promote digital trust, security, and stability.
- Foster global digital cooperation.

Then, in 2021 the UN Secretary-General released a report outlining a strategy for the UN and its Member States: "Our Common Agenda". The report calls for, a **Global Digital Compact,** that will be agreed upon at the **Summit of the Future** in September 2024.

Consultations for the Global Digital Compact are being held as we speak. It is expected to "outline shared principles for an open, free and secure digital future for all".

A key underlying theme of discussions about digital transformation is that making the best use of data and digital technologies is always about balancing a duality: augmenting/enhancing on the one hand and protecting/securing on the other.

This is reflected in the main thematic areas of this year's UN World Data Forum in Hangzhou; innovation, partnerships, inclusion, and making best use of data, but also building trust and ethics.

Therefore, the topic of this satellite event on "dealing with data dilemmas", here in Macau, is timely.

As we increasingly rely on data-driven decision-making algorithms, it's crucial to recognize that bias can significantly impact their accuracy and fairness. This crucial topic will be discussed during this satellite event.

If we manage to agree on mechanisms to ensure data security and privacy, as well as to define ethical practices in the development and use of algorithms, the enormous potential of Big Data and AI can be realized to benefit society, businesses, healthcare, and government.

Moreover, data and digital technology development create new opportunities for people's voices to be heard.

This inclusiveness is part of the vision of the United Nations University Institute in Macau, the host of this satellite event with partners from Centre for Data Science, University of Macau, Macau University of Science and Technology, and University of Saint Joseph, with great support from the Macau government represented by FDCT.

Over the years, UNU Macau has conducted UN policy-relevant research to address key issues expressed in the UN 2030 Agenda for Sustainable Development through high-impact innovations and frontier technologies.

The UNU Institute in Macau is situated in the Macau Special Administrative Region (SAR) of China, and it is the only UN entity in the city. Macau is one of the most dynamic regions in Asia, where technological innovations have become an integral part of driving social and economic change. Macau is part of the Greater Bay Area (GBA), which hosts many private sector companies and technological giants that are just a short distance away.

The institute follows two main research directions - participation and systems thinking, with the focus on enhancing the participation of diverse stakeholders in co-creating solutions to improve resilience against shocks and stresses (e.g., health, climate, technological, and socio-economic).

Collective intelligence, the combination of computerized and human intelligence, is an example of how people can be assisted by computers and Artificial Intelligence to make better decisions in complex decision-making situations when facts are uncertain, values are in dispute, stakes are high, and decisions are urgent.

In conclusion, the potential of data, digital technologies, and AI to improve our lives, and achieve sustainable development, is tremendous. As these technologies continue to grow in sophistication and use, it is up to us as global citizens to take the necessary steps to ensure that these technologies are used to create opportunities, not harm. We must address the dilemmas and balance the potential goodness of these technologies with the risks and harms that they may create.

Thank you for the opportunity to be here with you today and to share my views.

Keynote 2

Walter Gehr, Austrian Federal Ministry for European and International Affairs

Your Excellencies, Ladies and Gentlemen, dear colleagues,

The purpose of this keynote speech is to introduce you to the concept of Digital Humanism."

Chronology

The Vienna Manifesto for Digital Humanism 2019

The "Vienna Manifesto for Digital Humanism" of 2019 states, among other things:

> "*A flood of data, algorithms and computing power is affecting our social fabric in fundamental ways ... This change is creating and threatening jobs, creating and destroying wealth, shifting power structures and having massive ecological impacts, for better or worse*."

The Vienna Manifesto has since been endorsed by over 1.000 signatories from 45 countries as a step towards a blueprint for shared principles. The Manifesto is primarily a call to act collectively and mobilize support that transcends national borders and continents to build a more humane common future.

In Austria, the City of Vienna itself as well as its Technology Fund (WWTF) have invested millions of Euro for the development of the "Digital Humanism". A brochure summarizing the perspective of the City of Vienna on Digital Humanism is freely available on the Internet. And The University of Innsbruck in the Tyrol has devoted part of its First Austrian Digital Law Day in 2023 to this topic.

The Poysdorf Declaration for Digital Humanism of 30 June 2021

On 30 June 2021, Digital Humanism was brought to the diplomatic stage. In the so-called "Poysdorf Declaration," the foreign ministers of Austria, the Czech Republic and Slovakia

agreed to promote the values of Digital Humanism and to advance human-centered technologies, principles, regulations, norms, standards and legal instruments. Since then Digital Humanism has become one of the leitmotivs of Austrian science, cultural and arms control diplomacy[25].

What is Digital Humanism ?

Digital humanism is to be understood as the pursuit of supporting people through digital technologies, especially artificial intelligence, and of protecting people from adverse effects of these technologies. It stands for the claim to describe and analyse the complex interplay between digital technology and people, but above all for the attempt to influence this interplay in favour of a society that is fully committed to human rights. All decisions potentially affecting human rights must continue to be made by humans and that decision-makers must be responsible and accountable for their decisions. We have to ensure a human-centred based approach to new technologies which guarantee the full and effective implementation of existing international legal norms in all spheres of life, both offline and online.

In the own words of the ministerial declaration of June 2021,

> *"Digital humanism is a response to fears among citizens of the harms of technology. Digital humanism provides us with a framework to navigate digitalization towards human-centric approach. It allows us to regulate frontier technologies like artificial intelligence and safeguards our human rights, mitigate against unacceptable biases, intransparency and other harms, and to ensure human autonomy when confronted with systems based on automated decision-making. It is also an enlightened assessment of the true potential of technologies embracing their problem-solving capacity, without ignoring their risks …*

An article in the Macau Daily Times of 20 April 2023 described very well some of the major concerns of citizens with regard to Artificial Intelligence:
> *"… much of the concern is about AI systems amplifying harmful biases and stereotypes and students using AI deceptively. We hear about privacy concerns, people being fooled by misinformation, labour exploitation and fears about how quickly human jobs may be replaced…"*

Hence, we need to conceive and adopt a broader framework where other perspectives, in particular of ethical, social, legal, political and economic nature are included when we conceive and develop systems that have an impact on individuals and society[26].

Digital Humanism and Engineering

Although political declarations in favour of Digital Humanism or people-centered digital development are important, these objectives will not advance without the help of those who truly understand the Internet, algorithms and artificial intelligence. This calls for engineers who can go beyond their actual discipline to understand and question the ethical challenges

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[25] For instance, the Austrian Ministry for Foreign Affairs subsidized the book "Perpectives on Digital Humanism".
[26] H. Werthner, et al.,"Digital Humanism: The Time Is Now" in Computer, vol. 56, no. 01, pp. 138-142, 2023.
doi: 10.1109/MC.2022.3219528

of what they do. In this sense, the world's largest technical professional association, the Institute of Electrical and Electronics Engineers (IEEE), which has more than 400,000 members worldwide, has done ground breaking work: In 2021, it published the IEEE 7000 Ethics Standard for Intelligent and Autonomous Systems. The framework is intended to

> "*create the next generation of technologies for the benefit of people - not the few power players in surveillance capitalism*."

On 15 May this year, a UNESCO Chair on Digital Humanism is going to be inaugurated within the Technical University of Vienna. The Austrian Ministry of Foreign Affairs has actively supported this development. The Chair aims at fostering interdisciplinary collaboration and to establishing strong links with partner universities, especially in the global south, through research and education. Moreover, it intends to develop interdisciplinary teaching curricula reflecting the topics of Digital Humanism while taking into account UNESCO's Recommendation on Ethics of Artificial Intelligence: The Chair will further act as a networking hub, connecting partners and activities of the international Digital Humanism initiative and the Center for Artificial Intelligence and Machine Learning (CAIML).

Digital Humanism, the Arts and Philosophy
In the ministerial declaration of 2021, you will find a paragraph on the cultural role of Digital Humanism. According to this paragraph, Digital Humanism

"empowers the world of art, philosophy, and the humanities to explore what it means to be a human being in the digital age. Digital humanism is also a response to digitalization, a third way based on the belief in our basic rights as well as in the power of human resilience and imagination".

When we talk about the Arts, we cannot help thinking of the challenges posed by generative Artificial Intelligence like ChatGPT or Stability AI. In this regard, it is very interesting to read how the Cyberspace Administration of China proposes to regulate this kind of Artificial Intelligence[27]. In Europe, Italy has decided to ban ChatGPT altogether over privacy concerns. The ban may be lifted at the end of the current month. The European Union as a whole is now struggling about how to regulate this new generative technologies, including in terms of intellectual property rights.

Although digital humanism is rooted in the European spirit of Renaissance of the 15th and 16th century as well as in the Age of Enlightment of the 17thn and 18th century, embarking on this endeavour requires collaboration across the globe with input from many different cultures.

Digital Humanism and Diplomacy
Multilateral: Digital Humanism and the UN Global Digital Compact

In the same Austrian-Czech-Slovak declaration on Digital Humanism of June 2021, the three Ministers agreed to collaborate in the promotion of the values underlying Digital Humanism

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[27] Microsofts President of Microsoft, the biggest investor in OpenAI which developed ChatGPT sees Google and the Beijing Academy of Artificial Intelliegnce as ChatGPT's main competitors: https://asia.nikkei.com/Business/Technology/Microsoft-president-warns-China-becoming-close-rival-of-ChatGPT .

in multilateral fora such as the United Nations and UNESCO. The Austrian and the Czech Minister for Foreign Affairs did so in their speeches before the UN General Assembly.

My presence here in Macau is an illustration of Austria's intention to promote Digital Humanism through multilateral institutions. I had already the pleasure to do so at the 2022 International Conference on Theory and Practice of Electronic Governance (ICEGOV) in Portugal which had been organized by the United Nations University Institute established there in Guimarães.

As you certainly know, in his report of 2021 entitled "Our Common Agenda", the UN Secretary General proposed a "Global Digital Compact" expected to "outline shared principles for an open, free and secure digital future for all". Rwanda and Sweden are currently leading an intergovernmental process for this Digital Compact.

The UN Secretariat has also encouraged stakeholder from around the world the contribute to the discussion for the Compact to be agreed at the Summit of the Future which will be held in September 2024.

We are grateful to the Institute of the United Nations University in Macau for having included the concept of "Digital Humanism" to its submission for the UN Global Digital Compact. The concept also appears in the submission made by the European Union. I have no doubts that the concept will also appear in the national Austria contribution to the Global Digital Compact.

Bilateral diplomacy
At this point, I would like to mention that Digital Humanism is not a concept which is confined to Europe. In Colombia, the National Academy Area Andina has established a Digital Humanism Observatory lead by Vice-Rector Martha Castellanos Saavedra. Austria has therefore participated in a workshop on Digital Humanism in Colombia and we hope to find more partners through our bilateral ties.

Digital Humanism and China
So for instance, we would like to learn more about Chinese Digital Ethics[28] and its relationship to Confucianism, The issue is whether there is a kind of Digital Confucianism that we could contrast or match with western style Digital Humanism.

In my understanding of the United Nations, it would be a pity if we could not engage in a dialogue between the West and China about the ethics of cyberspace[29], thereby contributing to mutual understanding.

I think there would be much to be gained to have an in depth discussion about the Position Paper of the People's Republic of China on Strengthening Ethical Governance of Artificial Intelligence as well as its Position Paper on Regulating Military Applications of Artificial Intelligence. [30]

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[28] https://link.springer.com/article/10.1007/s10767-020-09370-8
[29] See also Pascale Fung and Hubert Etienne, Can China and Europe find common ground on AI ethics, World Economic Forum, 19 November 2021.
[30] See article „AI developers must „learn to dance with shackles on" as China makes new rules in a post-ChatGPT world" in the South China Morning Post of 25 April 2023.

To conclude let me say that the Austrian Ministry of Foreign Affairs hopes to find further partners in China, including Macau and Hong Kong, both among domestic and multilateral institutions.

We are convinced that we need to further promote or at least explore where there is common ground among all of us in order to ensure that digitalization and Artificial Intelligence are used for the benefit of individual citizens as well as humankind as a whole.

Extended Summaries of the Parallel Sessions

Data and Health: Cyber-Psychological Implications

Chair: Jaimee Stuart, UNU Institute in Macau

Speakers:
- Yu-Tao Xiang, University of Macau, Macau SAR China
- Claudia De Abreu Lopes, UNU-IIGH, KL, Malaysia
- Jacky Ho, University of Saint Joseph, Macau, Macau SAR China
- Calvin WL Ho, Hong Kong University, Hong Kong

Topic

During the pandemic more data than ever before was captured, stored, and utilised about our health. This was not only in the widespread use of public health surveillance applications and tracking systems to mitigate against viral transmission, but also in the increase in e-health and telehealth services, the surge in health-related information (and misinformation) search, spread, and access, as well as in the growth in research studies and data collection on health and wellbeing. What impact does this store of information – often globally distributed, sometimes unregulated, and potentially questionably collected – have on for us in the future and how does it (or did it) affect the way we behave, think, and feel? This session explores such questions and considers possible positive and negative future implications concerning data and health.

Summary

Data are inherently powerful; allowing us to make informed decisions, enabling modelling of current events, forecasting those in the future, and assisting humans to go beyond their narrow understanding of phenomena by mobilizing large bodies of real and simulated knowledge. It could be argued that some of the most important and powerful data are those that are collected about the human condition – or more specifically, data about our health and wellbeing. That is because health related data can be life-saving, preventing the spread of disease, identifying risks to wellbeing, and supporting medical interventions.

But our health is also fundamentally personal, with data about our bodies, minds, behaviour, and attitudes posing critical legal and ethical questions about what is private and what is public, what should be collected and shared for the common good as compared to what breaches our basic rights.

Given the power of this type of data, it is no surprise that more information than ever before is being captured, stored, and utilised about our health. Public health surveillance and tracking systems are now commonplace. There has been a major increase in e-health and telehealth services, a surge in health-related information (and misinformation) search, spread, and access, huge growth in research studies on health, and a rise in technologies for health data collection (both common use and medical).

In the contemporary global context that proliferation of health data collection and presentation was certainly propelled forward by the COVID-19 pandemic, but it was by no means the start of our interest in this area. In fact, we have been grappling with questions of who can access and use our medical information well before the digitisation of records and the proliferation of digital tools for monitoring health. Yet, now the sheer volume of data collected and the potential to use this data in unintended or unwanted ways is of critical concern. These issues were the key focus of the panel session.

In the session four interdisciplinary speakers address this topic, each whom discussed distinct facets of data, different population groups, and various elements of health. **Yu-Tao Xiang** from the University of Macau presented research on internet addiction and mental health among adolescents in Macau during the COVID-pandemic. A critical finding was that compensatory and avoidance strategies connected internet addiction to poor mental health. Calvin Ho from the University of Hong Kong outlined the ethics and legalities of Social Listening in the context of infodemic management. Results highlight that monitoring of sentiment through social media can help develop a deep understanding of people's needs, but a common set of principles based on human rights approach is needed to ensure this is ethical. Jacky Ho from the University of St Joseph highlighted the vulnerability for older age groups in Macau in an increasingly data-driven world. A key finding was that health information literacy was low among the elderly, and this is a lever for increasing quality of life. Finally, Claudia Abreu Lopes, from UNU IIGH discussed the risks and benefits of digital technologies for sexual and reproductive health from a gendered lens. The ethics of data linkage on sensitive health topics and the need to ensure safety were important insights from this work.

Just like the topic of health, the talks themselves were diverse in methods, theoretical backgrounds, and recommendations. However, even in this diversity, there were common implications derived that illustrate both challenges and opportunities in meeting health data dilemmas. Specifically, we must find new ways of harnessing the potential of health data related to both new and common-use technologies. Data is being collected all the time through many different devices and services, but this is often not by those who can use it for the broader social good. We need this data to make better models that reduce bias and provide more accurate solutions at both the collective and personal level. But there are potential privacy and security issues - digital health data is diverse and vast, creating novel possibilities that have complex ethical implications which require tech companies to work closely with decision-makers and citizens. Furthermore, the collection and use of health data needs to be transparent, there have to be mechanisms to ensure this is safe and secure, and citizens should be enabled to meaningfully engage and have agency over their health information.

Health (and health data), is a core part of a complex social, cultural, and economic system where issues of digital technologies are deeply and intractably related to our physical and mental functioning. We must unpack these associations to better understand issues of accessibility, literacy, misinformation, and trust. Indeed, the consensus in the session was to move forward and to go back to the basics – to ask ourselves why we are collecting health data, what is it used for, why it is necessary, and what harms could it cause?

Abstracts
Speaker 1: Yu-Tao
Internet addictions and depression among adolescents in Macau during the COVID-pandemic

Background and study objective: Internet use is common across different populations worldwide, with adolescents being a group where prevalence is higher compared to other age groups. According to the 47th China Statistical Report on Internet development in China, 13.5% of Internet users are adolescents. Internet addiction (IA) refers to an inability to control Internet use, or a maladaptive pattern of Internet use that results in clinically significant impairment or distress. IA is associated with a range of negative health outcomes such as mental health problems (e.g., depression) and decreased well-being. This study examined IA and depression in adolescents during the COVID-19 pandemic.

Methods: A total of 1,009 adolescents were recruited. IA and depression were measured using the Internet Addiction Test (IAT) and the 9 items-Patient Health Questionnaire (PHQ-9), respectively. A network analysis was conducted to identify Central symptoms and bridge symptoms using centrality indices. Network stability was evaluated using the case-dropping procedure. The Network Comparison Test (NCT) was conducted to examine whether network characteristics differed by gender.

Results: Network analysis revealed that nodes IAT-15 ("Preoccupation with the Internet"), IAT-2 ("Neglect chores to spend more time online"), PHQ-6 ("Guilty"), and IAT-16 ("Request an extension for longer time spent online") were the most central symptoms within the model of coexisting IA and depression. The most important bridge symptom was node IAT-11 ("Anticipation for future online activities"), followed by IAT-12 ("Fear that life is boring and empty without the Internet") and IAT-19 ("Spend more time online over going out with others"). Gender did not significantly influence the network structure. The IA and depression network model showed a high degree of stability.

Discussion and Conclusion: The central symptoms along with key bridge symptoms identified could be potentially targeted when treating and preventing IA and depression among adolescents. Data dilemmas appeared in this study included, first, this was a cross-sectional study, hence the causality between variables could not be inferred. Future longitudinal studies based on follow-up data are warranted to explain the temporal causal relationships between Internet addiction and depression in adolescents. Second, the data were collected online using a convenience sampling method, which limits the representativeness of the study sample. Third, the data on IA and depression were collected by self-report measures. Therefore, the possibility of recall bias could not be excluded.

Speaker 2: Calvin Ho
Ethical and Legal Determinants of Trustworthiness in Social Listening as Infodemic Management

An infodemic is an overabundance information, including misinformation and disinformation, that surges during a public health emergency. As people and communities tend to seek, generate and act on information more intensively during such an emergency, it is important that public health responses and strategies are evidence-based, engaging, reliable and trust

promoting. At a technical level, the science of infodemiology underpins infodemic management practices, which have rapidly evolved in recent years. Many tools that have been deployed in response to the COVID-19 pandemic have already been applied to other outbreaks, such as Ebola, polio and cholera, and new ones are being developed. Social listening in public health, for instance, has been enhanced by technological modalities like Big Data analytics, machine learning and artificial intelligence. At its core, social listening is the process of gathering information about people's questions, concerns, and circulating narratives and misinformation about health from online and offline data sources. Data gleaned from social media platforms may be used in a number ways to identify and understand outbreaks, geographic and demographic trends, networks, sentiment and behavioral responses to public health emergencies. Offline data collection may include rapid surveys, townhalls, or interviews with people in vulnerable groups, communities of focus and specific populations. These data are then integrated with other data sources from the health system (such as health information systems) and outside of it (mobility data) to generate infodemic insights and inform strategies to manage infodemics. However, the collection and use of this data presents ethical challenges, such as privacy and consent, and may not engender trust. For social listening and other approaches to infodemic management to effectively guide individuals, communities and health authorities, this paper explains how ethical and legal frameworks and mechanisms could help to link trust to trustworthiness.

Speaker 3: Jacky Ho
The World is Moving Unavoidably Fast - The Resurface of the Vulnerable in a Data-driven World
A world where personal data is constantly being collected, stored, and analyzed has been made possible by the development of technology and a data-driven culture. This has also highlighted worries about how vulnerable people are and how their personal information is. van der Hof and Kool (2017) stated the idea of digital vulnerability and presented the case that those with less digital literacy and expertise are more vulnerable to online fraud and privacy violations. Additionally, as access to online health services grows more widespread, elderly individuals may encounter challenges with digital accessibility and literacy which have a major influence on their health. The importance of digital literacy and digital health literacy in improving health and well-being among elderly was highlighted in available literature Chung et al. 2017, Mackert et al. 2016). Research demonstrated that digital literacy programs improve self-efficacy and health knowledge, and are positively correlated with greater utilization of health information and assurance in making healthcare decisions. The presentation will discuss that the vulnerability of individuals in a data-driven society is a complex issue which requires further investigation and care. It also emphasized how crucial it is to provide people with digital skills so they can protect themselves and use data in an ethical and responsible manner.

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Speaker 4: Claudia Abreu Lopes

Digital Technologies for SRHR: Debating Data Gaps and Governance

The impact of digital technologies on the lives of women and girls, particularly in relation to sexual and reproductive health and rights (SRHR), cannot be underestimated. With the help of technology and digital tools, access to reliable information and services related to contraception, abortion, STI prevention, counseling, and menstrual health can be significantly improved. This can be game-changing, especially in places where SRHR issues are still considered taboo.

However, it is also important to recognize that digitization can exacerbate inequalities in healthcare access and health outcomes due to gender, literacy, and income-related digital gaps, as well as the rural-urban divide, migrant status, and disability. For women and girls online, there is a serious concern that misinformation and disinformation about SRHR can further complicate their health knowledge and attitudes. Furthermore, the control of personal data shared with software applications by Big Tech companies poses a risk to the bodily autonomy of women and girls. The restrictions and attacks on SRHR in many parts of the world, including low-and-middle-income countries have been intensifying.

To ensure that the potential of digital technology for enhancing SRHR is realized, alternative approaches to data governance must be discussed. Additionally, given the prevalence of technology-facilitated gender-based violence and gender biases in algorithms and the datasets used to train them, we must place women's and girls' rights at the center of these debates.

Regulatory Dilemmas and Digital Technologies (AI)

Chair: Rostam Neuwirth, University of Macau

Speakers:
- Sarah Migliorini, University of Macau, Macau SAR China
- Tian Feng, Sensetime
- Celia Matias, University of Macau, Macau SAR China
- Muruga P. Ramaswamy, University of Macau, Macau SAR China
- Liang Zheng, Tsinghua University, Beijing, China

Topic

New technologies often pose difficult regulatory dilemmas in the field of law. Additionally, the creeping codification of international law and proliferation of international organizations may further contribute to the possibility of legal dilemmas to occur. The digital revolution and convergence of different technologies may be another factor in this trend, one that requires a greater consistency of the regulatory framework through better coordination between different legal fields or regimes. Overall, the regulatory challenges caused by the complexity of the present regulatory environment has given rise to a number of regulatory paradoxes, which will be briefly discussed and analysed with the goal of their possible solution.

Summary

The recent rapid pace of the development of disruptive technologies, best exemplified by digital technologies known as artificial intelligence (AI) and big data, has raised a number of serious dilemmas and related ethical concerns as to their potential beneficial or harmful impact on the planet, societies, governments, businesses, and individuals. These dilemmas often find their expression in numerous applications framed as various paradoxes or similar concepts, which have led to not only a rise in the number of apparent contradictions in terms but also legal conflicts.

Terminologically, these contradictions surface in the use of various concepts that carry opposite meanings, such as the concept of "artificial intelligence", which refers to both human and machine-related aspects of intelligence. In factual terms, the apparent contradictory character is best explained by the question about technology neutrality, that is whether a technology is good, bad or neither. In concrete terms, these problems surface in the case of dual-use technologies, which can provide both valuable benefits but also be used for nefarious purposes.

These dilemmas manifest themselves in various paradoxes such as the problem that disruptive technologies are of global character but addressed locally or that they are overestimated in their effect in the short-term and underestimated in their long term. Translated into the legal realm, they create the pertinent dilemma that the regulation of new technologies is hampered by the inability to predict the consequences of a technology in its early phase but made more

difficult to change in a later phase. This dilemma explains the need to future-proof new laws and regulations.

The regulatory dilemmas caused by such disruptive technologies can be traced to the continuous trend of convergence between different technologies, industries and products. This trend has led to these technologies to features cross-cutting, cross-boundary and cross-cultural characteristics. These unique characteristics cause fundamental problems to the legal systems around the world as they were built on the foundations of different concepts and distinct categories the boundaries of which are now becoming increasingly blurred.

The regulatory problems posed by such technologies for legal systems of the world surface first in their reach beyond a territorial conception of sovereignty, such as the use of small satellites operating in the low Earth orbit. Various new technologies, such as AI, big data, large language models, and cloud computing must not only be examined and legally qualified in isolation but also in their effective use in combination with other technologies, such as those of neurotechnology, biometric identification systems, nanotechnology and biotechnology. From a legal perspective, it means to enforce and adapt the existing laws accordingly as to effectively ensure their compliance with all existing laws and the values enshrined in the constitutional texts of each legal system separately and the global legal order as a whole.

In view of these dilemmas, it is important to note the adoption of the UNESCO *Recommendation on the Ethics of AI* in November 2021, which reflects the emergence of a global consensus on the necessity to regulate new disruptive technologies. This consensus is also backed by recent regulatory steps taken my many jurisdictions at the regional and national levels with the objective to address and tackle the serious risks and resulting problems from these technologies.

In view of the 2015 Sustainable Development Goals (SDGs) and the Global Digital Compact to be agreed at the Summit of the Future in September 2024, which is expected to "outline shared principles for an open, free and secure digital future for all", the following concrete regulatory recommendations have been formulated:

- Existing international treaties, laws and regulations at all levels and in all affected fields must be consistently applied and properly enforced in a non-discriminatory manner to all kinds of disruptive technologies.

- Private actors that detain the power and resources necessary to the operation and development of new technologies should be held accountable under existing laws and should also be empowered with new principles regarding their social responsibility and their obligation to behave in a manner that does not exclude certain individuals, groups, NGOs or smaller companies from access to such resources and power.

- Where lacunae persist or existing laws are deemed inadequate, new laws must be adopted – carefully balancing sectoral or comprehensive approaches – with the aim to effectively address the novel specific characteristics of these disruptive technologies.

- Jurisdictions shall institute agencies akin to law reform commissions to monitor the overall coherence of related policies and, when necessary, propose reforms to safeguard the consistency of the legal system and systems as a whole.

- A multilevel governance approach must be taken to seek optimal levels of effective coordination between international organizations, governmental authorities and regulatory agencies at all levels of legislative or regulatory activities.

- National and regional legislative proposals must be accompanied by serious efforts ensuring better coordination and greater global cooperation.

- Legislative proposals shall be prepared following a multi-stakeholder dialogue and supported by a reliable information and active involvement of the public.

- Given the impact on young people and future generations, educational measures informing about the technical, ethical and legal implications of such technologies must be taken by the competent authorities and educational institutions at all levels.

- Considering the cross-cutting, cross-boundary and cross-cultural characteristics of disruptive technologies, multidisciplinary approaches must be applied to their development, observation, examination as well as regulation.

- Dilemmatic or paradoxical problems also require a due consideration of the role of space-time, meaning that the exact spatial and temporal moment of regulatory intervention is crucial, recognizing that the regulatory process should not commence once a technology was put in the market but prior to that or parallel to the development of a new technology.

- New legal methodologies must be developed in parallel with the ongoing scientific and technological progress to foster the use of novel regulatory instruments and experimental legislation, such as those derived from the use of regulatory sandboxes.

- Novel and more holistic forms of legal reasoning must be developed and applied that transcend binary conceptions underlying traditional dichotomies, such as those of public or private international law, rights and duties, or recommendations and prohibitions.

- In the wake of the Sustainable Development Goals (SDGs) and the Global Digital Compact, a global public debate should prepare and inform related regulatory debates as to the context and purpose of the broader objectives pursued by the development of new disruptive technologies.

Data Policy for Addressing Data Dilemmas in Crisis Situations

Chair: Francis Crawley

Speakers:
- Virginia Murray, Head, Global Disaster Risk Reduction, UK Health Security Agency
- Simon Hodson, Executive Director, CODATA (Committee on Data of the International Science Council)
- Burack Basbug Erkan, Department of Statistics, Middle East Technical University, UK
- Perihan Elif Ekme, Head of History of Medicine and Ethics Department, TOBB University of Economics and Technology, Ankara, Turkey
- Yarime Masaru, Director, MPhil and PhD Programs in Public Policy, The Hong Kong University of Science and Technology (HKUST)

Topic

This session examined the need for data policy to address scientific and digital sustainability in humanitarian crises caused by health emergencies, natural and human-made disasters, and geo-political conflicts. Using the framework of UNESCO's Recommendation on Open Science, the session focuses on the need for well-prepared and robust data policy to address the digital, communication, research, and societal dilemmas that inevitably arise in fundamentally disruptive situations. The sustainability and continuity of the sciences, the assurance of robust working environments for scientists and support services, and the guaranteeing of the needed trust in scientific and information outputs require well-defined data policy principles supported by recommendations for preparing for and responding to crises. Ethics, human rights, good governance, citizen participation and, ultimately, the need to sustain economic, political, and social cohesion underlie data policy designed to address digital technology dilemmas in crisis situations.

Summary

The session addressed data policy with regard to scientific and digital sustainability in humanitarian crises caused by public health emergencies and natural or human-made disasters. Data dilemmas in crisis situations were discussed from both the theoretical perspectives to specific case studies with specific attention given to a human-centric approach. The theoretical perspectives examined largely the human-centered systems approaches needed for open science and effective collaboration among stakeholders.

The case studies then looked specifically at the challenges posed by climate disasters, particularly typhoons, and natural disasters, such as earthquakes in the context of latest ones in Turkey and Syria. The Covid-19 pandemic also provided an example of the challenges and actions explored most globally to date. These case studies were used to highlight the dilemmas and expand on the requirement for a human-centered data policy to successfully address these crisis situations.

The context was framed within the need for sustainability alongside the importance of continuity in the provision of accurate and trustworthy data as well as the production of scientific knowledge for preparing and responding to crises. A robust data policy depends heavily on a commitment to data integrity and the implementation of the FAIR principles. Data policy is essential for crises preparation and response while maintaining economic, political, scientific, and social sustainability during crises.

The session focused on two key concepts: the first is that of a human-centered data policy and the related need for open science and effective collaboration among the actors. The importance of investment in data infrastructures, systems, and tools for sustainable data and digital technology was seen as an essential point for developing human-centered data policies. The second key concept was the need for trustworthy, accurate, and FAIR (findable, accessible, interoperable, and reusable) data. The integrity and accuracy of data were considered to be essential to maintaining trust in science and the decisions taken by authorities based on data and the resulting evidence supporting interventions.

Three main data dilemmas were defined:
1. The data dilemma in the context of public health emergencies rests on the trade-off between accessing and using as much data as needed to provide maximum benefit to public health while also respecting and protecting the privacy and confidentiality of individuals. From the theoretical perspective this dilemma is framed as a tension between a utilitarian approach that argues for the utmost importance of maximizing benefit for all, on the one hand, and a rights-based approach, on the other hand, that prioritizes individual dignity, of which personal privacy and confidentiality are fundamental and does not permit public benefit to override these fundamental rights.
2. The second dilemma concerns the interoperability of data. In crises good data policy should promote the well-being of the community, requiring diverse stakeholders to work together across disciplines and sectors. The interoperability of data is one of the five key data essentials for cross domain crises disaster management enabling coordinated cooperation across stakeholders for synchronized and well-adjusted crises management.
3. The third dilemma is that of the digital gap between various sectors of society where specific groups have more or less access to (the latest) digital technology. This gap risks leading to power imbalances that may act against vulnerable or disadvantaged groups and deepen the existing inequalities as well as leading to breaches in the implementation of a human-centered data policy.

These dilemmas were addressed within the framework of UNESCO's *Recommendation for Open Science* and the ongoing work of the CODATA IDPC. Protecting and respecting human rights, compliance with ethical norms, coherence with good governance principles, and the effective and responsible use of emerging technologies (such as generative artificial intelligence) were discussed as essential for human-centered data policy. Open science and effective collaboration were addressed in terms of the importance of promoting cooperation between scientists and policymakers through relevant UN networks and frameworks and the crucial role of data policy in developing regional cooperation mechanisms for managing risk in crisis situations.

The integration of meteorological, hydrological, and disaster risk reduction components as well as the establishment of an efficient cooperation mechanism with all stakeholders should be ensured. In addition, it is of importance to leverage the multiple interests of these stakeholders, promote the spirit of open science, and foster the collaboration of these stakeholders when science and society are faced with crisis situations. In summary, we need to use well considered data policy to help advance open science by contributing to an ecosystem of trusted partnerships for better decision-making when faced with crises.

Datafied Macau: Seeing the City with Algorithms

Chair: Denis Zuev, University of Saint Joseph, Macau SAR China

Speakers:
- Gerald Estadieu, University of Saint Joseph, Macau SAR China
- Dalibor Vodenicarski, University of Saint Joseph, Macau SAR China
- Sandra Ng, University of Saint Joseph, Macau SAR China
- Terence Lee, Sustaincia
- Derek Ho Hong Kong University
- Robert Ruggles, University of Saint Joseph, Macau SAR China

Topic

All aspects of our life are being transformed into quantifiable data; everything is a subject to datafication – this phenomenon called "computational turn" in social (behavioral) sciences has been criticized for its excessive emphasis on "quantification" of very nuanced social data. At the same time the computer-aided methods reveal interesting patterns and aid social scientists in seeing a bigger picture. The aim of this session is to the debate on computer-aided methods and practices of research – identifying the practical hindrances and methodological, ethical implications and dilemmas. This session aims at (de)constructing the moralities of data production and specific dilemmas of governance - underlying each concrete case. This session also addressed epistemological fears of algorithmic thought and the sensibilities and competences that are needed to study contemporary culture and the city through data.

Summary

The aim of this session was to feed into the framework of the forum and contribute to scholarly debate on computer-aided methods and practices of research – identifying the practical hindrances and methodological, ethical implications and dilemmas. The following questions were posed:
- Can the ongoing datafication be sustainable?
- How can we account for losers and winners of datafication in the city?
- What can we learn better and problematize differently with computer-aided methods?
- Methodologically: how can we accurately translate social concreteness into abstract data and what are the compromises to be made?
- What comprises algorithmic thinking for understanding culture and society?
- How can we study culture through the critical reading of new types of data that are generated?
- How can we advance our understanding of the city and its intricate relations through computational methods?

At the end of the session the key question was: while the promises of the data, "poetics of the data" and computational methods are more clear and widely shared, what are the dark sides, and potential disruptive consequences of these technological applications and data?

The panel had six participants who presented results of completed or ongoing research projects, as well as reflecting on multiple applications of data in urban environment in Macau or Hong Kong.

Prof. Derrick Ho from University of Hong Kong in his presentation "Trends and uncertainties of "new urban data" for city design and urban health studies" spoke of applicability of Janet Jacobs ideas to the diversity of life forms in dense urban environment characteristic of Macau and Hong Kong. Due to a high population density and the compact environment, current research for city design and urban health in Asian cities often require "new urban data" for planning and analysis. They "new urban data" are generally big data information retrieved and aggregated from multiple sources, which may be able to better describe the mobility patterns and three-dimension environment of the compact cities. This discussion focused on the current trend of "new urban data" for city design and urban health studies, including 1) types and nature of common data, and 2) the potential applications with the uses of these common data. The uncertainties and limitations of these datasets will also be discussed, especially in 1) how we can reduce the issues from limitations, and 2) how we can apply these data frameworks globally and locally.

Prof. Gerald Estadieu from the University of St. Joseph in his presentation "Sensing Soundscapes: Engaging with Data to unlock intangible qualities of environmental sound" spoke about an ongoing research project on soundscapes and analysis of sound events in urban environment in Macau. The rationale for this project is two-fold. On the one hand, it is describing the Soundscape in a territory rich in diversity and huge potential for citizen participation. This includes efforts in noise mapping, sound mapping, soundwalks, grounded theory efforts on rich descriptions of the environment, and the use of alternative objective metrics. With these components, the project provided an original and substantial insight into the qualitative dimensions of soundscapes, attending to a wide variety of geographical, and cultural facets, following a multimodal sensing strategy. On the other hand, the project drew on the richness of the gathered data by developing artificial intelligence algorithms to autonomously assess and predict the evaluation of a given soundscape based on recordings alone.

Sandra Olga Ng, researcher from University of Saint Joseph, Macau discussed the "The Conditions of Achieving Mindfulness through (In)Tangible Virtual Reality Experience in Macao". Virtual reality, a computer-generated 3D environment, allows one to navigate and possibly interact with, resulting in real-time simulation of one or more of the user's five senses. Despite its history through past decades, this technology has quickly developed. Virtual tours and spaces have been widely used in the education, arts, and rehabilitation industries. According to the research, it has significant effects on mindfulness (improving mood), cognitive development (better learning ability), and embodiment (relieving pain and medical conditions). This research aims to identify the conditions for Macao's single-user experience to achieve mindfulness in virtual reality through immersion and interactivity.

Dalibor Vodeniciarski, managing director of Doppelmayer Macau Limitada discussed the application of blockchain and smart contracts in maintenance operations (CMSS) for aerial cableways. A Computerized Maintenance Management System (CMMS) is a cornerstone of any excellently exercised maintenance management policy. Defining the maintenance strategy and incorporating digital technology will give an edge to every technology enterprise. On a brick of the fourth Industrial Revolution, or Industry 4.0, digitalisation is taking a massive part in structuring the manufacturing, operational and maintenance processes in almost every Industry. From the stands of gigantic public transport, provided by the ropeway technology also called ariel ropeway transit, and massive demand for safe and reliable operations, new emerging technology must deal with the enormous amount of data calculated and compiled by the new digital technologies.

Blockchain technology and its Hyperledger Fabric Distributed Ledger Technology (HLF DLT) platform with its features have a potential in building a safe and secure CMMS with immutable, traceable, resilient, and reliably stored data on a decentralised ledger. The proposed system follows the five main paradigms, such as Blockchain, Internet of Things (IoT), Cloud Computing, Industry 4.0, and Smart Maintenance. We discussed developing applications with Smart Contracts, also called chain codes, to enhance maintenance operations, incorporate maintenance strategies and policies, and deliver the overall operational excellence of an enterprise which dealing with operational services of an urban cable car. Furthermore, we are exploring and defining the further work on developing the smart contracts for different business processes of an enterprise such as organisational, operational, competency processes, and financial processes integrating them with overall maintenance operations.

Robert Ruggles, an expert in security systems, and currently a PhD student at University of Saint Joseph, Macau, presented a talk "Seeing Macau through CCTV: AI and data governance". The use of CCTV, AI, and data governance in Macau SAR which heavily relies on the tourism industry can help support public safety, crime prevention, and tourism management. Macao is now covered by more than 1,600 cameras, which have been installed in phases since September 2016. The so-called Olhos no Céu (Eyes in the Sky) system is used to monitor border checkpoints, major roads and transport hubs, security black spots, tourist attractions, remote locations and places that may present security hazards. The *Macau Post Daily* says CCTV cameras were used in the investigation of 3,665 criminal cases last year, including homicide, drug dealing, robbery, theft, arson, possession of prohibited weapons, assault and fraud.

The use of AI and analytics in Macau can help enhance the capabilities of the CCTV system, allowing for more efficient and effective monitoring and analysis of CCTV data. However, the use of AI and analytics in CCTV must be carefully managed to ensure that it does not infringe on individuals' privacy or violate legal and ethical standards. Effective data governance in Macau is crucial to ensure the responsible and ethical use of CCTV data and AI technologies. This includes defining policies, procedures, and standards for managing and using CCTV data, as well as establishing protocols for data quality control, data security, and data privacy. Proper data governance can help protect the privacy of individuals and ensure that CCTV data is used ethically and responsibly for its intended purposes. The use of CCTV, AI, and data governance in Macau can help support public safety, crime prevention, and tourism management. However, it is essential to ensure that these technologies are used responsibly, respecting the

privacy and rights of individuals, and complying with legal and ethical standards. Analytics can be used in smart cities to improve the efficiency of infrastructure and services, as well as to enhance public safety and security. Overall, in the framework of creating Macau as a smart city, the AI and analytics can help authorities (police, transport commissions, tourism governing body) make more informed decisions, improve services, and enhance the quality of life for their residents.

Terence Lee, from Sustaincia, reported on the results of the FDCT, Macau funded project Structural City and spoke about the issues regarding the platform for smartification of property management in Macau. The application is the solution to help buildings "heal themselves via a unique complaint system on the platform. The platform connects all housing and commercial structures in Macau, that are defined as places where people live, work, play; as the system is driven by people who care, but there is also IoT subsystem which can take care of structures / locations which don't have actual human traffic, eg. bridges, basements, top of bridges, and even water filled mangrove areas.

Anyone can report to a structure and can even do it anonymously, which solves multiple issues: the "revenge situation", the illegal resident fear to report situations and the spamming situation. The data is only shown to the structure manager first, there is a whole 'need to know' system that's unique as well. Key issues about the platform the continuing low user number, the question how to sustain the platform economically and to benefit the "structure" as well. Solution suggested by Lee is to reduce reliance on management fee, as buildings can potentially offer revenue generating services with their surplus service or with the building itself, another long discussion.

The presentations touched upon different topics such as collection of data on diversity of urban forms in dense urban environment and sonification of urban environment and analysis of urban sounds. Speakers presented various applications related to multiple facets of urban environment in Macao: practical issues with surveillance data governance, the application of blockchain and smart contracts in maintenance of aerial cableways, the use of virtual reality settings for achieving mindfulness and finally, the smart property management applications.

While each presentation presented insights in a specific aspect of urban life in Macao, the key takeaway from the dialogue session was the importance of digital literacy in the accelerated digitalization of the urban environment. At the same time, it is crucial for social scientists and computer scientist to strive for more collaboration in understanding of complex urban sensorium. Finally, Macao is a fruitful experimental place for exploring the impacts of datafication, however the data generated should be treated respectfully and responsibly by government authorities and commercial entities.

Artificial Intelligence (AI) Applications. Challenges and Opportunities

Chair: Derek Wong, University of Macau, Macau SAR China

Speakers:
- Elwin Ho, Pachira
- Jiantao Zhou, University of Macau, Macau SAR China
- Xiaowei Wu, University of Macau, Macau SAR China
- Ryan (Leong Hou U), University of Macau, Macau SAR China
- 贾西贝 Jia Xibei CEO, Audaque Data Technology Co., Ltd

Topic

Artificial Intelligence (AI) continues to revolutionize various aspects of our lives, from electronic governance to personalized services, providing numerous opportunities for public organizations and industries to enhance their operations and efficiency. For instance, ChatGPT, a generative AI based on a Large Language Model, has recently gained significant attention for its ability to perform a wide range of generative tasks, including composing emails, generating articles, writing code, and creating proposals and PowerPoint presentations. However, AI applications also raise critical concerns regarding privacy and ethics.

Summary

In this session, we brought together speakers from both academia and industry to discuss representative AI applications and potential scenarios that could significantly benefit from AI. The session aimed to provide insights into overcoming the challenges posed by AI and how different stakeholders can contribute to this wave of technological transformation in the future. There has been extensive discussion about a wide range of issues and concerns during the meeting and panel, from the fairness and responsible use of AI technologies to the use of data in training the AI systems.

There were three main discussion topics in this session:
- The Technology Gap Between Countries
- Data Dilemmas in AI Applications
- Will AI Surpass Human Intelligence?

The technology gap between countries, particularly in underdeveloped or developing nations, was a prominent aspect of the panel session. An intriguing suggestion put forth during the discussion was the potential of AI technologies as a cost-effective means to educate and empower individuals in these regions. Traditional educational infrastructure may be lacking in certain areas, making it difficult for people to access quality education and training. Leveraging AI technologies could provide an opportunity to bridge this gap by making educational resources and tools more accessible to individuals in countries where resources and educational infrastructure are limited.

Moreover, AI technologies can extend beyond formal education and support skill development in various sectors. With AI-powered platforms and applications, individuals can gain access to vocational training, entrepreneurial resources, and even healthcare information. This can help foster economic growth, empower local communities, and bridge the technology gap. However, It is important to acknowledge the challenges in implementing such initiatives and recognize the need for infrastructure development, reliable internet connectivity, and AI solutions that consider the specific socio-economic and cultural contexts of underdeveloped regions. Collaboration between governments, non-profit organizations, and the private sector was highlighted as crucial in driving these efforts. By working together to overcome barriers, stakeholders can harness AI technologies to provide cost-effective and scalable educational opportunities, thereby empowering individuals in underdeveloped countries and narrowing the technology gap.

AI systems heavily rely on the use of data to train large language models. The panel delved into the pressing issue of data use and accessibility, highlighting concerns about the diminishing availability of public textual data and the abundance of AI-generated data flooding the internet. One speaker stated that by 2026, public textual data may be exhausted for training AI applications, leaving only inaccessible data such as private personal and sensitive information held by organizations.

The panelists acknowledged the significance of data in constructing AI systems and emphasized the need for responsible data collection practices. They underscored the importance of protecting privacy and addressing biases to prevent the development of unfair or discriminatory AI models. Data quality and representativeness are critical for ensuring the reliability and fairness of AI applications.

In response to the challenges posed by data scarcity and accessibility, the panel stressed the importance of collaboration among various stakeholders. Governments, organizations, and individuals must work together to establish frameworks that enable transparent and ethical data practices. This includes promoting data-sharing initiatives while respecting privacy regulations and legal considerations.

In some specific tasks, AI has proven its ability to surpass humans. However, the prevailing consensus remains that AI is unlikely to replace human beings. It is emphasized that AI should be viewed as a tool that enhances human decision-making rather than a substitute for human intelligence and creativity. AI technologies have the capability to automate repetitive and mundane tasks, allowing humans to focus on more complex and strategic endeavors and dedicate their time and expertise to tasks that require uniquely human skills such as empathy, critical thinking, and creativity.

Ethical considerations were also a significant part of designing AI systems that empower humans and align with societal values. This entails ensuring fairness, transparency, and accountability in AI algorithms and decision-making processes. Ethical guidelines and regulations are essential to prevent AI from perpetuating biases, discrimination, or unfair practices.

The potential of human-AI collaboration is highlighted, as combining the strengths of AI technologies with human intelligence allows individuals to leverage the analytical capabilities and efficiency of AI systems while applying their judgment, intuition, and contextual understanding to complex challenges. This collaboration fosters synergy and enables the creation of innovative solutions that effectively address multifaceted problems.

In summary, by adopting ethical practices and leveraging the strengths of both AI and human intelligence, the future of AI applications can bring about positive outcomes and address complex challenges.

Data Dilemmas in Public Services, Communication and GIS

Chair: Akio Takemoto, UNU Institute for the Advanced Study of Sustainability, Tokyo

Speakers:
- Tiziana Bonapace
- Peng Gong
- Shengru Li
- Sophia Cheng
- Xiaosong Li
- Gensuo Jia
- Meng Wang

Topic

Integrating space and digital innovations for accelerating SDGs. Leveraging geospatial information and digital applications has a vast potential to improve the quality and delivery of evidence-based decision-making for many critical sectors in Asia and the Pacific. Examples of such applications include a virtual satellites constellation for disaster risk management, rapid mapping of disaster hotspots through machine learning. Engaging the youth in the innovative use of geospatial information for sustainable development is critical to realizing this potential. Keynote speakers and participants of this meeting will discuss the enormous opportunities for applying digital innovations, as well as the challenges that prohibit countries from maximizing their full potential to reduce disaster risk.

Summary

This session was chaired by Akio Takemoto, Head of Programme and Administration at UNU Institute for the Advanced Study of Sustainability (UNU-IAS). The session brought together experts from various fields, including academia, UN entities, and private sectors.

At the plenary opening session of the Event, Akio Takemoto introduced the context of the parallel session focusing on the following:

- It is essential to transform the economy by integrating DX into various policies supporting the SDGs. Leveraging geospatial information and digital applications has a vast potential to improve the quality and delivery of evidence-based decision-making for many critical sectors in Asia and the Pacific.

- A virtual satellites constellation for disaster risk management, rapid mapping of disaster hotspots through machine learning which will be beneficial to climate change adaptation.

- AI and IoT play a significant role in climate change mitigation and public health policies through real time monitoring, automation, and connectivity which will be applicable to efficient traffic control and energy management of the building sector. Digitalisation and smart controls can reduce emissions from buildings by 350 Mt CO_2

by 2050 although we should address the increased carbon footprint from the ICT sector itself.

In the opening of the parallel session, Tiziana Bonapace (Director, ICT and Disaster Risk Reduction Division, Economic and Social Commission for Asia and the Pacific) highlighted the importance of leveraging digital innovation in integrated geospatial information applications for sustainable development. She emphasized the need for training and capacity building to implement all SDGs, especially climate action. Tiziana Bonapace discussed the Space+ for Earth and Future initiative that UNESCAP is working on, that is actionable and affordable in Indonesia. She also highlighted the importance of working with people to develop policies and practices that are applicable at the local and community levels. Bonapace discussed the challenges of mitigating data dilemmas, and how ESCAP is adopting a bottom-up approach to make geospatial information understandable by citizens.

Peng Gong (Professor, The University of Hong Kong) presented on the Global Seamless Data Cube and iMap. Gong highlighted the application of satellite data in predicting crop yield, sustainable cities, and pre-disaster prediction. He also presented on the remote sensing technology used for collecting earth data and introduced his team's recent work using a 1000PFLOPS computer to create a seamless data cube of 32 years of data of 5 meters resolution. This data and computing power can be used to monitor and predict climate change effects, such as the flooding pattern in the Amazon River.

Shengru Li (Research Fellow and Academic Associate for the Innovation and Education Programme at UNU-IAS) presented on the role of digital technology such as AI and IoT in promoting net-zero emissions by smart manufacturing through optimizing processes and wider applications of AI for reducing energy consumption among households and cities. Li emphasized the importance of having an inclusive approach to digital technology and called for interdisciplinary collaborations to address the challenges of digital innovation.

Sophia Cheng (Macau Water) discussed their smart water systems which allow for one plant to be staffed out of four treatment plants. They utilize a Program Logic Controller and supervisory control and data acquisition (SCADA) system for smart operations, along with a smart distribution platform. They also have an energy management platform for GHG analysis and management. Additionally, the company is piloting the use of AI for identifying harmful algae in Macau.

During the session, three experts from the Chinese Academy of Science (CAS) discussed their work related to big data and sustainability. Xiaosong Li (International Research Center of Big Data for Sustainable Development Goals, CAS) talked about the centre's efforts to collect data and inform environment-related SDGs, including launching the SDGSAT-1 satellite for monitoring. Gensuo Jia (International Research Center of Big Data for Sustainable Development Goals, CAS) discussed the CAS Earth Big Earth Data Program, which collates small pieces of data for earth science and decision-making, and the challenge of integrating social science and citizen science data into existing infrastructure. Meng Wang (The Institute of Remote Sensing and Digital Earth, CAS) spoke about the role of big data in accelerating the transmission of information from science to application, China's pledge to set up a Big Data Centre for SDGs, the launch of SDG Big Data Platform, and the use of remote sensing data to

track GHG intensive industries. The experts emphasized the importance of data analysis in achieving sustainable development goals.

In conclusion, the session chair Akio Takemoto underscored the critical need for partnerships to address data dilemmas in areas such as public services, communication, and GIS. He emphasized the importance of having a neutral platform for collaborations with private sector partners, while also recognizing the challenges of working with the private sector. He also highlighted the significance of taking a bottom-up approach to make geospatial information understandable to citizens and stressed the need for capacity building, particularly among young practitioners and scholars.
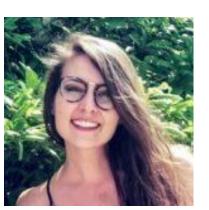
Data, Digital Technologies and Human-Centered Design for Decision Making

Chair: Cara Antonaccio, UNU Institute in Macau, Macau SAR China

Speakers:
- Chokdee Rutirasiri, Adjunct professor of Design at Boston College
- Paul Pun, Secretary-General of Caritas Macau

Topic

Achieving the SDGs relies on strong data and evidence to inform decision-making in the face of wicked problems. This session will present the key principles of the design thinking process and consider how a human-centered design thinking approach can be used to catalyze decision-making for sustainable development. Design thinking refers to social processes of data collection, analysis, and integration in a systems context to allow for collaborative, inclusive, and evidence-based decision-making. What distinguishes human-centered design from other problem-solving approaches is its emphasis on understanding the perspective of those who are most directly affected by a problem. Design thinking is especially useful for finding solutions that can have a long-term impact.

Summary

Most of the enduring problems that humanity faces today are complex and interconnected—spanning disciplines, knowledge bases, and value systems; and any viable solutions must do the same. In recent years, as more people strive to ensure that data is used in a way that benefits humanity and the planet, Human-Centered Design (HCD) has gained traction as a useful set of tools to solve the major data challenges in sustainable development. Human-centered design (HCD) is an approach to problem-solving that puts an emphasis on humans and their lived experiences in a specific context when designing strategy and process. This philosophy holds that a successful solution or service offering is only as good as its ability to address an identified need of those it intends to help. HCD emphasises user feedback and iteration in the design process. The Four Core Principles of Human-Centered Design are
- People
- Process
- Possibility
- Partnership

'People' refers to starting with human beings as the primary source of inspiration; 'process' refers to the use of a creative, iterative process to think systematically about problems and opportunities to solve them. 'Possibility' engages new technologies and solutions to meet communities' needs; and finally, solutions should be co-created with 'partners' and stakeholders.

This dialogue session at the UN World Data Forum's Satellite Event in Macau with Chokdee Rutirasiri, adjunct professor of Design at Boston College, and Paul Pun, Secretary-General of Caritas Macau, explored real-life examples of how HCD provides an ideal framework for

considering sustainability and inclusivity in decision-making. The two speakers discussed the range of activities they engage in, in their HCD processes—including defining needs and identifying desired outcomes; understanding people's experiences, behaviors, and motivations; analyzing people's stories to identify solutions; prototyping concepts and testing with beneficiaries; and finally, developing implementation plans for successful programs. This parallel session exemplified each phase of the HCD process, including a discussion of the ins-and-outs of human values, needs, and rights as part of the data collection and decision-making processes, as well as how it is important to consider the perspectives of all stakeholders throughout the lifespan of a program (for example, through in-depth case studies from Caritas Macau). Our discussion emphasized how HCD approaches ensure that data is collected and used ethically, with respect for the rights of the people it affects.

Aside from considering ethical implications of data, this parallel session examined how HCD also provides an effective way to address the major data challenges in sustainable development. In particular, the data challenges experienced in the development and service sectors are unique and require a more tailored approach. HCD helps to identify areas of improvement within existing data gathering processes, as well as areas where further data needs to be gathered. It also facilitates the sharing of data between different organisations and other stakeholders, in order to further progress in sustainable development.

We discussed the diverse ways in which HCD can be used to ensure that data is accurate and representative. Improving the accuracy and representativeness of data helps to reduce errors, leading to better decision-making and more accurate information about the progress of sustainable development initiatives. This can help to ensure that projects are on the right track and improvements are made in a timely and effective manner.

In summary, this parallel session underscored the innumerable ways in which HCD helps to ensure that decisions taken are data-driven and take into account individuals' lived experience and perspectives. HCD ensures that services and products are designed with the people they will affect in mind, and that the benefits of such projects are realised across different demographics. It is essential to use a human-centered design approach when tackling the major data challenges in sustainable development. Doing so ensures that data is used in an ethical and accurate way, and that projects are designed in a way that takes into account the needs and rights of the people that they are intended to help.

Building Trust by Computational Collective Intelligence

Chair: Serge Stinckwich, UNU Institute in Macau, Macau SAR China and Patrick Pang, Macao Polytechnic University

Speakers:
- Patrick Pang Macao Polytechnic University
- Peiling Yap I-DAIR
- Jolly Wong MUST
- Kin Sun Chan University of Macau
- Mamello Thinyane University of South Australia

Topic

The world is facing an uncertain future brought about by the COVID-19 pandemic, climate change, inequality, violent conflicts, and other global challenges. Citizen science and, more generally, public participation in scientific research and knowledge production can help generate data helpful in informing policies and mobilising action to address this world's challenges. Citizen science can help communities to participate in, understand, and trust science. However, this is not always producing the correct policies. To tackle scientific and societal challenges, in order to build trust around citizen science data involving policy actors, government bodies, academia, civil society, and other stakeholders, we need to put together the capabilities of humans and machines in new kind of trusted partnerships. Collective Intelligence emerges from the collaboration, collective efforts, and competition of many individuals and appears in consensus decision making. Tools based on participatory modelling or foresight approaches are some of the tools that might be considered.

Summary

In this parallel session, the speakers discussed topics including participatory modelling, Macao One Account, trust, making cities green and liveable, as well as transparency and accountability dilemmas.Collective intelligence is the idea that shared, or group intelligence emerges from the collaboration and collective efforts of many individuals, often combining humans and machines. In the context of urban governance, this can mean that decision-making processes can be more inclusive and effective if they are informed by a wide range of perspectives and expertise. Citizen science is a form of collective intelligence that involves scientific research conducted with participation from the general public. This can be a powerful way to engage citizens in scientific inquiry and decision-making processes and to generate insights and data that might not otherwise be available.

One key issue that emerged from the discussion was the institutionalization of citizen data and platforms. While these platforms are by default institutions, concerns were raised about the need to take into account issues of trust and accountability. In other words, just because a platform exists does not mean that it is automatically trustworthy or accountable. Trust was identified as a critical issue: it does not necessarily lie with the technology itself but with the platform and the people behind it. Another issue that was discussed at the conference was the role of citizens in the design of AI models. Many current AI models are driven by data

scientists and other experts, with the voice of citizens often not included in the process. However, there is a growing recognition of the importance of including citizens in the co-design process, to ensure that AI models reflect the values, needs, and priorities of the communities they are designed to serve.

Trust was also identified as a critical factor in citizen participation. Citizens' trust in government is related to the responsiveness of governments to citizens' needs and concerns. In Macao, for example, there is a high level of trust in government, but this is not necessarily the case in every country. In some contexts, too much citizen participation may not work, and a balance needs to be found.

Contextualization was identified as another key issue in the discussion of collective intelligence and citizen science. While participatory approaches can be very effective in some contexts, they may not work in others. It is important to understand the specific context in which a participatory approach is being used, and to adapt the approach accordingly.

In conclusion, collective intelligence and citizen science offer exciting opportunities for more inclusive and effective decision-making and scientific research. However, these approaches also raise important questions about trust, accountability, and the role of citizens in shaping these processes. By continuing to explore and refine these approaches, we can work towards a more collaborative and responsive approach to urban governance and scientific research.

Digital Entrepreneur Dialogue

Chairs: Jenny Philips, Dean Faculty of Law and Business, University of Saint Joseph, Macau and Denis Zuev, Faculty of Arts and Humanities, RLCS, University of Saint Joseph, Macau

Topic
Innovation environment is critical for regional development and start-ups have become key to development of entrepreneurial environment and creativity in the cities. Untangling the dynamic relationships between the digital and entrepreneurial ecosystems is crucial for understanding how digital technologies are reshaping the entrepreneurial process. This session invites practitioners, start-up representatives, scholars in the field of business and digital entrepreneurship to address the key issues that deal with the current use of data regarding the users, marketplace, and infrastructure. The geographic scope of discussion is beyond Macau and Greater Bay Area and comparisons between other digital economy examples are welcome. At the same time, we wish to identify several action points for Macau: what are the key challenges and how local digital entrepreneurs can overcome them and contribute to diversification of Macau's economic profile.

Summary
A panel discussion on the topic "Dialogue with Digital Entreprenuers" was held on the 25th of April in Grand Hyatt, Macao as one of the parallel panel discussions during the United Nations World Data Forum (UNWDF) satellite event entitled "Dealing with Data Dilemmas: Towards a human-centred systems approach to sustainable data and digital technology development". The panel was organised by the Faculty of Business and Law (FBL) and the Research Laboratory of Cultural Sustainability of the Faculty of Arts and Humanities (FAH-RLCS) at the University of Saint Joseph Macao (USJ).

The Dialogue with the Digital Entrepreneurs was co-chaired by Prof. Jenny Phillips, Dean of FBL, and Prof. Denis Zuev, Director of FAH-RLCS, who invited panel speakers from various organisations with expertise in digital entrepreneurship from Hong Kong and Macao. These organisations include Animoca Brands, one of the key global players in blockchain-based gaming; Linux Hyperledger Foundation, the umbrella project of open-source blockchains and Modwize, a data science start-up. Macao and Shenzhen-based start-up founders, entrepreneurs in digital entertainment, Greentech and Fintech, and experts in incubating start-ups also participated in the session.

The presentations touched upon three key topics: the transformations in the digital entrepreneurial ecosystem, key concerns for the users and entrepreneurs in a rapidly changing environment, and finally, the role of regulations in the digital ecosystem, specifically Web3.0, with its promises of greater control over personal data and decentralised data storage.
In the modern digital age, the panel agreed that AI, Blockchain, Cloud and Big Data have transformed how businesses start and run. It is not merely referring to technological-related

businesses. Firstly, entrepreneurs can easily start a business with just a computer in hand. Closing a business is also easy, as it renders investment in brick-and-mortar premises obsolete. Moreover, the increasingly easy access to data reduces the competitive advantages of companies with access to big data. With more open access nowadays, the strength comes not from data ownership but from excellence in data mining. Hence, literacy in data analytics has become more important in various industries. There is a swift change in an entrepreneur's knowledge and skills demand and their speed in adapting to the fast-changing technology development.

When discussing the challenges facing entrepreneurs given the digital development worldwide, four Cs were raised, including 'capability', 'competition', 'cyber security', and 'cross-border digital access'. The capability issue exceeded the skills in technology and the knowledge of computing in different jurisdictions. This issue is brought about by the globalisation of the business world with the use of the Web. Digital capability can no longer be locally based.

Therefore, businesses are facing more competition. In order to expand, businesses need to globalise and face competitors worldwide, each having significant capabilities and having to react fast in the speedy development whether the business is directly digitally related, or as a result of technological development contributing to business strategies in different industries. Then, as competition increases within the digital world or is supported by development in the digital world, cyber security becomes another major challenge. With the use of clouds, data becomes easily accessible to members and partners of a business. However, while this technology has contributed to the efficiency of services or product development, a company's data becomes more vulnerable without high data protection capability.

Another challenge brought about by the digitalisation and globalisation of businesses lies with cross-border digital access. Even though businesses are becoming more globalised, computing is not. There are still various restrictions in accessing and sharing data, and use of certain technological development in different countries. Therefore, as the digital world has created significant opportunities for cross-border businesses, the issue of cross-border digital access is still a major challenge.

The above challenges facing doing business in an increasingly digital world brought about two other concerns with investment and legislation. Although the use of social media and live-streaming seems to have lowered the cost of traditional marketing, with the increasing noise in the World Wide Web, investment in marketing has increased if one is to gain attention and awareness amongst the many competitors from different parts of the world, not to mention the investment in skills and technology in order to compete. It was also raised that there could be unexpected expenses in paying the unintentional intellectual property rights violation penalty. This results from the lack of universal digital property rights regulation and laws on virtual assets.

The panel discussion concluded with a few points that digital entrepreneurs need nowadays. Firstly, capability in digital skills, including computing, data mining, and selecting the right data. Secondly, knowledge of the various digital trends and fast-changing competition demands them to react fast. Then, there is the need for universal regulation on cross-border law on

data and the virtual world. Finally, a large amount of financial investment, so money is significant.

Cross Border Data Transfer. How to Turn Challenges into Opportunities

Chairs: Jerome Yen Faculty of Science and Technology, UM and Tianji Cai Faculty of Social Sciences, UM

Speakers:
- Felix Tong, InfoMacroTech
- Stanley Wong, Fnetlink
- 赵明 (Tang Ming), Nam Kwong Group
- Yu Yang, Tsinghua University, Beijing, China
- Zhao Xiongfei (Vincent), ICBC Macau
- Zhang Keke (张克科) ,Vice President, Shenzhen Association of Science and Technology

Topic

Officially released in Sep 2021, Guangdong-Macau In-Depth Cooperation Zone offers opportunities to diversify Macau's economy and provides new space for living, while differences between the legal systems of Macau and mainland China, such as data transfer and privacy protection, may potentially hinder the effort of promoting cross-border personnel exchange and business innovation. This panel will focus on discussing how to overcome issues for data transfer and privacy protection, and the possibility of building a third-party platform to facilitate Macau-Hengqin data transfer.

Summary

Since Internet based innovation and productivity become a driving force of digital economy, global data governance emerges as a critical issue for many countries. Due to differences in legal, political and economic systems, cross-border data transmission not only relates to technical architecture, but also involves legal, economic, and sovereign issues. The parallel section 10 "Cross-border Data Transmission: Turning Challenges into Opportunities" discussed issues related to cross-border data transmission from Policy, Legal, Environment, Economy, Technologies, and Solutions perspectives (PLEETS). Six talks were arranged covering issues such as technical solutions, exemplary cooperation between governments, and AI governance in cross-border data transmission.

Speakers from InfoMacroTech, ICBC and Nam Kwong offered successful examples using block chain technique to facilitate secured personal data transmission between Guangdong and Macau, such as converting Macau Health Code into Yuekang Code, verifying asset certificate on designated platform, and building a universal data verification platform for Guangdong-Macao cross-border trade.

The speaker from Fnetlink communicated the importance of building next generation internet infrastructure to improve the efficiency and security of cross-border data management. Issues such as data delay and packet loss, and security concerns have been increasingly prominent in cross-border data management. While technical solutions such as cloud and integrated network security can be used to address the issue of data delay and packet loss, a task force

that connects governmental agencies across boarders should also be established to promote a universal internet architecture.

Professor Yu Yang from Tsinghua University shared new research on how to implement a multi-party artificial intelligence auditing module in a trusted and measurable cross-border digital flow, which may have important implications for Macau SAR because its unique role in connecting China to the rest of world.

A presenter from Shenzhen provided a policy review regarding digital economy. Using Shenzhen's success as an example, the talk focused on how to break digital barriers, promote cross-border transmission, and provided suggestion to nurture cross-border digital services.

During the Q&A section, the chair pointed out that most of the discussions centred on personal data, while the issue of cross-border group data was largely ignored. The group data could be a great resource and asset for entities, such as enterprises to generate benefits. Multiple speakers pointed out that due to legal issues, how to utilize the group data to benefit both enterprises and customs, is still an open question, which requires further investigation.

Six speakers were invited to make contributions to the discussion, and the chair explained that the discussion will focus on the six keywords of policy, legal, environment, economy, technologies, and solutions (PLEETS).

Speaker 1: Felix Tong, from InfoMacroTech, gave a speech on "How to Practice Cross-border Data Secure Exchange Using Blockchain Technology".

The benefits of cross-border data flow include promoting development, improving digital life, and promoting cultural exchange. The current challenges of cross-border data flow include technical challenges and business and regulatory challenges. The solutions to the challenges of cross-border data flow include using blockchain technology. For example, the Macau Health Code (using blockchain technology) can prevent user data from being modified, and the process of converting the Macau Health Code into the Yikang Code was also using blockchain technology.

In conclusion, Felix Tong introduced the application scenarios of cross-border data flow, including insurance claims, cross-border supply chain, and other areas, and expressed great expectations for the future development of cross-border data flow.

Speaker 2: Stanley Wong from Fnetlink Technology Company Limited, gave a speech on "Intelligent Networking" improves the efficiency and security of cross-border data management."

Wong first summarized the two main problems existing in data transmission: in the digital age, the demand for network bandwidth and the number of applications has increased significantly, resulting in the emergence of two major problems: data delay and packet loss, and security concerns. Wong proposed measures to address these problems:

Firstly, a cross-department team should be established, with specialized personnel who can effectively communicate and establish good relationships with government departments in different countries.

Secondly, in the face of high-latency and security packet loss problems caused by cross-border networks, intelligent network solutions can solve enterprises' worries. A website should be designed to address these issues.

Finally, network investment should be expanded to promote the development of cloud and network security integration. SASE is the last mile of data protection, and with the acceleration of digital transformation and enterprise transformation, the trend of cloud and security serviceification is becoming increasingly evident. SASE is a solution for the new generation of enterprise network and security.

Speaker 3: Zhao Xiongfei, from ICBC, and Vincent shared the ICBC blockchain asset proof project. This project relies on the blockchain, and intelligent network technology presented by the previous two speakers. Based on the technology introduced by the previous two speakers, ICBC has implemented a cross-border asset proof project on the blockchain platform.

Simply put, a Macau resident uploaded their asset proof on the blockchain, then took the same asset proof to Hengqin, where the branch office uploaded it to the blockchain. If the hash values on both sides are the same, it means that the asset proof provided by Macau and Hengqin is the same proof, and the content inside is not tampered with. Therefore, the branch office can trust the asset proof material in the customer's hand and issue cross-border loans to customers within the relevant limit. This is a specific example of data cross-border transmission.

Speaker 4: Zhang Keke, the topic of speech is "Breaking Through Digital Challenges, Promoting Cross-border Transmission - A Case Study of Shenzhen Informationization Development".

Prof.Zhang combined China's development issues with the United Nations'2030 Sustainable Development Agenda and provided a detailed introduction to the digital economy content in China's "13th Five-Year Plan". Against this background, combining the experience of information technology development in various countries, Zhang Keke analyzed, evaluated, and reviewed the Shenzhen Information Technology Development Plan in the 12th Five-Year Plan, and proposed five new goals for cross-border digital services.

Speaker 5: Zhao Ming (Tang Ming), Nam Kwong Group

Mr. Zhao Ming mainly introduced the cross-border data verification platform that Nam Kwong Group is currently researching.

First, Mr. Zhao Ming introduced the problems of cross-border business: the current process of handling cross-border data business is risky in terms of compliance, there are generally data silos between institutions, and the process for customers (residents and enterprises in both places) is cumbersome and unsatisfactory. This is also one of the reasons for the emergence of the Guangdong-Macao cross-border data verification platform.

Secondly, Mr. Zhao Ming introduced policy benefits in various important policies of the central and local governments. It is mentioned to encourage the exploration of convenient cross-border information flow, which greatly promotes the establishment of the platform.

Finally, Mr. Zhao Ming detailed the platform architecture, the technology used in platform construction and application, and the progress of the platform.

Speaker 6: Yang Yu, from Tsinghua University

The speech topic is how transparent robot auditing can be applied to a trusted and measurable cross-border digital flow scenario.

Professor Yang Yu focused on analysing the challenges of stakeholder interests being affected in cross-border data flow, including senders, potential stakeholders, governments, and receivers.

Because commercial competition can disguise as stakeholder support for regular auditing or use information security as an excuse for political reasons to prevent the normal flow of cross-border data, it is necessary to have a trusted third party to do data transmission approval work.

Professor Yang Yu combined relevant technology to share how to establish a multi-party artificial intelligence auditing module, pointing out that his future information development needs trusted third-party auditing, and the United Nations will play an important role in the future, while the Macao Special Administrative Region government will also play an important role.

Q&A:
Question 1: The previous guest's analysis on blockchain information verification was from the perspective of personal data transmission, ignoring the perspective of enterprises and the issue of data being a resource that can generate benefits. If it is only for personal data transmission, the research significance of cross-border data transmission seems to be very small?

Answer:
Zhao Xiongfei: The product introduced just now is a very preliminary attempt of blockchain in cross-border products. As you said, if a customer's asset information or transaction behavior data in Macau can be combined with their mainland data for some analysis or model prediction, it will be more helpful for Macau residents or users who need to cross borders.

Stanley Wong: Professor Cai just gave an example of the health law, emphasizing some information from the perspective of enterprises. Since almost all consumers can only reach the corporate platform, such as financial health clearance, media demand declines, we need a system to use blockchain to close it. However, blockchain cannot handle these data because it only processes between two nodes and is optimized for itself. Therefore, the data can only be used for government management and cannot be used in other fields.

Question 2: I hope professors can give more examples, such as the example of cross-border data transmission in the financial industry in the Hengqin depth cooperation zone. How is the cross-border data transmission in this industry conducted, and what are the risks?

Answer: When conducting any financial business, multiple factors need to be considered. For example, if a Macau customer is in mainland China, whether he is eligible to purchase financial products issued in Macau depends on the financial regulatory policies of the Macau government. The policy may require customers to open accounts in Macau and meet other conditions before purchasing products. In addition, customers need to comply with anti-money laundering and fund supervision requirements.

For the buying and selling of cross-border assets, currently customers need to open accounts in Macau and meet the regulatory requirements of the Macau government. This may require customers to submit personal information and meet other requirements. In addition, customers need to comply with the laws and regulations of mainland China and Macau to ensure that the transactions are legal and compliant.

Currently, we cannot directly regulate the purchase of cross-border wealth management products by internal customers. Therefore, internal customers may need to open accounts in Macau and comply with the regulatory requirements of the Macau government before they can purchase products. This requires us to share customer information among different regions and financial institutions in order to provide cross-border financial services to customers.

Question 3: Can professors give more examples of new initiatives in cross-border data transmission cooperation in the Hengqin deep cooperation zone?

Answer: For example, for rent, the flow cycle of funds is one rent period. For the demand for selling houses in Macau, it requires Macau asset certification, and in the mainland, it requires our platform's core research on some outstanding debt assets. In addition, there are some issues with insurance claims, such as the verification of electronic diplomas by NanGuangTong Company. Although these problems can be solved offline, the national talent study centre has high requirements for electronic post. If the risk of counterfeiting is high, especially technical industrial requirements are needed. In addition, we also need to meet the requirements of building a high-growth industrial park plan for all, and the requirements for electronic certificates also need to be higher. These are all requirements proposed by the governments of the two places, including the Science and Technology Finance Development Bureau. We will incorporate these requirements into our APP and technology product work, and actively promote and try to achieve these demonstration infrastructure...

Addressing Gender Data Gaps for a Sustainable Future

Chair: Min Yang, UNU Institute in Macau

Speakers:
- Joyee S. Chatterjee, Asian Institute of Technology
- Lucia Siu, Heinrich Böll Stiftung
- JeongHyun Lee, Chung-Ang University
- Choi In Mei, Women's General Association of Macau

Topic

To achieve gender equality and empower women, we need robust information about the lives of women and girls. We also need to identify the underlying causes of inequality, measure its consequences, and design effective policy solutions through producing and using gender data. Gender data can be a powerful tool to measure and monitor the realities of women and girls. But in reality, we face gaps in gender data, including but not limited to the absence of information and data about women and girls. These challenges pose an obstacle for us to build a sustainable future for all. During this session, invited speakers and participants will discuss the importance of introducing gender perspective into data area, share their insights on why gender data is important for building a sustainable future, and propose recommendations on how to address gender data gaps.

Summary

In this parallel session, four speakers shared their insights around three topics: why is important to introduce gender perspective when building a sustainable future; what gaps we face in gender data; and how to address gender data gaps.

Why is important to introduce gender perspective when building a sustainable future? Four interdisciplinary speakers began answering this question through highlighting the significance of gender data. The United Nations defined gender data as data that adequately reflects differences and inequalities in the situation of women and men in all areas of life. Based on this definition, gender data can be used to reflect gender issues and reflect the diversity of women and men. For example, gender data can increase the visibility of women and girls' value in unpaid care and domestic work. Gender data can provide important evidence for addressing the domestic violence against many women. For policymakers, gender data can help them identify vulnerable populations and inform gender-responsive policies. Gender data can play a foundational role in designing and implementing gender-sensitive programmes and delivering public service on the ground, emphasized by speakers.

Although it is recognized that gender data is important, we face gaps in gender data, including but not limited to the absence of gender data, the low quality of gender data, the lack of gender data availability, etc. The term, gender data gap, refers to circumstances where data on women are missing and the majority of data are biased and collected in favour of men (Criado Perez, 2019, 2020). During the parallel session, four speakers exemplified the gender data gaps, especially the absence of gender data which is notable at different levels. At the global level, UN Women's SDG Indicator Framework maps gender-related

indicators in the SDGs but the UN Women Turning Promises into Action report noted that only 54 of the 232 SDG indicators explicitly target girls or women. At the regional level, the COVID-19 pandemic affected women and men from both medical and socioeconomic perspectives. However, incomplete gender data about the pandemic spreading and vaccine taking increased difficulty in responding to the public health crisis. According to the UNFPA statistics in 2020, in Asia where the novel coronavirus emerged, only 3 countries had shared complete data on infections and mortality by sex.19 At the local level, one of speakers illustrated gender data absence with an example that before the 1970s, only father's occupations were recorded in Hong Kong birth certificates, which led to mother's economic and welfare situation within families was unrecognizable for a long time.

Speakers also noted that the lack of availability of data on women constitutes another gap in gender data. For example, the World Bank Gender Data Portal shows only 24 per-cent of available gender-specific indicators have data from the last 10 years. Speakers also emphasized that substantial data gaps persist in some areas, such as in designing digital technologies, employment, asset ownership and access to financial services. The lack of available gender data will reinforce gender inequities in economic and social life.

How to address gender data gaps? All speakers highlighted collective efforts by multiple stakeholders are required. Some recommendations were proposed by them. For example, they suggested governmental and nongovernmental bodies to strengthen mutual collaboration in providing technical support to improve data quality and availability. It is always good for people to ask "what data is missing" before collecting data. It is necessary to conduct a comprehensive survey to understand women and ageing women's specific needs before designing policies and developing gender-related programmes. All recommendations were proposed for the same goal- to advance gender equality and build a sustainable future for all through addressing gender data gaps.

Data, Youth and Young Scientists

Chair: Jane WU, Executive Director, Venture Cup China

Speakers:
- Kai Miao, University of Macau, Macau SAR China
- Dai Yunlu, University of Macau, Macau SAR China
- Zhou Chao, Nano and Advanced Materials Institute, Hong Kong
- Wang Yuqing, University of Macau, Macau SAR China

Topic

The future of science and technology depends on youth. Processing data is amongst the everyday chores of students, researchers and young scientists. Promoting science technology exchange and encouraging innovation collaboration in youth as well as young scientists is a united goal among different countries. In the time now as data has grown to be a new type of "resource" globally, this session aims to examine how data could impact and facilitate the personal development of youth and young scientist. The invited speakers will share their own research experience relating with data resource and data process which hope to present a multidimensional meaning of data in different stage and sectors. Through further roundtable between university students and young scientists, it aims to carry out discussion about challenges and how data collaboration can foster future development of youth and young scientist in Macao.

Summary

The future of science and technology depends on youth. Processing data is among the everyday chores of students, researchers, and young scientists. Promoting science and technology exchange and encouraging innovation collaboration among youth as well as young scientists is a united goal among different countries. In a time when data has gone beyond information and tools, this session aimed to examine how data could impact and facilitate the personal development of youth and young scientists.

We invited five speakers to share their own work and research experiences relating to data resources and data processes in the hope of presenting a multidimensional meaning of data in different stages and sectors. Through a roundtable joined by university students and young scientists, this session aimed to carry out a discussion about challenges and how data collaboration can foster the future development of youth and young scientists in Macau.

The speakers were Dai Yunlu, Associate Professor of the UM Faculty of Health Sciences, Zhou Chao, Senior Engineer of the Nano and Advanced Materials Institute, Hong Kong; Miao Kai, Assistant Professor of the UM Faculty of Health Sciences, Sun Heng, Research Assistant Professor of the UM Faculty of Health Sciences; and Wang Yuqing, Ph.D. student of the University of Macau.

In presentations from five speakers, we learned that data is inaccessible in areas such as healthcare, nanomaterials, and education. But at the same time, data is a double-edged sword.

Data can make scientific research easier to understand and share, but in the absence of regulatory policies, data can also cause harm to science and even daily life. Our current social, scientific, and legal environment has not been ready for open data collaboration yet, but we will certainly work on it ASAP.

During the panel discussion, Chao Zhou suggested that promoting communication is not easy because of regional data privacy, and we had the dilemma that we would like to protect our own data while at the same time wanting to obtain more from others. Yuqing Wang claimed that we cannot fully trust technology; we need to evaluate it. She said, "People are different from AI". Science training exists in order to promote collaboration and understanding between each other, Miao Kai explained. As we all know, data itself is neutral, and its good or bad impact on the world depends entirely on how people use it. So we need to take some necessary measures to address the data sharing dilemma in science technology and research fields.

First, improve data quality and data policy in science. As a high regulatory target, data quality can not be easily evaluated by regulators. So we should try to build an instrument between scientists and regulators to help policymakers make informed decisions. There shall be a dedicated personal data policy within the scientific field, given that some of the subjects in science are confidential but vital for saving lives. With a clearer personal data policy for science, it will help scientists be aware of what can and cannot be shared in most cases during research and increase open sharing with other scientists. Some of the exceptions will exist when it comes to health and life. It will be initiated and led by the government.

Second, improving science communication abilities. Through the five speakers sharing, it is clear that cross-sector data is hard to interpret by other fields' scientists, particularly among young scientists. Using more data to support science communication is a great way to help not only fellow scientists but also the general public and policymakers understand the work and seek wider support.

Third, build up networks like today's UNWDF to provide platforms for young scientists to meet, share thoughts and data, and potentially generate new quality data. Training and mentorship structures should be in place under the networks. For Macao, we would like to share the news that we are going to launch the Macao Association for Young Scientists for the above functions. ChatGPT can be useful to collect basic information, however, it still depends on humans at the end of the day to verify and collaborate in data sharing.

Finally, in the idea world, everyone would like to share and obtain data from each other freely. However, in a time where data has grown to be a new type of "resource" globally, there might be a price tag associated with certain data. This is a real-life situation that we shall face and create proper mechanisms to address contribution and reward. Young scientists will benefit more from advocating for and devoting themselves to the development of such mechanisms.

Agenda

APRIL 25
DEALING WITH DATA DILEMMAS

MORNING

08:30-09:15
REGISTRATION

09:15-09:20
PLENARY
OPENING ADDRESS
JINGBO HUANG,
DIRECTOR, UNU MACAU

09:20-09:35
PLENARY
WELCOME ADDRESS
CHAN WAN HEI, PRESIDENT, FDCT, MACAO SAR

09:35-09:55
PLENARY
KEYNOTE SPEECH
PROF. TSHILIDZI MARWALA, RECTOR, UNU

09:55-10:00
PLENARY
INTRODUCTION TO THE THEME
FRANZ GATZWEILER, UNU MACAU

10:00-10:15
PLENARY
INTRODUCTION OF MORNING
PARALLEL SESSIONS
JAIMEE STUART, UNU MACAU
ROSTAM J. NEUWIRTH, UM
FRANCIS CRAWLEY, IDPC, CODATA
DENIS ZUEV, USJ, MACAO
DEREK WONG, UM
AKIO TAKEMOTO, UNU-IAS, TOKYO

10:15-10:30
MORNING BREAK

10:30-12:30
MORNING PARALLEL SESSIONS

12:30-13:30
LUNCH BREAK

AFTERNOON

13:30-13:50
PLENARY
KEYNOTE SPEECH: DIGITAL HUMANISM
WALTER GEHR
AUSTRIAN MINISTRY OF FOREIGN AFFAIRS

13:50-14:00
PLENARY
INTRODUCTION OF AFTERNOON
PARALLEL SESSIONS
CARA ANTONACCIO , UNU MACAU
SERGE STINCKWICH, UNU MACAU
JENNY PHILLIPS AND DENIS ZUEV, USJ, MACAO
JEROME YEN AND TIANJI CAI, UM
YANG MIN, UNU MACAU
JANE WU, VENTURE CUP

14:00-16:00
AFTERNOON PARALLEL SESSIONS

16:00-17:00
PLENARY
PRESENTATION BY CHAIRS
OF ALL PARALLEL SESSIONS

17:00-17:10
PLENARY
CLOSING REMARKS
JINGBO HUANG
DIRECTOR, UNU MACAU

Links

Event webpage: https://unwdf-macau.org
Speakers: https://unwdf-macau.org/en/speakers/
Agenda: https://unwdf-macau.org/en/schedule/