THE UNIVERSITY FOR SUSTAINABILITY

Artificial Intelligence for Sustainable Development Centre

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Artificial Intelligence for Sustainable Development Centre

Shaping the future by synergizing expertise from across its global ecosystem, the Artificial Intelligence for Sustainable Development Centre (AI4SDC) is a premier initiative of the University for Sustainability. Its vision is a future in which data science is harnessed safely and responsibly. Its mission is to accelerate discovery, development, diffusion, and adoption of artificial intelligence innovation for sustainable development and humanitarian action. In partnership with United Nations agencies, the World Bank and others, the Centre shall accelerate AI-based solutions for climate action by shortening the R&D&I cycle while aiding in the design, development and scaling of policy and thematically addressing the Sustainable Development Goals (SDGs). Its work will underpin muiltidisciplinary collaborations across the University's ecosystem, foster the next generation of data researchers and engineers and reshape the nature of the innovation process and the organization of R&D. Our ecosystem is not about infrastructure. It is about innovative solutions and their implementation.

> "The Centre is developing high-impact analytical tools to accelerate scalable solutions.

Functioning as an innovation platform, the Centre is developing high-impact analytical tools to accelerate scalable solutions. Sourcing exabyte-scale data, it partners with experts from non-governmental agencies, governments, academia, and the private sector to research, develop, and mainstream approaches for responsibly applying real-time data science to 21st century challenges.

Objectives:

- Strengthen the data science and artificial intelligence innovation ecosystem, responsibly turning breakthrough ideas into reality
- Synergize talent across the University for Sustainability's ecosystem and beyond working across disciplines on challenge-driven and applied research
- Train new generations of data science and AI leaders with the necessary breadth and depth of technical and ethical skills to match societal needs
- Achieve a critical mass of implemented innovations

These objectives are achieved through:

- Partnering with various organisations to access exabyte-scale data sets;
- The implementation of innovation programmes and a network of regional "AI Innovation Hubs" to provide member institutes and partners with access to the tools and expertise required to discover new uses of data science for development;
- The development of toolkits, applications and platforms to improve data-driven decision-making and support the evaluation of promising solutions;
- The provision of client organisations with policy guidance and technical assistance to strengthen their capacity for integrating actionable real-time insights into operations;
- The mitigation of innovation and investment risks through a stage-gate processes to take better and faster decisions, and expand perspectives with trusted and actionable data-driven insights for extraordinary results

- Defining and leading new and innovative research paradigms;
- The provision of open enrollment and bespoke Master Classes and the support of post-graduate offerings;
- Developing the next generation of data scientists and analysts;
- Delivering innovative SDG solutions to current national and international challenges; and,
- The development of public-private accelerator funds and entrepreneurial talent within an AI Innovation and Investor Network.

> “... harnessing real-time data and the emerging technologies of the Fourth Industrial Revolution for sustainable development and humanitarian action.

The role of science, technology and innovation (STI) in achieving sustainable development and humanitarian action cannot be overemphasized. Delivering benefits that no single institute could offer, the Centre is an innovation platform, bringing together STI and data science expertise from across the University for Sustainability's global ecosystem to advance data science and technology to yield new insights for decision-makers, improve resilience to the effects of climate change and accelerate the development, diffusion and absorption of solutions. The University for Sustainability's global ecosystem and its ability to work with partners across sectors and academic disciplines offers the ideal platform for the Centre to accelerate new applications from data science research. With strong links to a network of industry, public sector, and third sector partners, we are a convening power, bringing together academia, industry policy makers and the public with the best talent in the data science to address sustainable development goals.

The Centre shall facilitate the responsible development and accelerate the implementation of data science solutions, while harnessing real-time data and the emerging technologies of the Fourth Industrial Revolution (4IR) [1] for sustainable development and humanitarian action. Embracing open science and open innovation, we will address real-world problems, with recognition of the important legal, ethical and societal implications of these technologies. In this time of great transformation, data science-based solutions are crucial to the design of effective programmes and policy responses.

Our AI Accelerator Funds will be channel research toward a number of sustainable development challenges which represent areas in which data science can have a game-changing impact for science, society, and the economy.

Strengthening its data innovation ecosystem, the University's implementation strategy includes working with member institutes to establish a network of “Data Innovation Hubs” to train new generations of leaders, advance artificial intelligence innovation and scale up solutions to shape the future.

Initially, the AI4SDC shally be focused on shaping the future of smart argriculutre and forestry, energy, healthcare and financial technology.

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[1] Schwab, Klaus. 2016. The Fourth Industrial Revolution. Davos: World Economic Forum.

AI4SDC: Shaping the Future of Smart Agriculture & Forestry

To meet the commitments made in the Paris Agreement, land must turn from a source of emissions to a sink at scale. This will be one of the greatest challenges of the 21st century as the global population rises from 7.6 billion people to over 9.7 billion by 2050. In today's world there is enough food produced for all to be well-fed, but one person in eight is suffering from chronic hunger. Climate change represents an additional threat, already undermining agriculture, food and forestry systems in many regions, making it more difficult to achieve food security and nutrition goals and reduce poverty.

As early as 2030, we will need two planet earths just to feed our growing human population. Demand for foods like meat and dairy, which pose the greatest strain to the environment, has increased along with the growth of our global middle class. To feed a growing global population, food production will need to increase 25%-70% above current levels to meet 2050 demand while remaining low-carbon. [1]

“ As early as 2030, we will need two planet earths just to feed our growing human population.

The food production chain is responsible for 12 Gt CO_2e annually, which represents about 22.5% of greenhouse gas emissions resulting from human activities. Non-food agriculture and deforestation is responsible for an additional 5%. Thus, the world's 570 million farms produce 61% of food's annual greenhouse gas emissions, and deforestation produces another 20%. Agriculture accounts for 80-90% of freshwater consumption and 24% of global GHG emissions.[2]

Agriculture:
Smart agriculture (SA) guides actions needed to transform and reorient agricultural systems to effectively support development and ensure food security in a changing climate. SA aims to tackle three main objectives: resiliently increasing agricultural productivity and incomes; adapting and building resilience to climate change; and reducing and/or removing greenhouse gas emissions, where possible.

With AI as a key enabling technology, SA in which digital-based farm services are used to optimize crop yield, can have far-reaching effects. Using big data and sensors can help a farmer to optimize crop yield by calculating optimal harvest time. Smart agriculture can also improve the crop yield by intensifying plant density, as GPS-driven tractors can cover the entire field with greater precision. Greater precision can also be used in the appliance of fertilizers, pesticides, and water, minimizing the usage of each, thereby causing less damage to the environment and optimizing crop yields.

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[1] World Wide Fund for Nature. Overview: Deforestation. (2018). (available at: https://www.worldwildlife.org/threats/deforestation)
[2] Ranganathan, Janet, “The Global Food Challenge Explained in 18 Graphics”, World Resources Institute, December 2013, http://www.wri.org/blog/2013/12/global-food-challenge-explained-18-graphics; “FAO Statistical Yearbook 2013”, Food and Agriculture Organization of United Nations, 2013, http://www.fao.org/docrep/018/i3107e/i3107e00.htm

The development of new sensors, embedded systems, edge computing, robots and drones permits AI-enhanced precision agriculture can help halve fertilizer use and reduce water use and so dramatically cutting emissions from these sources.[2] Similar gains can be found from using technology to reduce methane emissions from cows and sheep. Implementing precision agriculture techniques in rice production could increase yields while reducing CO_2 emissions by at least 7 Gt by 2030, cumulatively.

Forestry

An estimated 80,000 and 150,000 square kilometers of the world's forests are lost every year to human activities, with up to 90% of tropical deforestation due to illegal activities. In 2017, the tropics experienced 15.8 million hectares (39.0 million acres) of tree cover loss, an area the size of Bangladesh. NGOs and technology companies have begun using AI to address this challenge, by monitoring and managing forest disturbances more quickly and efficiently than ever before. AI can analyse satellite data, or ground-based sensors, to monitor forest conditions in real-time and at scale, providing early warning systems for priority investigation and pattern analysis. Thirty two million hectares of forest could be saved globally by 2030, if governments maximize the use of AI in supporting law enforcement, resulting in a reduction of 29 Gt CO_2e of emissions, and wider benefits of forests to protect indigenous rights, generate water supplies, foster biodiversity, conserve species and provide valuable ecosystem services. [1]

> " An estimated 80,000 and 150,000 square kilometers of the world's forests are lost every year to human activities,

AI can play a highly important role in the transition from deforestation to reforestation by catalyzing the spread of what are mostly low-tech approaches. Much deforestation happens far from the eyes of officials, and by the time it is spotted it is often too late. But constellations of satellites now provide almost real-time imagery that with AI applications can be used to identify and tackle problem points. AI technology can also be used to assist tree planting at significant scales - drones can support the planting of 100,000 seeds per day.

With worldwide internet user penetration nearing 52%; global smartphone users approaching 2.87 billion; 30.7 billion connected devices, plus an infusion of disruptive technologies, AI provides a unique opportunity to provide farmers and those in the agriculture and forestry sector with the tools, information and education to transform the way they do business.

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[1] Global Forest Watch, "2017 was the Second-Worst Year on Record for Tropical Tree Cover Loss," June 2018; Nellemann, C., INTERPOL Environmental Crime Programme (eds). 2012. Green Carbon, Black Trade: Illegal Logging, Tax Fraud and Laundering in the Worlds Tropical Forests. A Rapid Response Assessment. United Nations Environment Programme, GRIDArendal. www.grida.no. Available at https://twosidesna.org/wp-content/uploads/sites/16/2018/05/The-vast-majority-of-deforestation-and-illegal-logging-takes-place-in-the tropical-forests-of-the-Amazon-basin-Central-Africa-and-Southeast-Asia.pdf

[2] N. Millar, et al., Nitrous oxide (N_2O) flux responds exponentially to nitrogen fertiliser in irrigated wheat in the Yaqui Valley, Mexico. Agriculture, Ecosystems and Environment. (2018).

By 2025:

- Internet coverage will reach all farming areas accelerating adoption of AI solutions and smart agriculture and forestry.
- AI-enhanced smart farming utilizing field sensors to precisely measure the impact of environmental factors and inputs on agricultural and forestry activities, and provide agri-advisory services tailored to individual farms reach global potential.
- Seed-planting via drones will accelerate massive afforestation efforts.
- Satellite monitoring will provide real-time reforestation, land restoration and sustainable agriculture information.
- Smart agriculture will be a dominant technique reducing fertilizer, fertilizer, and water use and increasing yields.
- AI enabled real-time complete visibility will reach all but the most remote places allowing farmers access to knowledge and data about their own farm and how its yields can rise and emissions fall.

> “ AI4SDC researchers are developing capabilities and implementing solutions in detection, analysis, forecasting as well as early warning systems

Achieving these gains, however, requires an ethically-informed institutional and data infrastructure and complementary 4IR technologies for AI to flourish. Access to data is key to driving these AI gains, and this will require sensors connected to the Internet of Things (IoT) continually pulling in masses of information on temperature, moisture, soil conditions, and so on by connecting the physical world to the digital ecosystem. The infrastructure for transmitting and processing this data will also need to develop in parallel, given many rural agricultural areas still face limited digital connectivity.

Advancing the state-of-the-art, the University for Sustainability's AI4SDC researchers are developing capabilities and implementing solutions in detection, analysis, forecasting as well as early warning systems.

Detection, Analysis and Predictive Modeling

- Early crop yield prediction
- Precision agriculture and nutrition
- Hyper-local weather forecasting for crop management
- Early detection of crop issues including plant disease identification and detection
- Automated and enhanced land-use change
- Detection for avoiding deforestation
- Monitoring health and well-being in livestock farming
- Food value chain resilience

Supply-chain monitoring and origin tracking

- Resilient breeding of plants

Early Warning Systems

- Natural catastrophe early-warning
- Social media-enabled disaster response
- Real-time communication of natural disasters
- Prediction and prevention of famines

AI4SDC: Shaping the Future of Smart Energy

“ AI will play an essential role in the transition of today’s electricity, gas and heating grids into the smart energy system of tomorrow.

The Future Smart Energy will be sustainable, efficient, cost effective, and intelligent in which renewable energy production, infrastructures and consumption are integrated and coordinated through energy services, active users, embedded and cloud-enabled technologies. In this connection ethically-informed AI will play an essential role in the transition of today’s electricity, gas and heating grids into the smart energy system of tomorrow.

In the energy grid, the application of machine learning, including deep learning, is increasingly widespread in industry. For the environment, the use of AI to make distributed energy possible at scale is critical for de-carbonizing the power grid, expanding the use of (and market for) renewables and increasing energy efficiency. AI can enhance the predictability of demand and supply for renewables, improve energy storage and load management, assist in the integration and reliability of renewables and enable dynamic pricing and trading, creating market incentives. AI-capable “virtual power plants” (VPPs) can integrate, aggregate, and optimize the use of solar panels, micro-grids, energy storage installations and other facilities. Distributed energy grids may also be extended to incorporate new sources such as solar spray or paint-coated infrastructure of vehicles, and to allow AI-enabled “solar roads” to expand, connect and optimize the grid further. In solar roads, for example, AI could allow a road to learn to heat up to melt snow, or to adjust traffic lanes based on vehicle flow.

Smart grids will also use other Key Enabling Technologies including the Internet of Things, blockchain (for peer-to-peer energy trading) and advanced materials (to increase the number of distributed sources and optimize energy storage).

All of this will require sufficient regulation to assure the security and integrity of the software, ownership and control of intellectual property rights (which may help unlock investment and innovation), management of, and responsibility for, operational elements that are powered by machine learning, and regulatory frameworks for transferring and trading energy, often virtually. As economies and settlements move away from “heavy infrastructure” towards Harnessing Artificial Intelligence for “smart” infrastructure with a low environmental footprint, the decentralized nature of distributed energy grids mean they have the potential to be used globally.

The AI4SDC is orchestrating a digital platform-based adaptive ecosystem conducting research and knowledge sharing with respect to:

The Internet of Things and Machine-to-Machine technology including the deployment of smart sensors and edge computing systems as key enablers of a transformation to data-centric management processes and the optimisation of load management.

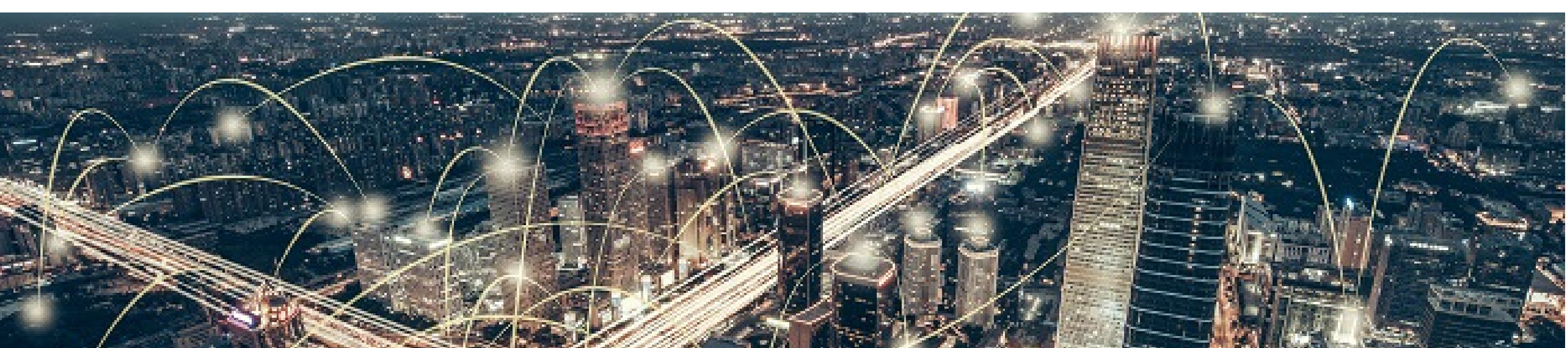
Descriptive and Predictive Analytics including applications such as Digital Twins; Real-time modelling support, AI embedded (edge computing); forecasting, predictive including systemic risk analytics to create cognitively-aware and resilient smart energy system.

With Worldwide internet user penetration nearing 52%; global smartphone users approaching 2.87 billion; 30.7 billion connected devices, plus an infusion of disruptive 4IR technologies, by 2022 the systems of detection, diagnosis and forecasting as well as early-warning may be transformed. Broadly available AI-enhanced smart energy solutions will be part of that paradigm shift. Smart energy will share the following characteristics:

- Efficient monitoring and distribution of information through the use of smart devices including edge computing and embedded systems and internet-connected appliances;
- Intelligent control systems in buildings can decrease the carbon footprints both by reducing the energy consumed and by providing means to integrate lower-carbon sources through Virtual Power Plants into the electricity mix. Specifically, Machine Learning can reduce energy usage by allowing devices and systems to adapt to usage patterns. Further, buildings can respond to signals from the electricity grid, providing flexibility to the grid operator and lowering costs to the consumer.

"AI4SD Centre researchers have developed deep neural networks as used for adaptive control in a variety of industrial networking applications,

Advancing the state-of-the-art, the University for Sustainability's AI4SD Centre researchers have developed deep neural networks as used for adaptive control in a variety of industrial networking applications, enabling energy savings through self-learning about devices' surroundings. To reduce Green House Gas emissions from heating, ventilation, and air conditioning systems, researchers are combining optimization-based control algorithms with Machine Learning techniques such as image recognition, regression trees, and time delay neural networks.



AI4SDC: Shaping the Future of Healthcare

How can the world deliver affordable and quality healthcare for nearly 9.7 billion people by 2050? What role could responsible AI play in transforming the continuum of care – from prevention to diagnosis, treatment, cure and maintenance of health – to enable people to lead healthier lives and access the care they need to fulfill their potential?

"With AI at its core, smart healthcare has the potential to transform medicine by tailoring treatments to individuals.

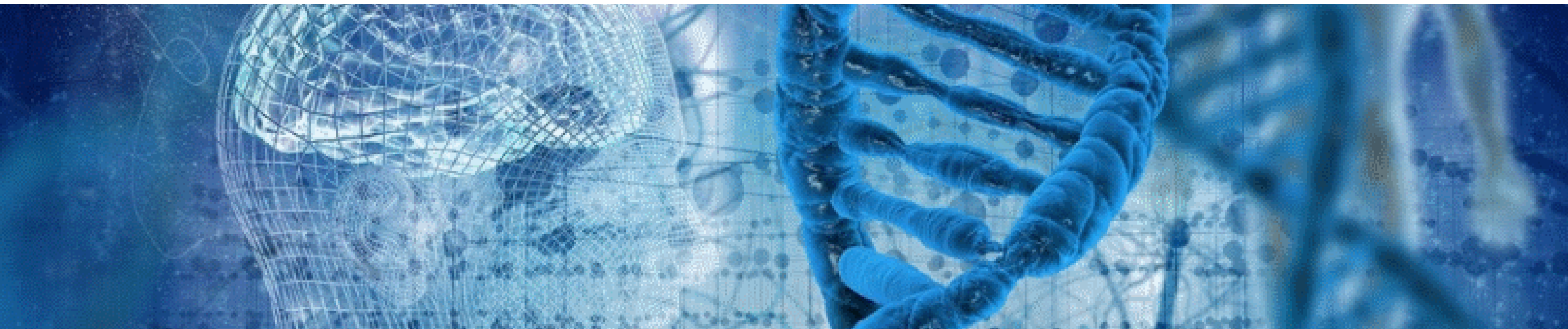
With AI at its core, smart healthcare has the potential to transform medicine by tailoring treatments to individuals, but also community-centred care. It is an emerging approach for disease treatment and prevention that takes into account individual variability in environment, lifestyle and genes for each person. AI-enhanced smart medicine has great potential to providing high value healthcare by improving outcomes while decreasing cost. It has already transformed the way diseases, such as cancer and mental health conditions are treated. The long-term vision for smart medicine is to fully integrate it into the healthcare delivery system from prevention, to diagnostics treatment and therapeutics. The emergent opportunity will require a paradigm shift in the healthcare sector transforming the systems of detection, diagnosis and forecasting of diseases as well as their outbreak.

Detection, Diagnosis and Forecasting

- Enable earlier, more precise detection, diagnosis, and treatment of illnesses
- Predict or prevent diseases before they arise for those at highest risk
- Model the outbreak and transmission of infectious diseases
- Model the consequences of medical interventions
- Maximize the information in patient data (while recognizing the legal, computational, and privacy needs)
- Forecast demand on, and improve, health services

Early Warning Systems

- Predict or prevent diseases before they arise for those at highest risk
- Model the outbreak and transmission of infectious diseases
- Real-time communication of healthcare threats



The AI4SDC is orchestrating a digital platform-based adaptive ecosystem enabling

Remote access to electronic patient's health records on smart devices and the use of wearables and biosensors

Data generation and Artificial Intelligence enable automatic processing and interpretation of data for self-directed health recommendations

DNA sequencing due to plummeting costs is becoming affordable for population-wide personalized therapies

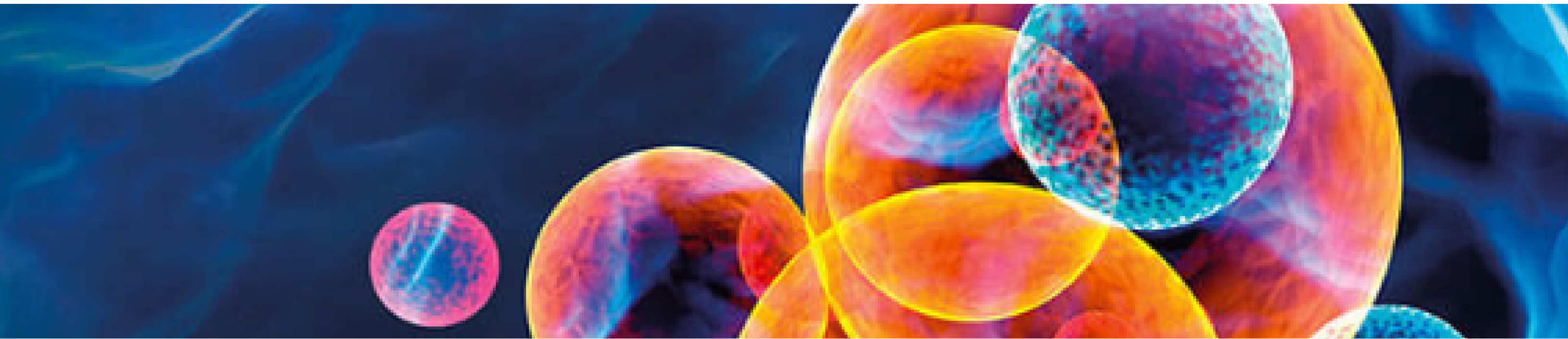
With worldwide internet user penetration nearing 52%; global smartphone users approaching 2.87 billion; 30.7 billion connected devices, plus an infusion of disruptive 4IR technologies, by 2022 the systems of detection, diagnosis and forecasting as well as early-warning may be transformed. Broadly available AI-enhanced healthcare solutions will be part of that paradigm shift. According to the AI for Good Global Summit Report (2019), basic healthcare for 1 billion more people powered by AI and digital applications is soon possible with smart medicine characterized by:

- Efficient monitoring and distribution of information for professionals and consumers, especially through the use of smart devices (e.g. wearable health-monitoring watches or mobile phones) connected to the internet
- Improved public health services through improved access to continuing education, training and a wealth of relevant data and in-the-field support for health workers
- Informed and empowered patients, enabled to manage their own health through on-demand access to health analysis and information about trends and treatments relevant to their specific conditions

> "Connecting human intelligence and clinical expertise with the unparalleled data processing power of deep learning

Connecting human intelligence and clinical expertise with the unparalleled data processing power of deep learning algorithms and advanced neural networks, AI is opening up a new frontier for precise, personalized diagnostics and treatment. It can similarly enable an epidemiological transformation at the level of communities. AI risk models can help doctors identify the early onset of diseases in their asymptomatic phases. Advancing the state-of-the-art, the University for Sustainability's AI4SDC researchers [1] have developed AI risk models for lipodystrophy, pancreatic cancer, stroke, and neuro-degenerative diseases such as Alzheimer's.

[1] Colbaugh, Richard and Kristin Glass. "Early Identification of Patentable Medical Innovations." 2018 40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC) (2018): 4924-4926; Colbaugh, Richard et al. "Robust Ensemble Learning to Identify Rare Disease Patients from Electronic Health Records." 2018 40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC) (2018): 4085-4088; Houben, Evi et al. "PRM113 - Prediction Model For Identifying Patients with Lipodystrophy In Electronic Health Records." Value in Health 21 (2018): n. pag; Colbaugh, Richard et al. "Ensemble transfer learning for Alzheimer's disease diagnosis." EMBC 2017 (2017). etc



AI4SDC: Shaping the Future of Fintech

Adequate, accessible and affordable financing is a key to achieving the Sustainable Development Goals (SDGs), as set out in the Addis Ababa Action Agenda as well as the Paris Agreement on climate. These global agreements from 2015 signal that: (1) much of economic analysis that substantiates today's financial system is not fit for purpose and (2) the need for a financial system aligned with the imperative of sustainable development. Indeed, an estimated USD 5-7 trillion of annual investment will be needed to deliver on UN Sustainable Development Goals and the Paris Agreement on Climate Change. Unprecedented mobilization of both public and private financing will be required of a financial system aligned to these development priorities. Yet, it is not a question of managing the present, but of building the future; of creating institutions that directly express the interest of all humanity. [1]

“ Rather than running society as an adjunct to the market and embracing a rationality that accords priority to a logic of maximization of market values, human livelihood must be embedded in social relations and the natural rhythms of the biosphere.

These historic agendas move the world to a low-carbon bio-economy and sustainable development. Rather than running society as an adjunct to the market and embracing a rationality that accords priority to a logic of maximization of market values, human livelihood must be embedded in social relations and the natural rhythms of the biosphere. As the United Nations Environment Programme Inquiry has spelled out in “The Financial System We Need,” realizing the Sustainable Development Goals (SDGs) and climate commitments agreed in 2015 depends in part on exploiting the potential of financial innovations, 4IR technologies and digitalisation to increase the effectiveness of tax systems, alter perceptions of risk and provide equitable access to finance. Access to finance is a pre-requisite of sustainable and equitable development and to ensure that financial capital is redeployed to finance the transformation to an inclusive bio-economy.[2]

The use of technology in finance is not new - but a step change is now expected with the innovative application of a number of nexus technologies notably involving blockchain, the ‘Internet of things’ (IoT) and artificial intelligence (AI). Innovative applications of these technologies could make the current wave of changes unlike any we have seen before in the world of finance. Financial technology (‘fintech’) is emerging as a disruptor of most every aspect of the global financial system. Offering disintermediation, these innovations may threaten the viability of today’s financial sector business models, as well as policies, regulations and norms that have governed modern finance. They will shift as well the traditional hub-and-spokes topology of financial networks towards a more decentralized structure. In the context of sustainable development finance, it is crucial to integrate

climate and transition risk factors in financial risk models. Research has highlighted how a decentralized network of financial contracts can lead to greater financial complexity and novel forms of risk including but not limited to “default ambiguity,” where it is mathematically impossible to determine who is in default.[3]

Digitalization of finance (fintech) and new AI-informed physical risk models allow for the delivery of more actionable insights about more diverse aspects of financing. This may allow liquidity risk to be more comprehensively assessed and managed and more accurately priced-in to financing decisions. Fintech is an opportunity to bypass traditional banks and conventional funding channels in sectors that are perceived as high risk or subject to unknown exposure and in such areas could compensate for the under-provision of funding. This is of particular interest to investments in key emerging technologies and the transition to a low-carbon bio-economy. Fintech can play a pivotal role where investors do not feel confident about and on which the traditional banking sector does not have enough knowledge to assess risk and value instruments. From this perspective, digitalization should improve the alignment of financing decisions to the SDGs. [4]

“ ... by using alternative data, fintech applications can identify creditworthy organisations not identified by traditional financial risk models.

While the number of people worldwide who lack access to financial services is falling, still two billion adults lack a basic bank account, and many more are not well served by markets for savings products, credit and insurance. Greater financial inclusion promises more inclusive growth and development. Enabling access to finance for SMEs is a particular priority. Seventy per cent of SMEs cite lack of access to finance as an impediment to growth and another 15% report they are under-financed. Severely uninsured, smallholdings contribute 70% of global food production. Yet by using alternative data, fintech applications can identify creditworthy organisations not identified by traditional financial risk models.

Fintech is being innovatively deployed, for example, to accelerate financing for women and micro, small and medium sized enterprise, catalyse the uptake of distributed solar energy technology, and improve the carbon profile of the built environment. Generally the challenge for the transformation to a bio-economy is twofold: to mobilize finance for specific sustainable development priorities and to institutionalise sustainable development factors across financial decision-making.

Mobilizing finance: Capital needs to be mobilized for financial inclusion of under-served groups (e.g. low-income citizens and SMEs), raising capital for sustainable and resilient infrastructure (e.g. energy) and financing critical areas of innovation (e.g. smart grid

energy solutions, smallholder agriculture, sustainable land use, and sustainable fisheries). Developing countries face an annual investment gap of around USD 2.5 trillion in areas such as infrastructure, clean energy, water and sanitation, and agriculture.

Institutionalising sustainable development: Sustainability factors are increasingly relevant and material for financial institutions' decision-making. This includes integrating environmental and social factors into risk management as well as incorporated into the performance disclosure and reporting to guide decision-making.

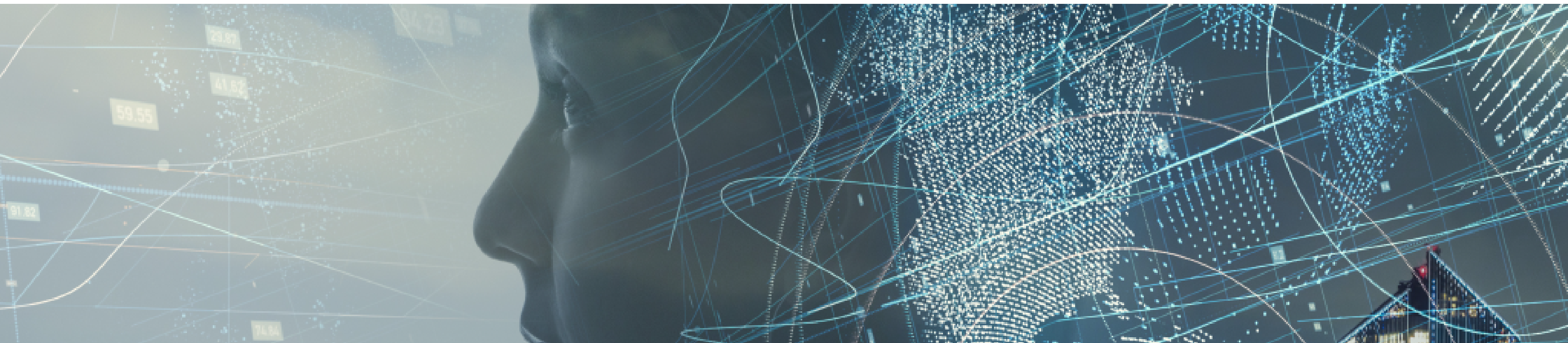
The challenge and opportunity are to consider whether, and if so how fintech can help to overcome barriers and concerns that may include among others:

> “Capital needs to be mobilized for financial inclusion of under-served groups

- Portfolio Maturity Mismatch: Financial intermediaries, notably banks, which have a portfolio of short-term liabilities and are thus unable to finance long-term investments in the face of weak capital markets;
- Models, Metrics and Data: Ambiguities regarding algorithms, models emerging from computational economics and data science, the measurement of sustainability-related outcomes, and the lack of associated data limits our ability both to predict risk or measure environmental, social and governance impact;
- Short-Termism: Financial markets actors focused on short-term returns, discounting the relevance of longer-term sustainability risks and outcomes on themselves or others;
- Address financial protection, risk management, default ambiguity, transfer and diversification for the vulnerable and exposed communities;
- Collect, analyse and distribute financial system and real economy data for better economic decision-making, better regulation and better risk management;
- Mobilize savings at scale to enable long-term investment directed at long-term sustainability of the real economy with investment in critical sustainable innovations;
- Significantly reduce the costs for payments and provide suitable access to capital domestically and internationally for the under-banked and for SMEs; and
- Emerging issues that remain to be addressed regarding systemic risk, governance, confidentiality, and traceability.

Shaping the future, AI4SDC shall to seek to identify fintech fit for purpose to advance the circular or low carbon economy asking:

- What are the main impediments to realizing these opportunities and the risks associated with them, and how might those impediments be overcome?



- How can fintech innovations for sustainable development responsibly and significantly reduce the costs for payments and provide suitable access to capital domestically and internationally for the under-banked and for small- and medium-sized enterprises?
- How can fintech address the provision of risk management, risk and diversification for vulnerable and exposed communities?
- What are the barriers and enablers for scaling of fintech for sustainable development.

These and other issues speak to re-shaping a financial system that is fit for purpose and can meet the needs of the 21st century circular or low carbon economy and the transformation to the sustainable and green financial system. The issues require a focus on the system's underlying purpose and resilience, not just on adaptive measures to cope with day-to-day turmoil. A continued misalignment between the financial system with sustainable development will ferment further profound instabilities among peoples, across economies, nations and ecologies. [5]

> ... reshaping a financial system that is fit for purpose

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[1] Passet, René, (November 20, 2012). La Bioéconomie de la dernière chance.
[2] Polanyi, K. (1944). The Great Transformation: The Political and Economic Origins of our Time. Boston, MA: Beacon Press; United Nations Environment Programme,"The Financial System We Need: Aligning The Financial System With Sustainable Development". (October 2015) http://unepinquiry.org/wp-content/uploads/2015/11/The_Financial_System_We_Need_EN.pdf
[3] Depository Trust and Clearing Corporation (DTCC) Exploring How Technological Innovations Could Impact the Safety & Security of Global Markets (October 2017). Available at: www.dtcc.com/~/media/Files/PDFs/Fintech%20and%20Financial%20Stability.pdf ; Schuldenzucker, Steffen and Seuken, Sven and Battiston, Stefano, Default Ambiguity: Credit Default Swaps Create New Systemic Risks in Financial Networks (December 5, 2018). Available at: https://ssrn.com/abstract=3043708 or http://dx.doi.org/10.2139/ssrn.3043708
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[5] Intergovernmental Panel On Climate Change , 2018: Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield (eds.)]. In Press; World Economic Forum. "The Global Risks Report 2019" 2019. http://www3.weforum.org/docs/WEF_Global_Risks_Report_2019.pdf; Network for Greening the Financial System."A call for action: Climate change as a source of financial risk," (April 2019). https://www.banque-france.fr/en/financial-stability/international-role/network-greening-financial-system/first-ngfs-progress-report ; "Breaking the tragedy of the horizon - climate change and financial stability", Mark Carney, Governor, Bank of England, September 2015: https://www.bankofengland.co.uk/ speech/2015/breaking-the-tragedy-of-the-horizon-climatechange-and-financial- stability

Notes

"All human beings are born free and equal in dignity and rights." These simple but powerful words are the first line of the Universal Declaration of Human Rights adopted by the United Nations in 1949. The declaration's power has always depended on our collective will to uphold its noble aspirations.The University for Sustainability does not discriminate on the basis of race, color, creed, national origin,gender, sexual orientation, age, or disability in any of its policies, procedures, or practices.

Secretariat Office
The University for Sustainability
150 Washington Ave, Suite 201
Santa Fe , New Mexico, U.S.A.
Tel : + 1 505.428.9599
Website: www.u4sustainability.org
Email: contact@u4sustainability.org