WHAT THE TECH? INNOVATIVE TECHNOLOGY

Just think about how much has changed since 1998. Most middle or upper income people didn't own a phone or even a personal computer.

As people all over the world go about their daily routines—working, shopping, commuting, and spending time with loves ones—virtually every aspect of our lives is increasingly influenced by an invisible network of technologies and devices that collect, transmit, and analyse incomprehensibly large amounts of information in the blink of an eye.

Now think about how much will change in the next 20 years. It's difficult to even fathom what the world will be like, but it will be different.

The rise of sophisticated hardware and software—sensors, mobile apps, robots, supercomputers, and ever-faster internet, to name a few—is changing the way the world lives, plays, and works; and Asia Pacific is no exception to its outsize influence. But one thought is emerging among sustainability advocates – as long as our consumption and production patterns are changing so radically, can we seize the opportunity to leverage the change for sustainability?

Some of the key technologies and trends expanding their influence on society are: the Internet of Things and Big Data, Blockchain, and artificial intelligence.

The technologies are both disruptive and exponential. That is, they are set to replace well-established ways of doing things with new process and markets; and they become more effective and cheaper extremely fast—which will see their adoption skyrocket rapidly.

Figures charting the historic and projected growth of these disruptive technologies are:

- **IoT:** McKinsey forecasts IoT as one of the three most impactful technological advancements globally before 2030—along with mobile internet and the automation of knowledge work—and expects its economic impact to be around US$11.1 trillion by 2025. **One application, smart meters, is gaining popularity.** In 2017, Asia Pacific (excluding China) installed 17.5 million smart electricity meters. 360,000 of these were in Southeast Asia. Four Japanese utilities aim to have 27 million meters installed by 2024, while Korean utility KEPCO aims to install 26 million smart meters by 2020. Australia and New Zealand are expected to average 500,000 smart meter installations every year between 2018 and 2025.
- **Big data:** Accenture found that 59 per cent of companies say big data is "extremely important" to their organisation. Almost eight in ten users (79 percent) agree that 'companies that do not embrace big data will lose their competitive position and may even face extinction. Forrester predicts the global Big Data software market will be worth $31 billion in 2018, 14 per cent more than 2017.
- **Blockchain:** WEF has predicted that by 2027, 10 per cent of global GDP will be stored using blockchain. A December 2017 study by technology giant Cognizant, found that 88 per cent of banking and finance sector executives view blockchain as critical to the future of their industry.

- **Artificial intelligence:** The International Data Corporation predicts a 50.1 percent compound annual growth rate for global spending on AI, reaching $57.6 billion by the year 2021. Diagnostic and treatment systems, and automated customer service agents are expected to be among the largest areas of spending. A survey by research firm Arm shows that 61 per cent of respondents believe AI will make the world better. Between 2000 and 2018, the number of start-ups working to develop AI systems has increased 14 times, and investment into the sector has increased six-fold.

1. INTERNET OF THINGS

What it does: IoT is a network of smart, interconnected devices and services capable of sensing or listening to requests or needs, and then acting on them. IoT technology can monitor metrics such as air and water quality, energy consumption, temperature and traffic flows, and help make many of the UN Sustainable Development Goals a reality, including Responsible Production and Consumption; Affordable and Clean Energy, and Smart Cities and Communities.

Applications: Smart meters can help Asia manage its energy challenges. Where traditional meters must be manually read, smart meters digitally measure energy use, transmit this information, and perform energy management functions such as selecting electricity sources and adjusting energy demand. They can enable energy suppliers to predict electricity demand more accurately and manage generation effectively. They give users control over when they consume energy from the grid, solar, and batteries. Smart meters can also facilitate demand response. This is when, during times of peak demand some users can temporarily reduce non-essential electricity use. This frees up capacity for heavy users, reduces the need for investment in new power generation, and cuts electricity costs. These devices can enable people with access to renewable energy generation and consumers to trade clean energy amongst themselves by recording how much energy is generated and consumed.

Examples: Singapore's Jurong Lake District aims to "demonstrate how technology can enable a liveable and sustainable urban environment", and a key feature is IoT technology.

Data from farecards and sensors throughout the district will give planners a clearer sense of the location, types, and frequency of transport services that are needed—and cater to these needs more effectively.

Smart meters have had a big impact in the Philippines, where incomes are low and electricity prices are high. Power distributor Manila Electric Co. (Meralco) began rolling out smart meters to 40,000 households in 2013, and has installed more than 80,000 to date.

Gavin Barfield, Meralco's chief technology officer, explains that with these smart meters, "Meralco could tell you your fridge is using more power this month than last so if may need servicing, or make suggestions on other products that are more efficient. "Budget-conscious consumers can also get alerts if they exceed their target daily consumption.

Meralco also plans to use the smart meters and communication network for demand response, distributed energy integration and smart streetlights.

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2. BLOCKCHAIN

With digitization making it possible for virtually anyone to create, access, and transmit data, verifying the credibility and authenticity of information is a key challenge for policymakers, businesses, and consumers alike. Blockchain is a transaction ledger where blocks of new information can be added, but old blocks cannot be changed. Transactions on the blockchain are performed across a network, with no need for a central intermediary such as a central bank.

A large number of computers are connected to this network, and there must be consensus among these computers before data can be added to the blockchain. Because the ledger is maintained across different computers, it is impossible for a single entity to take control of the blockchain.

Blockchain's decentralized, immutable, and consensus-oriented nature makes it a trustworthy and secure way to transact information.

Applications: Peer to peer clean energy sharing: In August this year, Australian firm Power Ledger commenced a trial in Bangkok's Sukhumvit neighbourhood where an apartment complex, a school, a mall, and a dental hospital with solar panels trade clean energy with one another, and the city's electricity grid, over a blockchain marketplace. The system is one of the world's largest peer to peer renewable energy trading platforms using blockchain.

Supply chain transparency: Blockchain is a tamperproof way to ensure environmental violations and human exploitation in supply chains are not illegally concealed. London-based tech start-up Provenance in 2016 used blockchain to monitor Indonesia's tuna industry. Provenance worked with fishermen to get them to register their catch on its smartphone app, which stores data on the blockchain. Information about the fishermen, their catch, and suppliers were all securely stored and conveyed to shoppers in the UK. Cambio coffee worked with ScanTrust to increase supply chain traceability using blockchain. When customers scan this QR Code, they can access nutritional data, information about ingredients, certifications, and blockchain enabled data about the beans' point of origin, harvest date, shipment date, and roast date.

Tokenising recycling: In August this year, blockchain firm TrustNote partnered with a local environmental technology company in Hangzhou, China that lets citizens digitally tag their recyclables using an app, and be rewarded with tokens for their efforts. Citizens can track where their recyclables end up and redeem their tokens discounts on renewable energy products, or recycled items.

Carbon footprinting: Blockchain can track a product's raw material stages to storefronts. It can also ensure that carbon credits are credible and effective. A product's carbon footprint can then be used to charge a carbon tax at the point of sale, pushing consumers towards products with lower carbon footprints. This has not been achieved yet, but signs are promising that this could be the future. Ben and Jerry's in May this year began paying for carbon credits to offset the impact of scoops sold in Soho shop in London. This is the first example of blockchain-powered carbon credits on the high street.

Rewarding good behaviour: Companies can also be given a reputation score based on their carbon or waste footprint—this would be managed using blockchain so that companies cannot tamper with the score; this would encourage companies to strive for lower emissions and waste generation, and shift economic drivers away from pure profits low-carbon, sustainable practices. Goodchain is a platform where brands place products and pledge consumer tokens to causes. This makes it possible to link provenance information and create a mechanism for rewarding consumers for verifying products with "IMPACT" points.

International treaties: Using blockchain to store environmental data in a public and transparent fashion can help hold corporations and governments to account on their progress on international environmental commitments, and prevent them from deleting or tampering with the data or backpedalling on their commitments. Brazil the International Tropical Timber Agreement, which aims to curb illegal timber, in 2013. Yet, illegal deforestation persists in the country. Brazilian non-profit BVRio analyses timber trade documentation data, satellite imagery, and other

deforestation and labour-tracking databases to identify consignments of timber that might be illegal. All data is stored using blockchain.

Enabling CSOs: Charities and civil society organisations can also use blockchain to show donors that money is spent on the intended cause rather than lost to bureaucratic expenses. Blockchain-based money could even be released automatically to the correct parties when certain environmental targets are met. Bitgive and Bithope are two cryptocurrency charities.

3. BIG DATA

Big Data refers to datasets that are so big and complex that traditional computers and data processing software cannot handle them. Often, this data is captured from devices such as sensors, mobile devices, cameras, and microphones. It's then processed by super computers and algorithms, in real time.

While the public sector can use IoT to collect large amounts of data, the same technologies are also available to private sector players and civil society organisations. This means that non-government entities can collect data to supplement official statistics. For civil society organisations, big data is a new source of evidence with which to hold governments and corporations to account; for others, it can be an opportunity to help facilitate and support public sector efforts to deliver essential services. or inadequate technology infrastructure.

Applications: In Kenya, Caroline Buckee, a Harvard University researcher processed data from 15 million cell phones in 2012 to identify how human travel patterns contributed to the spread of malaria—this helped officials allocate resources to disease control efforts.

Another big data initiative for sustainable development is Global Fishing Watch. Launched in 2016, the platform processes over 22 million position messages from more than 200,000 ships ever day to detect patterns that signify which vessels are fishing, when and where. This allows anyone with an internet connection to see fishing activity anywhere in the ocean in near real-time, for free.

4. ARTIFICIAL INTELLIGENCE

AI, or machine learning, refers to technologies ranging from robots that move around autonomously and perform tasks, to algorithms that can analyse enormous volumes of data and automate decision-making without human intervention to chatbots and household names like Alexa and Siri.

A subset of artificial intelligence, deep learning refers to a set of machine learning algorithms inspired by the structure and function of the brain—or "neural networks". Designed to imitate human decision-making, deep learning involves feeding a lot of data into a computer system through neural networks—these are logical constructions which ask a series of binary true/false questions, or extract a numerical value, of every bit of data which pass through them, and classify it according to the answers received.

Applications: A report by WEF and PwC this year found that there are six key environmental challenges that AI can help solve: climate change, biodiversity and conservation, ocean health, water security, clean air, and weather and disaster resilience. AI is also a crucial feature of smart electricity grids, and can help predict demand and supply, improve load management, and stabilizes grids as they integrate renewables into the system.

Deep learning's applications range from enabling self-driving cars to navigate and increasing and automating decision-making capabilities at low-cost.

Examples: The The International Transport Forum expects shared transport fleets using AI-powered self-driving vehicles to take nine out of 10 cars off city streets in the future, and completely remove the need for street parking in the process—freeing up the space for green or community uses instead.

MIT's Senseable Lab is exploring the application of AI to the design of our cities – from reducing traffic and parking space to enabling share economy models.

San Francisco-based digital agriculture company The Climate Corporation's Climate Fieldview software uses deep learning to analyse data entered by farmers, as well as that collected by IoT sensors. It gives farmers insights to improve their yields without time-consuming analysis. With these, farmers can optimise their seed investments, manage fertilisation, and analyse crop performance, get a real-time snapshot of field health.

CONCLUSION

The disruptive technologies that will shape the world's—and Asia's— future over the next decade have broad capabilities, but are also deeply intertwined with one another. Together, they form a complex ecosystem capable of delivering outcomes as game-changing as enabling low-income households to access solar energy and helping eradicate modern slavery; but they also carry risks such as privacy breaches, security threats, and perpetuating a divide between technology haves and have-nots.

These trends are also exponential—they are increasing in capability and cost-effectiveness at a breakneck pace, and the defining challenge of Asia Pacific's future will be delivering interventions that are effective, secure, and sustainable, even as they protect the privacy, livelihoods, and human rights of the region's inhabitants.