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Headline: Digital green economy: How technology can help save the planet

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As the world enters the Fourth Industrial Revolution, we're seeing the convergence of technologies such as Artificial Intelligence (AI), Cloud Computing, Blockchain and the Internet of Things (IoT) and their capacity to reshape entire industries.

Yet while these technologies provide revolutionary growth opportunities for businesses, they also have great potential to address some of the most pressing environmental issues facing the world today.

Often cited as carbon-emitting technology, Blockchain has come under fire due to the energy-intensive processes that underpin some of its applications. Bitcoin is one of them, and is only a specific application of the blockchain technology, yet confusion between these two remain in the perception of the general public.

However, this does not apply to all blockchain technologies, and some blockchains use much greener consensus mechanisms.

But how energy efficient is a certain blockchain technology is an intrinsic characteristic that does not solve any problem by itself. However, we have seen very recently the emergence of new 'green tech' that use blockchain technology to actively address the most urgent environmental issues we are facing and that take various forms: greenhouse emission, plastic pollution, forest conservation, protection of endangered species, etc.

Dr Simon JD Schilleeekk, whose research at Singapore Management University (SMU) focuses on digital innovation and sustainability, refers to this emerging domain as the 'Digital Green Economy'.

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He describes it as ‘a nascent ecosystem of start-ups, projects, and activities in which blockchain and other digital technologies such as AI, ML and IoT are employed to reinvent legacy industry processes, develop new solutions in existing markets and create entirely new markets in which private businesses put sustainable development at the very core of their business models.’

So how can this ‘nascent ecosystem’ have an impact on climate change?

Democratising environmentally-friendly impact investment

The idea of providing financial incentives to businesses and governments with green behaviours has been around for a while, however, has been limited by the systems used to manage them. Governments have set up regulations to try to mitigate climate change by forcing companies to compensate for their greenhouse emissions by buying Carbon Credits. These credits are then used to finance projects that have a positive impact on the environment, like the plantation of trees.

Carbon credits are bought on carbon markets that have lots of intermediaries and that is known to be quite opaque.

Furthermore, only big corporations have access to this market. Why is it a bad thing? Because consumers may also want to offset the carbon emitted in the atmosphere they are responsible for. When a consumer buys a pair of shoes for 100 USD, the carbon footprint of this purchase is around 250g of CO₂, which could be offset for 23 cents only.

This is not possible with the current carbon markets, which trades carbon in tonnes. Blockchain could make a difference and allow transaction in grams.

Add to this the inherent characteristics of the blockchain technology like traceability of the transactions, it becomes a tool for the consumer to track where its money goes – which again is not possible with carbon markets. Blockchain solves this.

Minimising the structure cost

In traditional carbon offsetting platforms, between 30 to 80 per cent of the price you pay to offset your carbon footprint goes to verification, through consultants, and intermediaries.

The transparent nature of blockchain makes it the optimal system for tracking and verifying that the money that goes into the system finds its way to its intended project.

A brilliant example of this is the Global Mangrove Trust (GMT), a non-profit organisation based in Singapore that is developing a solution to support the reforestation of mangrove forests, one of the most effective carbon stores on the planet. They are pushing this concept of Peer-to-peer philanthropy by developing a new kind of crowd-funding tool for forest conservation.

Their platform gives the ability to everyone to track on a dashboard the impact of their contribution over time: where the trees were planted, how much carbon it has absorbed from the atmosphere, the impact on the biodiversity, how many jobs it has created, etc.

The evolution of the forest is constantly monitored with satellites and the images are translated, using AI, into the amount of carbon stored by the forest.

Despite sounding expensively high-tech, the automated way of working coupled with the blockchain infrastructure allows for a very low operational cost (less than 10 per cent of the token value), resulting in more value going towards the environment in comparison to other projects that do not use AI or blockchain.

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In collaboration with a major Singaporean bank, GMT is building a platform that can easily be integrated into existing payment platforms, which will hopefully drive mass adoption. The long-term vision is that this model of the platform will be integrated into the value chain in a fully automated way to offset carbon emissions of individuals and companies.

Brands will be able to make the promise of being carbon-neutral or even carbon-negative by buying such tokens on behalf of their consumers to offset the carbon generated by the life cycle of the product they sell, engaging their customers in that process and automatically delivering reporting on their impact on the environment. Game changer.

Creating real-time precision and cost-efficiency

Platforms that facilitate carbon emission offsets already exist, however, are often complex and opaque. Blockchain solutions have begun to replace current systems to provide transparency and efficiency in terms of time and cost.

For example, when buying a plane ticket from Singapore to Paris for US\$1000, the airline may offer to offset your carbon footprint for an additional US\$20.

The airline will then use your US\$20 to buy carbon credits on the carbon credit market which is currently only accessible to large corporations. These carbon credits go towards funding green projects such as the construction of solar panel farms or financing reforestation.

The formula the airline uses to calculate the US\$20 offset is defined by the UN and based on a complex equation that includes details on the airline, the airplane, and route amongst other factors. What's more, it's not updated regularly, so it is only a guide to the amount needed for the offset, not a pure calculation of the exact amount needed at that point in time.

With a blockchain-based technology, real-time data is fed into the formula. If the airline has bought 50 new planes that are 20 per cent less pollutant than average, this will affect the offset figure. The blockchain ledger will record the formula as well as the exact source of data that was used to calculate the carbon offset price.

But it's not just about reaching more accurate figures. Traditional offset approaches also have high structure costs which reduces the amount of money that can be redirected to green projects.

The first reason is that UN regulation imposes audits on the projects financed by carbon credits, which averages US\$100k per project. Secondly, they have high banking structure costs due to the high number of relatively small payments.

Smart contracts have the potential to disrupt the way these activities are conducted. Put simply, a smart contract is a piece of code that runs on a blockchain and executes a specific transaction when some condition is met.

It automates transactions such as payments in a transparent way (you can see which wallet sends and which one receives), and it does so instantly without the intermediation of a bank. Consequently, the use of smart contracts will reduce the operational costs of these platforms, and hence more of the money will go directly to the environmental projects.

Facilitating the Machine-to-Machine economy

Imagine your washing machine is smart enough to decide when to start and when to stop based on real-time information about the price of electricity, or the availability of excess wind or solar energy near your home.

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Now imagine that your machine could be paid for offering greater flexibility to the smart grid. A smart IoT device could be linked to a smart wallet and be reimbursed when it is willing to delay its operations to a moment when there is less peak energy needed. Your electrical vehicle could decide when to charge its battery or when to offload energy back into the grid to help provide stability.

This is already possible with the machine to machine (M2M) economy, which will be blockchain-enabled and will have a massive impact on the energy market.

Over the next few years, the blockchain infrastructure will become much cheaper to operate, fulfilling its promise of enabling micro-payments that are currently too expensive to run on the existing payment railroads of global financial infrastructure like SWIFT, VISA, MasterCard, or AMEX. This will produce a cheap, feasible, and ever-present M2M economy, connecting billions of IoT devices all over the world.

However, having a smart grid and smart machines will not automatically reduce energy consumption. Yet there is an indirect effect on the environment. Most governments currently provide massive subsidies to fossil fuel industries to ensure grid stability at times of peak demand – for example when it is unusually hot in Singapore and all air-conditioning units are working hard.

The ability to meet peak demand comes at a high cost in terms of the required infrastructure – in this case, gas plants that lie dormant most of the year only to be fired up rapidly when demand is rising.

This infrastructure comes at a massive cost, running into the billions of dollars. By increasing demand flexibility through M2M systems, we could reduce the need for these largely redundant fossil fuel plants, dramatically decrease the subsidies that go to fossil fuels, and use the money for much-needed projects that address climate change.

We're currently in the middle of a climate awakening as businesses, governments, and individuals all start to accept the severity of the environmental situation and look to address it. Blockchain technology allows the development of platforms that are trustworthy, cost-effective, efficient, with transactions that are traceable.

The ability of this technology to democratize tokenisation at an individual level will also help drive green behaviours, bringing a more relative and personal dimension to the debate.

In the near future, we can imagine a standardized blockchain-based system that incentivizes consumers to recycle, and then pays them in a cryptocurrency for doing so. Consumer-driven aspirations may also encourage the adoption of such technologies by major brands and retail companies, driving the emergence of an ecosystem that systematically rewards plastic recycling and carbon offsetting.

The combination of blockchain technologies with IoT and AI gives us a glimpse of the major changes set to happen across numerous industries.

In the near future, IoT devices will capture real-life data to be processed by cloud-based AI engines, producing actionable insights whose value can be exchanged or traded seamlessly on blockchains, in an automated fashion, and without the use of intermediaries.

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Beyond the fairy tale picture, these technologies present limitations in their adoption. A big hurdle in the short-term is working out how to scale these technologies so that they can be maximised across industries. For the IoT, the lack of industry-wide standards does not allow interoperability at the current level of maturity.

But for now, we should be celebrating the innovations of many of these projects and looking at how we can leverage the technologies further in pursuit of positive environmental impact.

Blockchain, and the platforms it enables, have the potential to transfer climate-friendly consumer choices into real action in an efficient and transparent way.