



Can computers help save our planet?

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Contents

1. Executive Summary	4
2. Current Climate	5
3. Monitoring	6
4. IoT and AI	9
5. Agriculture	10
6. Blockchain	12
7. Insurance	14
8. Looking forward	17

Executive Summary

Technology is ever-evolving. The way we capture, process and use our data is becoming a key part of everyday life. At the same time, our environment is declining at an equally alarming rate. New developments in technology show promise in helping to monitor – and potentially slow down – the environmental decline we are experiencing.

Environment

Environmental changes are impacting the habitats of both humans and animals. Factors ranging from rising global temperatures to ocean acidification to melting Arctic ice are challenging the lives of a growing range of species.

A recent World Wildlife Federation study highlighted that there has been a 53% decline in the size of forest wildlife populations since 1970. [1]

Warming sea temperatures are decimating marine wildlife while rising sea levels continue to threaten densely populated coastal settlements.

Technology

Technology, however, is providing some hope. Technological advances are providing new ways of collecting and understanding more accurate data in an attempt to decelerate the effects of climate change.

Satellites, drones, GPS, radio-frequency identification (RFID) and cameras with unprecedented zoom capabilities are just a few examples of modern technologies that are helping us understand and monitor the environmental changes happening.

Artificial intelligence, blockchain and autonomy are examples of advancing processes that are allowing us to predict, process and communicate worldwide the effects of the decline in our natural surroundings. The information we can gather from these technologies will help us implement the changes required to reduce – and hopefully reverse – environmental decline.

Insurance

More frequent and intense weather events in recent years have cost tens of billions of dollars in the US alone. Insurer losses – and the consequent reduction in the size of the market – suggest insurance premiums can only increase and the level of cover decline.

But technology may be able to change that. New innovations introduce new insurable risks and opportunities for growth. Businesses that are implementing such technology, increasing their inter-connectivity and becoming more reliant on data require a broker and insurer that can understand, manage and insure the associated risks. By assessing exposures, which extend far beyond losses to tangible assets, businesses are best prepared to both seize new opportunities and to recover if and when the worst happens.

Current Climate

What's happening now?

Awareness of our impact on the planet is greater than ever. From increasing temperatures, extreme weather events, wildfires, flooding and droughts to flora and fauna depletion and extinction, the effects are everywhere.

Like a computer network, our ecosystem requires that each of its elements has the right conditions to perform its intended purpose in order to ensure smooth functioning. The attack on, or the failure or breach of any component, has a knock-on effect on the entire network. The resulting damage spans globally.

It is worth noting that the regions that are already feeling the effects of climate change and those predicted to suffer the most from it have contributed the least to it.

“Things that normally happen in geologic time are happening during the span of a human lifetime.”

Daniel Fagre, United States Geological Survey as Research Ecologist and Director of the Climate Change in Mountain Ecosystems Project

Rising temperatures

- The temperature has increased by 1.1 degrees Celsius [1] since global records began in around 1880.
- Independent analysis by NASA and the National Oceanic and Atmospheric Administration shows that 2016 temperatures were the highest since modern records began.
- It is calculated that human activity is 95% responsible for the consistent increases since 1970 [2].
- Computer models predict temperatures will continue to rise between 1.8 and 4 degrees Celsius during this century. [3]

Extreme weather

- Floods and extreme rainfall events have increased by more than 50% in this decade and are now occurring at a rate four times higher than in 1980. [European Academies' Science Advisory Council.
- Regions including California, the Eastern Mediterranean, East Africa, South Africa and Australia have all experienced severe – and, in some cases, record-setting – droughts in the past several years.
- Siberia, Alaska and Greenland have seen record levels of wildfire-related CO2 emissions due to stronger winds, increasing temperatures and a resultant increase in lightning strikes.
- 2019 Arctic wildfires burned the longest on record and in Siberia alone spanned over 1m hectares. [4]
- While wildfire is essential for the regeneration of forests, the increasing size and severity of such fires is threatening the forests' ability to recover.

Coral bleaching

- A coral is not a plant but does undergo the process of photosynthesis. In warming waters, this photosynthetic pigment is expelled and the rate of photosynthesis decreases, causing the coral to turn white or 'bleach.'
- It is estimated that half of the world's coral reefs have been lost as a result of bleaching in the last 30 years.
- Reefs are resilient but once bleached can take decades to recover.
- Bleaching has a permanent and devastating effect on the population and diversity of fish species and, in turn, the entire ocean ecosystem [5]

Rising sea levels

- Sea-level rise is caused by water warming and expanding, coupled with increased air temperatures melting glaciers.
- Global sea level has risen by about eight inches since scientific record keeping began in 1880 [6] and is rising quicker than any average over the past 2,000-3,000 years. [7]
- At the current rate, the sea level will rise by 65 centimetres by 2100, putting numerous coastal cities at risk. [8]

Melting ice

- Temperatures are rising fastest in the Arctic, increasing the volume of meltwater entering the already-expanding oceans.
- The number of glaciers in Glacier National Park, Montana, has decreased from an estimated 150 to fewer than 30 since opening in 1910. [7]
- The snows of Kilimanjaro have melted more than 80% since 1912. [8]
- 95% of the oldest and thickest sea ice in the Arctic is already gone. [9]



Monitoring

How do we know about climate change?

High-tech satellite imagery and drones fitted with various sensors enable scientists to explore environments previously only accessible by plane or helicopter. This provides not just a cost-effective solution, but also an environmentally friendly one.

Satellites

Hundreds of satellites operating globally not only show the severity and scale of damage, but conversely the discovery of new animal colonies and behaviours as brilliantly depicted in the BBC's 'Earth from Space' series.

These satellites contain sensors to measure temperature, carbon and sulphur dioxide, moisture in soil, wind speed and direction, rain, cyclones and storms.

For example, thermal imaging via satellites enables scientists to monitor plant biodiversity in order to understand traits before they become visible to the naked eye. Lasers and radar used in conjunction with satellites can measure the precise thickness of ice.

Satellite technology is already being used for the prevention of illegal palm oil plantations in Indonesia, where vast areas of forest are being destroyed. It is now possible to see and record this mass deforestation in real time.

Hurricane Dorian

The importance of satellite technology is becoming more evident in the wake of Hurricane Dorian, a Category-5 storm that hit the Bahamas in 2019 and is regarded as the worst natural disaster in the country's history. The sheer magnitude of such a storm is only realised when seen from space.

Data and images collected by satellites enable scientists and forecasters to monitor a storm's development in real time in order to provide detailed warnings as early as possible.

Algorithms are applied to current and historical data to predict the future movements and behaviour of a storm.

RFID

The honey bee is vital to the survival of our ecosystem and so we need to understand the reasons behind the depletion of their population. A survey of commercial beekeepers discovered that 50 billion bees – representing more than seven times the world's human population – died during winter of 2018-2019 [10].

Only when we understand their behaviour can we attempt to restore the balance for future generations. Radio-frequency identification (RFID) technology is aiming to help. Hitachi and CSIRO [1] developed RFID technology that is being used to understand honey bee behaviour. A harmless 2.5mm x 2.5mm chip, similar to those used in car park tokens, is placed on the bee and RFID readers are placed on the nest to monitor movement and identify any correlation with changes to their environment [2].

Drones

Unmanned aerial vehicles (UAVs) – better known as drones – not only record ultra-high-resolution video but also use thermal imaging, as well as temperature and humidity sensors, to monitor animal population densities and changes in the environment with more accuracy than ever before.

In addition, the data and images gathered by drones following storms such as 2013's Typhoon Haiyan, one of the most powerful tropical cyclones on record, was vital both for evaluating the damage caused and for planning reconstruction.

Drones are currently being used by insurance companies following such natural disasters and large-scale losses. This technology provides fast mapping of affected areas, helping insurers gather more data without putting humans at risk.

Losses can be assessed and calculated much faster, enabling quicker recovery than ever before, thereby reducing the consequential impact to the economy of an affected region.

With any new technology comes new insurable risks. Drone flights are heavily regulated because – despite their size – they can cause physical damage and widespread disruption as demonstrated by attempts by activists at Heathrow Airport in 2019.

The associated risks and a lack of historical data on drone flights render traditional insurance policies inappropriate and costly. Insurtech* startup company Flock (underwritten by Allianz Global Corporate & Specialty) have developed a solution which spans from an app-based "pay-as-you-fly" insurance policy to a usage-based solution for large drone fleets.

*Insurtech – a combination of the words insurance and technology – refers to the use of technology in insurance in order to revolutionise the industry.

"Honey bees — wild and domestic — perform about 80 percent of all pollination worldwide. A single bee colony can pollinate 300 million flowers each day."

Greenpeace

[\(www.greenpeace.org/usa/sustainable-agriculture/save-the-bees/\)](http://www.greenpeace.org/usa/sustainable-agriculture/save-the-bees/)



IoT and AI

We see and hear these acronyms regularly, but what are they and how can they help our environment?

90% of the world's data has been collected in the last two years alone. [1] Data collected using technologies such as the Internet of Things (IoT) can be fed into computers with human-like learning capabilities, or artificial intelligence (AI).

In addition to satellites, cameras and drones, we are maximising the potential of the data collected on the ground by using various interrelated sensors, computers and subjects.

IoT

The majority of portable and home-based appliances such as lights, kettles and central heating systems have the capability to connect and talk to each other via Wi-Fi and smartphones. This technology is known as IoT. The interconnectivity of these devices, combined with real-time cost data, allows a more economic use of energy at home.

Such technology is now being implemented everywhere. Modern vehicles and buildings are using IoT to provide real-time information on water leaks and faulty parts for maintenance purposes, for example.

Numerous sensors, combined with machine learning, can bring invaluable benefits to sectors like agriculture by helping farmers reduce waste and improve productivity. This, in turn, benefits our environment.

AI

"By 2020, it's estimated that 1.7MB of data will be created every second for every person on earth." [2]

Using complex algorithms and rules, we can program computers to process and understand data in order to use it. The computer is constantly learning, therefore the more high-quality data that is processed, the smarter the computer becomes.

From smartphone apps to driverless cars, both IoT and AI are now readily available without the requirement of expensive or advanced equipment. The technologies can be accessed via an internet connection, so a growing number of consumers and businesses can use them.

IBM Watson

The power of AI was evidenced back in 2011 when the language-fluent supercomputer challenged two top-ranked contestants on game show "Jeopardy!" and won.

At the time, John Rennie (journalist, writer and editor) claimed that Watson could process 500 gigabytes – the equivalent of a million books – per second. [3]

AI can – and is – bringing huge benefits to various industries. Its applications range from providing fast, available and cost-effective medical research and diagnosis to developing smartphone apps that can coach people to exercise or quit smoking.

Driverless cars

Vehicle autonomy will eventually revolutionise the transport sector. Real-time data on road, traffic and environmental conditions, maintenance requirements and location will only optimise our use of vehicles, both in business and personally.

Electrification will of course dramatically reduce emissions, though the technology comes at a price. There is also a lot of work to be done to provide the infrastructure to support an increasing number of electric vehicles and their charging requirements.

Automation will bring with it numerous challenges along with new opportunities for the insurance sector and those willing to evolve with technology. Traditional motor insurance products will no longer be fit for purpose. As our ownership and manual operation of vehicles declines, so does the users' liability.

As data is constantly being collected by the vehicle and processed centrally via the cloud, there is a need for smarter insurance solutions. There is potential for an app-based, pay-as-you-go or usage-based product similar to the product used for drones, for example. The uncertainty over liability in the event of an accident will remain for some time, however.

Agriculture

Can we modernise this ancient and energy-consuming practice?

Agricultural production tripled between 1960 and 2015, [1] making it one of the largest contributors to greenhouse gas emissions. Vast amounts of land and natural resources are required for production – before taking into consideration the logistical requirements.

The demand for crops grows as our populations do. While climate change presents new challenges for farmers by disrupting growing seasons, so does the drying up or flooding of farmland.

Pest infestations and plant diseases are a constant threat to crops and the livelihood of farmers. Trade and other human-migrated movement, as well as environmental forces, intensify these threats.

However, one of humankind's earliest practices is being modernised – and with that comes the potential for better management of environmental challenges. Farmers are beginning to use technology to increase yields of crops and improve quality while also reducing the resources required.

IoT sensors recording the moisture and nutrient content of soil feed data into intelligent AI systems which make precise calculations and send the information to autonomous spraying and irrigation equipment.

Sensors, combined with data collected by drones, provide farmers with real-time information in a digestible format either via computer software or a smartphone app. This allows farmers to identify and mitigate threats instantaneously, predict yields and make more accurate financial forecasts in order to maximise productivity.

Vehicles and machinery

Electrification and autonomy are more difficult to implement in large commercial and off-road vehicles as the power and range requirements are far greater than those of a car.

Tractors are required to run for up to 12 hours a day. The batteries required would cost more – and be larger – than the tractor itself.

However, new vehicles as well as solutions to modify existing equipment are in constant development.

John Deere Ltd has recently developed an autonomous electric tractor. Rather than using batteries, the tractor uses cables that are connected to the border of the field and deliver continuous power. An intelligent guidance system and robot arm remove friction while ensuring the tractor does not run over the cable.

US-based Autonomous Tractor Corporation offers an alternative and cost-effective solution by modifying existing equipment. Electronic components and a generator in place of hydraulics utilise energy that was previously wasted, thereby reducing emissions and maximising power output.

“The industry will be transformed by data science and artificial intelligence. Farmers will have the tools to get the most from every acre.”

Gayle Sheppard,

Vice President and General Manager, Intel® AI



Blockchain

What is Blockchain and how can it benefit the environment?

Blockchain technology is commonly seen to have a negative impact on the environment due to its original application - Bitcoin. Substantial computing power is required to process transactions, which consumes vast amounts of energy. However, there are alternative applications which could save vast amounts of energy.

In a world where data is becoming more valuable and more important, blockchain provides a platform on which data can be stored, shared and viewed only by those with permission, but can never be changed by anybody.

The blockchain grows as each record or “block” is added. Blocks are linked cryptographically and contain a reference to the previous block, a timestamp and transaction data.

In order to change or update data, a new block must be built. This provides an invaluable audit trail and has the potential to streamline many complex processes involving a number of parties such as supply chains and global shipping companies.

Cryptocurrency

Blockchain was invented in 2008 in the form of decentralised digital currency Bitcoin.

It is estimated that an equivalent amount of energy is required to mine \$1 USD of cryptocurrency as is required to mine \$1 USD of certain metals. [1]

Computers are tasked with solving complex equations, thereby verifying transactions of the currency and receiving “coins” as a reward for doing so. The more computing power used, the more equations can be solved at a faster rate.

This poses a threat to businesses operating with powerful machines as they can be hacked into and used to mine cryptocurrency – a process referred to as cryptojacking. This causes huge disruption to the network and can lead to overheating and physical damage. This process is energy intensive and victims of cryptojacking will receive an extortionate utility bill.

Alternative uses

As with any technology, blockchain has evolved from its original application and can be used in a variety of ways across a number of sectors.

Seattle-based company Nori have developed a marketplace in which companies can pay farmers for storing carbon in soil. The network provides transparency, allows businesses to reduce their carbon footprint and a new way for farmers to maximise their income.

This increased transparency will underline the importance of corporate social responsibility. Businesses must be accountable for their decisions and the impact of those decisions on both people and the environment.

IBM applications

Forever at the forefront of innovation, IBM has adapted blockchain technology for use in two products that have the potential to revolutionise supply chains:

TradeLens

Jointly developed with Maersk, this solution provides a single network accessible by businesses, shipping companies and authorities in order to streamline the process. Blockchain allows access to real-time shipping data that is secure and cannot be changed.

This speed and transparency enables trust from start to finish and – in the event of an error – the source is immediately traceable.

The streamlining and digitisation of the shipping process can only have a positive impact on the environment and the economy, paving the way for the industry to embrace automation.

IBM Food Trust

This solution enables companies still using old, paper-based processes to modernise, cut costs and cut emissions. A system that enables real-time tracking, expiration and waste data can bring vast benefits again to the environment, the economy, businesses and consumers alike.

Businesses can – and have – spent millions on product recalls over the years. Using traditional methods, it would take over six weeks to trace the source and journey of a mango from supplier to customer. Using IBM Food Trust and blockchain technology, this can be done in under three seconds.

“A shared digital food supply chain powered by blockchain helps supply chain players better collaborate with each other to operate more efficiently and reduce waste.”

IBM Corporation 2018

Insurance

Can new challenges bring fresh opportunities for the sector?

Insurance companies are now beginning to realise the value of digitisation, automation and the data that is available.

Emerging technologies bring new risks and new opportunities. Those willing to adapt and embrace these opportunities will lead the way in the evolution of insurance and risk management. As we move into a less tangible and more subscription and service-based society, insurance policies need to be flexible, available and responsive.

Automation and driverless cars, in particular, present a whole new concept from an insurance perspective in terms of insurable interest and liability. As we have the infrastructure to accommodate automated vehicles, there will need to be a simple and transparent insurance solution in place.

The future of motoring could see the removal of ownership completely in favour of subscription-based services with insurance products built in. The technologies discussed allow transparency from supplier to end user with real-time maintenance and mechanical data available, enabling the shift of liability from an individual or business to the service providers and product manufacturers.

Insurance brokers and insurance companies have the opportunity to play a big part in turning these technological possibilities into reality. Driverless cars will remain a futuristic possibility until solutions are available that retain the key principles of insurance, while moving away from the traditional annual, one-size-fits-all product.

Along with large corporations, there are numerous tech startup companies with a variety of new products and solutions for the future. Many of these will benefit the environment by replacing or streamlining existing practices that have remained static for a number of years, or even decades.

A broker that can provide such startups with clear, comprehensive and flexible insurance solutions will allow them to grow. At the same time, as the broker draws on the experience of working with companies of all sizes, this will add value to companies' risk management and business continuity strategies.

Surprise! You've won a prize

The first 5 people to email hello@travelers.com with the subject 'Can computers help save our planet?' will get a free Travelers umbrella. Here's the T&Cs if you want to check them out.





Looking forward

There is no doubt that our planet and climate are changing. We need to change with it and embrace the new technologies enabling us to do so.

The increasing willingness of individuals to adapt and reduce their impact needs to be mirrored by the sectors with the largest environmental impact, namely transport and agriculture.

We have established that the technology and data is available for big change. The insurance industry can fuel this change by using technology and data to provide new, transparent and accessible risk management and insurance solutions.

Insurance companies will favour risks that are implementing technologies such as blockchain within a supply chain to allow full traceability and rights of recourse, as well as keeping product recall costs as low as possible.

While the implementation of technology and big data is encouraged, businesses should be aware of their exposures and ensure comprehensive security and protection is in place, alongside suitable insurance coverage for when all else fails.

It's important to remember there are reasons for optimism.

A lot of negativity surrounds climate issues. This can be met with positivity and open-mindedness to embrace the solutions that are available to us as well as those in constant development, in order to work with – and not against – our environment.

Sources:

Exec summary

[1] <https://www.wwf.org.uk/sites/default/files/2019-08/BelowTheCanopyReport.pdf>

Current climate

[1] NASA's Goddard Institute for Space Studies. <https://www.giss.nasa.gov/research/news/20170118/>

[2] The Intergovernmental Panel on Climate Change fifth assessment report - summary for policy makers. https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_summary-for-policymakers.pdf.

[3] University Corporation for Atmospheric Research

[4] The Climate Change Service (C3S) & Atmosphere Monitoring Service (CAMS) for the Copernicus Earth Observation Programme.

[5] Lancaster University. "Coral bleaching causes a permanent change in fish life." Science Daily. Science Daily, 18 June 2019. www.sciencedaily.com/releases/2019/06/190618070807.htm

[6] U.S Global Change Research Program <https://www.globalchange.gov/browse/indicators/global-sea-level-rise>

[7] Daniel Glick - National Geographic <https://www.nationalgeographic.com/environment/global-warming/big-thaw/>

[8] NASA's Goddard Space Flight Center/Kathryn Mersmann <https://climate.nasa.gov/news/2680/new-study-finds-sea-level-rise-accelerating/>

[9] National Oceanic and Atmospheric Administration 2018 Arctic Report Card <https://arctic.noaa.gov/Report-Card/Report-Card-2018/ArtMID/7878/ArticleID/780/Seanbsplce>

[10] Bee Informed Partnership's 2nd edition of Diagnosis and Treatment of Common Honey Bee Diseases

Monitoring

[1] The Commonwealth Scientific and Industrial Research Organisation

[2] https://social-innovation.hitachi/en-gb/case_studies/sweet-spot-how-hitachi-tech-is-helping-save-the-bees/

[3] Jeff Masters, meteorology director at Weather Underground. - Tampa Bay Times <https://www.tampabay.com/hurricane/2019/09/03/hurricane-dorian-still-wont-move-or-turn-north-as-four-potential-tropical-systems-emerge/>

[4] flockcover.com/enterprise – The future of insurance for connected drone fleets white paper

IoT and AI

[1] Forbes (2018). "Big Data Analytics Adoption Soared in the Enterprise in 2018". <https://bit.ly/2PalU1H> (Accessed: 19/02/19)

[2] Data Never Sleeps 6.0 by DOMO Inc.

[3] "How IBM's Watson Computer Excels at Jeopardy!" February 2011. (article no longer available)

[4] <https://www.ibm.com/thought-leadership/football/uk-en/> & <https://www.ibm.com/watson/media/highlights-clipping>

Agriculture

[1] Food and Agriculture Organization of the United Nations - <http://www.fao.org/3/a-i6583e.pdf>

Blockchain

[1] Quantification of energy and carbon costs for mining cryptocurrencies - Max J. Krause, Oak Ridge Institute for Science and Education

[2] © Copyright IBM Corporation 2018 <https://www.ibm.com/uk-en/blockchain/solutions/food-trust>

