SPINVIEW

Digital twins: A data-driven approach to sustainability

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A data-driven approach to sustainability in asset management

Sustainability is more than just a buzzword, it is a way of life. From homes to businesses and even entire cities, becoming sustainable is a necessity to keep carbon emissions low and climate change at bay.

In recent years climate change and sustainability have become two of the most important challenges facing businesses with greater focus on environmental reporting, sustainability strategies and full disclosure on the impact a business has on the environment, **in fact as of 2019 it's a legal requirement.**

The next decade will see the climate change agenda become an even greater focus for businesses. For the first time environmental risks are listed as one of the top five global risks to businesses edging out other areas such as regulation, reputational and cyber risk. Sustainability now needs to play a fundamental role within an organisation with 62% of executives agreeing that a sustainability strategy is a necessity to be competitive today and a further quarter expect sustainable operations to be essential for businesses in the future and expecting to deliver over $35trillion in additional savings/revenues from ESG for organisations.

According to the UK Green Building Council, the built environment and infrastructure contributes to approximately 40 percent of the UK's total carbon footprint, half of which comes from the energy output of buildings. Facilities managers and asset owners, therefore, have a critical role to play in meeting and reporting on sustainability measures such as utilities performance, waste management and recycling practices in order to reduce a building's environmental impact.

If an asset manager is aware of the overall impact a building or its contents, systems or processes has on the environment they can begin to integrate effective sustainable measures to help reduce carbon emissions. Armed with the right tools, managers can ensure they have made the best possible decisions resulting in the best possible outcomes for their business.

A comprehensive sustainability strategy can benefit businesses by

- **Reducing costs.** Simple cost savings can be achieved from smarter and efficient use of resources.
- **Increase Revenues.** Companies that understand the implications of sustainability to their business can use the information to both enhance and develop new products and services.
- **Attracting investors**. An organisation's sustainability efforts and transparency of reporting has become a priority for investors.
- **Managing risks.** Research has shown businesses that integrate sustainability measures into the overall running of a company outperform those that do not.
- **Increasing engagement.** As more and more people and companies will seek sustainable premises to work and live in

Integrating comprehensive sustainable strategies can play a pivotal role in both supporting and delivering an organisation's sustainable business model and in this paper we will show how leveraging the power of digital twins and immersive technologies can provide the necessary foundations needed to execute on your sustainability strategy.

Building a sustainability strategy

Sustainability is reducing the demand for Earth's natural resources and finding ways to lower our carbon footprint and the negative impact we have on the environment.

There are two key components in making a building sustainable:

- **Manage the building's systems.** This would include heating, ventilation and air conditioning, energy supply, fire safety and protection, IT and communications, lighting, refrigeration, security, water, drainage and plumbing, and more.
- **Manage the building's infrastructure.** This would include the workspace design and the employees' interaction and relationship to the space. Managers have a crucial role to play in the happiness, wellbeing and productivity of the people.

Facilities and building managers are now increasingly responsible for not only the building's infrastructure, amenities and systems but the workspace too. The architecture and how we design new buildings and even cities has a significant role to play in the overall impact it has on the environment. In order to sustain ourselves through the climate change crisis we need to design our buildings and cities with sustainable and equitable carbon footprints.

In the UK, 80 percent of the buildings that will be occupied in 2050 have already been built (including all infrastructure from train depots to offices). Existing buildings account for 40 percent of global energy use making it imperative that efforts are made to monitor, report and reduce the greenhouse gas emissions that these assets produce. This would be hugely beneficial not only to the environment but to any organisation with assets.

There are a number of approaches to mitigate the overall energy consumption of a building including:

- Switching to renewable energy sources.
- Introducing low-impact materials and technologies.
- Use sustainable suppliers.
- Monitor waste.
- Adopting strategies to reduce carbon emissions at both the construction and operational level.
- Change of behaviour

With newer buildings, sustainability measures can begin at construction level, making sure non-hazardous materials are used and emissions are reduced on and off site. Following on to an operational level, sustainability efforts can continue by monitoring energy levels, heating, electricity, water and waste management within the building. All of these actions, and much more, can help contribute towards achieving net-zero carbon buildings.

As new buildings already tend to be planned and designed to be energy efficient for their full life cycle, existing buildings will need to make changes to reduce their energy output through retrofitting.

Digital Twins

A digital twin is a digital 'copy' of an environment, system or process which could include large structures such as buildings, factories and even whole towns or cities.

In today's world where building operations and maintenance activities are increasingly being digitised and connected to the internet, managers are confronted with multiple and complex data streams.

The monitoring of carbon emissions or reporting on sustainability measures within a building can therefore, seem like an enormous task. This is where digital twin technology can help by identifying ways to become efficient, streamline operations and provide one central source of information.

Any device that can be connected to the internet and provides information on its performance can be linked to a digital twin. The data captured from IoT (Internet of Things) devices such as smart meters, water meters, CO2 sensors and more, can provide valuable real-world insights of a physical asset, system or process and be displayed in a 3D or 4D visual format. Manufacturing plants, for example, could then use the information to monitor power usage, temperature and Co2 levels within a building to predict shortcomings, plan maintenance and provide accurate reporting.

What distinguishes a digital twin from any other digital model is its connection to the physical twin.

Collating 'big data' from the digital twin can capture the health of an entire environment or space, not just the assets within it. By assessing the real-world data, asset managers can make informed decisions and adjustments to variables such as room temperature or energy where required.

Many businesses find it challenging when it comes to accessing and interpreting data but with a digital twin data is captured and displayed simply through one visual source making it easy to monitor and manage the performance of an asset.

Establishing a baseline & performance analytics

Many organisations have committed to reducing their carbon emissions, however, many do not know that they are currently underachieving on these targets on a day to day basis. Without a way of accurately measuring and reporting on current carbon emissions it is impossible to keep track.

With a digital twin businesses can accurately measure and set an authentic baseline. A reliable baseline offers a holistic snapshot of information and real time data which can provide recordings of pollutants and other environmental impacts from which to set sustainable targets and effectively report them.

In addition, companies can record and monitor anything from water usage and waste to heating and electricity output. Information from IoT sensors, utilities or building data can be mapped and placed on the visual twin providing an accurate and simple-to-use baseline for any business. By setting an authentic baseline from the beginning, organisations can make informed decisions and adjustments where required throughout the lifecycle of an asset.

Once an accurate baseline is established, it is then integrated into a digital twin which will project a realistic representation of the past and present state of a space. This information can also be utilised to forecast or predict scenarios with assets, environments and even whole cities.

An example of such a system has been developed in China to simulate the effects of disasters such as fires and prepare efficient responses to such events.

"Put simply, AI can enable our future systems to be more productive for the economy and for nature,"

Celine Herweijer
Global Innovation and Sustainability Leader, PwC UK

Similarly in Japan, the 'Tokyo Virtual Living Lab' integrates street and traffic data to simulate an accurate depiction of Tokyo's road network to identify spikes in carbon emissions. It relies on map data from OpenStreetMap and overlays the information within a 3D virtual environment allowing users to simulate real-world traffic scenarios.

These two examples show how the real world can be integrated with the virtual one to increase our levels of understanding complex networks and systems. We do not always need, however, to recreate entire cities. Any space that is connected to IoT devices and sensors offers an in-depth look at what's happening with a physical asset which is particularly useful when it comes to performance analytics.

Through the use of smart sensors, asset managers can not only obtain accurate audits of assets but monitor performance and identify discrepancies. If a factory manager, for example, fails to detect a flaw within a production line or a fault in a machine it could cause costly disruptions and delays. With digital twin technology, assets can be monitored via a digital dashboard in a visual context allowing managers to interpret data quickly and efficiently. By monitoring assets in this way, organisations can forecast for future maintenance, prevent irregularities and can therefore streamline operations in line with their sustainability goals.

Engaging people in your sustainable journey

You can have all the programmes in the world but if your employees and consumers don't engage, your results will be limited.

Companies can now set individual and team challenges to achieve their carbon reduction and sustainability goals through Koras sustainability app.

Employees, suppliers and even users/ consumers actions can be rewarded for their actions in the form of "koras"

"Kora is an engaging & rewarding platform giving users and partners a unique sustainability solution"

Valery Prunier - head of the Blue Activist @ EdF

redeemable in the special marketplace where participants offer products and services are offered for exclusive discounts - positively reinforcing behaviour change.

Companies can choose from a range of data connectivity options for performing more sustainable and healthier lifestyle actions, including sustainable mobility, food, energy sources and waste
All this GDPR compliant, real time tracking directly impacts your business and carbon reduction goals and incentives positive actions.

Success Stories

Digital and visual twins have helped many organisations capture data through visual representation, monitor assets effectively, interpet analytics for business optimisation and empower users with actionable insights in their drive for a more sustainable business model. Here we show how some organisations have leveraged visual twins to optimise business operations and provide measurable data for their sustainability reporting.

Design and build

A leading Norwegian residential property company, **Oscar Properties**, utilised their digital twin to test sustainability in building design looking at the impact of performance on the build and management of spaces the impact on clients propensity to purchase. By capturing data from sensors in real time, they were able to correlate the data and determine which architectural designs had the most desired effect on meeting its sustainability and wellbeing targets. **Oscar Properties** could make informed decisions based on these findings before construction began.

Their properties were proven to deliver a 'healthier' sustainable lifestyle for their tenants and were in line with their corporate sustainability values.

A Scandinavian care home provider, **NREP**, similarly used digital twin data to assist with the design and architecture of their new care homes. Using VR and sensor technology to create visual representations of their designs, **NREP** were able to test their concepts and the impact they had on residents and careers to gain insights before construction. By testing design concepts in this way, **NREP** were able to make carefully considered decisions on design and the impact it had on their residents.

Corporate communications and operations

Ericsson's USA 5G Smart Factory in Texas is one of the most advanced manufacturing complexes in the world. When it launched earlier this year its engineering professionals were trained with almost no face-to-face interaction.

By utilising the power of VR in the months prior to opening, new **Ericsson** employees were able to learn directly from peers in the company's Tallinn smart factory 8,000 km away in Estonia. Without the need for US employees to travel to other **Ericsson** locations for face-to-face training the organisation was able to onboard ready- trained staff and open the complex as scheduled.

Using the power of digital twins and VR technology **Ericsson** was able to provide new employees with training for a working environment without the need of a physical site visit. As a result, long distance travel was reduced, cutting costs and saving time.

Anna Cau, Head of People, Group Supply, Ericsson says,

"Immersive knowledge sharing just ticks so many different boxes – efficiency, safety, sustainability,

We are proud of having staffed our 5G USA Factory with highly skilled professionals who were able to facilitate 5G product manufacturing from day one thanks to the innovative VR approach we took during their onboarding."

Train operators and asset owners

Transport infrastructures and how they are managed and monitored can be greatly improved with digital twins. **Transport for London (TfL)** is currently working on the delivery of the London Mayor's London Transport and Environment Strategies (MTS) to provide energy efficient travel and reduce carbon emissions in London's transport system.

By using advanced multi sensor devices to capture intelligent asset data displayed through vision, **TFL** can monitor and track all environmental emissions from assets through one user- friendly source. The data captured can be utilised by the entire **TfL** organisation regardless of training or education levels.

The environmental sensors used here are compliant with the Clean Air Strategy 2019. In addition, other sensors provide a visual representation of train tracks and infrastructure as well as useful information on temperature, track condition or blockages such as foliage or debris in tunnels. Armed with this information, **TfL** can streamline operational efficiency leading to greater sustainable working practices.

The visual twin also prevents engineers from literally having to 'walk the line' as the software can find faults (often undetectable by the human eye) and provide inventory assessments on emission levels in seconds rather than days or weeks.

All of these outputs are downloadable in multiple file formats and displayed with geographical accuracy in simple maps, which are time stamped and traceable. This allows **TfL** to track, monitor and hold accountable the performance of their entire system. With such efficiency a transport infrastructure, such as a train or bus network, can make improvements quickly without exposing workers to dangerous environments unecessarly or for too long. A streamlined systematic approach to operations can help any company meet its sustainable targets.

Through the use of digital twin technology **TfL** are ensuring they:

- Establish a carbon base line map for their network.
- Optimise operational efficiency.
- Provide one source of truth for data.
- Have accurate management and control of projects and remote access for all.
- Understand the environmental impacts over time in the network.

With a digital representation of its assets **TfL** can accurately monitor machine performance, carbon emission outputs, detect faults and predict outcomes from the physical environment through the use of AI and real time analytics.

Monitoring assets and planning

Ensuring data is captured and delivered in a practical way is key to good road management. Accurate data is essential for making informed decisions in highway maintenance but historically, data from road infrastructures and highwayways has been difficult to access and complex to capture. High quality visual location based data has the potential to generate over $100bn of revenue savings for road services providers and deliver a more sustainable road network.

Designed to support smarter cities with particular focus on road health, **Nuova Tech** uses digital twin technology to simplify data management and sustainable reporting. By monitoring the road asset's physical performance over time through a digital representation allows them to identify anomalies, changes or indescrepencies within the road environment that may not adhere to their sustainability performance targets. The data provided can empower companies to make changes where required with minimum disruption to operations.

From the first scan **Nuova Tech** captures a baseline of a road's condition. The data is then analysed for deterioration levels eg. cracks, potholes, surface roughness and general deterioration.

Subsequent scans then build up new datasets of the same roadway with the same parameters. Over time a living history of the road is captured and therefore, non-cyclic factors can be identified.

Having access to a visual representation of these assets allows engineers to diagnose faults and predict problems in a timely manner, making critical decisions on what needs to be repaired or replaced.

Digitalising road infrastructures, therefore, can reduce the cost and environmental impact of inspections and unnecessary maintenance by providing engineers with data to plan ahead for more efficient repairs.

Embracing technology for a low-carbon future

Organisations are embracing innovative digital technologies to change and adapt the way they operate and reduce their carbon emissions. Digital twins can help organisations improve their data analytics, asset management, day to day efficiencies, employee retention and so much more.

Geospatial analytics and digital twins are expected to play a huge role in the future of our planet with data-driven insights helping large companies, towns, cities and even governments make informed decisions to help reduce global warming. It is predicted that digital twin technology will contribute to a 20% reduction in global carbon emissions by 2030 making immersive technology fundamental in the fight against climate change.

Sustainability has become increasingly more important in today's world and with innovative immersive technologies businesses can repurpose their sustainability values and make a difference to both the planet and to profits.

Rise to the challenge

There is no doubt that the digitalisation of an environment, system or process provides organisations with a wealth of valuable information and simplifies business operations. However, it is not without its challenges. The successful implementation of technologies such as automation, cloud computing and machine learning into existing processes is an ambitious task. The challenge could in fact demand capabilities not yet available to a business. Nonetheless, these technologies offer many opportunities that are hard to replicate.

A digital twin offers the ability to 'visualise' data in a simple way and in real-time. Its implementation can change how planning, development, operations and maintenance are carried out in any industry and can simplify processes as well as predict behaviours in various conditions. Through a 3D replica connected to its real-life counterpart, the digital twin can also be a 'safe' place to test new processes before deploying in the real world saving an organisation time, money and manpower.

Engaging with AI technology and digital twin technology can seem daunting for some businesses, but by doing so operations can be streamlined and sustainability targets can be achieved. Thanks to a digital twin and the operational efficiency that it offers, organisations can set off on the right foot on their sustainability journey that's so important in today's corporate climate.

Spinview deliver

We are committed to shaping innovative solutions that provide answers for a better future, answers for more livable and sustainable cities, connecting the real and the digital world to increase competitiveness and lay the foundation for people to be empowered.

Unlocking data to deliver smarter, safer and more efficient spaces.

If you want to understand how a digital twin can support your company's sustainability goals, or would simply like to understand more around carbon reduction and creating a baseline, please speak to us at hello@spinview.io