



Rediffusion
Consumer Lab



Digital Twins

THE INSIDE OF THINGS



PROF. AVANINDRA CHOPRA
Culture, Customs & Conversations
Specialist, Red Lab



Johannes Gutenberg in his workshop
Source: Fine Art Images/Heritage Image/age fotostock



For many historians, the invention of the printing press by the German goldsmith **Johannes Gutenberg** in 1440 marks the beginning of **the modern scientific world**. With this singular invention begins the era of mass communication, and the resultant proliferation of information and knowledge leads to the **European Renaissance**. And, later developments in communications and computing have given a powerful fillip to the myriad ways in which information and knowledge reach us and have absolutely altered how we interact with the world around us.

The **STL Partners'** report **The Coordination Age: A third age of telecoms** (2018) interestingly captures the communications transition. It says that from the 1850s until around 1990, the telegraph and then telephony enabled the **Communications Age** in which people were able to communicate instantly over long distances and overcome geographic boundaries. In the 1990s, the **Internet** emerged, heralding in the **Information Age** in which people could connect to computers directly, and social media and other platforms were enabled. Traditional voice communication services, entertainment, buying and selling stocks, products and services and more were available at the mere touch of a button on PCs and mobile devices. The Internet truly heralded in the new age by enabling **'the decentralization of information'** in a manner and on a scale unimagined ever. And, the report predicts, that in the upcoming **Coordination Age**, people will connect with computers and, increasingly, with **'things' – machines, products, buildings and processes**, and even with themselves in ways unthinkable earlier.

Source: Dataquest



The Metaverse Festival
 Source: Duncan Rawlinson - [Duncan.co/Flickr](https://www.duncan.co/flickr)

This coming age has also been referred to as the **Web3 metaverse** or the **virtual immersive 3D world**. It is a decentralized version of the Internet and runs on peer-to-peer technologies such as a public **blockchain**, the underlying tech for cryptocurrencies and non-fungible tokens. Many experts believe that this is the next big deal, a **multiverse** where each one of us is likely to have a digital twin, a **3D digital, holographic double**, an **avatar**, and everything that we do digitally becomes absolutely and seamlessly interconnected – the physical persona and the digital persona becoming a unified reality. Now, companies are building intelligent 3D avatars that look, sound, and behave like the actual persons. These digital twins simulate a person's voice, face, and personality, enabling never-before-possible social and virtual interactions in the emerging digital world. The digital avatar will be

able to enter into any environment made by any company, **'to work, socialize, play games, conduct business, heal, learn, shop and live'**.

Similarly, all other **'things' – machines, products, buildings and processes** – too can have their own connected digital twins – a **'digital replica'** or a **'device shadow'**.

Already, this **digital twin technology** is one of the fastest growing key concepts of **Industry 4.0** where artificial intelligence, gene editing and advanced robotics are blurring the lines between the physical, digital, and biological worlds. Anticipated by **David Gelernter's** 1991 book **Mirror Worlds**, the concept and model of the digital twin was first introduced by **Michael Grieves**, then of the University of Michigan, in 2002. The concept was subsequently called the "digital twin" by **John Vickers** of **NASA** in 2010.



David Gelernter



Michael Grieves



John Vickers



Defining Digital Twin Technology



IBM defines the digital twin as "... a virtual representation of an object or system that spans its lifecycle, is updated from real-time data, and uses simulation, machine learning and reasoning to help decision-making."



Yana Arnautova

HITACHI
Inspire the Next

Yana Arnautova, Manager, Sales Enablement, GlobalLogic, a Hitachi group company, explains, "In the simplest terms, a digital twin is a virtual replica of a real-world object or a system that is run in a simulation environment to test its performance and efficacy."

IBM further describes the digital twin as "a technological leap '**through the looking glass**' into the very heart of physical assets. Digital twins give us a glimpse into what is happening, or what can happen, with physical assets now and far into the future."

But models have been made earlier. The key difference between **classic modeling tech** and **the digital twin concept** of the smart world lies in the constant information flow that leads to continuous synchronization of the digital to the real, and in the way the models

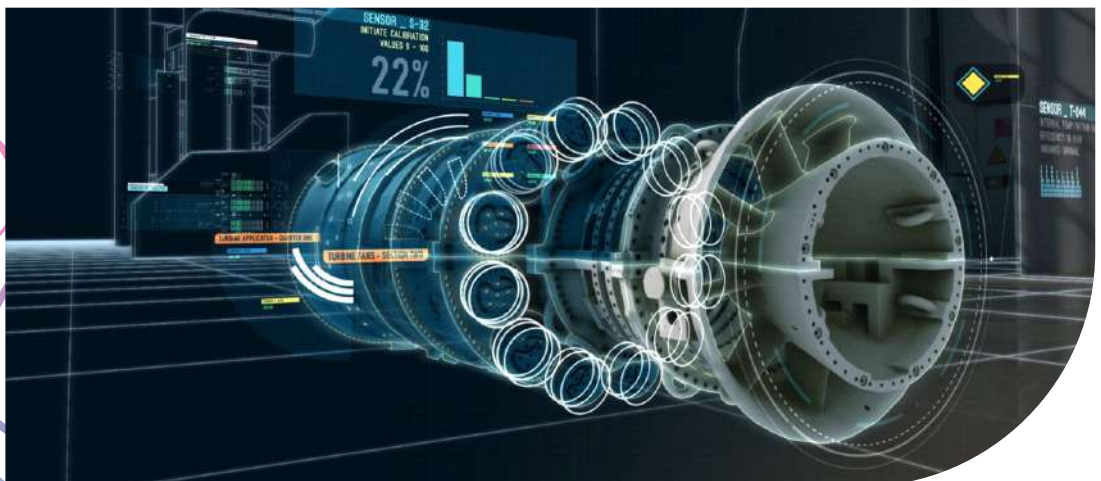


are constructed that allow them to be continuously updated. With multiple sensors connected to the physical asset, valuable real-time data can be mapped onto the virtual model using latest machine learning and artificial intelligence tools, big data and drones, and computing power that uses modern **smart technology, machine-to-machine communication (M2M), IoT (Internet of Things), 3D CAD, and IIoT (Industrial Internet of Things)**. All this has been made possible by faster internet networks that instantly connect devices worldwide.



Source: twi-global.com

This allows for an easy peep into the **'inside of things'**, making it possible for experts stationed anywhere across the world to assess crucial information about how the physical thing actually is performing in the real world, in real-time, over its lifetime, or what is wrong with it, completely transforming how people interact with the world around them. This software-led remote simulation acts as a **critical enabler** in recording, controlling, monitoring, testing, managing, troubleshooting, experimenting, developing and maintaining machines and systems.



A digital twin of a turbine by General Electric. Source: General Electric.

Digital Twins: Applications



Digital twins have been initially put to extensive use in **manufacturing and logistics** where they have led to fine-tuning of technology, bringing down operational costs and increasing efficiencies resulting in a productivity revolution. These have become vital tools that aid operators and engineers to comprehensively understand the present and predict the future. Whatever is happening in the physical factory or shop floor is reflected inside the virtual one in real time, connecting manufacturers, organizations, products, and customers seamlessly, be they anywhere in the world. This tech helps manufacturers innovate, create new and better products and experiences, optimize operations and costs, prevent downtime, improve customer satisfaction and plan for the future using simulations.



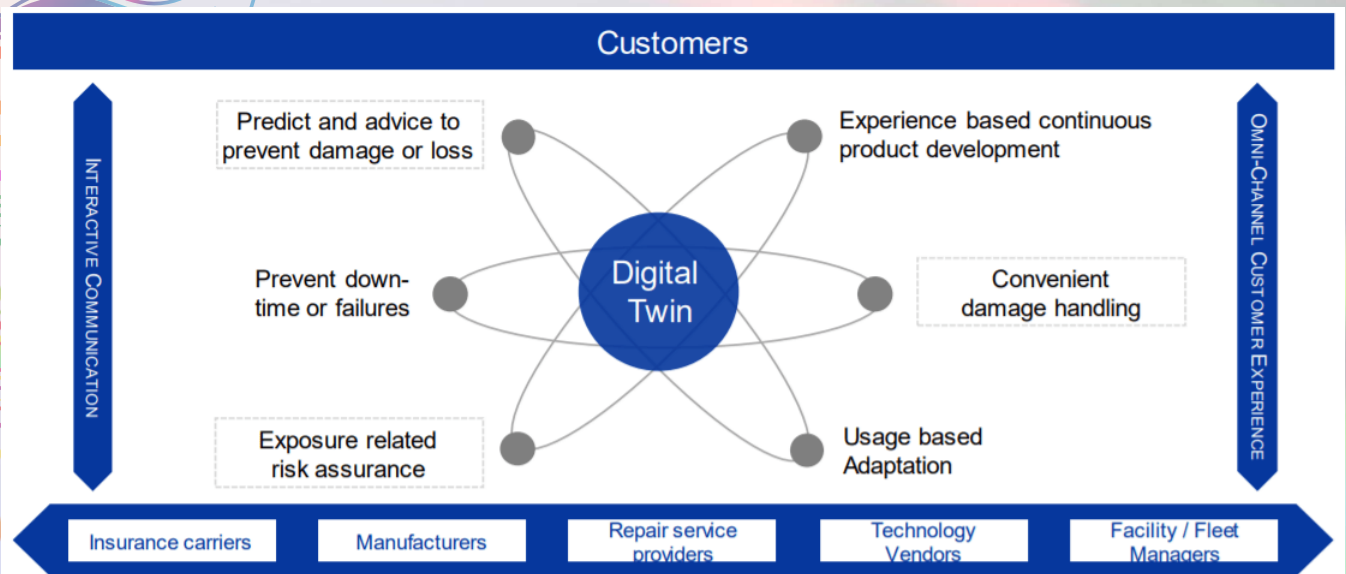
Maggie Mae Armstrong



According to **Maggie Mae Armstrong, Marketing Content Director - AI Applications, Automation, and Sustainability, at IBM**, digital twins assist manufacturers and engineers accomplish a great deal, like:

- * Visualizing products in use, by real users, in real-time
- * Building a digital thread, connecting disparate systems and promoting traceability
- * Refining assumptions with predictive analytics
- * Troubleshooting far-away equipment
- * Managing complexities and linkage within systems-of-systems

She adds that digital twins are helping organizations stay ahead by understanding changing customer preferences, customizations and experiences. This knowledge means businesses can deliver products more rapidly, with higher quality, and at lower costs.



Source: Cognizant



Source: RINA.org



It is claimed that there is no limit to the endless uses that an exact model of real-world things and processes and people can be put to. Besides manufacturing and logistics, there are several other industries that can use this tech. And, digital twins of an automobile, an aeroplane or a spaceship, a building, a bridge, tunnels or household items, railways, ships and stadiums, schools and hospitals and banks, a smart city or a jet engine and those that man them, are all being envisaged. Digital twins can also be used in other complex and potentially dangerous machines, from nuclear reactors to wind turbines, and oil and gas operations. Here are some of the more promising and exciting areas.

Digital Twins, PAIs and Holograms



Source: IQ Magazine



Nikhil Jain
Co-Founder
& CEO, ObEN
and his PAI

At the **Spring Festival Gala, 2019**, aired on **China Central Television**, the four human hosts were joined by an AI copy of themselves – their very own digital twins created by **ObEN**, the artificial intelligence (AI) company that has created **Personal AI (PAI)** technology to revolutionize digital interaction. They were more than computer-generated avatars because they used **machine learning, natural language processing and computer vision** to build virtual copies of the hosts. **ObEN** claims that their **PAIs** are the closest digital approximation of a human being, a 3D intelligent avatar designed to look like us, speak like us, and behave like us in the digital space. They can perform tasks as our representatives and interact with the world on our behalf.



Microsoft
HoloLens



Prime Minister
Shri Narendra Modi



And then there is **'Holoportation™'**, which as per developer **Microsoft** is 'a new type of 3D capture technology that allows high-quality 3D models of people to be reconstructed, compressed and transmitted anywhere in the world in real time... this technology allows users to see, hear, and interact with remote participants in 3D as if they are actually present in the same physical space. Communicating and interacting with remote users becomes as natural as face-to-face communication.'

The fields of **entertainment, healthcare, education, and other personalized products** are open to such tech. Similar tech has been used earlier and can be incredibly

realistic too, as proven by the holograms of famous stars like **Tupac** and **Michael Jackson**, performing at 'live' concerts and even politicians like the Indian **Prime Minister Narendra Modi** addressing 'live' election rallies. In future, **AI-powered teachers and specialists** in other fields can be built to assist in real-life situations making it possible for one person to be present in more than one place at a time. This technology will also enable users to create, use, and manage their own PAI on secure, decentralized platforms opening up interactive vistas galore. The same can be used to provide all kinds of services.



The pandemic made us realize the utility of **online education** and **'digital teachers'**. Though not completely satisfactory, it really did serve some purpose. To build upon the experience during the pandemic and to universalize quality education, many countries are encouraging high-quality e-content that can be disseminated to students anywhere. Even lab work and research can be carried out in simulated environments. India too is setting up a **digital university** 'to provide world-class quality education and personalised learning experiences'. And the many start-ups in the ed-tech sector will be using this tech to further the business of education.



Digital Twins in Marketing and Retail



Source: forbes.com



Jason Deign

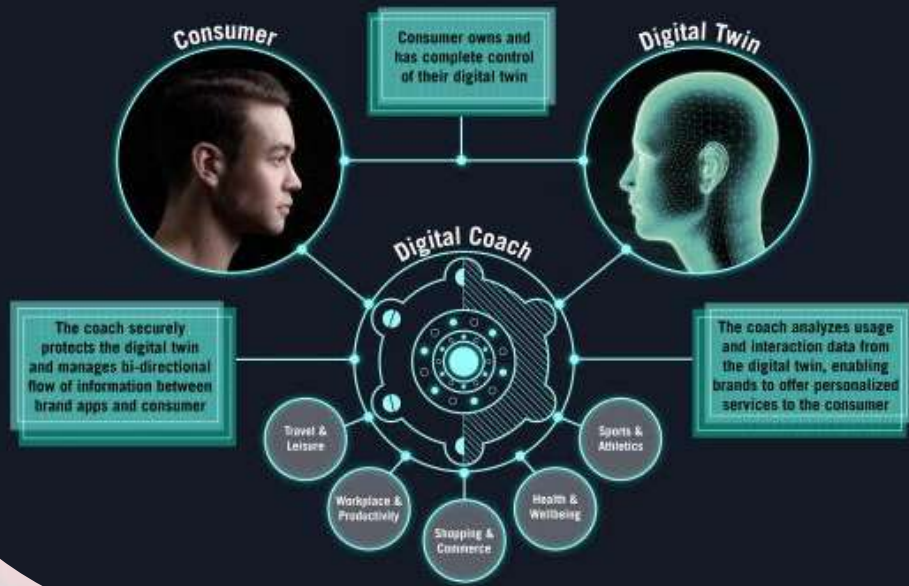


In the retail industry, digital twins are useful both in supply chain management and for enhanced in-store experiences. Retailers create supply chain simulations to maintain optimum inventory levels. They also create in-store digital replicas, by using data captured by RFID readers, motion sensors, and smart shelves, that allow them to analyze customer movement and purchase behavior and test the effectiveness of different store layouts. In addition, it also offers better security implementation and energy management. Also, retailers can provide ideal fashion clothing and other customized products to buyers based on their digital twin models.

Jason Deign, a Barcelona-based business journalist and author, writes in the **Cisco Technology News Site**, 'Digital twins can help marketers by showing what happens to products as they get older, as a result of a range of patterns of use. For instance, a tyre company might know your car needs new tyres because you search for 'new tyres' on the internet. With a digital twin, the brand might be able to predict when your tyres will wear out and send you an offer before you even knew you needed it.'



Enabling the next level of personalization



Eric Cohen

Source: Cambridge Consultants

But digital tech can go much further. **Eric Cohen**, SVP, Consumer Business at **Cambridge Consultants**, writes that today, most apps collecting information to personalize the experience are working in silos, creating partial twins on information that isn't shared. **AppleWatch** collects GPS, vital signs, and knows whether you're walking, running, or sitting. **Amazon** and **Google** know what you buy and what content you consume. When, there is a broader ecosystem that is able to collate information from multiple sources about a person, a more complete twin of that individual is possible. With this centralized and more complete, integrated digital twin, a system can be created that will anticipate all the

person's needs and provide him real-time assistance in all his day-to-day affairs, while at rest, play, exercise, shopping or work, keeping him healthy, safe, and more productive.

He adds, "It would be like having a digital assistant, or digital personal coach, that knows you inside out and can anticipate what's right for you across your entire life. Not only does your personal coach know you better than any app, it serves as the digital guardian of your valuable digital twin. Your personal coach becomes both your digital assistant and digital protector, only granting digital and data access to apps on a 'need-to-know' basis."

Digital Twins in Banking and Insurance



Budget 2022 announced the introduction of the **Digital Rupee** – the Indian Rupee's digital twin. It will be a central bank digital currency (**CBDC**), an electronic record or digital token of the country's official currency.

Also on the anvil is the setting up of **75 digital banks** in 75 districts of India, marking the entry of big-time digitisation and technology in the banking system.

This will boost the introduction of digital twin tech in India's banking system. Many will be its uses. For one, digital twins can be utilized to predict the fate of a project before it is financed by a bank. Whole scenarios of how the customer will respond can be envisioned and banks can analyse the conditions well in advance before investing in risky projects. Different market conditions on future projects can be simulated so that funds are utilized in an optimum manner. Risk factors while lending to potential clients can be predicted.





Görkem Gençer

Similarly, digital twins have the potential of transforming the **insurance sector**. As claimed by **Görkem Gençer**, an industry analyst at **AIMultiple**, digital twin tech offers improvements in core insurance practices such as **underwriting, claims processing and fraud detection**. Moreover, digital twins' combination with the Internet of Things (IoT) can change the insurance sector as they can prevent damages before they occur by providing 'a virtual platform for insurance companies where any risk scenario can be predicted and evaluated'.

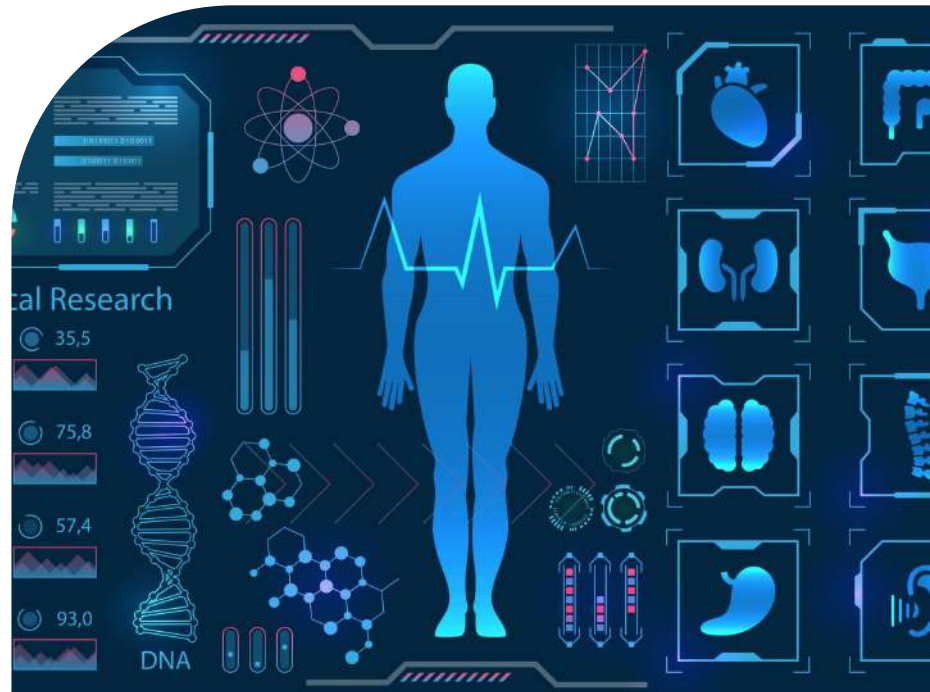


Digital Twins in Healthcare



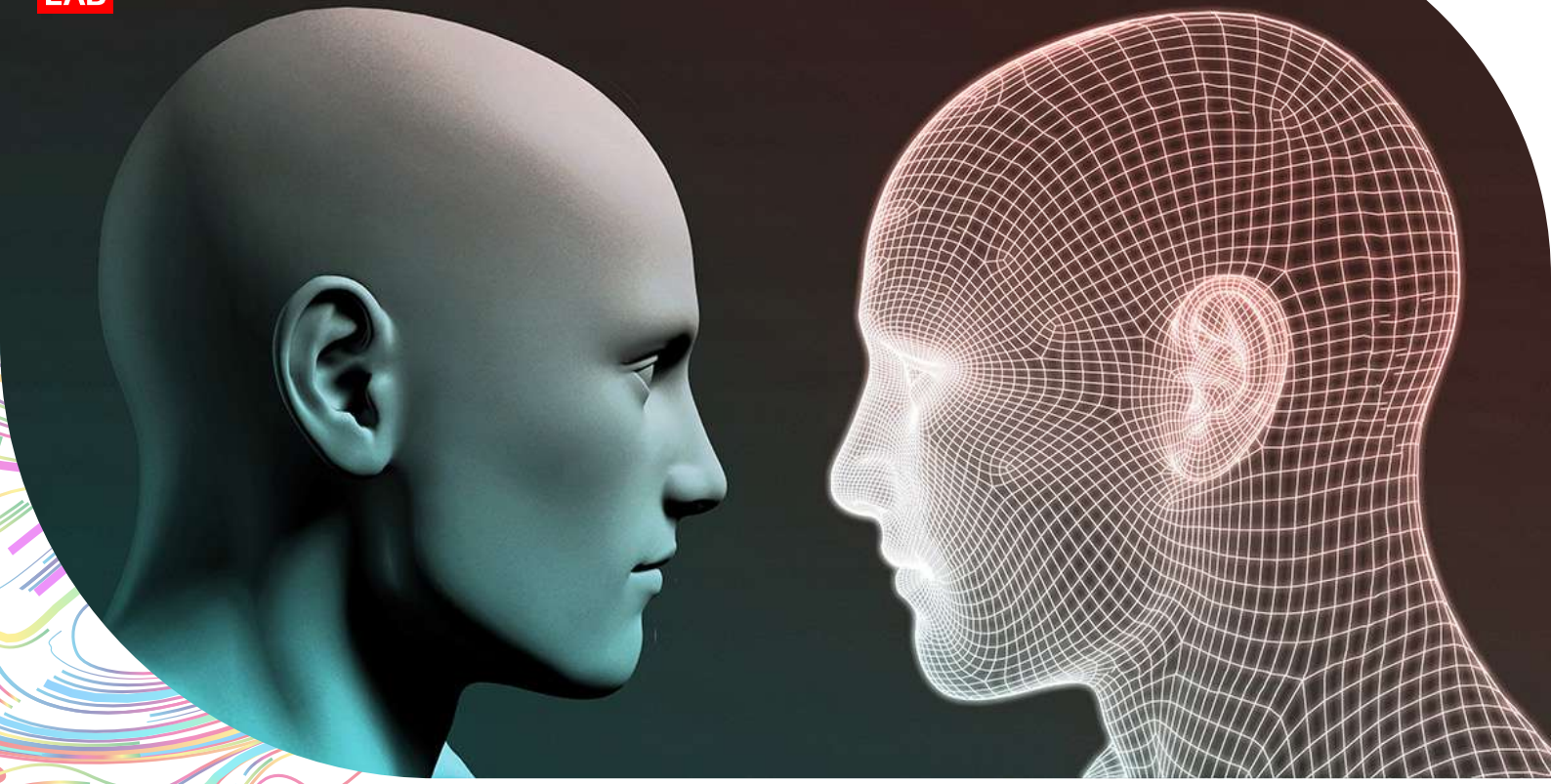
Perhaps, because of the **Covid-19** pandemic situation, the use of digital twin tech has evoked the most intense interest in healthcare. But healthcare industry has been using digital twin tech in product and equipment design and manufacture, and diagnostics and treatment, even much earlier.

Source: Dassault Systems



Source: KOHb/Getty

Dassault has introduced **“The Living Heart”** (2015) which is a 3D digital twin of a heart. A surgeon can use the digital twin for a digital visualization of the heart, before operating it and practice procedures in a simulated environment rather than on a real patient. Researchers hope the first-of-its-kind process will increase industry innovation and pave the way forward for patients to access safe, effective new treatments for heart disease, the leading cause of death in the world.



Source: thenetwork.cisco.com

And, surgeons at **Auckland Bioengineering Institute (ABI)** have built a **digital lung** that operates like a flesh-and-blood one. With its assistance, they can apply different kinds of treatment including radiation to the virtual twin lung, and then determine the most likely outcomes on the real lung.

The pharmaceutical giant **GSK**, much before the COVID-19 pandemic had teamed up with **Atos** and **Siemens**, two of the world's leading expert companies in digital transformation and technology, to create a digital twin for vaccine development and

manufacturing. It created a complete and real-time simulation of the entire vaccine manufacturing process.

Twin Health, headquartered in California, USA, and Chennai, India, invented the **Whole Body Digital Twin™** to reverse and prevent chronic metabolic diseases, improve energy and physical health, and extend lifespan.



A "digital twin" will ideally be an exact replica of a complete human body that displays all physiological and pathological outcomes in the present and future, all mapped out in a highly detailed visual. And once the tech enabling the visualization of a complete virtual patient is freely

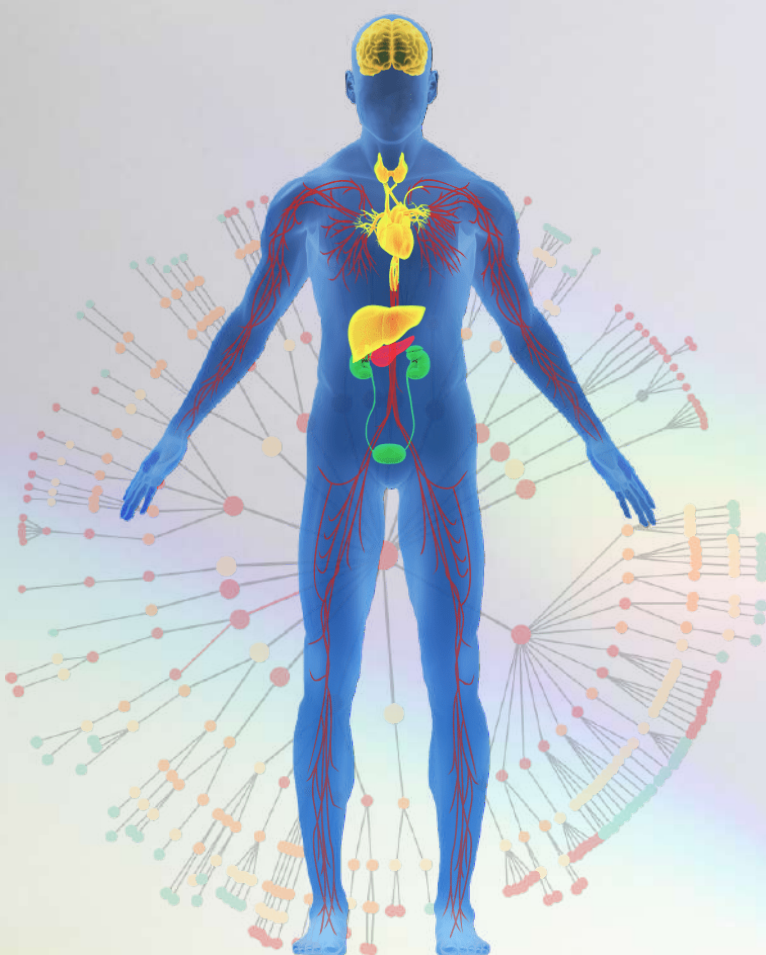


available, detailed analysis of the health of an individual patient is possible, thereby improving the quality of health services delivered to patients.

Also, the complete physical environment of a hospital can be digitally twinned, problems foreseen and addressed remotely. As indicated by a **Challenge Advisory** report, implementation of digital twins in hospitals offers numerous benefits. The “Digital Twin” concept can be applied to enable electronic medical records, personalised treatments, enable collaborative data to be researched, and determine successful treatment and diagnostics by running treatment simulations without harming the patients. The ultimate goal is to use various current

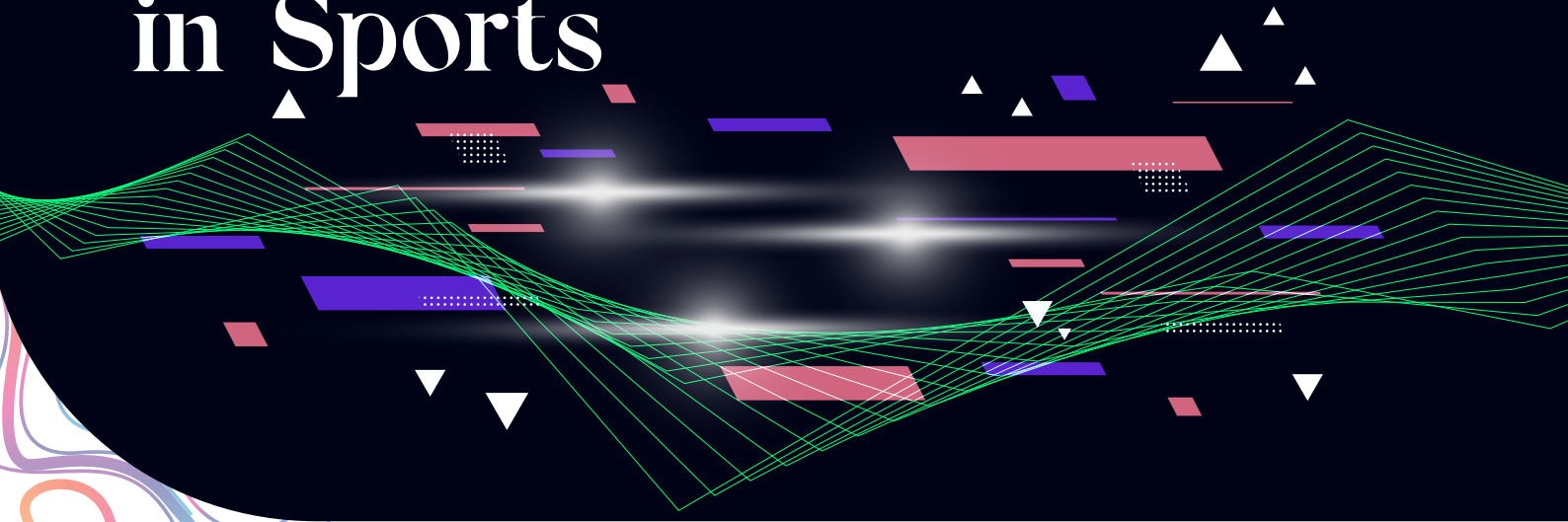
AI concepts in synchronisation to aid development of a fully functioning Digital Twin.

Telemedicine is being used to fight the pandemic. Digital twins of doctors and nurses can be used to provide remote cure to patients. A patient's digital twin can access care from anywhere. This can give more choice to the patient, an expert second opinion, freeing him from the limitations imposed by localized general healthcare and also giving doctors access to more individualized health data from which to make informed decisions.



In India too, an open platform for the **National Digital Health Ecosystem** is being rolled out. It will consist of digital registries of health providers and health facilities, unique health identity and consent framework for universal access to health facilities, marking our entry into digital healthcare. This will go a long way in introducing digital twin healthcare in the future.

Digital Twins in Sports



Not only will this tech revolutionize healthcare, it can also lead to deep insights into the working of the human body contributing to better performance from athletes and sportsmen. Imagine the kind of information digital twin technology can yield on the various physical and mental attributes and parameters of players in stressful situations. This information can support researchers and trainers guide their wards more efficiently. It can also assist in rehabilitation of injured players.

Source: Frasen Systems



The **NFL** and **Amazon Web Services** have created a “**digital athlete**” that will run infinite scenarios to better understand and treat football injuries. The underlying goal is to “predict the risk of player injuries” to make way for prevention. **Joe Lemire**, a senior writer of **SportTechie**, elucidates that the Digital Athlete is a computer simulation model of an actual player that can be analyzed in virtual game situations. Already, position specific helmets have been designed to prevent injuries. The ultimate goal is towards true personalization: recommendations of gear and helmets to each individual athlete based on game play, venue, and weather.



Joe Lemire

Japanese telecoms giant **NTT** has created a “digital twin” of the **Tour de France** to give operations staff real-time visibility of race data to ensure the continuity and safety of the cycle race and also to provide insightful visualisations and immersive fan experiences.

With realistic avatars of players available, this tech can lead to a much more immersive spectator involvement during matches enhancing the sports spectacle. Perhaps, players’ thoughts and personal reactions to evolving situations can be accessed, giving the spectator exciting experiences and insights, never available before. Digital twin tech can also be associated with the designing of sports infrastructure for better experiences. All this can yield larger profits and enhance the billion dollar investments in teams.

Digital Twins in Urban Planning



Source: Haltian.com

Digital twins have been put to use by the **architecture, engineering and construction** businesses. With more urban systems and buildings becoming connected or “**smart**”, more data is being collected, giving constant, accurate feedback on all aspects of urban living. **Smart city** projects have used digital twin tech to capture and display real-time 3D and 4D spatial data in order to model ‘**holo**’ cities and buildings and the data feeds within them. Augmented reality (AR) systems are being used for designing and planning the cityscapes and even managing traffic.

For instance, ‘**Virtual Singapore**’, a part of the Singapore government’s **Smart Nation Singapore** initiative, is the world’s first digital twin of an existing city-state, providing Singaporeans a real-time model of what’s happening in the physical city. The digital twin will make it possible to simulate and analyze data from its real-world counterpart, offering the opportunity to increase efficiency and improve operations in the smart city.

Digital twins of **Wellington City, Shanghai, London, Belfast and several other cities** are being built with the purpose of showcasing the multitude of real-time activity and studying the urban environment by simulating unanticipated scenarios.



The concept of the digital twin is also beneficial for use in individual building projects. It presents the physical space as a virtual model, allowing user input and uses real-time data to better the design and plan of the project. Digital twins of buildings and skyscrapers use **BIM (Building Information Modelling)** in real-time to update data.

Construction and transport activities within urban areas are a significant contributor to global warming. As indicated by a report of the **International Energy Agency**, cities generate around 70% of global carbon dioxide (CO₂) emissions. As societies recover from the Covid-19 pandemic, CO₂ rates are rebounding

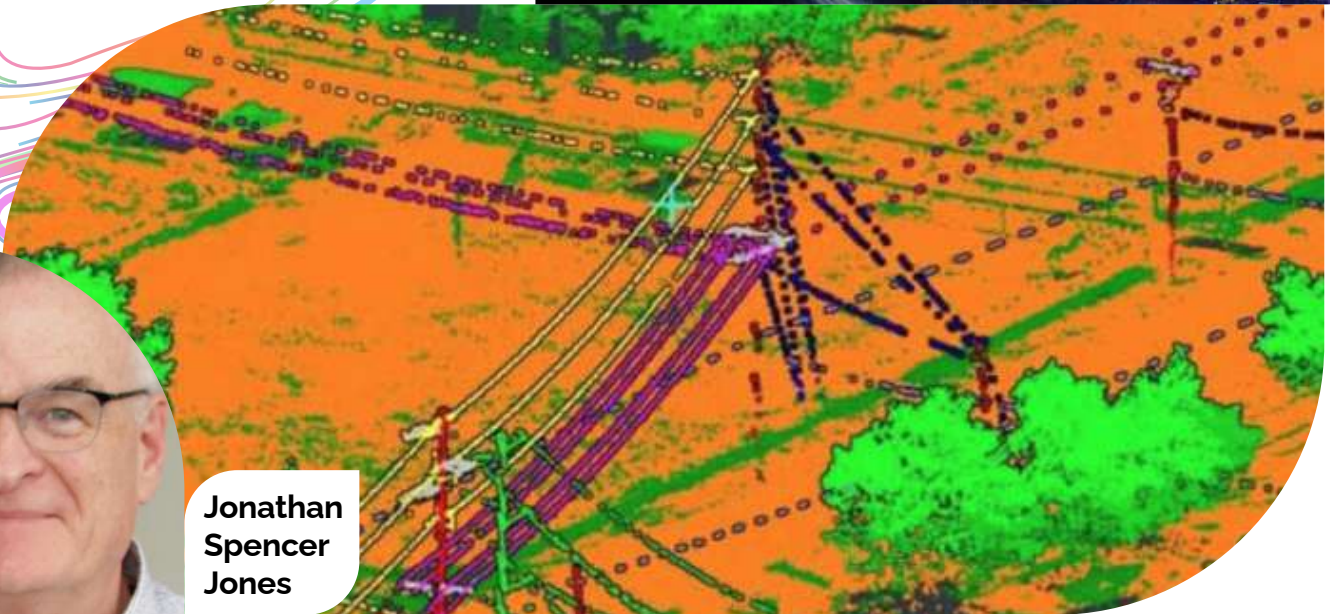


Michael Jansen



rapidly. The increase in global energy-related CO₂ in 2021 is expected to be the second-largest in recorded history. This will adversely impact environment worldwide. **Michael Jansen, Chairman and Chief Executive Officer, Cityzenith**, says that cities across the USA, including **Miami, Los Angeles, New York and San Diego**, are all predicted to be at least partially – if not entirely – underwater by 2050. At current rates, **North Jakarta** is expected to be 95% underwater by 2050, while approximately 43 million to 57 million people in **China** currently live on land that will be underwater by the end of the 21st century. Studies indicate that with the aid of digital twin tech in the planning and administration of our cities, the carbon footprint can be

lowered significantly and the transition towards renewable energy for net-zero emissions expedited. And terrible scenarios as a result of global warming prevented. An Indian digital twin startup, **Pratiti Technologies**, provides data analytics systems for solar energy assets.



**Jonathan
Spencer
Jones**

Source: Sharper Shape

A report in **Smart Energy International** by **Jonathan Spencer Jones**, a writer and analyst, states that the '**Living Digital Twin**' for powerlines has been introduced by **Silicon Valley** headquartered asset management solution provider **Sharper Shape**. The '**Living Digital Twin**' introduces **time as the fourth dimension** to the traditional **3D digital twin model** to provide a model which

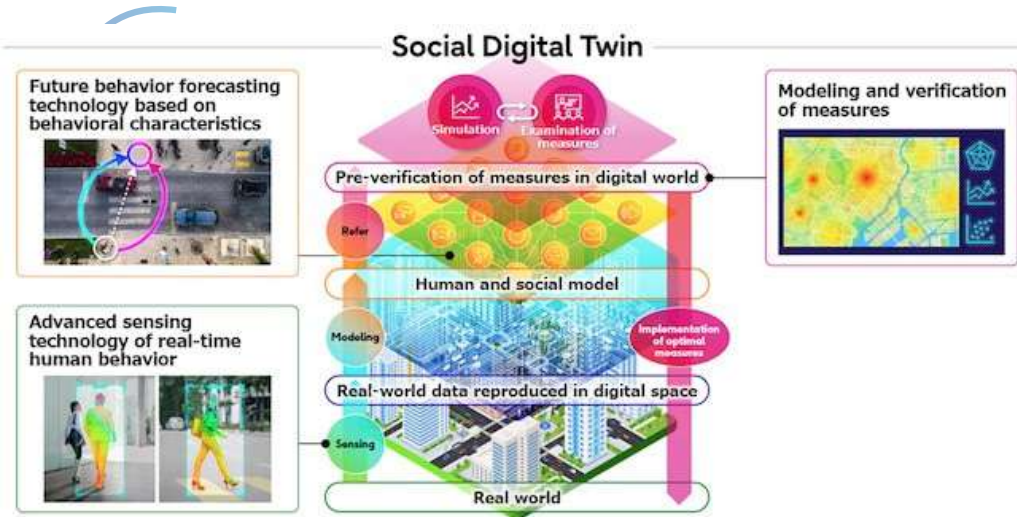
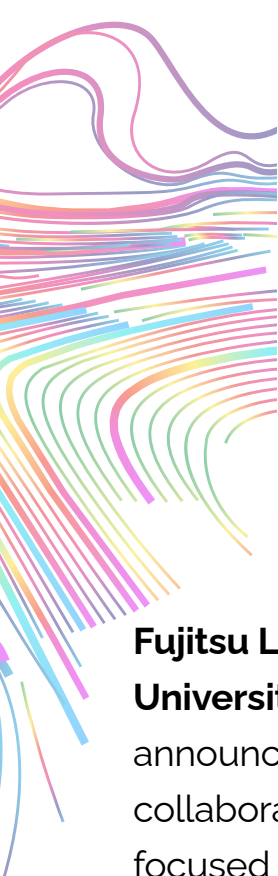
is continuously updated. **Sharper Shape's CORE Living Digital Twin** integrates aerial and ground data on powerline assets with third party data from sources such as weather satellites into a single artificial intelligence and machine learning-driven software platform that continuously updates the model as the surrounding environment and the asset itself changes.



Vu.City's model of London Source: smartcitiesworld

Vu.City's map of Belfast Source: smartcitiesworld

Others are deploying the technology at an even larger scale, to create digital twins of entire countries. The **National Digital Twin programme (NDTP)** of **Britain** visualizes the setting up a complete ecosystem of connected digital twins to foster better outcomes in the infrastructure and construction sectors resulting in benefits to society, economy, business and environment.



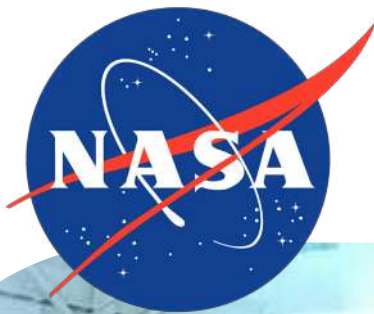
Source - Fujitsu

Fujitsu Limited and **Carnegie Mellon University** researchers have announced the launch of collaborative research projects focused on the development of **“Social Digital Twin”** technology. A Social Digital Twin digitally reproduces the relationships and connections between people, goods, the economy and society to offer a simulation, prediction and decision

making environment in which to solve diverse and complex social issues in global communities. The researchers anticipate that the Social Digital Twin technology will play an active role in improving efforts to ease congestion, positively influence travel behavior and ultimately help to realize more sustainable and safe cities in the future.

Digital Twins in Automotive and Transportation Industries

NASA was one of the earliest to use pairing technology in the 70s, the precursor to digital twin technology, to solve the issue of operating, maintaining and repairing systems when they were far away in space. This was precisely how engineers and astronauts on Earth determined how to rescue the **Apollo 13 mission**. Today, digital twins are used at NASA to explore next-generation vehicles and spacecrafts.



A digital twin of an aircraft designed by Siemens. Source: Siemens.

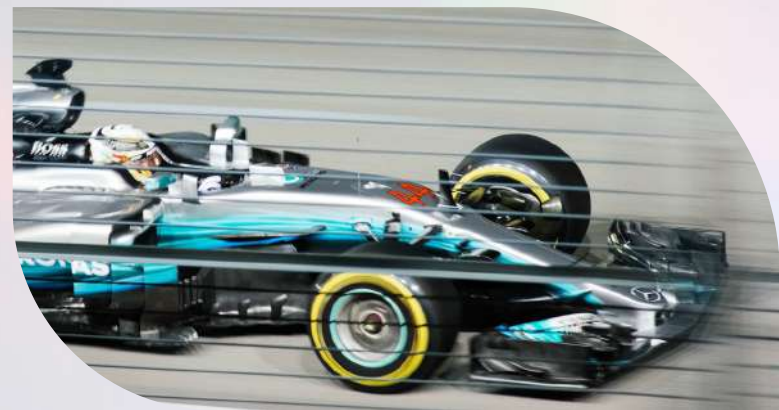


Porsche Taycan 'digital twin' for maintenance and service. Source: Porsche



An image from the digital twin of BMW's factory in Regensburg, Bavaria, created in NVIDIA's Omniverse. Source: BMW

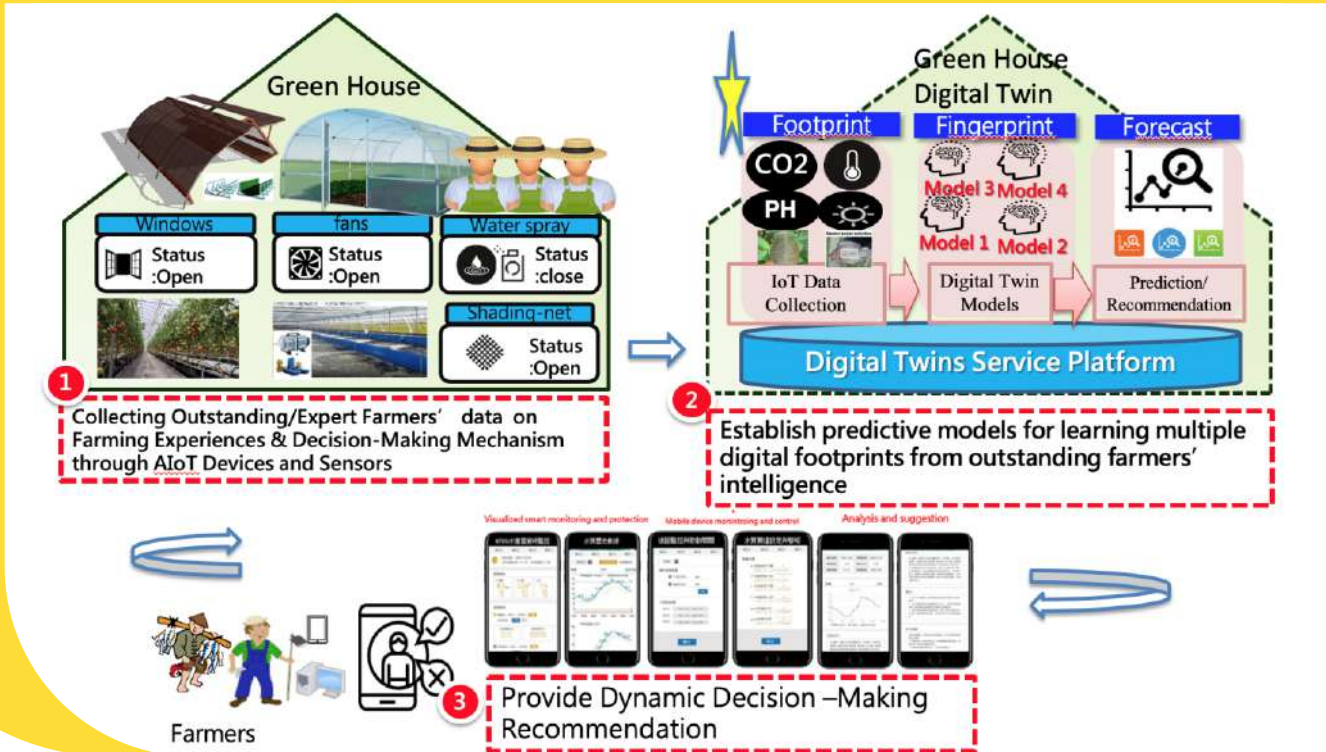
From those early days, **automotive and transportation industries** have been beneficiaries of digital twin technology. Automotive engineers use digital twin technology in order to analyze an engine's maneuverability and safety. Now engines can be stress tested in all kinds of simulated environments, with various variables introduced without actually taking the car, the ship or the aeroplane on to the road, in the waters or the skies respectively. And, their safety can be investigated using this tech in various situations without destroying actual models. Data about the performance can be assessed, and, if needed, adjustments made, creating a better version of the product by reprogramming the digital twin when needed.



A remarkable example of the digital twin tech is of **Mercedes** and their success in consistently winning races in **Formula One**. They have developed a digital twin for simulating how their race cars perform under various conditions, analyzing everything from weather conditions to unique characteristics for each circuit on the F1 calendar. The drivers are made to feel that they're driving the race car for real and this leads them to victory.

And **Hero Moto Corp** is the first automobile company in India to start a project on Digital Twin tech in 2016 to transform conventional manufacturing approach into a digitally enabled one.

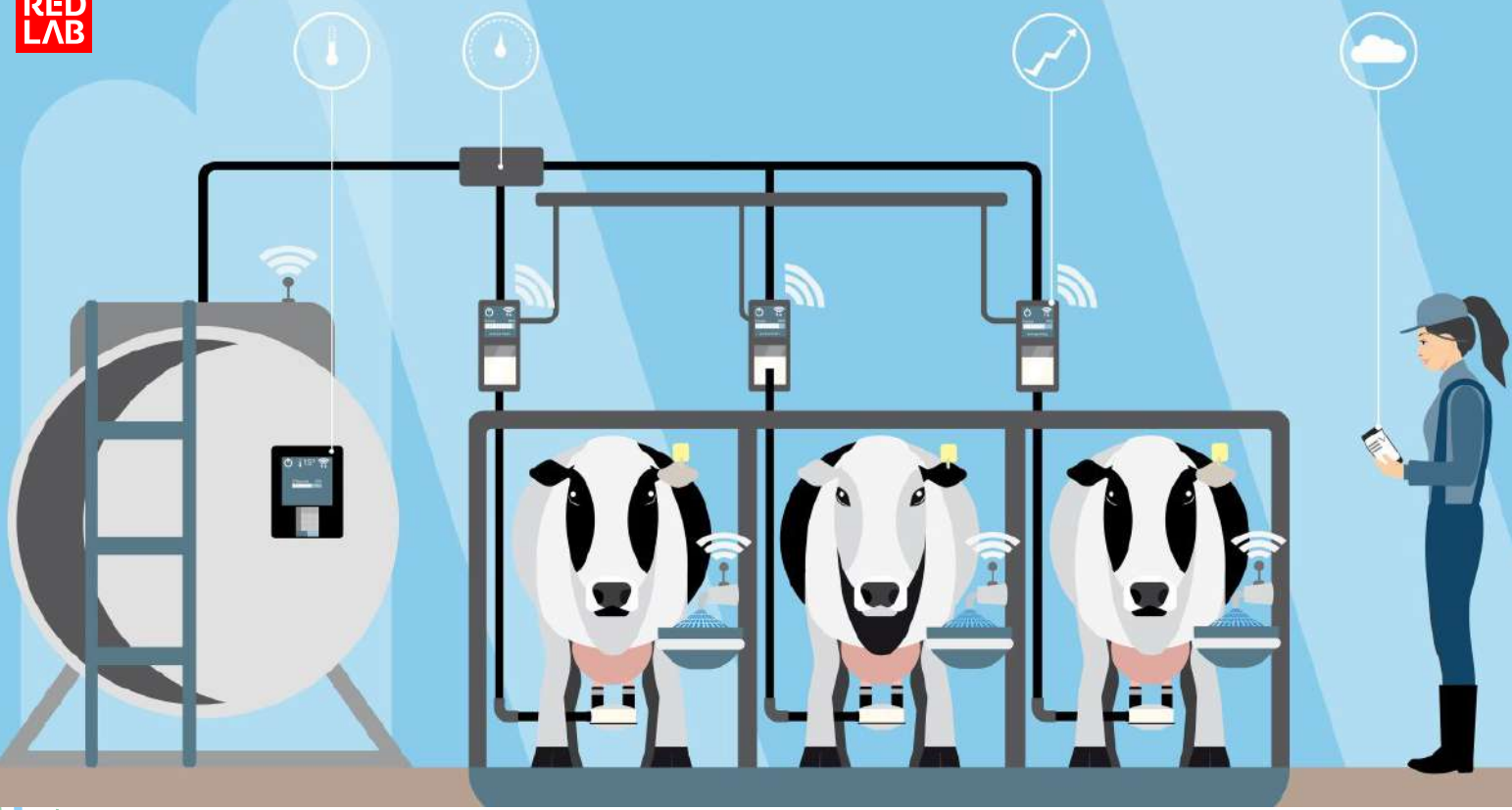
Digital Twins in Smart Farming



Source: rdworldonline.com

Smart farming is one of the several thrust areas for digital twin tech. In a research paper, the **Information Technology Group, Wageningen University and Research, the Netherlands**, looks at digital twin tech as a central means for farm management. Farmers can manage operations remotely based on (near) real-time digital information instead of having to rely on direct observation and manual tasks on-site. This allows them to act immediately in case of deviations and to simulate effects of interventions based on real-life data. Digital Twin farming can lend a hand in arable farming, dairy farming, greenhouse horticulture, organic vegetable farming and livestock farming.





Source:connecterra.io

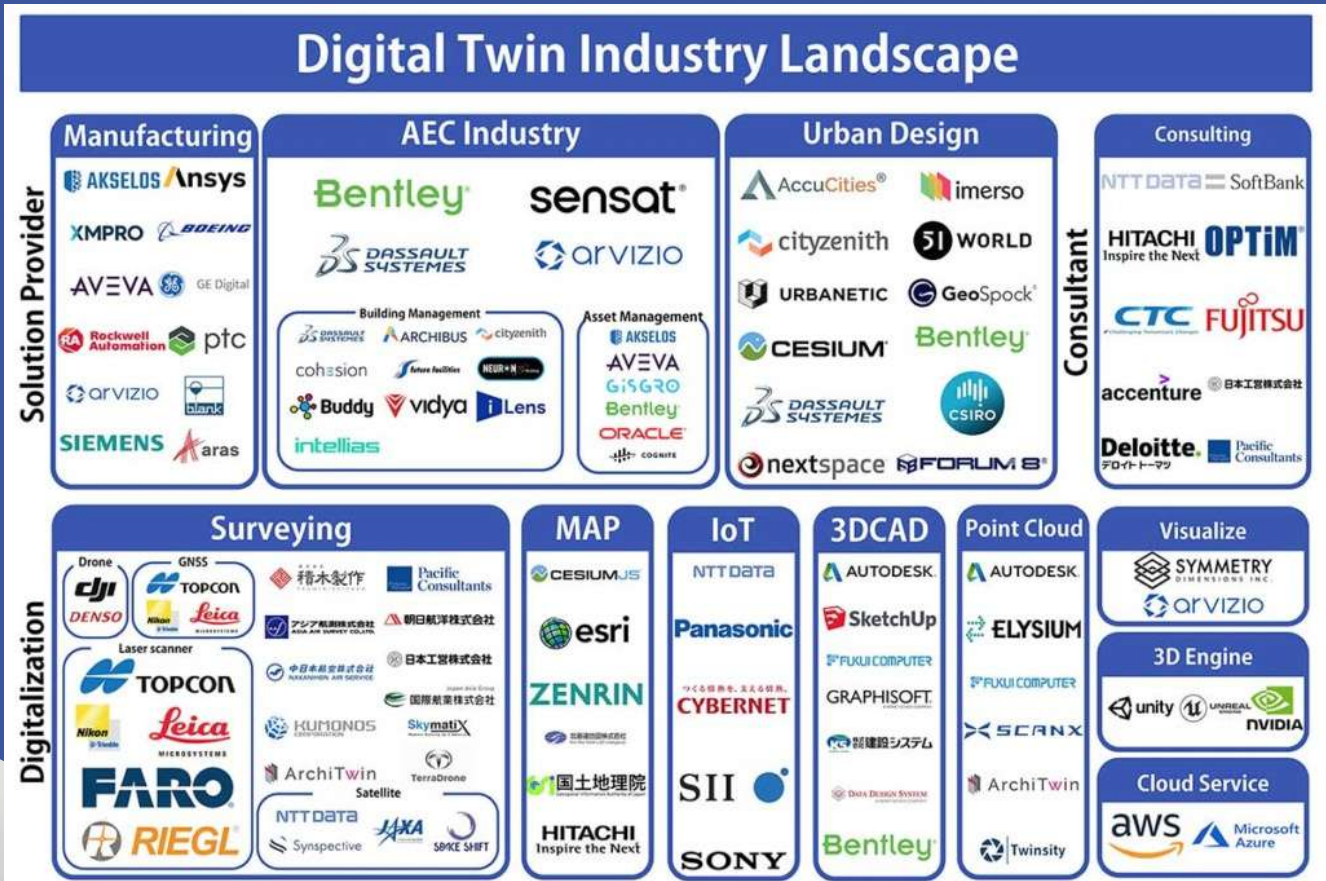
Dutch firm **Connecterra** has created digital twins of dairy cows. A dairy monitor placed on cattle detects heat and health analysis and enables visualisation of dairy production differences for that day and enables them to create a plan to correct dairy flow.

Even in India, '**Kisan drones**' are being promoted for crop assessment, digitisation of land records, spraying of insecticides, nutrients, etc.



Source:specdrones.us

Digital Twins: Industry Opportunity



Source: AccuCities

Many are the industries riding this digital twinning wave as it brings in unlimited possibilities for hundreds of companies in diverse spheres. There are immense possibilities in fields of artificial intelligence (AI), the Internet of Things (IoT), data analytics, Industry 4.0 and related segments. The above diagram illustrates a few of the companies involved in this new, emerging landscape.

To drive consistency in vocabulary, architecture, security and



interoperability and advance the use of digital twin technology across industries, the **Object Management Group (OMG)** with founders **Ansys**, **Dell Technologies**, **Lendlease** and **Microsoft**, has formed the **Digital Twin Consortium**. This open membership organization collaborates across multiple industries so that they learn from each other and develop and apply best practices.



Digital Twins: The Telecom Opportunity



While Digital Twin tech can improve operational efficiencies and provide benefits in planning, design and deployment for telecommunications operators themselves, all industries will require faster networks which can connect tens or hundreds of billions of sensors coupled with advances in digitisation and automation.

All this opens up special opportunities for telecom players. As data needs to be moved from one location to another **quickly, securely and reliably** enterprises are gearing up for the implementation of fifth-generation (**5G**) communications that have far more features than fourth-generation (**4G**) communications. At peak speeds, 5G at 10 Gbps is 10 times faster than 4G at 1Gbps.

But between 2027 and 2030, the sixth-generation (**6G**) system, with a top speed of 1Tbps, 100 times 5G, with the full support of artificial intelligence, is expected to be implemented. This will enable three-dimensional networking, cell free communications, and holographic transportation among many other technologies.



Source: Microwaves & RF



Tailor Insight



According to a white paper in **GlobalNewswire**, on “**6G: Overall Vision and Potential Key Technologies**” by **Tailor Insight**, a fintech market research organization, 6G will facilitate “the beautiful vision of intelligent connection of everything, digital twin.” The report says that if 5G is opening the door to the interconnection of all things, 6G will enable the intelligent connection of all things.

The **STL Partners'** report, **The Coordination Age: A third age of telecoms** asserts that telecom operators will need to move beyond providing just core communications services. If they don't choose this path, they are likely to be left fighting for a share of an increasingly small 'telecoms pie'. The report states that successful telecoms operator in the **Coordination Age** will have to gear up for the changing times to remain relevant. Only then can they help governments, enterprises and consumers to collaborate in such a way that precious resources – **labour, knowledge, energy, power, products, housing, and so forth** – are managed and allocated more efficiently and effectively than ever before.



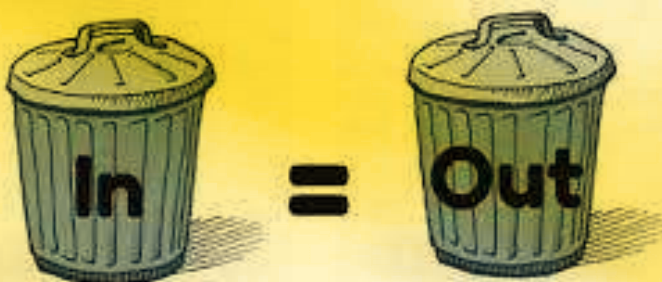
Digital Twins: Drawbacks and Pitfalls

Digital Twin tech has emerged as a market differentiator. The possibilities of what can be done are immense. But, it must be recognized that digital twin implementation requires an extraordinary investment of time, capital, computing and engineering. Not all companies will find this profitable and each will have to chart its own careful way forward. Rushing in, using half baked data, can lead to catastrophic consequences for the company as well as for its customers.

It is axiomatic that insights that the digital twin provides are completely dependent on the data generated. The concept, **Garbage in, Garbage out (GIGO)** or the alternate **Rubbish in, Rubbish out (RIRO)**, for the idea that flawed or defective input data produces nonsense output from the early days of computing applies even more today. Then, there are difficulties with sharing and

processing of data between disparate systems. And, there will always be concerns about internet connectivity and security. But all these can be overcome by high-tech.

What will perhaps remain a lasting concern is the much more intrusive nature of this tech, especially where human beings interact with machines and the data generated lands in manipulative and exploitative hands. Even now, there are grave concerns on how **Big Tech** is handling issues of personal privacy, safety and cyber security with accusations of data misuse and stealth common. Then there are legitimate human rights concerns coupled with social media generated problems like cyber bullying, abuse, disinformation and social polarization. Many a time this is leading to depression and anxiety and lower self-esteem. Digital twins, with terabytes of integrated data on all participants in the operational chain, will make these sensitive issues all the more severe and acute, and accentuate problems.

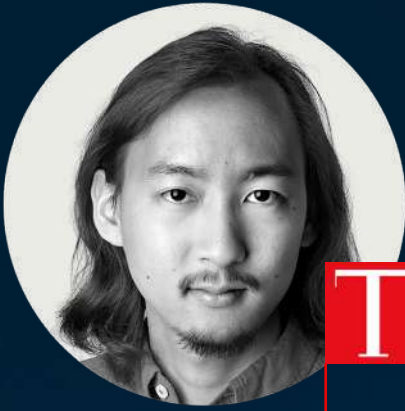


Digital Twins: the Future

Many continue to question the tech's business impact and consider it just a buzzword that has created a lot of hype. Here, a look at the idea of a **"hype cycle"** coined by **Gartner** will be quite fascinating. The idea details that initially, a potentially new technology breakthrough kicks in an **"innovation trigger"** that causes it to reach a **"peak of inflated expectations"** with a number of success stories — often accompanied by scores of failures. Then, interest wanes and it drops to a

"trough of disillusionment". Finally, through the **"slope of enlightenment"**, it reaches a **"plateau of productivity"** where mainstream adoption starts to take off. At what stage of the **"hype cycle"** are we with digital twin tech can be debated.

Gartner



TIME

Andrew R. Chow

Andrew R. Chow, a reporter for **Time Magazine**, wrote in December 2021, "But digital twins are now proving invaluable across multiple industries, especially those that involve costly or scarce physical objects. ... And this year, digital twins began to break into the mainstream of manufacturing and research..."



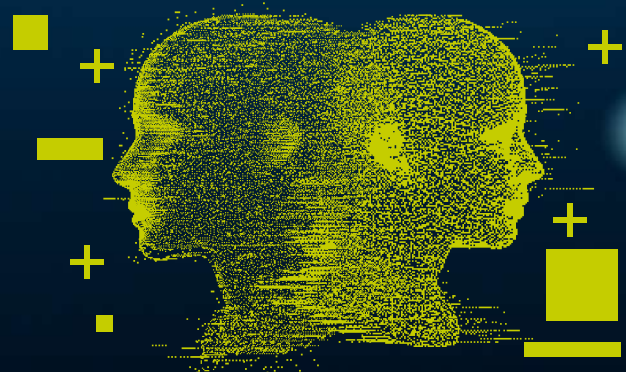
Bernard Marr

Bernard Marr, a world-renowned futurist, influencer and thought leader in the fields of business and technology, points out that there will be billions of things represented by digital twins within the next five years. These proxies of the physical world will lead to new collaboration opportunities among physical world

product experts and data scientists whose jobs are to understand what data tells us about operations.

Now, various businesses and activities are being disrupted by the digital twin technology **as it emerges as an indispensable tool for Digital Transformation**. According to **Gartner**, 13% of organizations implementing **Internet of Things (IoT)** projects presently use digital twins, while 62% are either in the process of establishing digital twin use or plan to do so. The digital twin market is estimated to grow from \$3.8 billion in 2019 to \$35.8 billion by 2025, at a CAGR of 37.8%, as per the latest report from **MarketsandMarkets**. And, the latest analysis by **Emergen Research** expects the global digital twin market to reach \$106.26 billion by 2028 at a CAGR of 54.7%.

So, it seems that the digital twin tech is emerging out of the **"trough of disillusionment"** and is well on its way to the **"plateau of productivity"!**



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