Digital Twins:

a strategic enabler for sustainability

ADDNODE GROUP

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01. Introduction to Digital Twins

Digital Twins are gaining recognition and popularity as a solution for digitally representing a product, building or even a human being. This is enabling new opportunities to improve performance, operations, productivity, or quality of life.

A Digital Twin strategy to drive sustainability programs can be profoundly effective. Digital Twins offer significant benefits when planning, implementing, and realizing:

• Reduced energy consumption
• Reduced material consumption and the switch to more sustainable materials
• Workforce activity optimization – travel, server usage, etc.
• Automation and robotization of hazardous and/or repetitive tasks to improve working conditions and health

Furthermore, Digital Twins provide several advantages in the recycling of a product based on a comprehensive and digital description, allowing for strong traceability and the efficient and controlled dismantling and recycling of material.

In the late 1980s, the concept of a Digital Twin was created as a tool to aid design in the aerospace and automotive industries. With examples such as smart cities, it was later applied in various industrial areas and is today a key facilitator for driving innovation and services in the public sector. In the coming years, digital twin use is likely to skyrocket. Markets and Markets estimates that the market will increase from 3.1 billion dollars in 2020 to 48.2 billion dollars in 2026, according to their research.

We're very proud of how Addnode Group companies guide our customers to leverage digital twin technology to impact sustainability and ultimately create a better society.

**Addnode Group CEO,
Johan Andersson**

As seen below, the Gartner Group's definition of a Digital Twin emphasizes the relevance of this technology and processes.

"A digital twin is a digital representation of a real-world entity or system. The implementation of a digital twin is an encapsulated software object or model that mirrors a unique physical object, process, organization, person, or other abstraction. Data from multiple digital twins can be aggregated for a composite view across a number of real-world entities, such as a power plant or a city, and their related processes."

Addnode Group defines a Digital Twin as follows:

A digital representation of an asset, system, product or creature realized through a system with an objective to simplify management of its lifecycle and operation. Digital twins can be connected and added to each other to manage highly complex scenarios. The digital twin representation can be augmented with additional technologies such as simulation, optimization, and machine learning to realize additional benefits.

Addnode Group Digital Twin Solution Domains

Addnode Group has extensive experience developing digital twin strategies for public, infrastructural, and industrial environments.

The capacity to convert the aforementioned approach into a digital and user-friendly solution is well-developed, as evidenced by the following real-life examples from **Addnode Group companies:**

In the six solution domains that follow, we'll present the reasoning for, and examples of Digital Twin strategies and solutions.

1. Circular Services and Optimized Logistics
2. Construction and Facility Management
3. Smart cities & Infrastructure
4. Industrial and Research Facilities
5. Industrial Solutions
6. Healthcare and Medical Devices

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TRIBIA
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1. Circular and Optimized Logistics

DECERNO
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Many organizations struggle with planning and organizing complicated logistical situations where hundreds of people must do thousands of jobs in specified locations and at specific times. In many sectors, establishing a digital twin of the flow and then utilizing computer power to identify the best scheme has shown to be successful. Employees spend less time on the road, vehicles wear out faster, and fuel is saved!

Technology for improving transportation has existed for decades, but the significant benefits of this sort of digital twin are only realized when the transportation demands are connected to the company's other operations, customers, and the outside world.

We can simulate, test, and build alternative circular business models in a fast and cost-effective manner using the digital twin.

This leads to, among other things:

- Faster time to market
- More efficient business development
- Better basis for decision-making in business development
- Satisfied employees
- Streamlining of production

Case: Rentokil and Service +
For Rentokil and its 7000 field specialists, Decerno created a digital twin and planning solution. The twin supports digital models of the production chain and planning. Decerno is an Addnode business that specialises in creating customised and one-of-a-kind digital solutions for high-end clients.

NEED:
A smart digital assistant to staff that helps planning the workdays for the field workers.

SOLUTION:
Operations, production, and business metrics and agreements are represented by a digital twin. The twin is used to plan the daily activities of 7000 thousand field workers.
Starting with automated route optimization, which, once implemented, saved fuel and reduced vehicle fleet wear and tear. Rentokil also required KPIs for technicians, customer metrics, average service times, and contract SLAs.

RESULT:
- Reduced fuel consumption for vehicle fleet with 32%
- Reduced maintenance cost with 21%
- Production increase with 34% (less time in traffic)

Learn more about Rentokil

2. Construction and Facility Management

The technology, based on creating digital clones of real objects or systems, is already a revolution within health care, manufacturing, and logistics. Experts anticipate that digital twins will transform how cities and structures are planned and maintained in the future, and they are already having an influence on architecture and city planning.

The ability to create a digital representation of a building, city district or an infrastructure network is powerful in many ways. Well informed decisions can be made throughout the whole lifecycle of an object with a digital twin. Examples of where the digital twin can be used within construction and facility management are:

• Simulation and optimisation of the original design before construction.
• Efficient and quality assured aggregation of data for production and construction purposes.
• Input to an efficient maintenance during the whole lifecycle.

Case: ØKERN PORTAL – SYMETRI & TRIBIA in partnerhip with Tyréns AB

Symetri and Tribia are market leaders in the Nordic countries regarding BIM Design and Information Tools as well as Collaboration and Communication solutions for information driven building projects.

NEED: Økern Portal had set the target of creating a project where it is possible to create value form the accessible object and asset information before, during and after the visit. It was also important to ensure a sustainability focus with for balance in everyday life and carbon footprint analysis. The trend toward smart buildings is on the rise, as are expectations for long-term building sustainability. A digital twin approach is well suited to these developments, and the real estate sector is beginning to recognise this. The establishment of new consumer services and business models is also possible with digital twins.

SOLUTION: The architectural design model is the foundation of the Økern Portal digital twin. Architects created the digital model of the buildings using Naviate software from Symetri together with Autodesk software. With the Symetri solutions the project was prepared for maintanence already at the early stages of the project. Tribia solutions Interaxo and Bimeye contribute to secure the structure of all data needed for creating a digital twin.

RESULT: With a digital twin the Økern Portal project will resulted in a smart, future proof building complex. By for example optimizing cooling and heating as well as using predictive maintenance the building owners will be able to achieve an optimal level of sustainability and profitability.

Learn more about ØKERN PORTAL

3. Smart Cities and Infrastructure

S-GROUP SOLUTIONS
ADDNODE GROUP

We live in a world that is becoming increasingly complicated, with environmental and social issues to contend with. Community planning becomes more complicated, and new goals, such as Agenda 2030, must be considered.

The ability to explore in a digital environment becomes easier as a result. You can examine how the environment is impacted by modelling changes. Construction, rainfall modelling, security, traffic planning, trash management, integration, and accessibility are just a few examples. With a data-driven shared view of the issue, it will be possible to make better decisions faster and respond to them in the most effective way possible.

Case 1: Karlskrona Municipality – S-GROUP Solutions

S-GROUP Solutions are the leading company for GIS-based solutions for the digital building process in Sweden. Based on a world leading GIS-platform, ArcGIS, and their own developed COTS-system, GEOSECMA for ArcGIS they provide a platform for data driven digital twins.

NEED: To be able to explore a major change in a city in advance creates the possibility to take wiser and more sustainable decisions. Today, it is both costly and time-consuming to produce an overall picture of the city. With a digital real-time twin, the municipality has constantly updated and available data in a geographical interface that provides an excellent overall picture. It will be easier to understand how changes in the city's sub-areas affect the

whole. In addition, the result is cost savings in the community planning process and an increased possibility to engage the entire society in the development of their municipality.

SOLUTION: More than half of Sweden's municipalities rely on the company's solution, GEOSECMA for ArcGIS. The system is based on ArcGIS from Esri Inc., the world's most popular GIS platform. We have a presence in 85 percent of the country's municipalities, including sections of our complete product line.

RESULT: The platform ensures that the municipality may manage its geodata in a systematic manner, contributing to a digital twin for planning that is updated in tandem with the real municipality's growth.

Learn more about ArcGIS

3. Smart Cities and Infrastructure

ADTOLLO
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SOKIGO
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Waste management and recycling is a key part of circular thinking to secure safe and sustainability handling on the last phase of a products or buildings lifecycle . A digital twin can be leveraged to trace the different materials and their hazardous material as per regulatory requirements such as RoHS or WEEE.

The recycling systems, plants and sites also benefits greatly by leveraging a digital twin to efficiently plan, design, build and commission new recycling sites. A life cycle management approach and efficient digital twin technology for 3D geodata secures lifetime sustainability aspects.

Case 2: Ragn-Sells - ADTOLLO & SOKIGO

The environmental company Ragn-Sells converts waste into pure raw materials so that they can be used over and over again. Ragn-Sells drives the transition to a circular economy through solutions that reduce the environmental and climate impact of others, and with a vision of being living proof that caring for the earth and business go hand in hand.

NEED:
In order to be able to manage and treat about a 6.3 million tons of different material Ragn-Sells have several facilities where all Material are managed and temporarily stored. The operations are vast and needs to follow environmental regulations and restrictions creating great need for planning and logistics covering both geodata, analysis, field measurements etc.

SOLUTION:
Adtollo and Sokigo provides Ragn-Sells with a 3D-system to store and maintain geodata for the facilities in a 4D-structure database, from which information can be distributed to all related processes and different users.

RESULT:
Large-scale use of structured geodata is relatively new to Ragn-Sells and the work of collecting, supplementing, and improving the quality of data takes place continuously.

Ragn-Sells are still in the startup exploring all the possibilities with Topocad, for example using their digital twins for simulations.

Learn more about Ragn-Sells

4. Industrial and Research Facilities

TECHNIA
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The need for innovative and more environmentally friendly materials and products has prompted significant expenditures in research and automation. This necessitates the development of new facilities in which digital twins enable the control of the whole lifetime, from conception to decommissioning. In order to lead in sustainable innovation and manufacturing, Europe's future competitiveness in an increasingly global context will necessitate collaborative projects and initiatives.

Robotization and digital simulation of an industrial facility provide for lower carbon emissions and a more pleasant working environment for people. A digital twin also allows for accurate traceability of most environmental characteristics of a plant over its entire lifespan.

Case: ESS - TECHNIA

ESS, the European Spallation Source, is a multi-disciplinary research center based on the world's most powerful neutron source. The investment in the research infrastructure, which is held by 13 European countries, totals more than €1.8 billion. Construction of the research facility started in 2014. The on-going pandemic has significantly impacted the timeline, which is currently under revision.

The ESS research center is allowing new ground-breaking research that will provide society with new innovative materials and solutions that will improve quality of life and make society more sustainable.

NEED:
Society needs new materials to ensure sustainability and medicines to cure current and new diseases. A digital twin solution can support the creation and management of new Research and Development facilities.

SOLUTION:
The solution is based on the 3DEXPERIENCE platform enriched with data from Autodesk/Revit and PDMS. TECHNIA are supporting ESS in the methods and establishment of the Digital Twin in many areas such as design and structural, radiation and external threats simulation.

The partnership between TECHNIA and ESS started in 2014 and will continue as the facility is brought into full operations.

RESULT:
The ESS project is able to handle the design, building, and commissioning phases in an efficient and completely traceable manner thanks to a digital twin approach. Additionally, the digital twin will ensure effective administration during the usage period, as well as an ecologically responsible decommissioning .

Learn more about ESS

5. Industrial Solutions – B2B

TECHNIA
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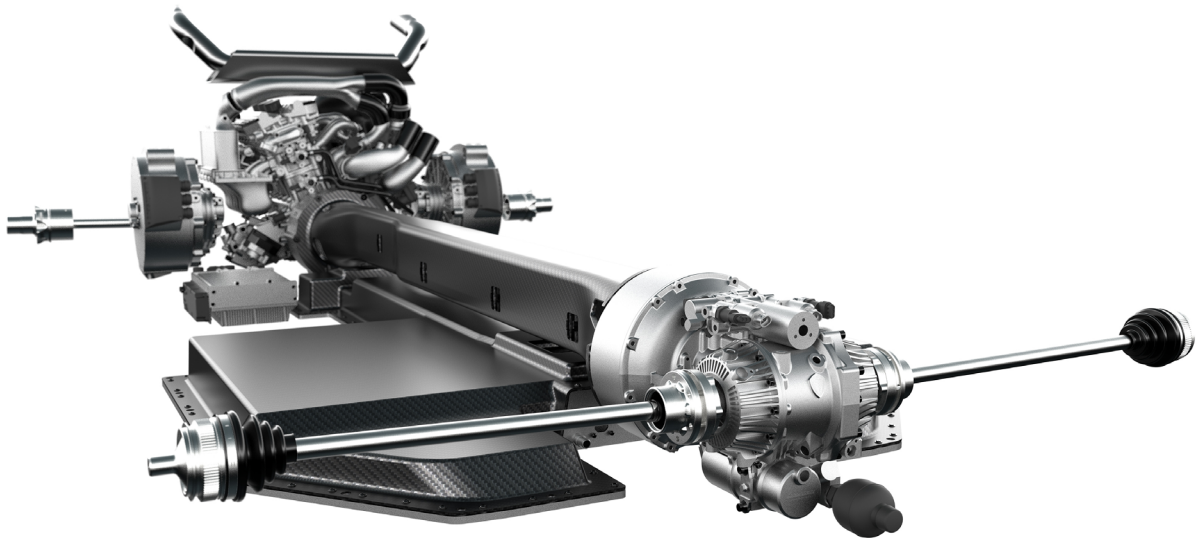
PLM (Product Lifecycle Management) is an adaptable and efficient system that serves as a platform for all product-related data and information.

Information may be efficiently stored, managed, and utilized by multiple users, functions, stakeholders, or other systems of a firm through one system and by numerous users, functions, stakeholders, or other systems of a company.

The same data and information can also be used for example in 3D-visualization of different product configurations in sales phase, in optimizing and verifying manufacturability for the production, in advanced preventive maintenance planning, or ultimately creating a virtual representation of a physical product like an individual machine or equipment.

Together with other technologies like sensors, industrial IoT, communications and advanced data analytics, the modern PLM solution works also as a solid foundation for value added services and new business opportunities for the installed base products.

Case: Koeningsegg - TECHNIA

TECHNIA helps Koenigsegg increase the value of its digital investment by utilizing the digital twin and digital continuity concepts. TECHNIA are supporting super and megacar manufacturer, Koenigsegg, as they step into the world of digital manufacturing - becoming more sustainable as they do so.

NEED:
Rapid and sustainable production ramp up of new products.

SOLUTION:
The solution is based on the 3DEXPERIENCE platform, including CATIA V6, digital manufacturing and composites design. TECHNIA are supporting Koenigsegg in the methods and establishment of the Digital Twin.

RESULT:
Ability to verify and validate products and processes digitally before entering a production phase results in less physical prototypes, better production quality and faster time to market.

This is an essential part of PLM, and it improves sustainability in many aspects of Koeningsegg's business.

Learn more about Koenigsegg

6. Healthcare and Medical Devices

TECHNIA
ADDNODE GROUP

Therapies will be revolutionized by digital twins of humans. These will allow for process simulation, completely customized treatments, and the use of robots for more surgeries. This will lead to improved patient outcomes, higher efficiency, and the potential to go forward with individually designed devices that are connected to the digital twin, allowing for prediction and safety.

Medical devices with digital twins will be safer to use and operate, such as ventilators and other complicated and life-sustaining systems. Digital Twins can also help with time to market for innovative products.

TECHNIA has a dedicated, global Life Sciences team of more than 50 consultants. Our mission is to Make Product Creation Sustainable in the Life Sciences industry by turning regulatory complexity into a competitive advantage. Domain specific knowledge, best practices and industry solutions are critical to be able to support, guide and challenge our customers. We provide the Life Sciences community with regular networking at global events, customer advisory boards, webinars and more.
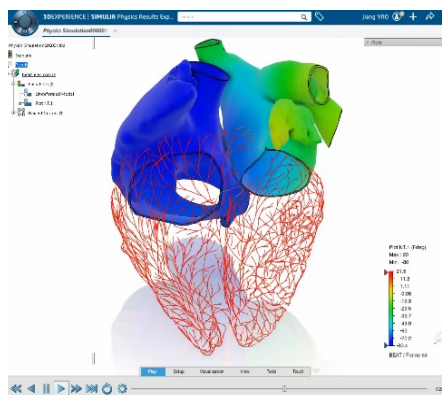
Skåne University Hospital is the third largest hospital in Sweden, offering a full range of highly specialised care, research and education.

The Living Heart Project is uniting leading Life Sciences professionals across the world to develop and validate highly accurate personalized digital human heart models.
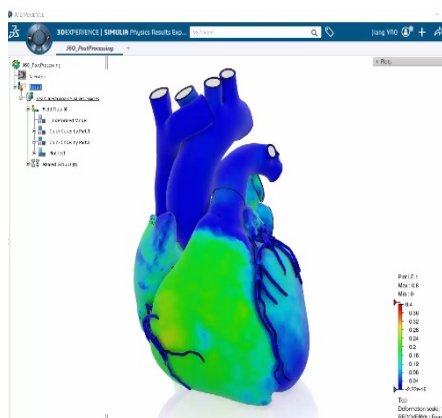
Case: SKÅNE UNIVERSITY HOSPITAL - TECHNIA

TECHNIA is contributing to research and development in simulation methodologies with the goal to predict heart valve function following surgery through the SIMULIA "Living Heart" solution.

NEED: Many adults and children suffer from serious heart valve diseases that require open-heart surgery, with uncertain outcomes.

SOLUTION: TECHNIA has provided a patient-specific digital twin model that enables simulation of heart valve functions.

RESULT: With the help of TECHNIA's model, doctors today can simulate blood flow through a simplified valve to assess the potential surgical outcome.

Learn more about
Digitalization in Life Sciences

Addnode Group's Sustainability Efforts

In close collaboration with its customers, Addnode Group creates digital solutions that make use of software and services to build a more sustainable society. The possibility to offer customers solutions that enable them in turn to make a positive contribution to society is at the core of Addnode Group's sustainability work. The biggest impacts are achieved through Addnode Group's products and services, including design for sustainable development and circular economy, product lifecycle management, simulations for environmental and health benefits, and improved citizen involvement and dialogue.

In 2020 Addnode Group began a systematic process of building a sustainability agenda.
As a result of this work we selected Sustainable Development Goals that are relevant for us, we decided on focus areas and KPI's to direct our sustainability efforts to, and we developed a Code of Conduct and Sustainability Policy.

Follow this link to read Addnode Group's Code of Conduct and Sustainability Policy.

Sustainable Development Goals that Addnode Group Contributes to

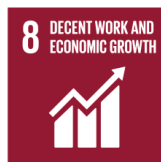Addnode Group has selected six of the UN's global Sustainable Development Goals that are most relevant for its business and in which Addnode Group has the possibility to make an impact.

SDG 3
Good health
and well-being

SDG 5
Gender equality

SDG 8
Decent work
and economic
growth

SDG 9
Industry,
innovation and
infrastructure

SDG 11
Sustainable
cities and
communities

SDG 13
Climate action

Addnode Group's
Focus Areas and Related KPIs

1

Digital solutions that contribute to sustainable development

- Innovation for sustainability
- Ensuring privacy and integrity
- Designing for sustainable development and circular economy
- Simulations for environmental and health benefits
- Improved citizen involvement and dialogue

2

Care for people and the planet in our own operations

- Diversity and gender equality
- Employee well-being and safety
- Attracting and retaining talent: values-based leadership
- Proactive and engaged employees who want to make a difference
- Environmental initiatives to reduce travel and impacts from office space

3

The way we work with our partners and suppliers

- Long-term commitments
- Fair business principles and anti-corruption
- Ensuring that we respect human rights throughout the value chain
- Supplier screening

4

Long-term financial viability

- Organic growth
- Acquisitions
- Decentralised business model
- Recurring revenue

5

Sustainability management and governance

• Code of Conduct and Sustainability Policy • Certifications • Communication • Reporting

About Addnode Group

Addnode Group acquires, operates and develops cutting edge enterprises that digitalise society. Addnode Group's companies delivers digital solutions in close collaboration with customers that contribute to a more sustainable society, such solutions are for example design for sustainable development and a circular economy, product lifecycle management, simulations that benefit the environment and health, and improved interaction and dialogue with citizens.

Addnode Group's companies are organised in three divisions:

• **Design Management** - Digital solutions for design, BIM and product data for architects and engineers in the construction and manufacturing industries, and digital solutions for more efficient project and facility management.

• **Product Lifecycle Management** - Digital solutions for the entire lifecycles of products and facilities – from idea, design, simulation and construction to sale, aftermarket and recycling. Customers are in the manufacturing, automotive and life sciences industries, among others.

• **Process Management** - Digital solutions for the public sector. Our solutions keep track of cases, simplify communication with citizens and contribute to more secure and reliable social services.

Addnode Group has 1,900 employees in Sweden, UK, Germany, Australia, Austria, Canada, Denmark, Finland, France, India, Ireland, Japan, Netherlands, Norway, Poland, Serbia, Slovakia, and USA. Net sales in 2020 amounted to SEK 3.8 billion. Addnode Group's Series B share is listed on Nasdaq Stockholm.

For more information, please visit www.addnodegroup.com

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