Digitalization in the Energy Sector

Trend report

What's happening in the Energy sector?

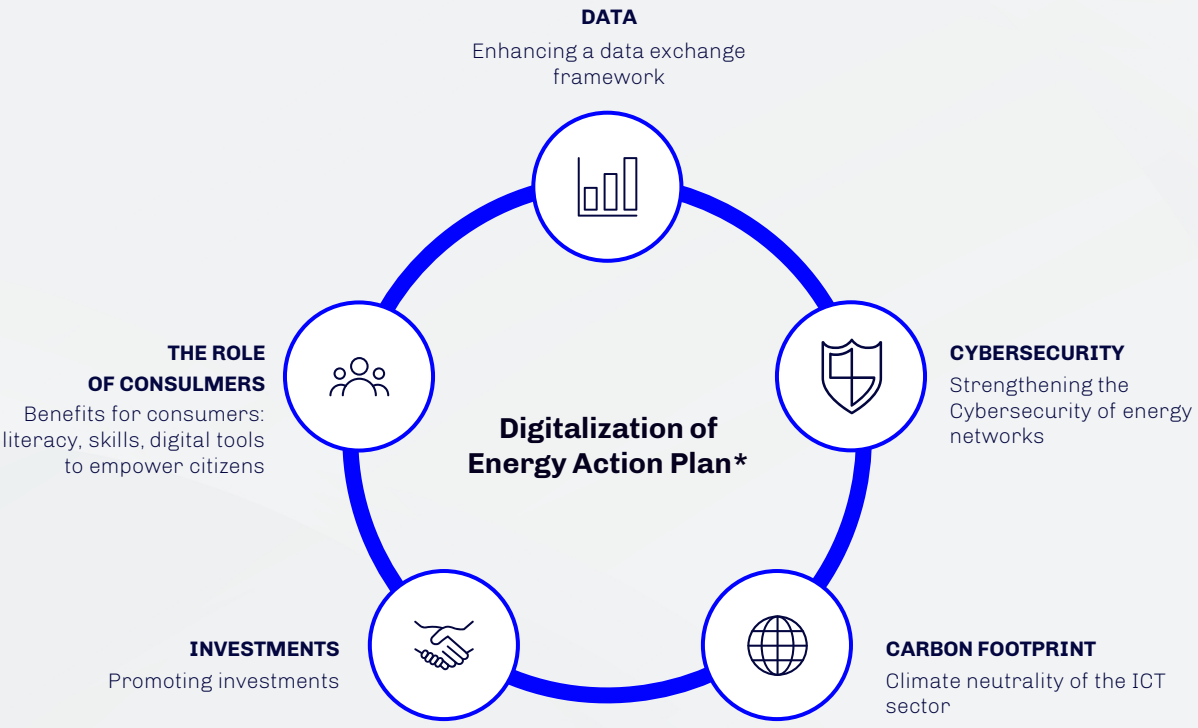
The scope of digitalization is entering the energy sector to improve the safety, production, and sustainability of energy systems globally.

For the EU, digitalization is at the center of its future. To achieve its digital ambitions by 2030, the European Commission emphasizes the importance of digital technologies to deliver flexible energy generation and consumption and increase renewable energy usage.

The European Commission suggested the Digitalization of Energy Action Plan in 2022.

The action plan seeks to build a competitive digital energy service and infrastructure market. One that is cyber-secure, efficient, and sustainable and promotes cooperation between the energy and digital sector.

Alongside enhancing the uptake of digital technologies in the energy sector to mobilize research and innovation, the European Commission ensures interoperability of energy data, platforms, and services.



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The development of European data-sharing infrastructure will deliver a competitive market for energy services, which values demand-side flexibility and supports energy infrastructure planning and monitoring.

Furthermore, the plan also sets out to increase the participation of 'prosumers' in the energy markets, tailor data-driven services, and implement reskilling and upskilling pathways.

The action plan promotes R&I projects that have developed new services and user-friendly apps for people to grant access to their data and intelligent metering. As a result, citizens can engage in the energy transition as active consumers and investors.

A system-wide digitalization of the energy action plan will contribute to EU's energy policy objectives and support the development of a sustainable, cyber-secure, and competitive market for digital energy services. Whilst ensuring data policy, sovereignty and supporting investment in digital infrastructure.

The EU strategy seeks to empower businesses and people toward a more sustainable future and see the benefits digitalization can bring to the entire energy value chain.

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The power of renewable energy

Renewable energy stems from natural sources such as the wind, sun, and sea and biofuels such as ethanol.

The renewable sector has grown rapidly, driven by policy support and sharp cost reductions, as seen in the share of renewables in global electricity generation jumping to 30% in 2023, up from 27% in 2019.

Renewable energy is easily replenishable, reducing dependence upon non-renewable energy and lowering greenhouse gas emissions. Yet, implementation remains a challenge. High initial costs, storage concerns, and its intermittent nature are some of the issues the sub-sector must overcome.

However, as costs decrease and technological issues are solved, governmental policy and financial incentives shall push businesses and consumers to adopt renewable energy. As a result, predicted investments in renewable energy will grow by 4% per year until 2035, accounting for 37% of global energy investments in the next 15 years.

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Trends of the Energy Sector

Digitalizing the energy sector has massive potential to steer the world toward a more secure, sustainable, and smarter energy future.

Here we will discuss the trends shaping the sector's future.

Dig deeper

The Future of Energy: Applying the Internet of Things

Towards a New, Lower Cost Higher Efficiency Industry

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Cloud Computing vs Fog Computing

Digital Workforce and Specialist Supply with Energy Expertise

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Keeping Infrastructure Management Compliant

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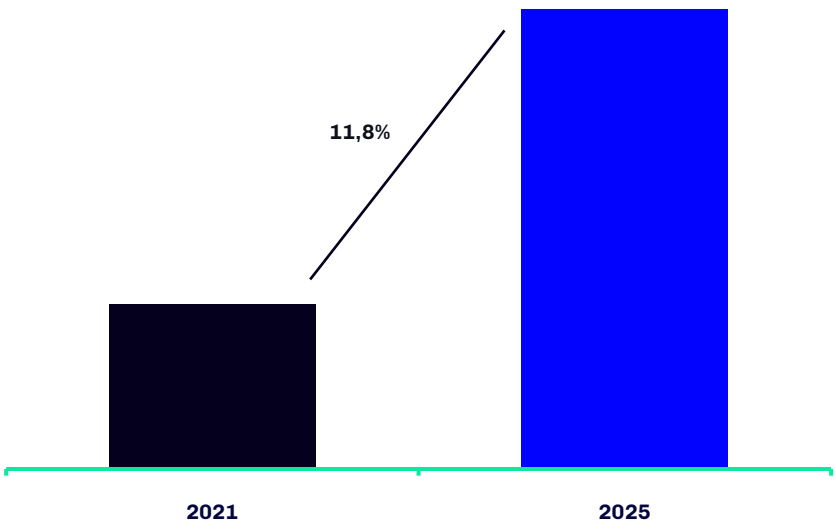
The future of energy: Applying the Internet of Things

The influx of Internet of Things (IoT) appliances supports the Energy sector's adaptation to a digital world through improved connectivity and efficiency.

IoT devices use the Internet to provide connectivity between devices and users. For example, home sensors allow for real-time room temperature monitoring and control over energy consumption patterns.

Moreover, IoT devices support consumers in managing their energy use through everyday objects and businesses to find innovative ways to improve productivity and decision-making.

Expected growth of value of the IoT market with energy capabilities (measured by CAGR)



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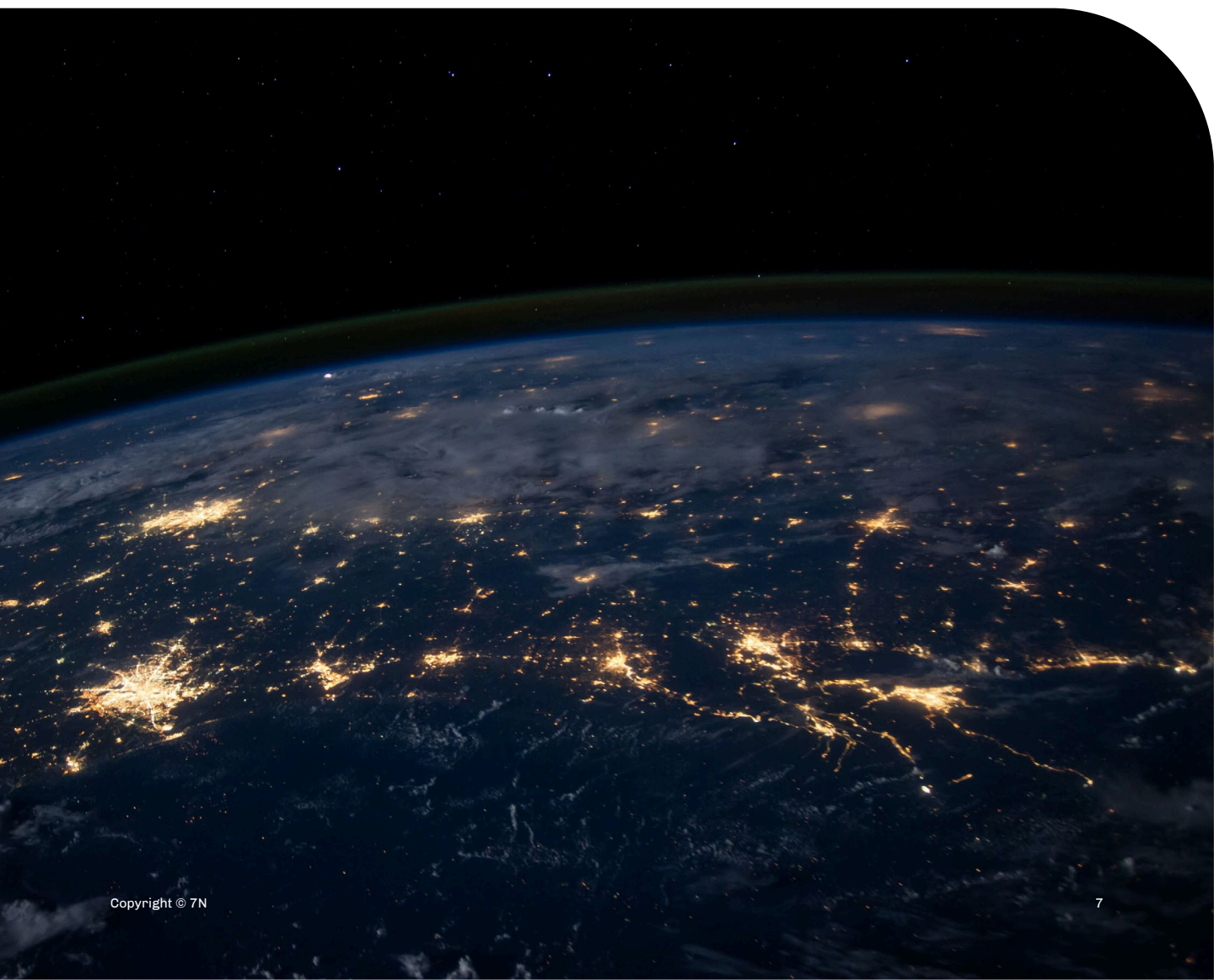
Toward a new, lower-cost, higher-efficiency industry

For businesses, real-time applications and intelligent process monitoring can supply data that allows for faster decision-making, improves quality and reduces waste.

IoT devices in energy management can deliver real-time insight, support maintenance forecasting and address performance issues through system metrics.

Therefore, IoT devices can support the reduction in system downtime. Alongside managing energy consumption patterns and resources to promote positive energy conservation practices. Furthermore, the automation of specific tasks helps to minimize human effort and save costs through modernization.

The effective targeting of IoT applications at specific issues within the energy sector could usher in a lower-cost, higher-efficiency industry capable of meeting the challenges of the 21st century.



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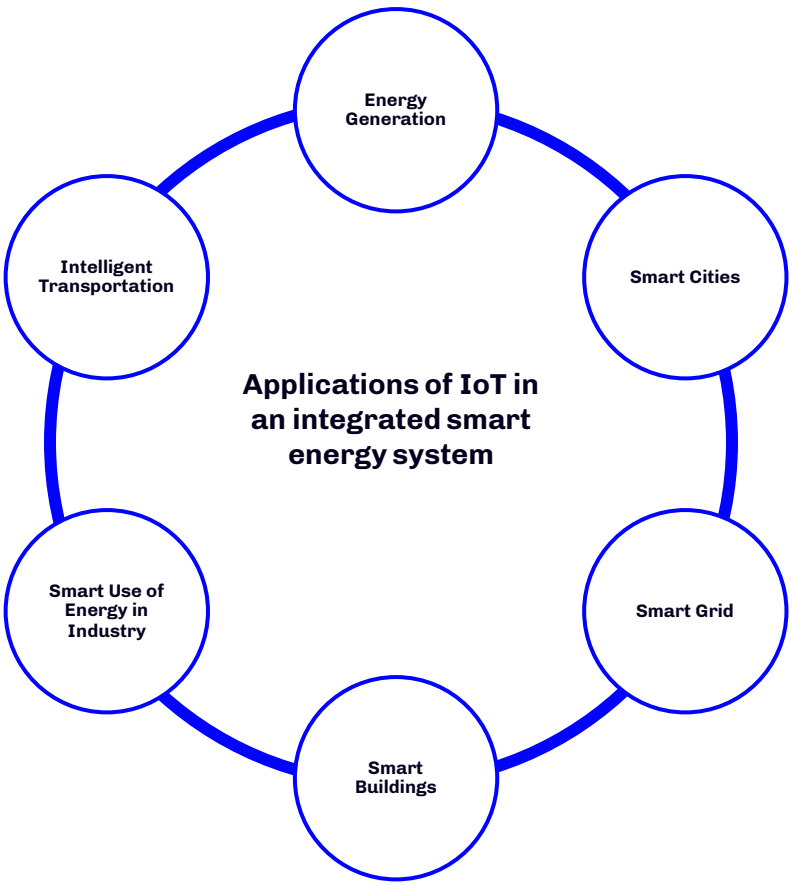
Internet of Things applications in the Energy sector

Although efforts to make technologies, such as smart appliances and connected homes a reality are still at an early stage, the scope of IoT technology across the energy sector is delivering benefits to businesses.



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Energy Generation

For legacy power plants, their equipment and management are expensive. However, IoT technology can help reduce the challenges in managing power plants.

IoT sensors can support industrial process automation and deliver an enhanced supervisory control that monitors processes and equipment. Thus, helping to detect failures or decreases in efficiency and reduce the risk of loss of production or blackouts.

IoT devices can improve the reliability of power plant systems while reducing maintenance costs. For example, a new IoT-based power plant can save 230 million USD during its lifetime, whereas an existing plant equipped with IoT technology can save 50 million USD.

Smart Cities

Digital technology is driving the application of intelligent IoT-based solutions across city life.

In a smart city, the connection of buildings, urban infrastructure, energy networks, and utilities to intelligent sensors allows for monitoring every aspect of life.

To improve the cities' efficiency and sustainability, data relating to energy consumption, with the application of cognitive learning and context awareness, inform decision-making regarding energy demand and deliver cost savings.

The rise of smart cities is crucial to dealing with the challenges of pollution, environmental concerns, and energy access and demand.

Smart Grid

A smart grid enables control over power flow and the curbing of energy consumption at significant levels.

Connected smart grids develop multidirectional information flows to optimize system management, and deliver efficient energy distribution, making it adjustable depending on the need.

Additionally, the collaborative nature of the smart grid alerts operators through appliances before problems occur.

Therefore, a smart grid reduces unnecessary consumption, caters to fluctuating demand, and delivers energy to prevent any breakdown of critical processes.

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Smart Buildings

The buildings and construction sectors contribute almost a third of global energy consumption. It is essential to reduce the energy consumption in buildings to meet global energy and environmental challenges. IoT devices can help to combat the energy losses of residential or commercial buildings.

Through managing lighting systems or using wireless thermostats that, upon detecting an unoccupied zone, can lower energy consumption; additionally, real-time data analysis can help adjust high-peak to low-peak levels and optimize the use of electrical energy. IoT devices ensure that demand response can become more agile and management more efficient.

Smart Use of Energy in Industry

For businesses, a significant outlay of time and resources are on production and quality control. However, a connected, flexible system can ensure issues are recognized and avoid wasted energy.

The monitoring of manufacturing processes, with all equipment connected via IoT sensors, can successfully manage each component and identify faults.

Furthermore, data from the sensors enables businesses to analyze results to make more efficient decisions and optimize production. For example, they can detect when mechanical devices reach their threshold limit and prevent machinery depreciation.

In addition, through an innovative collaboration between customers and manufacturers, companies can ensure they deliver products specific to their orders and lower energy consumption.

Intelligent Transportation

The application of IoT technology within transportation presents the opportunity for a global management system.

It allows for real-time data processing regarding the current state of transportation networks and enables the successful management of traffic through congestion control and intelligent parking systems.

For passengers and drivers, with the information at hand, they can choose routes with shorter distances and find cost savings. Thus, reducing energy usage and helping to lower carbon dioxide emissions and other forms of air pollution.

The value of IoT devices across transportation was $135 billion in 2016, with an estimated increase to $328 billion by 2023.

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Converting data to insights through machine learning

Businesses across the energy sector are identifying ways to implement machine learning to automate core processes.

As countries shift toward green energy, swings in demand can prove challenging.

However, companies can train their machine learning algorithms with historical data to accurately match supply and demand by forecasting change.

For companies, it allows them to predict how much energy they may generate on a given date. Thus, helping them to plan accordingly to ensure they have sufficient supplies to make up excess demand.

Furthermore, system failures can significantly disrupt energy providers. However, implementing predictive maintenance through sensors installed in equipment or power lines allows for operational data collection.

From there, machine learning algorithms can predict when a component may fail, helping to reduce maintenance costs and improve performance.

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Cloud Computing vs Fog Computing

Data is central to the energy sector's growth.

However, the volume of structured and unstructured data generated requires processing capabilities beyond traditional methods.

Therefore, advanced computing and analytic methods are necessary to process and analyse data efficiently. In particular, the use of cloud computing and fog computing is vital to these efforts.

Cloud computing

Cloud computing is a data processing approach that offers services, applications, storage and computing through the Internet and hardware systems in data centers.

The features of cloud computing enable the processing of big data and provide complex computation capabilities and data from IoT devices to be analyzed, controlled and sorted efficiently.

There are many benefits to cloud computing. Firstly, it eliminates the costs of purchasing hardware and software. Secondly, it enhances the computing power and storage capacity of multi-core architectures supporting data management. Thus, reducing the electricity required for local data computation.

Fog computing

Although cloud computing enables data processing from IoT applications, the bandwidth capabilities of centralized resources used for data processing can cause delays.

In pursuit of more efficient methods, fog computing moves computing and analytic services to the network's edge. Thus, expanding the cloud to a greater scale enables a larger workload.

Any device with computing, storage or network connection capabilities can act as a fog node in fog computing. Providing local storage instead of sending it to the cloud reduces network traffic and latency.

Therefore, in contrast to cloud computing, fog computing offers processing services with attention placed on delivering a highly responsive and secure service.

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Digital workforce and specialist supply with energy expertise

Advancements in digital technology are transforming traditional energy operations. However, a lack of digital skills in the workforce hinders progress in the energy sector.

The European Commission's Joint Research Centre published a news announcement on March 21, 2024, discussing workers' participation in digital skills training. It highlighted that more than half of EU+ workers consider themselves digitally under-skilled, meaning they believe they lack the digital skills needed for their current job.

Energy companies must invest in digital skills training and foster an individual and collective mindset geared toward digitalization to deliver value.

Investments into new systems, processes, and technologies are worthless if the company structure and culture prevent the digital transformation strategy from becoming established.

The energy sector has the opportunity to progress its digital capabilities through its workforce. Investing in its people and digital upskilling can safeguard energy companies' futures, create an innovative working culture, and attract great talent.

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Enhancing cybersecurity

A digitalized energy sector poses complex challenges. As exposure to cyberattacks and cybersecurity incidents increases, it jeopardizes the security of energy supplies and consumer data privacy. Therefore, the energy sector must improve its resilience to technological threats.

Although there is a comprehensive framework for cybersecurity, the energy sector presents specific challenges:

a. **Real-time requirements**: Some energy systems must react so fast that standard security measures, such as command authentication, or digital signature verification, can not be introduced due to the delay these measures impose.

b. **Cascading effects**: Electricity grids and gas pipelines are interconnected globally. Therefore, an outage in one country might trigger blackouts or supply shortages in other areas.

c. **Converged legacy systems with new technologies**: The design and construction of many energy system elements occurred before cybersecurity became a consideration.

As a result, these legacy components must co-exist today with the latest equipment for automation and control, such as smart meters, connected appliances, and IoT devices, without being exposed to cyber threats.

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Keeping infrastructure management compliant

Global electric, gas, oil, and utility providers are embracing new technologies to improve their efficiency whilst reducing operational costs.

However, the capital-intensive sector is becoming of keen interest to regulators due to the scale of operations and demand.

Consequently, businesses must adapt to operate in an increasingly regulated environment. Especially for example, as the value chain turns digital, the cybersecurity of the data infrastructure and facilities is crucial.

The E&U sector must establish critical infrastructure protection (CIP) reliability standards to protect its assets, including:

a. Establishing policies and procedures to safeguard physical and electronic access to control systems.

b. Introducing CIP compliance training for personnel.

c. The reporting of security incidents.

d. Maintaining preparedness for cyber-incident recovery.

Energy companies must show flexibility in compliance plans, analyze potential risks on a case-by-case basis, track performance and effectiveness, and ensure high standards of compliance evidence management to handle multiple regulatory bodies and requirements.

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If you want to know more

We are always more than happy to meet for a virtual cup of coffee. Thus, do not hesitate to get in touch, if you have any questions or want to know more about how 7N can help you along your digital journey.

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