AUTOMOTIVE SOLUTIONS

Start your Catena-X journey with Siemens today

The first open and collaborative data ecosystem for the automotive industry

Executive summary

The automotive sector is encountering challenges related to the fragmentation of information and language barriers within global supply chains. This whitepaper introduces the remedy to address these issues: Catena-X, an open data ecosystem designed to enhance clarity and efficiency. Siemens, a reliable partner for Smart Manufacturing and secure data exchange, actively contributes to the advancement of Cantena-X. Through alignment with Siemens, businesses can promptly and efficiently harness the advantages of Catena-X, fostering mutual comprehension and propelling industry-wide transformation.

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Contents

Abstract

This white paper focuses on Siemens' role in addressing the challenges of data fragmentation and missing standards for cross-company data exchange in the automotive industry, caused by the complexity of global supply chains and the need for sustainability.
It introduces Catena-X, a collaborative and open data ecosystem designed to enhance transparency and efficiency across the industry's value chains. With standardized data formats and shared principles, Catena-X aims to foster seamless data exchange, ultimately improving productivity, resilience, and sustainability.
Siemens, a firm believer in ecosystem collaboration and secure data sharing, actively participates in the development of Catena-X. Leveraging their expertise in the automotive industry, Siemens offers tailored solutions to participants within the Catena-X ecosystem, facilitating better mutual understanding through data harmonization.

The white paper also highlights the significance of ready-to-use applications specifically designed for the automotive industry, such as carbon footprint documentation and secure product traceability.
Drawing from Siemens' own manufacturing and supply chain experience, these applications are optimized for integration, meeting the convergence requirements of IT and operational technology (OT) while ensuring data sovereignty and interoperability in accordance with Catena-X guidelines. As part of the Siemens' co-creation DNA, Catena-X aligns with the company's commitment to digital transformation, leveraging the power of the Digital Twin and fostering an active ecosystem for open collaboration.
Siemens provides comprehensive support, from app download to integration with existing automation and IT landscapes, ensuring seamless implementation and long-term value for automotive industry players. In conclusion, the white paper emphasizes the collaborative partnership between Catena-X and Siemens as a means to effectively empower the industry, and drive sustainable transformation.

At Siemens we believe that close collaboration in ecosystems and fair, secure exchange of data is the right way to go.

The Catena-X approach

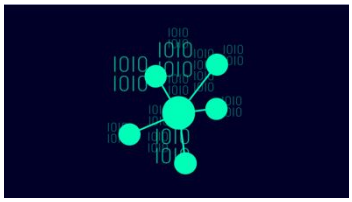
Overview

The automotive industry has always been a pioneer in automation and digitalization. This is true for the manufacturers as well as for their thousands of partners and suppliers worldwide.
But the automotive industry faces several challenges regarding the value chain processes in the current landscape:

Supply chain disruptions

The automotive industry heavily relies on complex global supply chains. Disruptions in the supply chain, such as natural disasters, political instability, or pandemics, can lead to component shortages, production delays, and increased costs. Ensuring a resilient and flexible supply chain is a crucial challenge for automakers.

Digitalization and connectivity



Rising digital tech integration in vehicles poses connectivity, data, and security challenges. Connected cars yield abundant data - driver behavior, diagnostics, and location. Effectively managing, utilizing, and securing this data while respecting privacy are vital for automakers. Cyber threat prevention is also a key concern.

Electrification and circularity

The mobility revolution, sustainability demands, and global supply chain complexities are driving a need for more extensive value chain optimization. The automotive sector must adjust to EV supply chain needs, establish efficient battery processes, and create a solid charging network for widespread EV adoption.

Regulatory and environmental pressures

Tough emissions rules and sustainability goals drive auto sector to create cleaner, efficient vehicles, requiring substantial investments in R&D, greener manufacturing, and sustainable supply chains. Adapting to changing rules and lessening environmental impact across the value chain presents a challenge to automakers.

These challenges can be mastered, among other things, through a more intensive and meaningful use of data. However, this is countered by technical barriers in the form of data silos, as each involved company collects, prepares, and uses its data (if at all!) in the way it has historically grown in the respective organization.
This includes harnessing data-driven value chains, where the optimal utilization of existing data by all participants becomes crucial for optimizing workflows, spanning from goods delivery and production processes to product delivery and invoicing. This means that the existing data needs to be used optimally from all participants to be able to optimize the workflows, from delivery of the goods to production workflow, product delivery up to invoicing Catena-X the first collaborative, open data ecosystem for the automotive value chain of the future, aims to change that. And together with Siemens you are able to benefit from the full potential of Catena-X.

Function of Catena-X

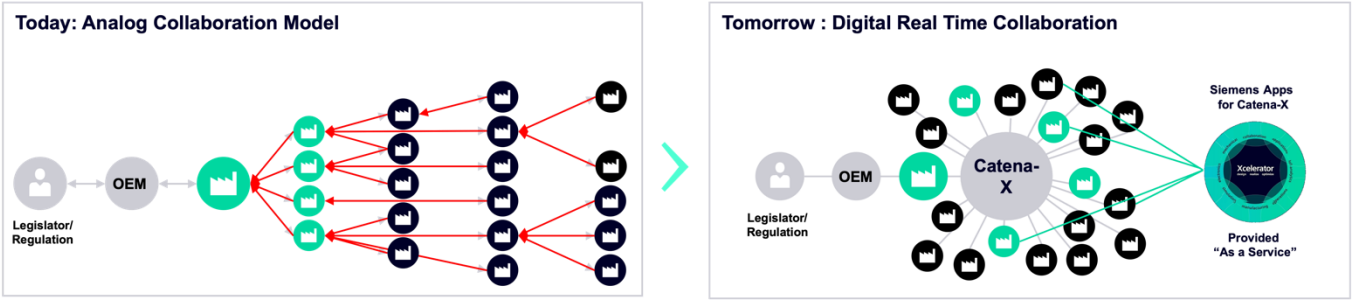
As the first collaborative, open data ecosystem for the automotive industry of the future, Catena-X networks global players to form end-to-end value chains – as simply, securely, and independently as never before. The common goal is standardized, global data exchange. The claim is data sovereignty and interoperability: Whoever makes data available retains control and decides individually who is involved in the data exchange, how, when, where and under what conditions. Siemens supports a secure and reliable Catena-X implementation.

Thanks to end-to-end digital documentation, for example, the integral carbon footprint can be determined, or traceability can be provided in accordance with supply chain law.
Standardized data exchange and the possibility of using cross-company applications offer all companies – from SMEs to large corporations – investment security and strengthen their competitiveness in the long term.
Catena-X is a collaborative effort that only works through the participation of many stakeholders. The goal is to establish a globally active network. Users meet with suppliers, SMEs meet with large companies, resource suppliers meet recyclersall companies can achieve new value creation, especially through the cross-company use and exploitation of data. This is how new business models are created in the supply chain.

The Intention of Catena-X

The goal of Catena-X is to enable data exchange and ensure data sovereignty along the entire automotive value chain. The focus lies on benefits and added value for each participant in the network while maintaining data sovereignty in accordance with the standards set out by the European Union in the form of Gaia-X. With a powerful and decentralized network approach, Catena-X ensures the economic viability of all network partners – from small and medium-sized enterprises to corporate groups – internationally.
It aims to improve competitiveness for the companies involved, through the provision of a user-friendly environment for building, operating, and collaborating on end-to-end data chains along the entire automotive value chain:

- **A collaborative approach** in selecting and implementing scalable and system-relevant use-cases, regardless of company size, fast scalability is offered “As a service”
- **Provision of data sovereignty** for all partners by applying the concept of International Data Spaces (IDS) and Gaia-X
- **Openness** and non-discriminatory access to a secure network for all market participants, whereas data is separated from the application
- **Interoperability** of the planned technology landscape,data and insights along the entire value chain be easily shared from development to sales and aftersales
- **Industry standards** and certified, network-based applications (Catena-X standards to be defined)



Catena-X collaboration in the automotive industry

To tackle the most pressing topics of our time the automotive industry has to deal with a wide range of challenges throughout the entire supply chain.

This must be done across multiple parties and involved companies, which is not always easy. After all, each company has its own network of suppliers, including its own IT systems. In addition, many companies shy away from sharing too much data with other companies.
Within the framework of Catena-X, a set of rules ensures data sovereignty. The data also remains within the own company.
In future, for example, a data portal will provide a precise overview of the circular economy.

With the help of data from suppliers, it will then be possible to see which components are used in a vehicle. This might be extended to the raw materials that are processed in the battery.
If, for example, a vehicle is taken out of service, manufacturers, suppliers, and recycling companies will be able to see detailed information about the raw materials and components used via Catena-X. This could significantly increase the recycling rate.
In order to use the data meaningfully in the process, reliable applications and an associated marketplace are required. Siemens offers certified solutions and applications on the Catena-X marketplaces. The first marketplace is provided by Cofinity-X.

Added value of Catena-X for the automotive industry

- **Data sovereignty**
  Whoever makes data available in the Catena-X data space has full control and decides individually who, how, when, where and under what conditions is involved in the data exchange.
- **Interoperability**
  Catena-X certified solution packages and applications are designed for interoperability with solutions and applications from other vendors and enable seamless data usage.
- **Decentralized data system**
  In order to prevent lock-in effects and allow users to access further platforms and eco systems, the Catena-X partner network relies on a decentralized operator model.
- **Cofinity-X brings Catena-X to life**
  Siemens is also one of the ten founding partners of Confinity-X. This is the operating company, which, in compliance with the Catena-X standards, will provides and operates a central and interoperable marketplace as well as an open data space from distributed, sovereign data sources for the Catena-X partner network.

A closer look at the automotive value chain and its use cases – how is Catena-X supporting your processes

There are three domains in which Catena-X currently provides support in terms of standards, process definitions as well as ready-to-use available solutions:

1. Sustainability and circular economy

The objective is to tackle the industry's supply chain challenges, focusing on achieving greater sustainability, particularly in terms of reducing CO2 emissions and promoting circularity. Up to 90% of emissions can be traced back to the supply chain.

Besides that it is crucial to ensure the compliance with the supply chain act and various ESG (Environmental, Social and Governance) regulations. Additionally, our dedication extends to adhering to the EU Digital Product Passport, with special emphasis on the emerging Battery Passport in alignment with the European Battery Regulation.
To accomplish these goals, Catena-X has established clear guidelines for the calculation and exchange of the Product Carbon Footprint (PCF) throughout the entire supply chain. This initiative is designed to provide astructured approach to measure and reducing the environmental impact of products.

In the context of sustainability Siemens offers certified solutions.

One noteworthy, certified solution for facilitating the exchange of PCF is SiGREEN, developed by Siemens.

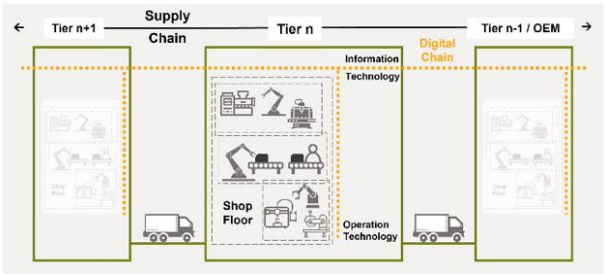
SiGREEN offers invaluable support to our customers, helping them transition from traditional static PCF reporting to a more dynamic and adaptable PCF management system. This evolution in reporting and management will play a pivotal role in achieving our sustainability objectives and ensuring a greener future for our industry.

2. Resilience

Solutions that aim at strengthening the resiliency of the supply chain and related shopfloor processes are grouped in the domain resilience.
Many of the challenges that are addressed relate to changes in demand or capacity, and how the different partners can efficiently communicate and react to these.
The management of demand and capacity involves various time scales:

- Long-term planning to anticipate demands that will materialize at least six months in the future
- Shorter timeframes, stock levels are closely monitored, with a time horizon of up to several weeks
- Finally, on a daily basis, estimated delivery times for specific parcels are communicated between manufacturers and logisticians

The approach for Manufacturing-as-a-Service adds another layer and describes an architectural framework that brings different on-demand manufacturing platforms together to provide a one-stop-shop where customers and manufacturers can meet to automatically compare demand with available manufacturing capabilities.
One of the on-demand manufacturing platforms that is integrated is the Additive Manufacturing Network from Siemens. Means of reacting to change and improving resilience as late as on the shopfloor are addressed



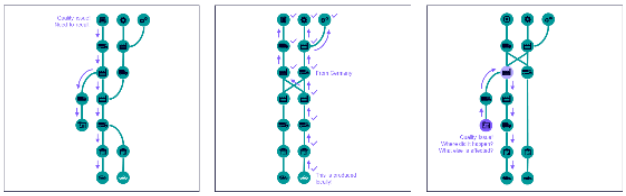
through Capabilities are demonstrated that optimize planning and reconfiguration during production to increase flexibility based on any type of disturbance in the supply chain or on the shopfloor.

Product lifecycle management (PLM) & Quality

One of the major objectives of Catena-X is to be able to build and maintain data chains in a decentralized fashion along the supply chain e.g. in accordance with how the product was assembled. This traceability is a fundamental part of the domain PLM & Quality in which topics closer to design and engineering are developed.

One example of an implementation of the decentralized traceability is the Trusted Traceability application from Siemens.
The data chains can be used to communicate along the supply chain to request analysis of root causes to quality issues or alerting upstream about a potential quality problem.

Speed up recall | Proof claim | Root cause and others



Identifying quality issues early is another focus of the domain PLM & quality and the processes, data and specifications needed to this in a collaborative fashion between an OEM and its tiers are defined and demonstrated.

Field data collected by the OEM is shared with the supplier to analyze and compare it with the corresponding historical production data. Quality issues can thus be tracked, and patterns and anomalies be recognized to provide early warnings in the future.

Early design of vehicles includes simulation of overall characteristics of the vehicle, including aspects from several different suppliers. The process, data, and specifications needed to exchange such simulation models to bring them together in a cooperative fashion which safeguarding intellectual properties are defined and demonstrated in Catena-X. This way, a capable digital twin of the behavior of the vehicle can be created, and continuously managed across the supply chain.

The guiding principle emphasizes that a company is only permitted to access or request data from entities 'one level up' and 'one level down', which pertains to its immediate customer or direct supplier, while giving strict attention to data sovereignty.

In this area Siemens put their Simcenter portfolio to use in order to support these aspirations: https://blogs.sw.siemens.com/art-of-the-possible/2023/05/23/simcenter-meets-catena-x/.

A holistic overview of Siemens solution approaches

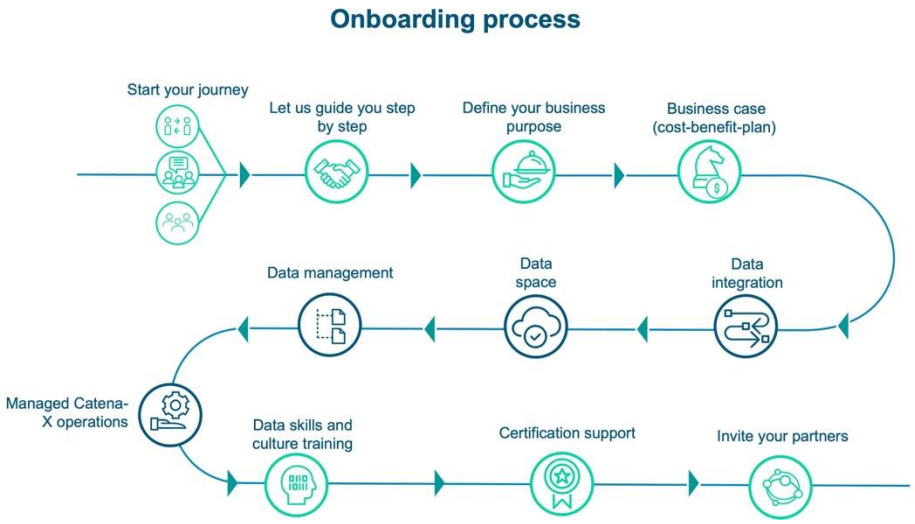
Siemens contributes to the most pressing use cases of Catena-X with research and development and of course with concrete solutions and applications.

Automotive requirements	Siemens solution focus
Sustainability	Capture and exchange Scope 3 PCF efficiently
Traceability	Build decentralized data chains for regulations and more (e.g. quality alerts)
Circular economy / Product- / Battery passport	Comply with European and other regulations and support PCF calculation use cases and circularity topics
Behavioral digital twin	Enable collaborative system simulation and the combination of basic data processing and analytics services from multiple partners
Online control & simulation	Optimize continuous production and logistics simulation and exchange accurate delivery dates and times along the supply chain
Quality improvement	Share and jointly analyze usage data together with production data for early fault detection and root cause analysis
Manufacturing-as-a-service	Match demand and capabilities across different on-demand manufacturing platforms automatically
Modular production	Optimize re-planning and re-configuration of running production and expose up-to-date delivery date as well as operator guidance

Catena-X with Siemens – from industry for industry

At Siemens we are committed to enter in a new era of digital transformation and sustainability through Catena-X. Our services include solutions for a wide range of essential tasks, ensuring your seamless integration into the Catena-X ecosystem.
You will receive customized end-to-end solutions. From strategic concept to implementation by deploying out-of-the-box software where feasible and coding tailor-made software when necessary. The team consists of entrepreneurial minds who offer an exceptional combination of advisory and implementation know-how.

- **Onboarding excellence:** We offer comprehensive support throughout your Catena-X onboarding journey. From initial setup to technical assessments, our team stands by your side, ensuring a smooth and hassle-free transition into the Catena-X network.



Source: https://catena-x.net/en/catena-x-introduce-implement/onboarding

- **Pioneering business models:** The future belongs to innovative business models, and we specialize in their generation and implementation within the Catena-X framework. Together, we can explore new horizons and opportunities to elevate your business.
- **Building sustainable foundations:** Sustainability, Product Lifecycle Management (PLM), and supply chain resilience are at the forefront of modern business. We help you create a solid foundation, enabling the scalability of Catena-X use-cases in these critical areas.
- **Embracing circularity:** Circular economy principles are paramount. We empower your business to embrace circularity through digital product passports, Product Carbon Footprint (PCF) tracking, and transparent value chains. Join us in shaping a more sustainable and responsible future.

Catena-X with Siemens: from the industry for the industry

Together, we can harness the power of Catena-X to drive innovation, sustainability, and resilience across your business. Join us in this transformative journey towards a brighter tomorrow.

A selection of our offerings for Catena-X

Consulting services

With Siemens Advanta as a strategic partner, you will receive customized end-to-end solutions. From strategic concept to implementation by coding tailor-made software. The team consists of entrepreneurial minds who offer an exceptional combination of advisory and implementation know-how.

Siemens Advanta Consulting is the global management consultancy for strategic projects focused on digitalization, sustainability, and green energy transformation. The global team taps deep into the Siemens knowledge pool, technological expertise, and intellectual property to provide clients with best-in-class solutions.

Trustworthy decarbonization

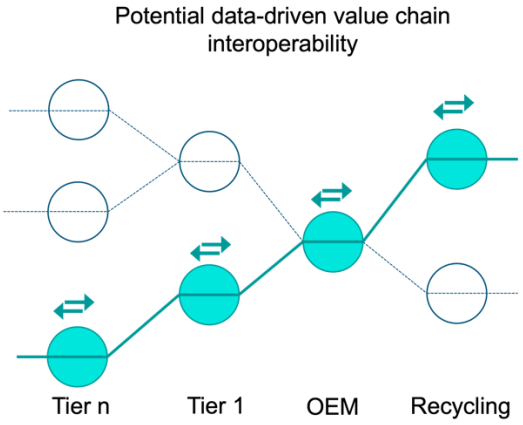
SiGREEN allows you to track emissions in your supply chain by decoding the carbon DNA of your products. A digital credential is assigned to each stage of the value chain, containing metadata for proof of origin and authenticity. This forms a data-driven basis for product decarbonization that`s directly linked with the value chain.

Increased resiliency

We look at the supply chain from the Tier-n supplier to the automotive OEM and of course backwards too. Our applications are based on a cooperative concept. This means that the applications executed on each tier level arebased on information obtained from one tier level up or one level down.

Faster traceability

It enables customers to store and retrieve genealogy data for products from their production process as well as their supply and value chain. Together with other data or data links, this enables customers to identify ancestors, descendants, and relatives to a product. It can enable you to prove claims or to speed up necessary investigations in case of product quality issues or product recalls.



Circularity

The growing number of sustainability-related requirements worldwide increasingly presents companies with the challenge of fully capturing and correctly interpreting the information relevant to them. The Circular Economy Radar from Siemens Advanta Consulting is a concept to make worldwide regulatory requirements, standards and norms, initiatives, and associations, as well as KPIs related to circular economy transparent for organizations in the automotive value chain. Designed as a platform solution, the Circular Economy Radar is intended to offer industrial companies, research institutions, standardization bodies and legislators the opportunity to exchange information easily and securely.

Focus on future

The Automotive Catena-X initiative has achieved a significant milestone by establishing the first functional dataspace dedicated to the automotive supply chain. This achievement marks a crucial step forward, and the project is poised for rapid expansion.

As outlined in this paper, Siemens is a strong partner in Catena-X, furnishing tangible solutions and strategies to initiate Catena-X integration. We are your primary point of contact, offering guidance on onboarding procedures and recommending fitting applications.

In tandem with the advancements in manufacturing processes, the significance of data spaces is set to increase exponentially in the coming years. Siemens, as a key player in this arena, is taking the lead in shaping the future landscape through the introduction of Smart Manufacturing concepts and technologies.

Looking ahead, the sharing of data will not be confined to a horizontal plane within the supply chain. Instead, it will extend vertically, encompassing various levels of production and distribution.

To learn more about Siemens Smart Manufacturing solutions for the automotive industry, go to www.siemens.com/automotive-smart-manufacturing

Manufacturing-X
Based on our experience with Catena-X, Siemens will leverage the full potential of data rooms in many industries.

A recently commissioned study[1] conducted by the Fraunhofer Institutes, with support from prominent industry bodies such as VDMA and ZVEI, unveiled a groundbreaking blueprint for the Manufacturing-X data ecosystem. This development represents a pivotal leap towards realizing the principles of Industry 4.0. Notably, this forward-looking data space places a premium on both flexibility and security. It is designed to be adaptable to the specific needs of medium-sized manufacturing enterprises, ensuring they can thrive in an increasingly digitized landscape.

By leveraging established standards, Manufacturing-X aims to facilitate seamless data exchange while also safeguarding data sovereignty. This dual focus on interoperability and security offers the industry a unique opportunity to bolster its resilience, competitiveness, and sustainability.

The Manufacturing-X initiative stands as a testament to the transformative potential of collaborative data ecosystems in propelling the automotive sector towards a more dynamic and interconnected future.

Source: https://www.plattform-i40.de/IP/Navigation/EN/Manufacturing-X/Manufacturing-X.html

[1] https://www.iosb.fraunhofer.de/de/presse/presseinformationen/2023/manufacturing-x-bauplanstudie-datenraum.html

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