Bosch and ISG co-present:

BOSCH

CAPTURE THE X-FACTOR
## (CUSTOMER-X, PRODUCT-X, ENTERPRISE-X)

WITH DIGITAL THREAD

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imagine your future*

Businesses today across the globe are having to adapt to large-scale disruption and change. Markets are volatile and customer expectations are evolving all the time. How can enterprises keep up? Digital transformation is key to realize value across functions and Digital Thread is a vital tool towards the digital transformation of your enterprise.

However, enterprises struggle to realize a return on their Digital Thread investments, missing out on up to 65% of possible value. We must dig deeper into the hows of Digital Thread adoption and implementation to understand why this is the case.

Digital Thread helps drive X-periences across engineering, manufacturing, operations, and services. But the key question is:
Are enterprises able to capture the value and scale of what is implemented?
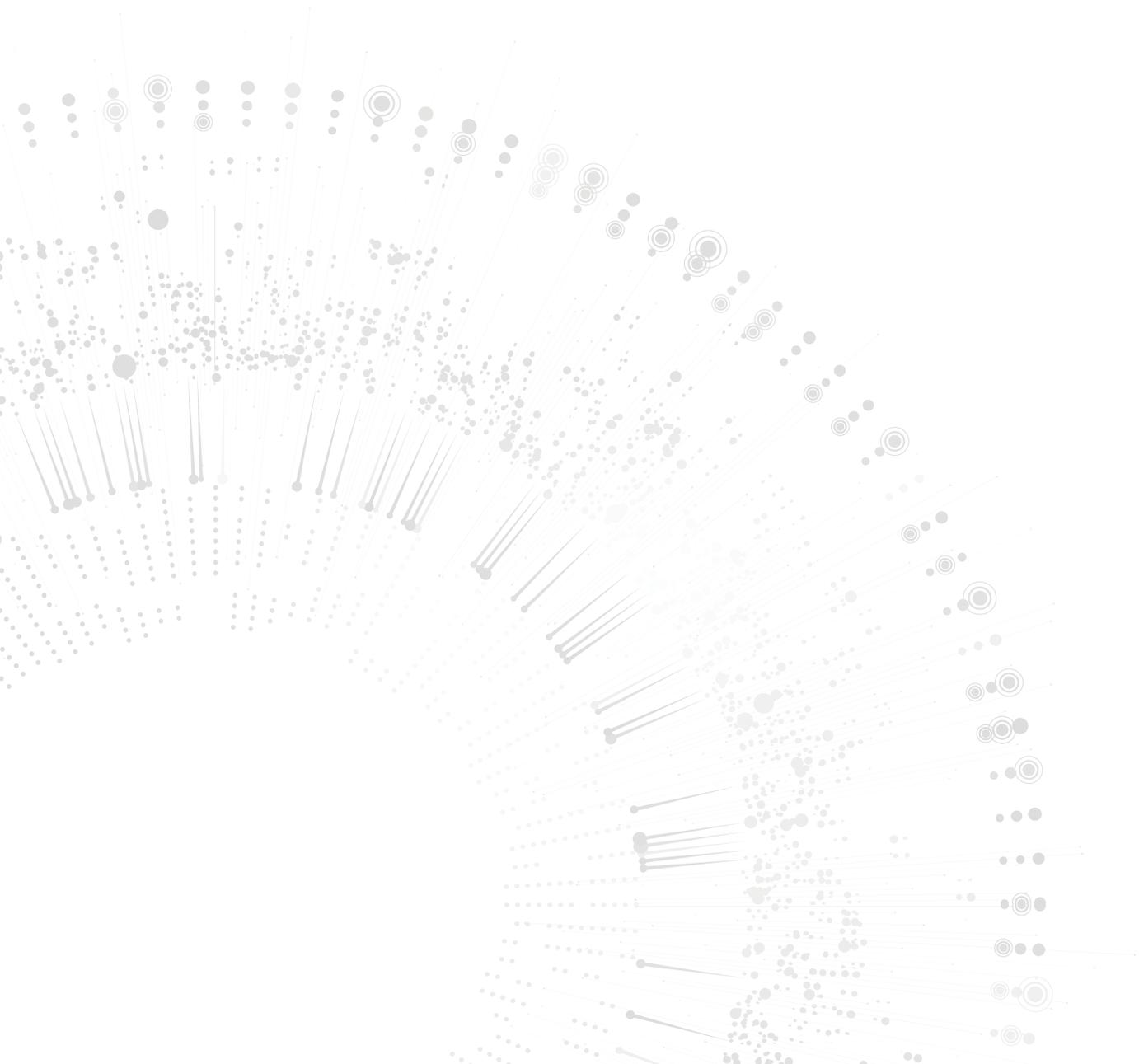
The X-Factor and Role of Digital Thread

According to HBR:

Compared to their industry peers, brands with leading customer satisfaction rankings for three or more years grow revenues **2.5 times faster** and deliver **two to five times** more shareholder returns over the following decade.

Immersive customer experiences are more important than they have ever been before. As customer expectations change and evolve rapidly, how can enterprises keep up? Product digitization and digital transformation enable the creation of intelligent enterprises and help transform business models. With the ecosystem orchestrated around this transformation, enterprises can deliver an immersive, intuitive, and seamless customer experience during the entire product lifecycle. Intelligent enterprises enable immersive decision-making.

According to this AI journal survey:

AI will help make **business processes more efficient** (74%), create **new business models** (55%) and generate **new products and services** (54%)

AIoT is the glue that binds all of this together because of its immense potential to create and capture value across the product lifecycle. It does so by helping OEMS to not only defend their market position but also excel in global competition.

What is Digital Thread?

A DIGITAL THREAD is a source of data truth to create consistency, collaboration, and alignment across functions through real-time data synchronization of related upstream and downstream derivative information. This scalable, universalized, and democratized set of data enables enterprise-wide accessibility and continuity across products, processes, and people.

The benefits enterprises can derive from Digital Thread are myriad and tangible. **Digital Thread enables** removal of **silos** within an organization, full **traceability** of information throughout the product journey across value streams of an organization, understanding of **upstream** and **downstream** (Cross-Domain) decisions, reduction of **physical prototypes** and **modularization** of product **architecture, streamlined** engineering change, **reduced** time to market and increased **revenue** from aftersales.

The **industries** that stand to benefit most from Digital thread in terms of enhancing their Customer-X/Product-X/Enterprise-X are the ones which produce **complex connected products** while trying to develop new revenue models, improve product quality and manufacturing processes Key industries are listed below:

Power generation including Turbine, Engines, batteries

Industrial machinery – pumps, compressors etc.

Food and agricultural machinery

**Construction equipment**

MedTech equipment

Commercial vehicles

How Digital Thread can enhance value for the manufacturing industry

Whether it is power generation or Medtech, all these manufacturing industries are invested in six key themes to drive their CX, PX and EX. Digital Thread is the tool and throughline that enables organizations to create and enhance value from these themes:

The six investment themes are:

1 **New revenue streams** through aftermarket services

2 **Data driven** product innovation for faster time to market

3 **Customer lifetime value** and experience enhancement leading to trust

6 **Security and sustainability-by-design**

5 **Ecosystem** and alliance orchestration leading to additional profits

4 **Intelligent Enterprise** with digitally connected value streams

## AIoT – the value enabler behind Digital Thread

Siloed data is counter-productive for organizations looking to move from product creation to value creation for their customers and ecosystems. This is where Digital Thread plays a pivotal role, as it creates a universal access to data. To enable this, technology should be composable, interoperable, deployment agnostic and scalable.

AIoT helps accelerate innovation while the organisations transition and scale up from a product-centric mindset to connected products, from connected products to connected services, and finally, from connected services to connected customer experience (CX).

In each phase of the transition, value is created through technology, data, and tools.

Bosch Software and Digital Solutions

AIoTValue Creation Leveraging the Digital Thread is at the Core of the Digital Transformation
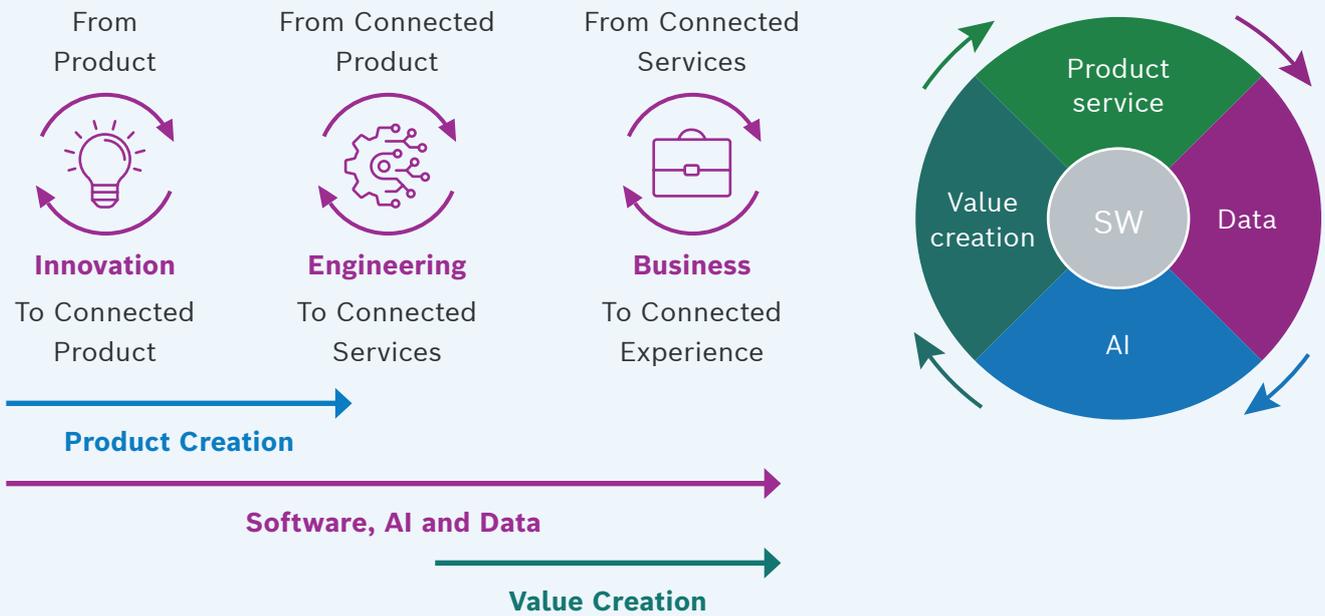
AIoT-enabled **Digital Thread** addresses the entire **product lifecycle value chain** both inside and outside the enterprise to unlock value by being universal, ubiquitous, and boundary-less (e.g., reduction of functional silos). Here is a quick overview of how Digital Thread enhances PX, CX and EX in the entire value chain:

**Within Enterprise (EX)** – Realtime visibility and silos are removed

Within Industry Value chain (CX and PX) – Field performance and predictions are enabled, real-time integration with partners and supply chain through ecosystems are created leading to new business models

Cross industry Value chain (PX, CX) – Value is generated through process flows running across industries enabling enhanced and optimal response to demands and orchestrating a network of multi-industry value chains

In summary, AIoT-enabled Digital Thread generates value through the process flows across industries, thus helping the enterprise gain significant leadership in the market.

Digital Thread as it creates value from order to fulfilment across functions:
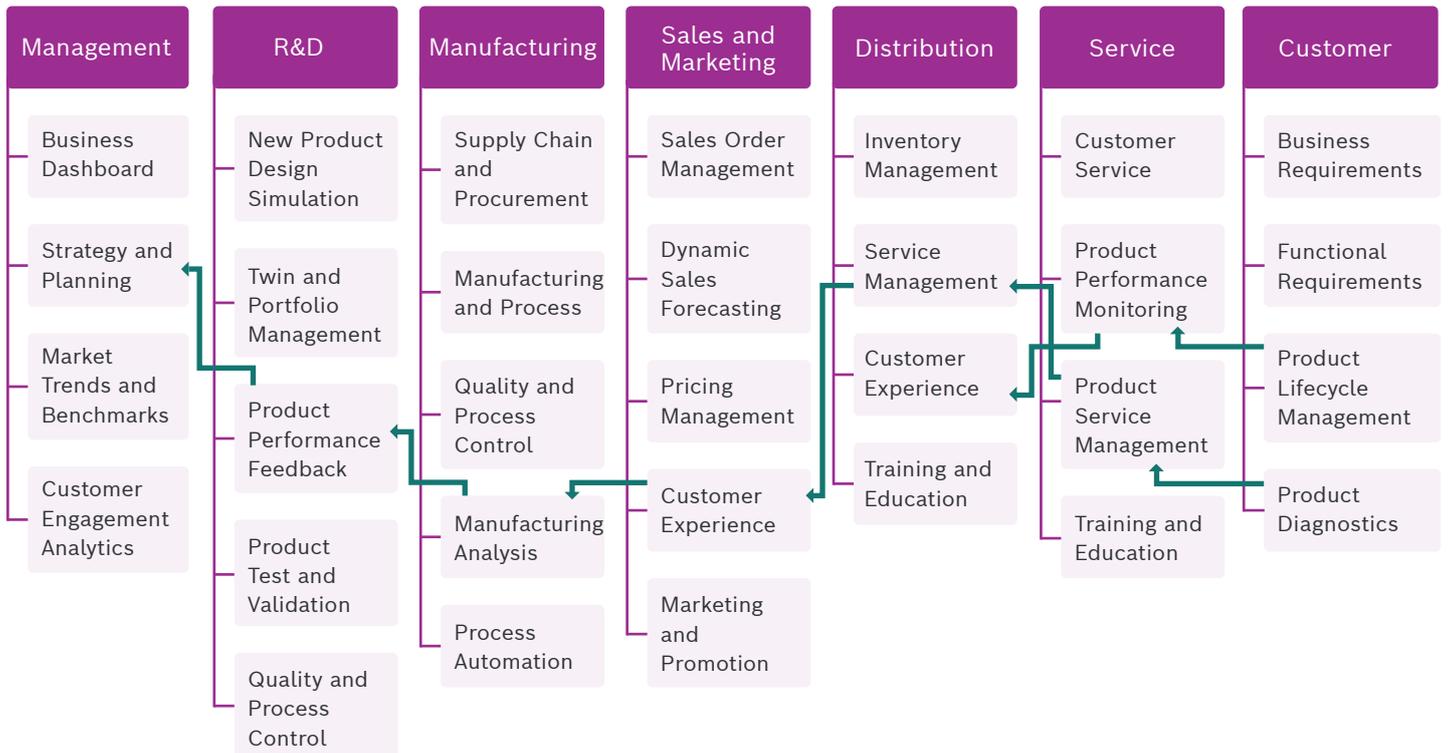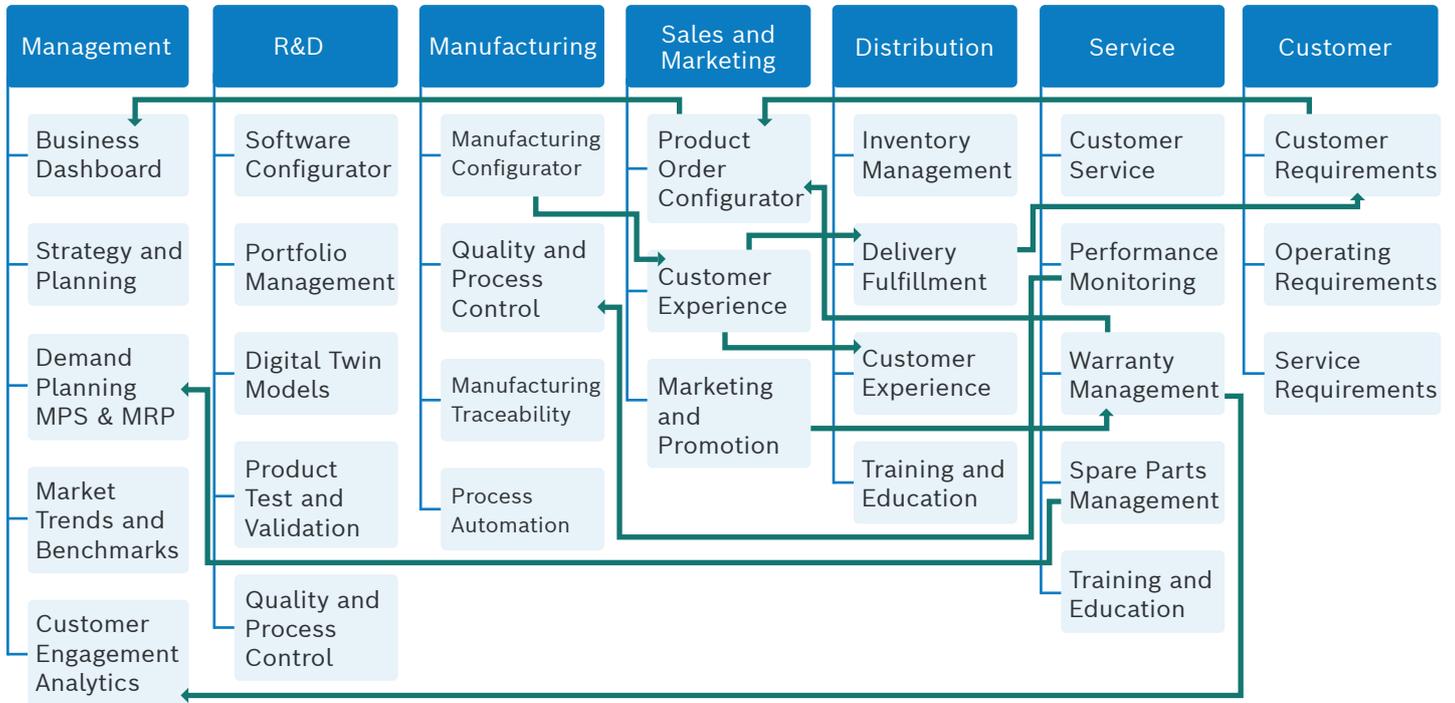
Why is capturing value at each stage of the product lifecycle value chain important?

In a nutshell, value translates to money. We at ISG/Bosch see this as being locked in three layers:
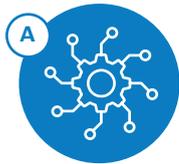
A **Developing intelligent products:** Intelligent products enable the organization to move to the right side of digitalization. Here, the value lies in innovation and quick adaptability to market demands, thereby increasing the PX.
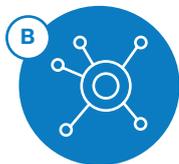
B **Creating connected services:** Services help enterprises move up the value chain, stay relevant to the market needs, and increase customer retention. Analytics and AI help develop new business models and alternate revenue streams.

Some examples are **Remote monitoring, Predictive maintenance, Enhanced asset management**, etc.
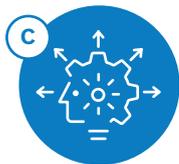
C **Ecosystem orchestration:** As enterprises scale up in value, it becomes even more important to own and orchestrate the ecosystem – software, data and technology are the cornerstones of this process.

Some examples are **Track-n-trace, Data brokering** and **integrated services, multi-vendor maintenance, shared software** and **apps.**

Taking EaaS as an example and drawing out the e2e scenario, we can see that it plays a crucial role across its each stage. EaaS model is beneficial for both service providers as well as end users. For service providers, it helps in establishing reliable revenue streams by developing hi-tech intelligent products and creating connected services. And for end users it facilitates cost effective yet hi-tech products and solutions in their manufacturing setup.

EaaS services in Product life cycle value chain begins with enabling equipment being sensorized and allows them to evolve with AI, ML, and Edge, and help businesses to derive intelligence from connected devices. The equipment in EaaS model derive inferences from real-time usage and accurately schedule maintenance services by collecting data on the cloud. Connected services helps in OTA updates in the systems. The other key attributes of EaaS are managing automatic spare parts orders, ticketing system for error analysis, new billing systems for end customers (subscription model), and automatic customer helpdesk. Real time alerts, reduced equipment downtime, and reduced capex are some of the key benefits of EaaS model.

ETO/MTO

Connected Equipment

Engineering → Quotation management → Sales → Project Specific Purchase → Quality → Transport

Manufacturing

Installation

Commissioning

After Sales

EaaS Model
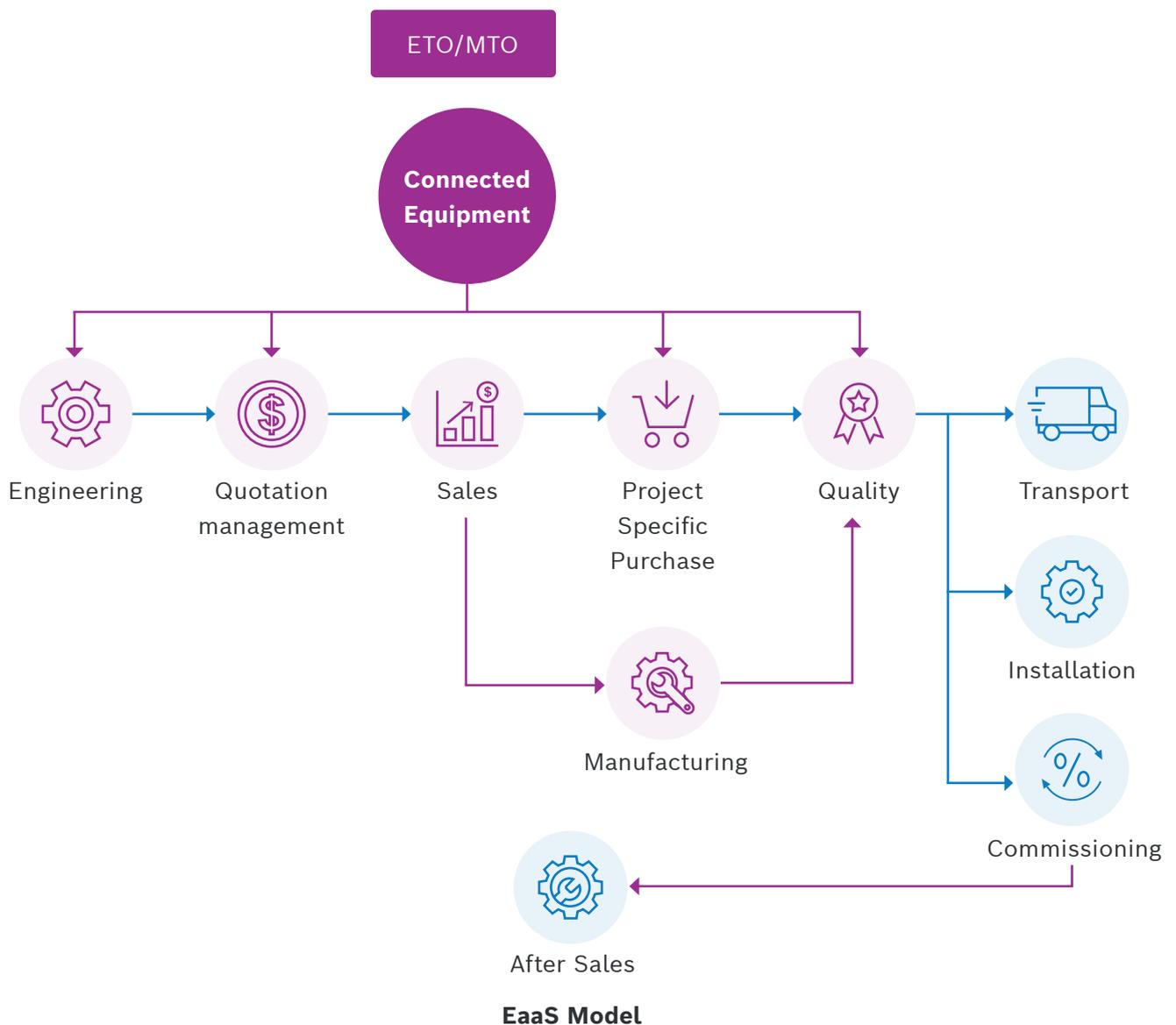
How has the Digital Thread evolved

Digital Thread has evolved along four key aspects - **coverage, understanding, technology, and scalability.**

A Coverage has expanded from use in R&D to full life cycle across the value chain

B Understanding has evolved, initially from basic to esoteric, and now towards a more practical orientation.

C Scalability is expanding from solely increasing functionality to increasing integration, interoperability, and data exchange within the ecosystem and also scalability of the operating model

D Technology has evolved from on-premises simulation tools to combining the power of Digital Thread with cloud and Big Data, cognitive, AI and Mixed Reality.

The practical challenges preventing the adoption of Digital Thread

Some factors that impede the adoption and scale-up of Digital Thread initiatives are:

Lack of a comprehensive value realization strategy

- Even though the industry has moved to a 5–10-year lease models , the aftermarket is not generating enough new revenues
- Long lifecycles leading to limited capability on the sale of more equipment
- Lack of reliable access to real-time field data for business decisions
- In an increasingly complex business landscape, organizations are unable to prioritize the expected outcomes, as a result the AIoT initiatives don't deliver value and remain stuck in the **pilot stage.**
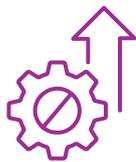
Lack of operationalized or implementation of an operating model aligned to the new software as-the-core

- Legacy/monolithic product architecture
- Lack of interoperability and standardization impeding assets and systems to seamlessly communicate with each other
- Lack of continuous integration and delivery
- Lack of IT-ET-OT-CT* data integration to enable data insights
- Shortage of Digital workforce
- Misaligned skill & capability pyramid

Inadequate feedback loop for Digital Thread to optimize product functionality & user experience

- Product design being hardware-dependent with little to no abstraction of edge HW from application, hampering security and scalability
- Lack of definition of Quality of Service (QoS)
- Enabling remote Access to distributed assets without thorough analysis of risk to the organization
- Difficulties adapting to changing customer or user behavior
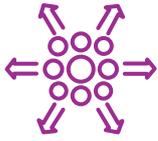
Fragmented technology landscape

- Legacy ET-OT Apps & technology hinder the move to a flexible & predictive organization
- PLM technology not scalable and integration to enterprise layer restricted
- Lack of an all-encompassing cloud strategy and low maturity levels of cloud adoption
- Siloed organizational structure
- Lack of cross-domain collaboration preventing ecosystems to work in tandem

Regulations

- Compliance with changing regulations, especially in ESG
- Complex regulatory environments at industry, regional- and national level
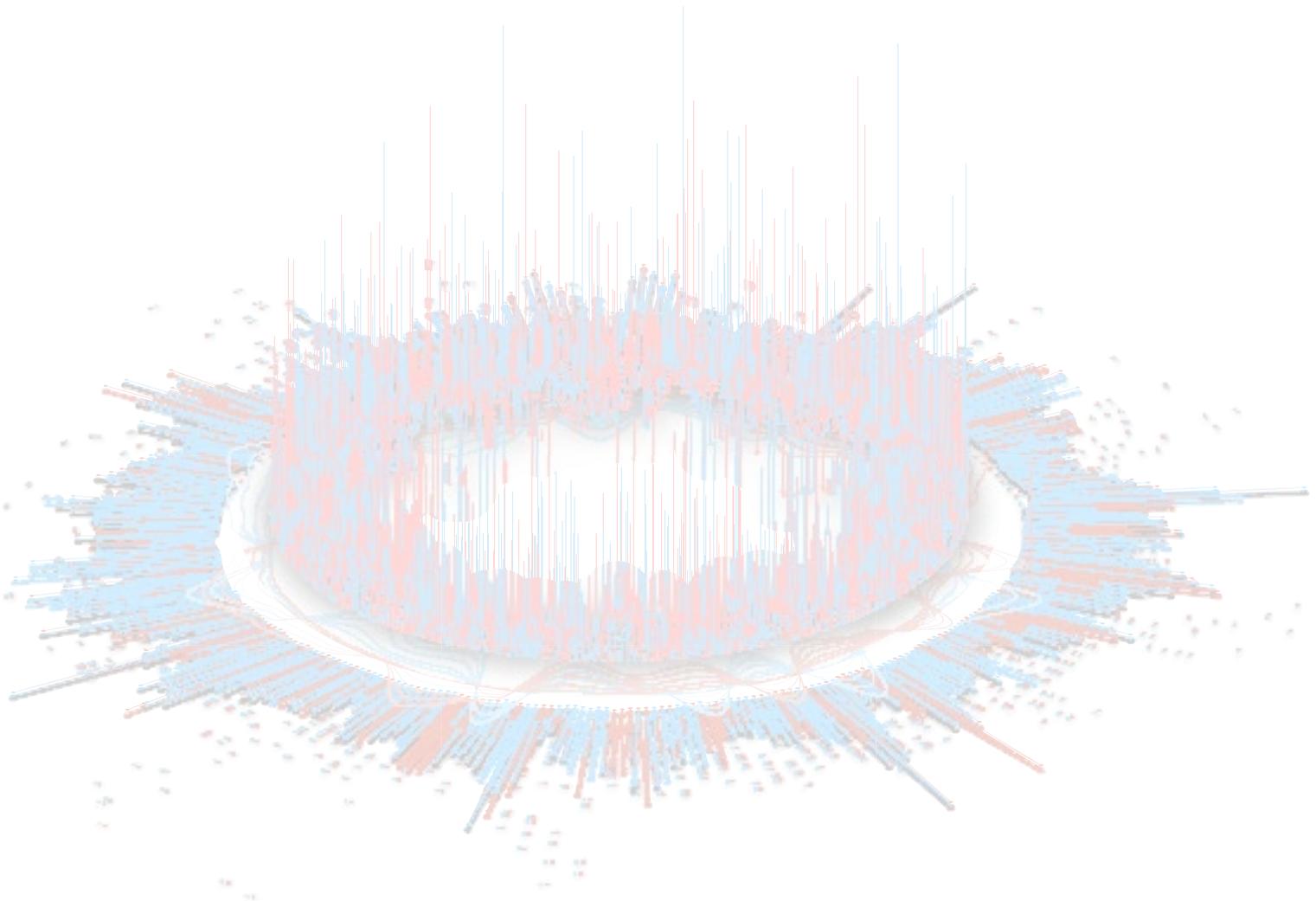
How can you resolve these challenges to enable a successful Digital Thread strategy for your enterprise? Here are our thoughts

To build a successful Digital Thread program, we propose the following steps.

Carry out a current Digital Thread capability assessment to create a business case and roadmap

- Obtain CXO sponsorship and stakeholder alignment
- Identify the white spaces in terms of the product, process, and technology landscape
- Review future plans and roadmap to understand dependencies across businesses
- Identify target areas for the implementation roadmap and any existing roadmap considerations
- Initiate KPIs and levers to measure value and success
- Prioritize opportunities with respect to **relative value** to relative cost and challenge
- Build **initiatives** that would drive these opportunities
- Build an **overall functional architectur**e aligned to enable high level capabilities with expected maturity
- Create a **business plan and roadmap** based on the initiatives

Build a target operating model encapsulating people, process, and technology along the dimensions of

- **Business Value,** which is at the centre and drives the overall operating model strategy
- **Workflows,** which simplify the processes across the Digital Thread project delivery streams
- **Organizational structure,** which enables a business-centric culture with R&R aligned to the common goal
- **Tools and Platforms,** which enable collaboration, free flow of information, removal of silos, and automation for repeatable processes
- **Workforce Empowerment,** which enables the culture shift through change leadership, continuous improvement, adaptability, and accountability

Bring in partners early to

- **Create** an ecosystem where scarce skills and specific technology are available
- **Share Innovation** across the Digital Thread program
- **Align and manage** them culturally to derive the joint benefits

Setup a governance mechanism

- Which is focused on value measurement, ROI monitoring at each level during the continuous evolution of Digital Thread

Conclusion : Digital Thread can transform your enterprise

The journey to drive removal of information silos and Digital Thread adoption will take time and requires a company-wide strategy with buy-in from all stakeholders. Enterprises should start small and keep evolving towards properly defined long-term goals.

But the journey will be undeniably worthwhile as Digital thread can unlock multiple opportunities to save costs, increase productivity and deliver value whether it is generating more sales, increasing the product quality, or improving operational efficiency.

AIoT is the glue holding Digital Thread together for all three levers in the product lifecycle value chain, for the development of intelligent products and connected services (PX), the integration of various systems from multiple disciplines (EX), and the orchestration of an enterprise ecosystem (CX/PX).

The role played by AIoT in enabling the X-factor for enterprises cannot be overstated andthe following characteristics of AIOT are of great importance:

- **Collaborative approach:** Since building isolated connected products has little value to both consumer and professional users, AIoT should enable an ecosystem of connected products and services. Having said that, not every enterprise needs to build its own ecosystem. Being part of one or several ecosystems to gain experience is a good starting point to understand one's organizational needs.

- **Open standards/open source based:** Due to the high fragmentation of this market with specialized and niche players, standardization and open-source communities would drive success and scale. Community-based platforms not only help to share cost and risks among the partners, but they also allow enterprises to focus on developing features that differentiates them from their competition.

- **Developer Community:** A growing ecosystem needs to have access to an active developer community, that develops new functionalities and maintains it. Many enterprises underestimate the effort/cost for maintaining software platforms and are highly dependent on inhouse developers.

- **Deployment strategy:** The deployment strategy is very crucial to build a business model which is scaleable. AIoT should be able to support a variety of deployment strategies including the deployment to different Hyperscalers, or if necessary, on-premise deployments.

- **Enterprise Integration:** AIoT should be able to work with various enterprise systems, such as PLM, CRM, and helpdesk systems in order to build a user-centric, connected product that accompanies the users along the entire product lifecycle, e.g. for service, maintenance or aftersales.

The move towards product development for digital age helps in enhancing the EX, PX, CX through the power of collaboration and use of digital means in a seamless, concurrent, consistent, and reliable manner keeping optimal cost in mind.

The below picture describes this in a nutshell.

VALUE ADD

PRODUCT DATA MANAGEMENT
Managing numerous amounts of data (functional and technical), product development being an organization's key internal stakeholders

PRODUCT LIFECYCLE MANAGEMENT
For collaboration between the manufacturer and its suppliers and customers to facilitate difference organizations to work together on product development, for increased visibility throughout the product lifecycle

DIGITAL THREAD & DIGITAL TWIN
Combining the product value chain from engineering, manufacturing and aftermarket support through each phase of a product's lifecycle, connecting people, process, and systems

DIGITAL PRODUCT DEVELOPMENT
Smart, connected products and business models that live both physically and virtually, unified by data that is continuous, bi-directional, open feedback loop leveraging AI, IOT, AR/VR, 3D Printing, Machine Learning, Blockchain...

TIME

THE POWER LIES IN COLLABORATION WHICH IS SEAMLESS, CONCURRENT, CONSISTENT AND RELIABLE AT OPTIMAL COST

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About Bosch Software and Digital Solutions:

Bosch Software and Digital Solutions (Bosch SDS), an integral part of the Bosch Group is a global provider of engineering and IT services in the areas Connected Enterprise, Connected Products and Connected Healthcare. Led by a vision of strong customer centric approach amongst enterprise customers, SDS is tasked with winning and delivering large and strategic projects in software and digital services for the Bosch Group. SDS's aim is to "Accelerate the Digital World" for its customers, by enabling them to achieve shorter product development cycles, improved operational efficiencies, great customer experiences and new business models with our solutions, services and products. Bosch SDS is headquartered in Bangalore, India and operates in the North America, Japan, Europe and Asia Pacific markets through a network of on-shore, near shore and off-shore delivery centers.

For more information, visit **https://www.bosch-softwaretechnologies.com**.

About ISG

ISG (Information Services Group) (Nasdaq: III) is a leading global technology research and advisory firm. A trusted business partner to more than 800 clients, including more than 75 of the world's top 100 enterprises, ISG is committed to helping corporations, public sector organizations, and service and technology providers achieve operational excellence and faster growth. The firm specializes in digital transformation services, including automation, cloud and data analytics; sourcing advisory; managed governance and risk services; network carrier services; strategy and operations design; change management; market intelligence and technology research and analysis. Founded in 2006, and based in Stamford, Conn., ISG employs more than 1,300 digital-ready professionals operating in more than 20 countries—a global team known for its innovative thinking, market influence, deep industry and technology expertise, and world-class research and analytical capabilities based on the industry's most comprehensive marketplace data.

For more information, visit **www.isg-one.com**.

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