ISG® imagine your future®

DIGITAL PRODUCT IT

A New Responsibility for Manufacturers on the IoT Journey

Vishnu Andhare and Christian Decker

INTRODUCTION

As manufacturing companies become digital enterprises, their capabilities typically mature, moving from traditional stand-alone products, to connected products, to products or offerings packaged "as a service." With the help of digital technologies like the internet of things (IoT), cloud and edge computing and advanced data analytics, enterprises are improving their business operations and creating new digital products and services to drive new business models. Manufacturing enterprises know they must take advantage of emerging technologies like IoT, but some are still struggling to find and capture the value IoT offers. In fact, many manufacturing organizations trying to apply IoT are stuck in the early phase, still trying to align their business, technology and partner ecosystems.

A company is an organism in which optimizing only certain parts can sub-optimize the whole.

A company is an organism in which optimizing only certain parts can sub-optimize the whole. It is no surprise that approximately 30 to 40 percent of IoT pilots fail to become enterprise-wide solutions. Most often, these pilot projects fail to secure the right resources, get de-prioritized (read: shelved) or are compromised by an enterprise trying to make a forward-looking solution align with an outdated organizational way of working.

Tech entrepreneur and investor Chris Dixon uses the term "full-stack start-ups" to define companies that care about every aspect of their product/service and become good at many different things besides software. This allows them to create something out of all those interlocking pieces that is extremely hard for competitors to replicate.

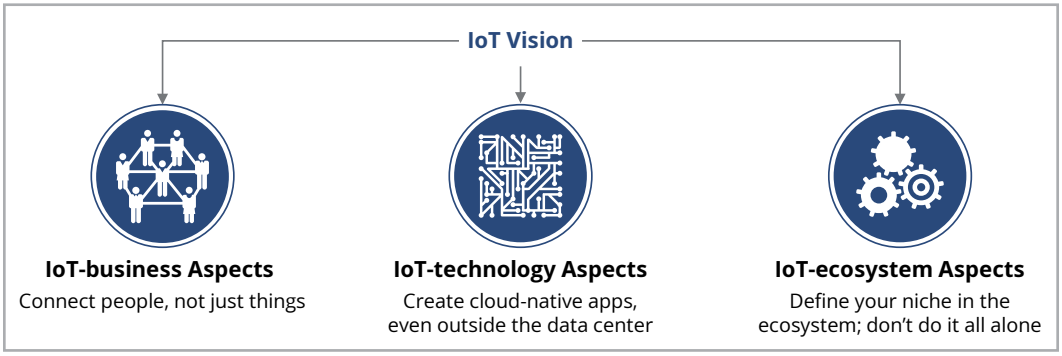

Figure 1: Key "interlocking pieces" to create a unique and sustainable value from IoT Initiatives

Let's extend the analogy to ask, "what's the secret sauce to get unstuck from the pilot stage and realize full value from IoT initiatives?" The answer lies in simultaneously considering business aspects, technology aspects and ecosystem aspects for an IoT initiative. It is in this context that some successful companies have created a new responsibility around "digital product IT" to bring together the three "interlocking pieces" creating a unique advantage that competitors will struggle to replicate.

This paper focuses mainly on the need for such a function or responsibility, which is based on the key challenges in each of the above three aspects. The modality for structuring this function in the manufacturing enterprise varies from organization to organization.

The challenge is all IoT products are complex multi-disciplinary "systems" involving multiple applications, hardware and software components, networks and infrastructure backend – from the cloud on one end to the edge on the other.

Key Challenges in Creating Unique and Sustainable IoT Initiatives

A. IoT–business Aspects

Creating a Common Definition for an IoT Product, Business Case and Success

Enterprises often ask, "Can you give us a set of KPIs to measure performance and financial aspects of my IoT product?" The challenge is all IoT products are complex multi-disciplinary "systems" involving multiple applications, hardware and software components, networks and infrastructure backend – from the cloud on one end to the edge on the other. Defining the landscape of an IoT product can be like the proverbial blind man with the elephant, with participants from the enterprise's business and technology organizations and partner ecosystem each perceiving only a limited part of the full system.

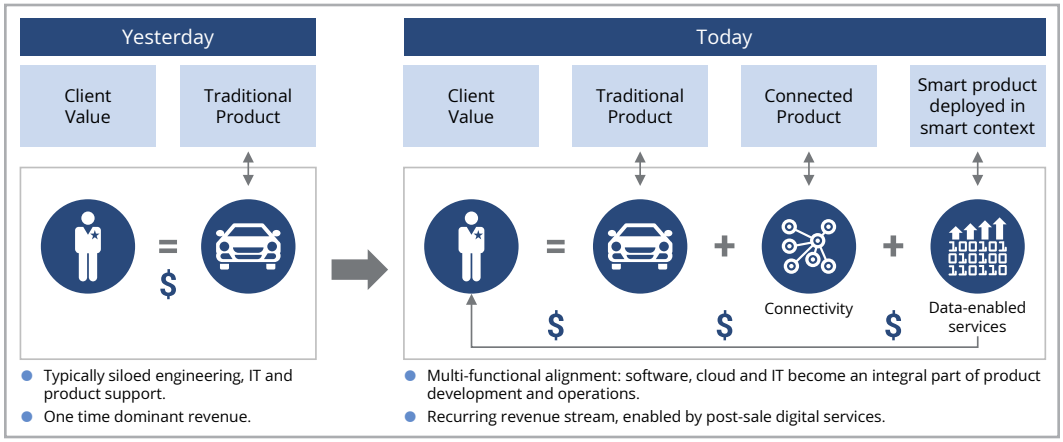

Figure 2: Expanded definition of an IoT product

Traditionally, each part of an enterprise has its own strengths and weaknesses. The operations technology (OT) team does not always have the IT expertise it needs to deploy and remotely manage applications across the globe at distributed scale and security. And a traditional IT team does not always have the domain know-how it needs to build, test and innovate new apps to improve the business. As a result, some gaps may be exposed in the end-to-end value stream of the IoT product, which are either left unoptimized or have no clear ownership for the outcomes/KPIs.

A partial or incomplete definition of an IoT product can keep an enterprise from accurately calculating the total cost of ownership (TCO) of the product. For example, as software becomes a key differentiator, manufacturers are "unbundling" applications and functional software from the hardware with the goal of exerting more control over software domains. However, software follows continuous development approaches and can have a life of 10 to 15 years. Considering only development investments in the IoT business case without considering the very real, ongoing costs involved in running, supporting and operating the product post-production can derail the TCO budgets.

Building System-level Solution Integration and Managing Interdependencies

Apart from the cost mentioned above, agility is a key focus area in IoT. Reducing interdependencies across teams and simultaneously making relevant information available to the stakeholders can have a major impact on agility. Now, consider these aspects with respect to IoT products, which, by definition, are multi-disciplinary involving business, IT, operations and ecosystem partners in development and delivery.

When it comes to reducing interdependencies, crosslinking product development, production and operations domains with that of IT can be complex. Traditionally, these domains have used different development processes, which can create roadblocks to Agile delivery.

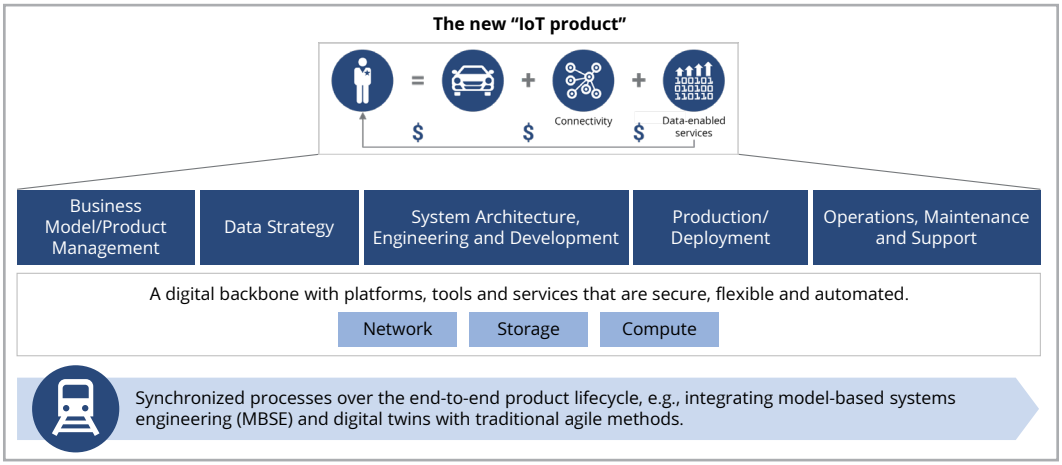

Figure 3: IoT products are complex multi-disciplinary systems, involving multiple stakeholders

The solution is not to shift every team to Agile methods but to evaluate if Agile is right in the specific context and, if so, to adopt it with necessary modifications.

Consider a typical manufacturing organization:

- Mechanical development follows a stage-gate-driven waterfall process with tools such as product lifecycle management (PLM) and team data management.
- Embedded systems engineers follow hybrid or partially Agile processes with a specific electrical/electronic (E/E) tool chain.
- Mobile app development follows fully Agile methods and tools with continuous integration.
- Production (shopfloor) engineers follow ISA 95 standards with manufacturing execution systems (MES) tools.
- IT back-end systems follow hybrid or partially Agile processes with their own custom-designed tools.

The solution is not to shift every team to Agile methods but to evaluate if Agile is right in the specific context and, if so, to adopt it with necessary modifications. For example, integrating methods such as model-based system engineering (MBSE) and digital twins with Agile methods can provide a "single source of truth," ensuring that cross-functional decisions are made with the big picture in mind.

B. IoT-technology Aspects

Optimizing the Cloud-edge Continuum

The IT architecture for most manufacturing enterprises was designed many years ago and does not meet today's business challenges when it comes to the distributed computing requirements of IoT systems.

Enterprises using "cloud only" solutions face challenges in terms of latency, bandwidth usage for data transfer and upgrades to networking infrastructure. And "edge only" solutions can be complex to execute, as the devices at the edge vary in hardware and connectivity capability, and the legacy technology architectures at the edge hinder security and scalability, with each device needing to be customized.

Tomorrow's IoT architecture will likely use a mix of cloud and edge computing. Future industrial IoT products will require automatic remote updating of the software stack – from the application at the top to the underlying operating systems – at a large scale and over a long lifecycle. These products will include a diverse set of assets, gateways, protocols, applications and legacy technologies at the edge. Sound familiar? Similar challenges once existed in data centers, but, thankfully, cloud technologies have made tremendous progress in addressing them.

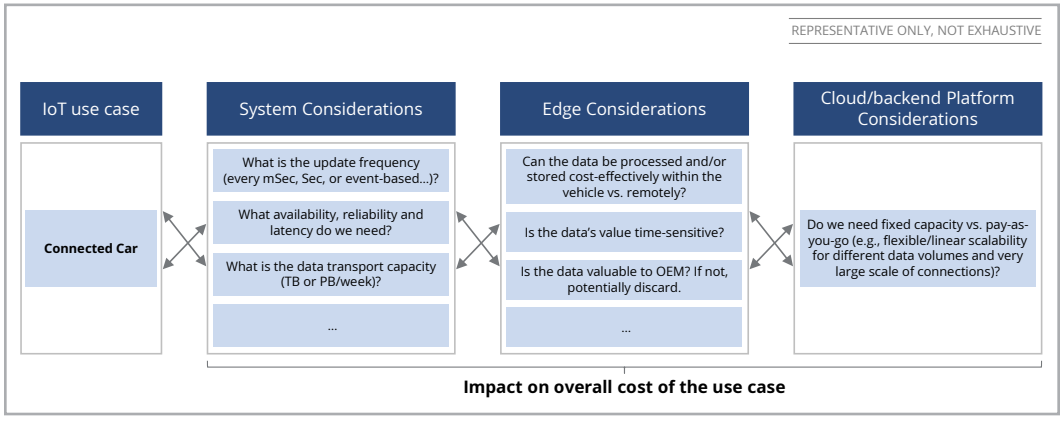

Figure 4: System and cost considerations for IoT use cases need to be optimized for cloud-edge

Addressing challenges at the edge – including, even inside embedded systems – is where IoT system developers will have to make effective use of cloud principles, such as containers, orchestration software and DevOps, for a purpose-built edge orchestration solution. In some cases, replicating the flexibility and reliability of the cloud at the edge also may require virtualization to decouple software from hardware.

Choosing IT Infrastructure that is Equipped to Handle IoT Data

Data-driven insights are well recognized to be at the heart of every successful IoT project, as the value in IoT moves from software based purely on code to systems that combine code and data to deliver value. However, legacy architectures may not be equipped to handle this change. When IT departments are running a race against time to set up a modern data infrastructure for IoT, they often use a motley combination of old and new solutions by accident, and not by design. The old and new solutions are driven by two types of data use case, including:

Data-driven insights are well recognized to be at the heart of every successful IoT project, as the value in IoT moves from software based purely on code to systems that combine code and data to deliver value.

1. Business intelligence/dashboarding (old solutions, internal facing): Typically, these are data warehouses with "locked data," i.e., structured data stored in predetermined and constrained formats to serve specific, predefined applications
2. Customer-facing products and advanced applications (new solutions, external facing): Typically, these are data lakes/databuses with "open (fluid) data" that enable users to run semantic queries and combine diverse data sets in unique ways to power any application regardless of the source of data.

A wrong choice of the data infrastructure made here may mean that the requirements of distributed IoT systems are not met – one of the reasons why many organizations have not been able to go beyond simple use cases such as remote asset monitoring and diagnostics.

C. IoT-ecosystem Aspects

Standardizing IoT Services for Plug-and-play Reuse

Rolls-Royce introduced the product-as-a-service business model when it started maintaining and replacing jet engines for a fixed cost per flying hour, calling it "power by the hour." As IoT matures, product-as-a-service is poised to become more common. Viewing this in the context of IoT sourcing, we might think of the as-a-service revolution on enterprise IT's "back end" – including infrastructure-as-a-service (IaaS), platform-as-a-service (PaaS) and software-as-a-service (SaaS) – as reappearing at the "front end" for managing globally distributed IoT products. This will shift IoT sourcing to a managed services model, giving enterprises the option of buying IoT-as-a-service and allowing them to operate it as an operational expense rather than as a capital investment.

This is where a standardized IoT service catalog across various lifecycle phases of the IoT product – including design, build, run and optimize – can help enterprises reuse, scale and optimize IoT investments. Standardized and modularized IoT services also improve speed by maximizing reuse and preventing individual IoT devices from turning into custom implementation projects that require re-engineering.

Standardized definitions of IoT services also help enterprises benchmark performance, innovation and financial KPIs across various ecosystem providers, as they enable comparison of best-in-class IoT services sourced from multiple ecosystem partners.

Standardized and modularized IoT services also improve speed by maximizing reuse and preventing individual IoT devices from turning into custom implementation projects that require re-engineering.

Designing Ecosystem Partner Contracts

In IoT, there is a lot of talk about the importance of ecosystems, and most manufacturers agree that their business will be shaped by new opportunities emerging from services exchanged within an ecosystem. However, engagements that involve shared risk, shared incentives and mutual benefit present enormous challenges to manufacturers that have built monolithic businesses based on closed, proprietary "command and control" approaches.

Challenges in the "value exchange" between enterprises and ecosystem partners can be addressed with two important principles:

- **Outcome-oriented approach to sourcing IoT:** Goal-driven problem-solving through a prescriptive RFP is not always the best way to manage innovation. Instead, it is a discovery process that can happen as you come to understand the ecosystem. We have entered a phase in which ideas can emerge from anywhere in the world; no single company should look to innovate on its own. A sourcing approach for IoT should allow an iterative process for tendering end-to-end business and technical services, with an "outcome oriented" approach that prescribes the "what" of the desired end state rather than the "how" of service delivery.

- **Flexible contracts for Agile services:** The digital landscape is evolving quickly, and large-scale digital programs built on upfront investments with three-to-five-year timeframes are failing. In other words, if what you seek with your IoT initiative is not long-term project goals but short/medium-term "minimum viable products," then contracts with providers should reflect that. Contracts for Agile services should include 1) a lean and modular contract structure to allow for a swift contract negotiation process with clear separation between various contracts, and 2) the providers to adapt to the complexity and timelines of the task at hand – for example, by estimating the burn rate per sprint or per release. The contracts should have the flexibility to be changed or terminated once the sprint is complete but retain the full value of the services delivered until then.

Conclusion

Different manufacturers will take different approaches on their IoT journey, but considering the business, technology and ecosystem challenges equally and simultaneously is the only way to create a durable competitive advantage for an IoT initiative. The current IoT challenges span multiple facets of the organization and even beyond. Considering that many manufacturing organizations are divided into siloes, there may not be a magic bullet to solve these challenges.

New dedicated functions such as "digital product IT" could be an important step toward defining and addressing these challenges. The task, after all, is to acknowledge that IT and OT (aka "business functions") have walked in the other's path in the past, at least partially. Hence, each can learn from the other to build the "interlocking pieces" that are hard for competitors to emulate.

ABOUT THE AUTHOR

Digital Product IT
A New Responsibility for Manufacturers on the IoT Journey

VISHNU ANDHARE

As an advisor at ISG's Smart Manufacturing practice, Vishnu helps enterprises to drive "full-stack" IoT transformation, bridging IT and OT worlds and covering business, technology and ecosystem aspects. This includes custom market research, collaborative solution shaping & service design, ecosystem development and designing new "operating model" for the software-driven world.

ISG®
imagine your future®

ABOUT THE AUTHOR

Digital Product IT
A New Responsibility for Manufacturers on the IoT Journey

CHRISTIAN DECKER

Christian Decker is Partner at ISG, leading the Smart Manufacturing vertical in EMEA. He has sound technical and business skills to offer, bringing to ISG client projects a wealth of professional. He has gained his experience over a period of more than 17 years as an IT Product Manager, Service Manager, Team Manager and Management Consultant. His expertise encompasses Portfolio-Management, IT Sourcing Strategy, IT Infrastructure Outsourcing, Service Design and Product-Management, Transition Management as well as IT Service and Cost controlling, P&L responsibility and Benchmarking.

ISG®

imagine your future®

ABOUT ISG

ISG (Information Services Group) (Nasdaq: III) is a leading global technology research and advisory firm. A trusted business partner to more than 700 clients, including more than 75 of the top 100 enterprises in the world, 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.

www.isg-one.com

Let's connect NOW**...**

ISG®

imagine your future®

