INTELLIGENT PRODUCTS AND SERVICES

UNLOCK THE OPPORTUNITY OF A CONNECTED BUSINESS

#GetTheFutureYouWant

Capgemini RESEARCH INSTITUTE

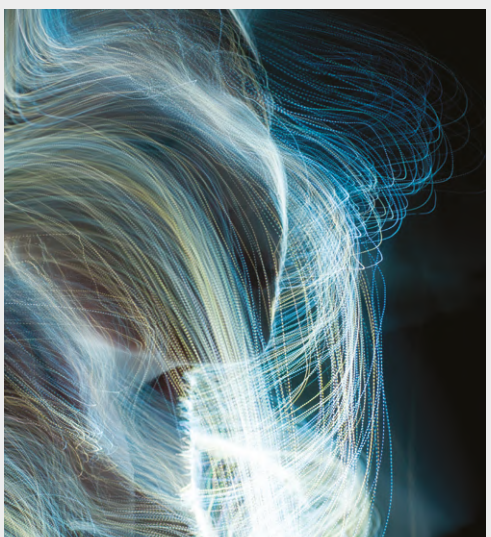
Introduction

Technology is redefining product potential, enabling new business models, and transforming customer experience (CX) across every industry:

- Samsung's new AI-powered fridge-freezer can alert users to low supplies, even making meal suggestions based on stored ingredients. Users can also see what's in their fridges from their smartphones while out grocery shopping.[1]
- US-based medical-devices company Propeller Health's connected inhaler can record when and where patients experience asthma conditions and provide insights into local aggravating environmental factors. It also sends insights directly to doctors, enabling more informed symptom-management[2]
- In the automotive industry, greater software-based functionality means that new features can be introduced through over-the-air (OTA) updates, without the customer having to visit a repair shop. For instance, a Tesla vehicle in need of repair can autonomously download corrective software or request a valet to pick up the car and deliver it to a Tesla facility.[3] Manufacturers such as John Deere have also implemented OTA updates for their tractors and mobile agricultural equipment.[4]
- Detailed data obtained from connected wind turbines on Norway's Havøygavlen wind farm enables operators in Germany to balance wear on components against required power output. The model also helps engineers to anticipate when specific parts will fail, facilitating predictive maintenance.[5]

Fueled by data, a product can be connected interactively with a broader ecosystem offering enhanced CX, optimized product performance and services, agile

Introduction



supply chain, and delivering new sources of value more sustainably, helping organizations to transition to 'solution-provider' status. We call these smart, connected, software-enabled products that empower organizations to move from traditional 'make, sell, ship' business models to new service-based models as **intelligent products and services.**

However, many organizations are struggling to fuse the strategy, design, technology, engineering, data science, and operational excellence required to make the leap. How can organizations realize the benefits they hoped for from intelligent products and services? How can they focus on rebuilding their product portfolios with the latest software and technologies embedded, making them both smarter and more sustainable? How can they capitalize on data assets to offer new value-added services? And finally, how can they scale successful initiatives?

To address these questions, we surveyed 1,000 traditional product and service organizations globally in automotive, medical technology, consumer products, industrial and capital goods, hi-tech manufacturing, and energy and utilities.[6] These organizations all have either a well-defined or work-in-progress vision and strategy for intelligent products and services. To complement the quantitative insights, we also conducted in-depth interviews with representatives of these traditional sectors, as well as digital-native firms.

Our questionnaires explored organizations' intelligent products and services strategies and governance structures, capabilities, and product development and launch processes, as well as the benefits and key challenges in building an intelligent products and services portfolio. Please refer to the methodology for more details on the survey.

Introduction

In this report, we focus on four key questions:

01

Why is it important for organizations to seize the intelligent products and services opportunity?

02

How will a shift to a service-based model drive new growth and business value opportunities?

03

What is the current level of adoption, and what are the greatest challenges to ambitions for intelligent products and services?

04

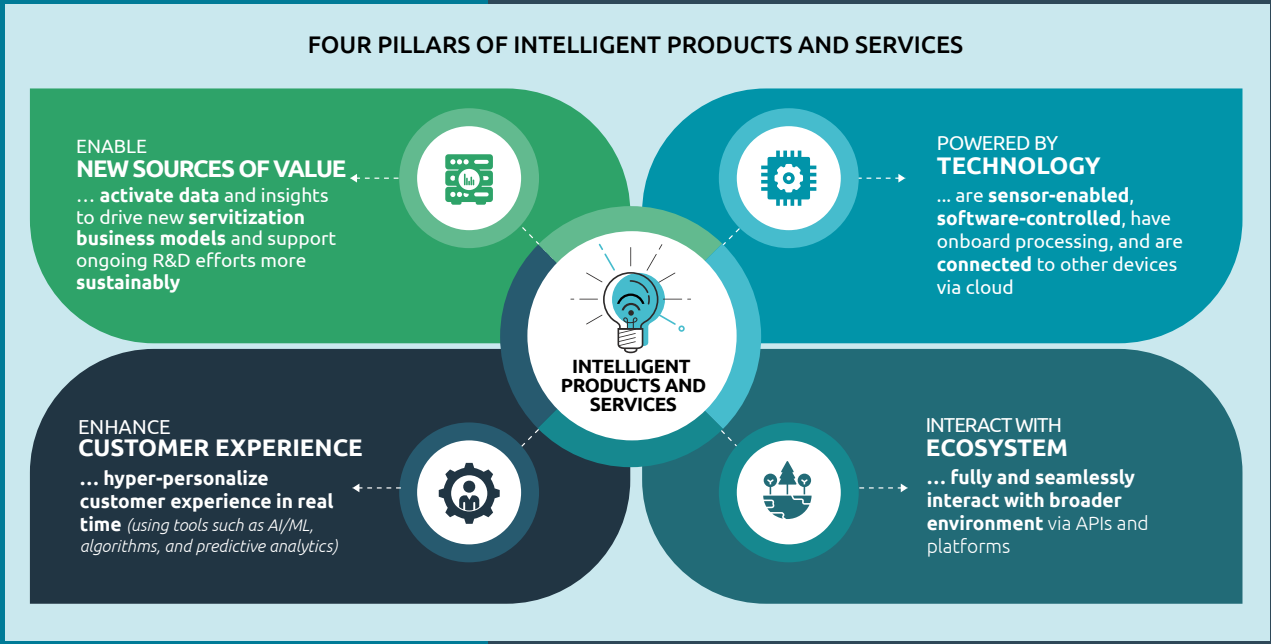
And, finally, what are the key recommendations for organizations in terms of closing the maturity gap and scaling intelligent products and services portfolios?

DEFINING INTELLIGENT PRODUCTS AND SERVICES

Intelligent products are smart, connected, software-enabled products that can be continuously improved using real-time feedback. The data they generate and collect can enable organizations to offer **intelligent services**, leading to new 'servitization'-based business and revenue models. Figure 1, provides an overview of the four pillars that define the intelligent products and services approach.

Fig.1

Key dimensions of intelligent products and services



Source: Capgemini Research Institute Analysis.

Executive summary

The era of intelligent products and services has arrived – impacting every industry from connected cars to remote health monitoring to smart home services and more. This coupled with heightened competition from digital natives is increasing the urgency for traditional organizations to make a pivot. Eighty percent of organizations in our research acknowledge that the shift from product- to service-based models is the key trend impacting their industries today. The few businesses that already have well-defined visions and strategies for this shift are realizing significant benefits in the form of new, profitable revenue streams; increased customer loyalty and satisfaction; greater efficiency; reduced total cost of ownership; and improved competitive advantage, among others.

However, transitioning from traditional products to Intelligent Products and Services is complex: it demands customer centricity, new business models, organizational change, new ecosystem partnerships, and digital proficiency. A majority of organizations are in early stages of this transition with many yet to move beyond pilots and proofs of concept (PoCs); just 7% of organizations have implemented these use cases at scale across business units or geographies.

We found that a small cohort of 'Leaders,' – 8% of the surveyed organizations – are ahead in their transformation journeys. These organizations have successfully strategized to transform their end-to-end value chains and operating models; actively focused

Executive summary

on outcome-based or service-based business models; and moved away from legacy technology and systems. Leaders do this through holistic and innovative strategy, agile culture, collaboration, and a focus on developing and recruiting the requisite talent and skills.

To harness the full potential of intelligent products and services, organizations must adopt the best practices. In addition to establishing an **end-to-end strategy** and inculcating **agile** in their ways of working, organizations must put **customer experience (CX) and outcomes at the heart of intelligent design and operating models.** Tactical projects impacting the customer should be prioritized to create significant business value and brand differentiation. Further, traditional legacy systems must give way to a **more service-oriented architecture**. Organizations should invest in comprehensive **data-management systems** and **data-analytics capabilities** to build profitable service-based business models and generate competitive advantage. Finally, organizations must take a '**toe-in-the-water' approach**: build only a few use cases at one time and test those out before scaling.

"The key approach is to think **big, plan thorough, start small, scale fast,** and **evolve!**"

01

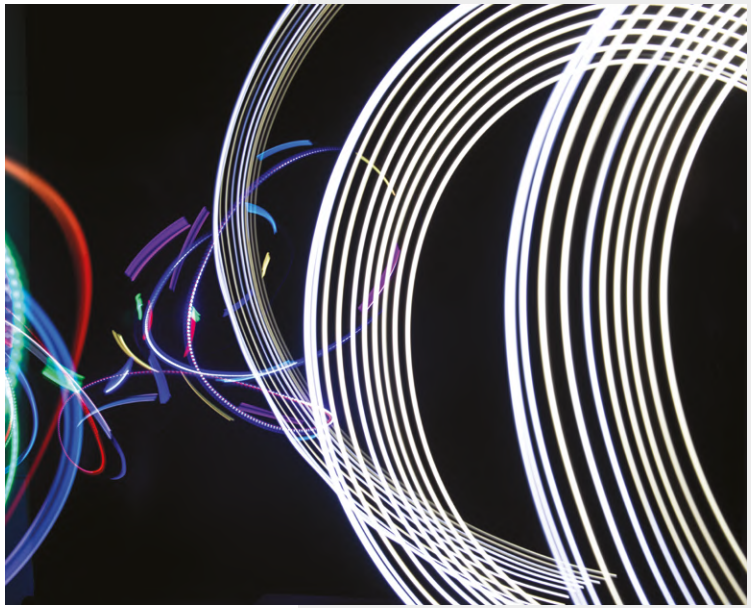
SEIZING THE INTELLIGENT PRODUCTS AND SERVICES OPPORTUNITY

A shift to software- and service-based models is impacting all industries

Nicolas Veauville, Senior Director at Philips Domestic Appliances: *"Intelligent products that can adapt their performance based on customer needs will make the competitive difference. I believe that bringing an intelligent product is not the end goal; the end goal is to create a better experience for our customers, so that it drives more revenue over the lifetimes of our brands."*

We found that 78% of all the organizations we reached out to have, or are building, a vision and strategy for a move to intelligent products and services. We continued our survey with those 78% (1,000) of organizations to understand more about maturity, challenges, and priorities. Of these 1,000 organizations, 59% already have well-defined visions and strategies, and the remaining 41% are developing them.

More than 80% of organizations acknowledge that the shift from product- to service-based business models (e.g., 'as-a-service' models) is the key trend impacting their industries today (see Figure 2). This is particularly prominent in industrial manufacturing, with 87% of organizations recognizing it as a key trend, closely followed by MedTech and consumer products manufacturing (both 84%). Moreover, 87% of organizations say that intelligent products and services are crucial to their business strategy, and 69% agree that not investing in intelligent products and services would constitute a serious risk and could lead to a loss of market share/competitive advantage. However, despite this imperative, many organizations feel inadequately prepared to manage these trends.

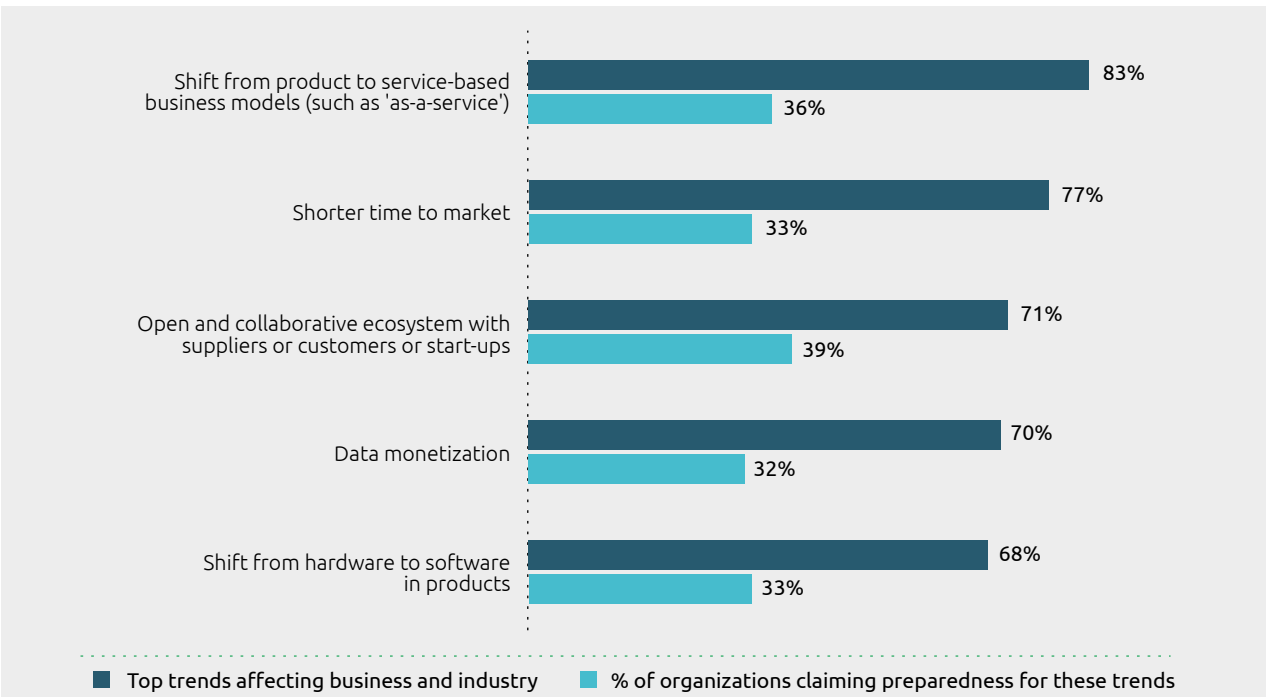


83%

of organizations acknowledge that the shift from product- to service-based business models is the key trend impacting their industries today.

Fig.2

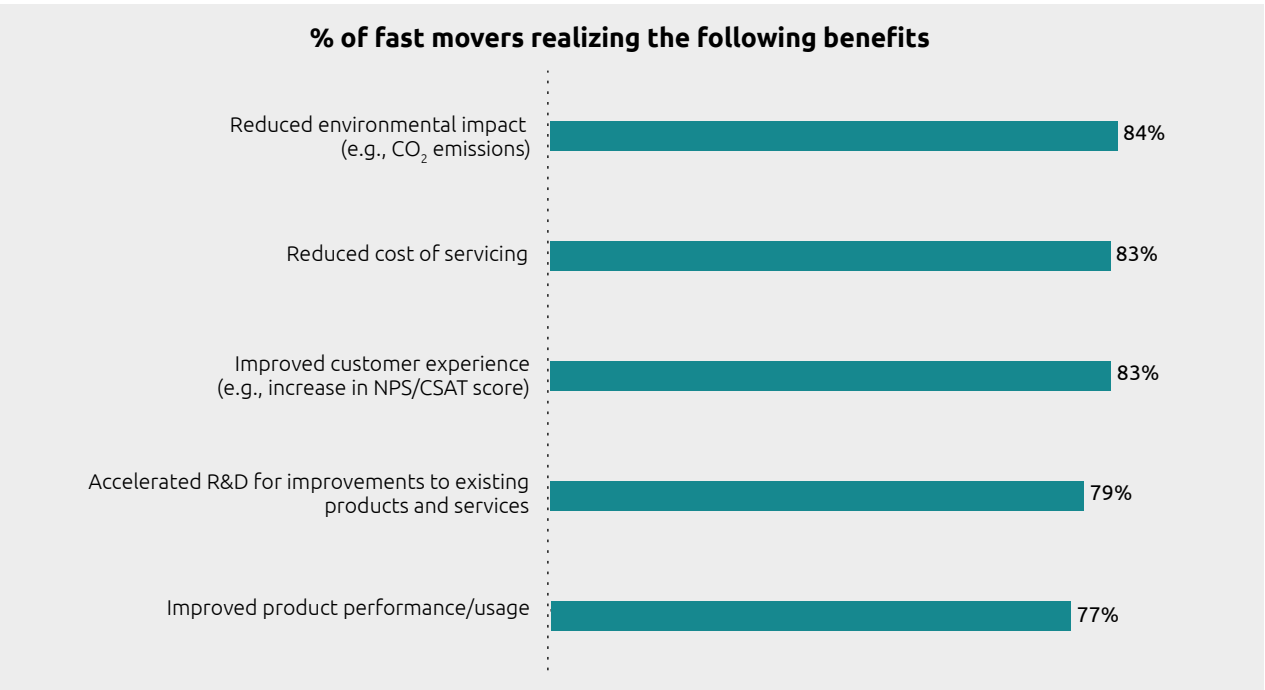
Organizations currently feel ill-equipped to manage key trends



Source: Capgemini Research Institute, Intelligent products and services survey, April–May 2022, N=1,000 respondents from unique organizations that have or are currently building visions and strategies for a move to intelligent products and services.

Fig.3

Fast movers are seeing benefits related to cost, sustainability, and CX from intelligent products and services



Source: Capgemini Research Institute, Intelligent products and services survey, April–May 2022; N=587 organizations that already have well-defined visions and strategies for intelligent products and services.

Fast movers are already reaping benefits

We analyzed the benefits gained by organizations with well-defined visions and strategies for intelligent products and services (59%) - which we will refer to as 'fast movers' - and found that these took the form of reduced environmental impact, increased customer loyalty and satisfaction, greater efficiency, and reduced total cost of ownership (see Figure 3).

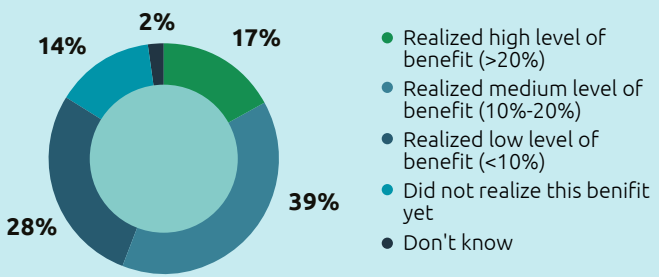
Looking at the extent of some of these benefits realized among fast movers:

Shift from product to service-based business models (such as "as-a-service")

84% of fast movers realize this benefit

Extent of benefit

56% of fast movers have already seen reduction of more than 10% in their carbon emissions



Example

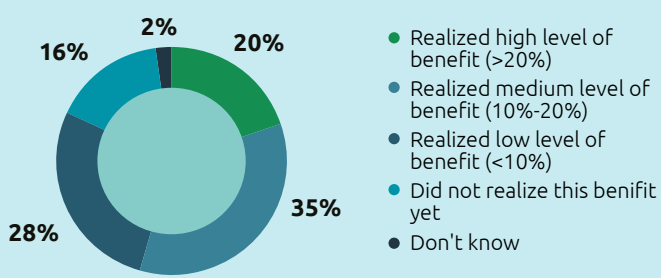
Signify (formerly Philips Lighting) offers "light-as-a-service" (LaaS), providing customers with lighting for an annual fee, while Signify retains ownership of all fixtures and lamps. This eliminates the customer's initial capital investment in switching to energy-efficient LED lighting, resulting in savings in energy costs and carbon emissions, and it allows Signify to re-use or recycle lighting products and systems, further reducing the environmental impact.[7]

Improved customer experience

83% of fast movers realize this benefit

Extent of benefit

55% of fast movers have already seen an improvement of more than 10% in Net Promoter/Customer Satisfaction score



Example

To enable a contactless CX during the pandemic, **Schindler Elevator Corporation**, a leading global mobility solutions provider, developed the ElevateMe mobile app to enable passengers to call elevators and select their floors using their smartphones.[8]

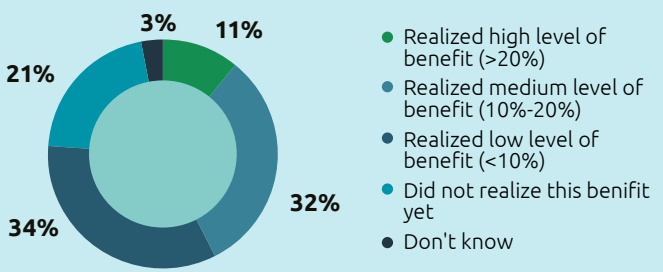
Source: Capgemini Research Institute, Intelligent products and services survey, April–May 2022, N=587 organizations that already have well-defined visions and strategies for intelligent products and services.

Improved product performance

77% of fast movers realize this benefit

Extent of benefit

34% of fast movers have seen an improvement of up to 10% in product performance, and 43% have seen an improvement of more than 10%



Example

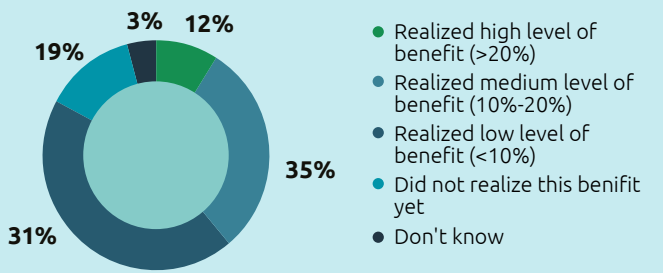
Elisabet Svensson, Global director, Digital Innovation at **SKF Group** says: *"To make our bearings durable, we use Machine Learning to identify anomalous patterns and warn technicians of evolving asset failure, meaning you can fix a defect before it escalates. More than 50% of the bearings that fail before assumed lifetime is caused by erroneous placement or maintenance. There is, in other words, a high potential for our customers to save a lot of money with a condition monitoring system."*

Faster research and development in existing products

79% of fast movers realize this benefit

Extent of benefit

Almost half (47%) of fast movers have seen a reduction in time for R&D of more than 10%



Example

"Atlas Copco has over 100,000 connected compressors operating at more than 35,000 customer sites worldwide. These compressors are delivering in excess of 150 data measurements per second. This is proving vital, on one hand in enabling data-mining engineers to analyze performance patterns intelligently and, on the other, in helping design teams to apply the data in the development of new and more customer-suited compressed-air technologies," says Stef Lievens, Business Line Manager at **Atlas Copco Compressors**.[9]

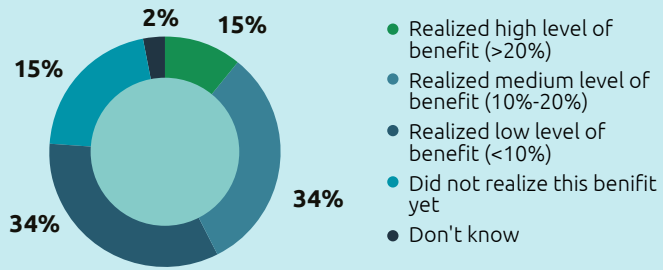
Source: Capgemini Research Institute, Intelligent products and services survey, April–May 2022, N=587 organizations that already have well-defined visions and strategies for intelligent products and services.

Reduced cost of servicing

83% of fast movers realize this benefit

Extent of benefit

Almost half of fast movers have seen a reduction in servicing costs greater than 10%



Example

"Rolls-Royce's Intelligent Borescope[10] can reduce by up to 75% the time required to inspect an aircraft engine, potentially saving £100m in inspection costs over five years. Paul Flint, Head of Future Service Propositions at Rolls-Royce, adds: *"As engines become more connected, contextually aware, and capable of comprehension, they become more and more 'intelligent.' These intelligent engines are linked in an ever-evolving ecosystem that allows us to sense and respond to changes in the operating environment, and, through big data, unlock a host of operational efficiencies for airlines."*[11]

Swiss food manufacturer Nestlé boosted its corporate coffee-machine offering with the Internet of Things (IoT), not only to enable remote configuration of its machines, but also to carry out predictive maintenance, thereby increasing the efficiency of its technicians.[12]

Source: Capgemini Research Institute, Intelligent products and services survey, April–May 2022, N=587 organizations that already have well-defined visions and strategies for intelligent products and services.

83%

of fast movers have seen a reduction in cost of servicing due to intelligent products and services.

"To make our bearings durable, we use Machine Learning to identify anomalous patterns and warn technicians of evolving asset failure, meaning you can fix a defect before it escalates. More than 50% of the bearings that fail before assumed lifetime is caused by erroneous placement or maintenance. There is, in other words, a high potential for our customers to save a lot of money with a condition monitoring system."

Elisabet Svensson

Global director, Digital Innovation, SKF Group

INTELLIGENT PRODUCTS AND SERVICES HAVE THE POTENTIAL TO DRIVE SUSTAINABILITY AGENDA

Intelligent products and services can power green transformation

Intelligent products and services, with their ability to capture and share data and insights, can drive sustainability by enabling measurement of waste; identifying opportunities to save energy, carbon, water, etc.; and promoting circular-lifecycle management.

For instance, Schneider Electric supported a large water plant yielding 220 million gallons per day, with annual energy expenditure worth $6 million. For its flooding-control system, the plant installed advanced controllers using plug-in programming libraries. With transparent data empowering smart decisions, the operation reduced energy consumption by 30% and cut more than $1.8 million in electricity costs annually.[13]

A shift to as-a-service models is also promoting sustainability by discouraging sole ownership of products and, as a result, reducing the number of products created, used, and disposed of.

Professor Tim Baines, Director of Advanced Services Group at Aston Business School, adds: *"Servitization is all about manufacturing businesses responding to the shift in society's appetite for services over society's appetite for products. And not just [repair or replacement] services, but services that provide outcomes."*[14]

"Servitization is all about manufacturing businesses responding to the shift in society's appetite for services over society's appetite for products. And not just [repair or replacement] services, but services that provide outcomes."

Professor Tim Baines

Director of Advanced Services Group at Aston Business School.

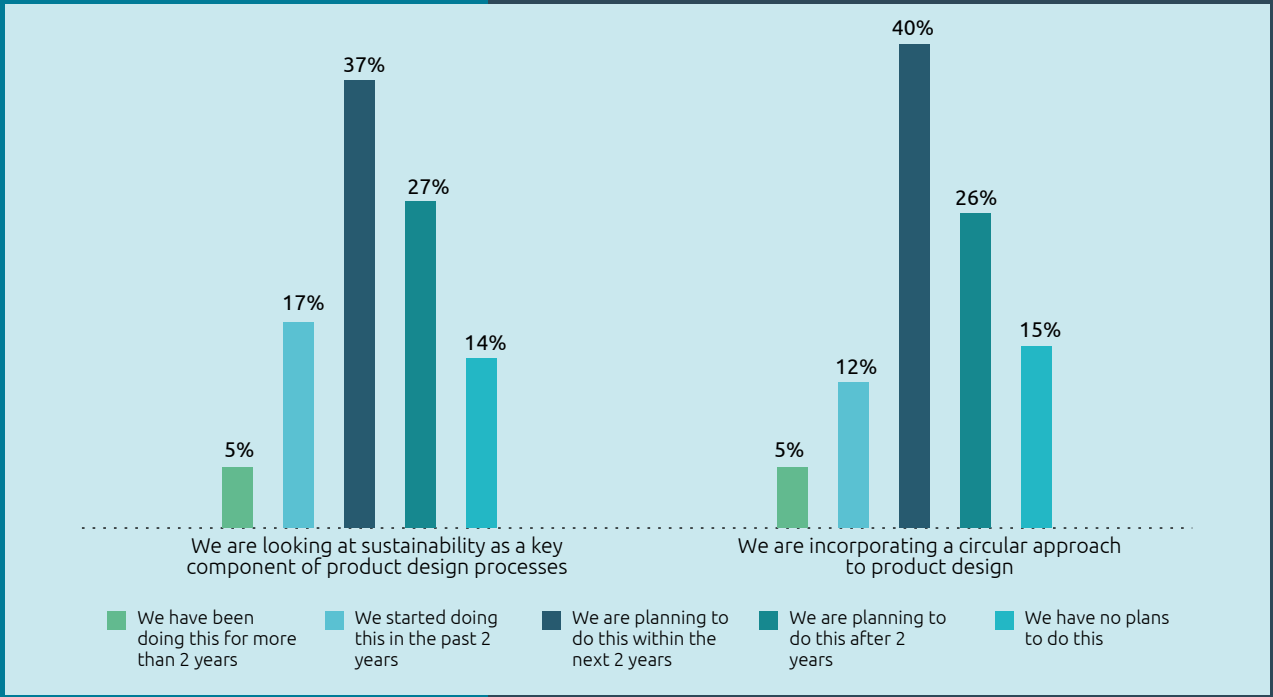
Today, however, sustainability is not at the core of products and services design

Our recent research into sustainable product design highlights that, despite increasing awareness around sustainability, only 22% of organizations prioritize it within their products and services design processes. Only 17% of organizations focus on circular product design (including practices such as reducing, reusing, repairing, refurbishing, remanufacturing, and recycling) aimed at decoupling growth from the consumption of finite resources.[15]

Along with the design, organizations also need to focus on the circularity of their intelligent products. A recent estimate indicates 57.4 million metric tonnes (mt) of e-waste was generated in 2021 – outweighing the Great Wall of China.[16] Conducting a data-powered lifecycle assessment (LCA) of the entire footprint of intelligent products – from raw material extraction, manufacture, and transportation to use and disposal – can help organizations make the most effective changes.[17]

Fig.4

Uptake of sustainable product design strategies is low



The remaining respondents answered, "Don't know."
Source: Capgemini Research Institute, Sustainable product design survey, April–May 2022, N=900 organizations.

02

INTELLIGENT SERVICES TO FUEL GROWTH

Organizations to shift focus to service innovation

In our research, only 35% of organizations currently claim to offer intelligent services. However, 53% plan to do so in the near future (see Figure 5). Karl Lowe, ex-Head of Panasonic European Service at Panasonic Heating & Cooling Solutions Europe, says: *"Companies are now starting to realize that, while the product is massively important, more customers are focusing on the solution, and satisfaction in general. Panasonic [is] moving away from simply being a product manufacturer to [being] a solution-driven organization."* [18]

The consumer products and energy and utilities sectors plan to focus more on intelligent services, with 59% and 54% of organizations, respectively, confirming this. Nearly 80% of larger organizations (with revenue above $20 billion) already offer intelligent services, whereas 65% of smaller organizations (with revenue of $1-$5 billion) plan to do so in the next five years.

88%

of organizations would be offering intelligent services in the next 5 years.

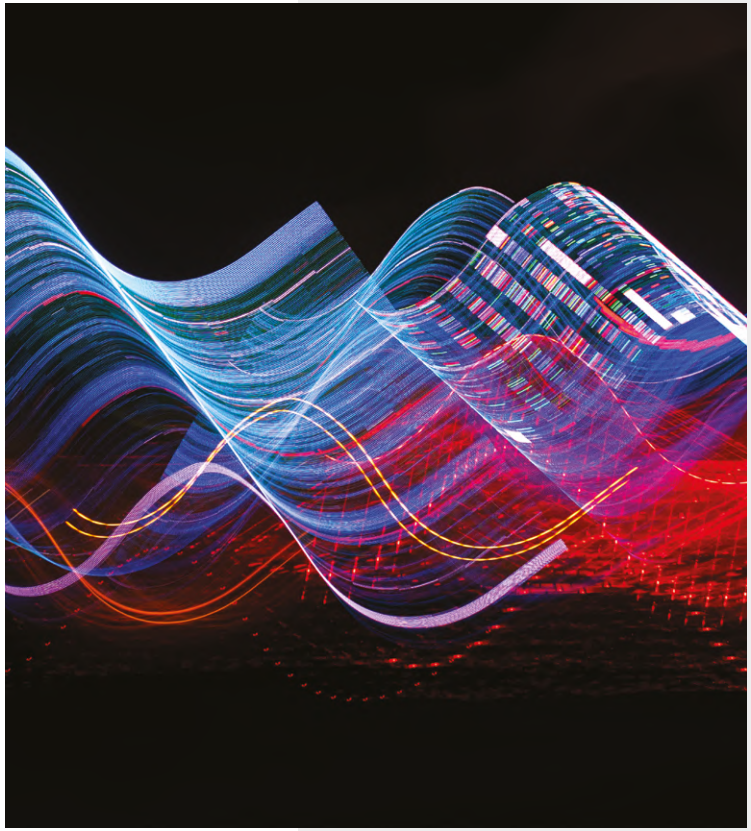
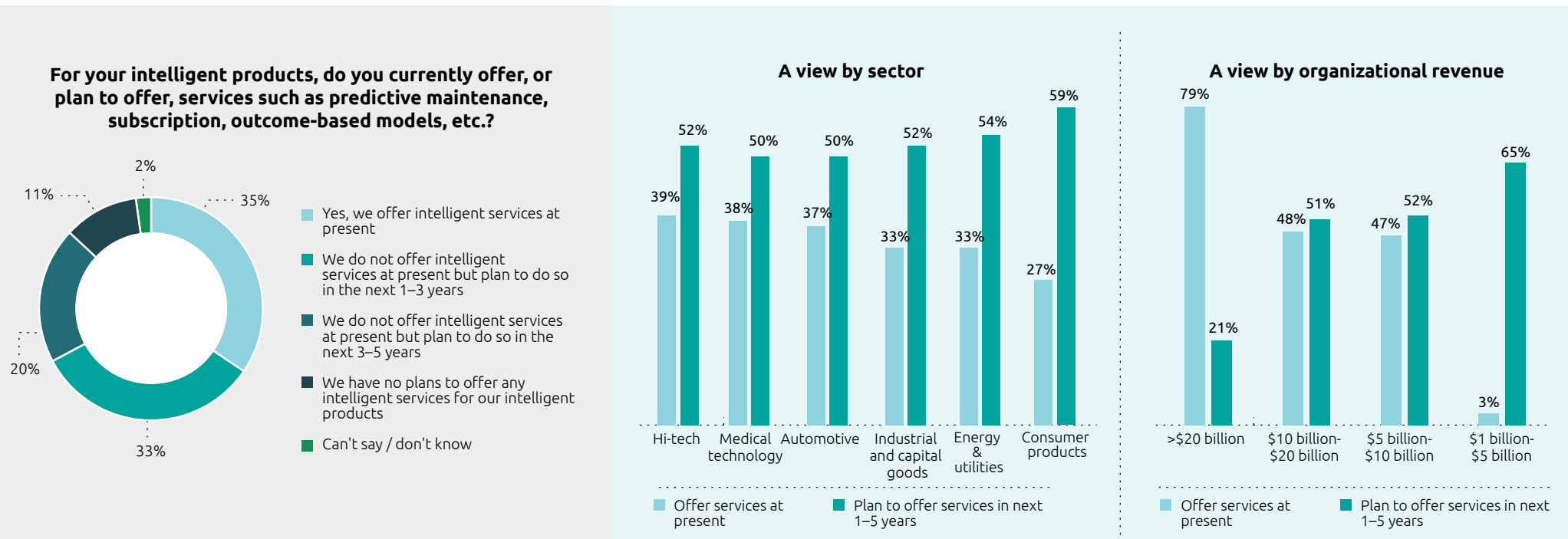


Fig.5

More than half of organizations plan to offer intelligent services in the near future



Source: Capgemini Research Institute, Intelligent products and services survey, April–May 2022, N=944 respondents from unique organizations that have or are currently building visions and strategies for a move to intelligent products and services (remaining 56 organizations claimed to offer only intelligent services).

"When you offer fancy services, it might stir up interest in customers, but they won't necessarily bring you business because customers won't be willing to pay for it. So, you should choose services whose value is blatantly visible. There must be a clear proposition that this is the value added when you do it the traditional way versus the intelligent way"

Bidisha Paul

Director, Data and Applied Sciences, Microsoft

In 2018, in the MedTech space, Philips established an 'enterprise-monitoring-as-a-service' (EMaaS) model with Jackson Health System, one of the US's largest public health systems. In an intensive care unit (ICU), there is usually a patient-monitoring system that is connected to a network, allowing nurses to monitor the vital signs of patients centrally and respond appropriately to any changes. Philips offered these patient monitors as a service, based on a per-patient fee. Philips maintains ownership and is responsible for all the software updates throughout the lifecycle.[19] The solution is helping Jackson Health System to achieve a four-point objective: improved financial outcomes, clinical outcomes, patient satisfaction, and staff satisfaction.

Servitization business models

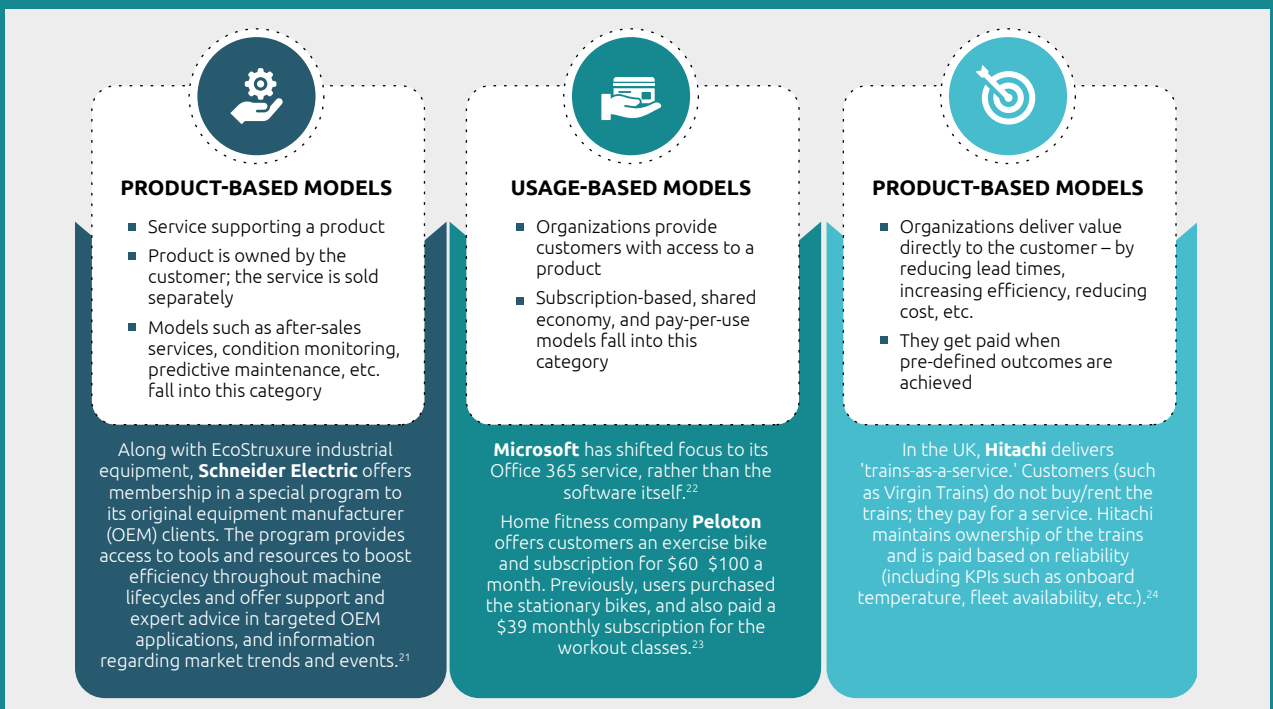
Servitization is the key to generating value, fueling growth, and boosting resilience in organizations. Elisabet Svensson from SKF Group adds: *"The extra services, in the form of a portfolio of intriguing digital products, will be key. If you have two very similar products that cost the same and have the same CO_2 usage, then the digital portfolio on top of the product will be the differentiator."*

There are various approaches to classifying servitization-based business models. Here, we explore an approach that focuses on the relative importance of goods and services.[20]

It is important for companies to realize that servitization is also a transformation journey. In order to succeed, redesigning of organization is required to continually

Fig.6

Servitization business models



Source: Capgemini Research Institute Analysis.

The value of the services opportunity

Today, organizations on average receive only 12% of their overall revenue from intelligent services, but many organizations plan to capitalize on the opportunity in the near future (see Figure 7).

In the next three years:

- 43% of organizations expect more than 20% of their revenue to come from intelligent services
- 46% expect to gain up to 20% of their revenue from intelligent services
- On average, 28% of organizational revenue is expected to come only from intelligent services as opposed to 12% today
- Only 6% of organizations expect that they will not derive any revenue from intelligent services

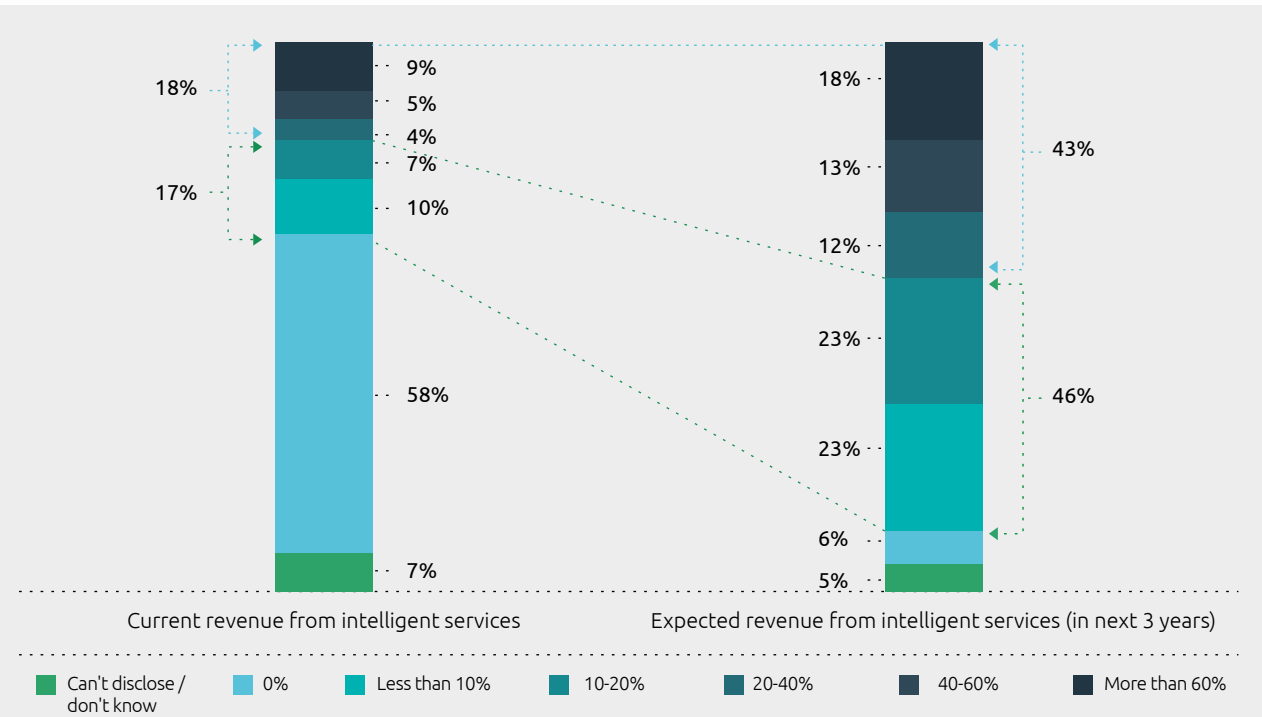
Talking about the emergence of service-based models, Bidisha Paul, Director, Data and Applied Sciences at Microsoft, says: *"All organizations were initially looking into product-based offerings that could be sold at scale, but now every consumer wants services personalized and customized to them."*

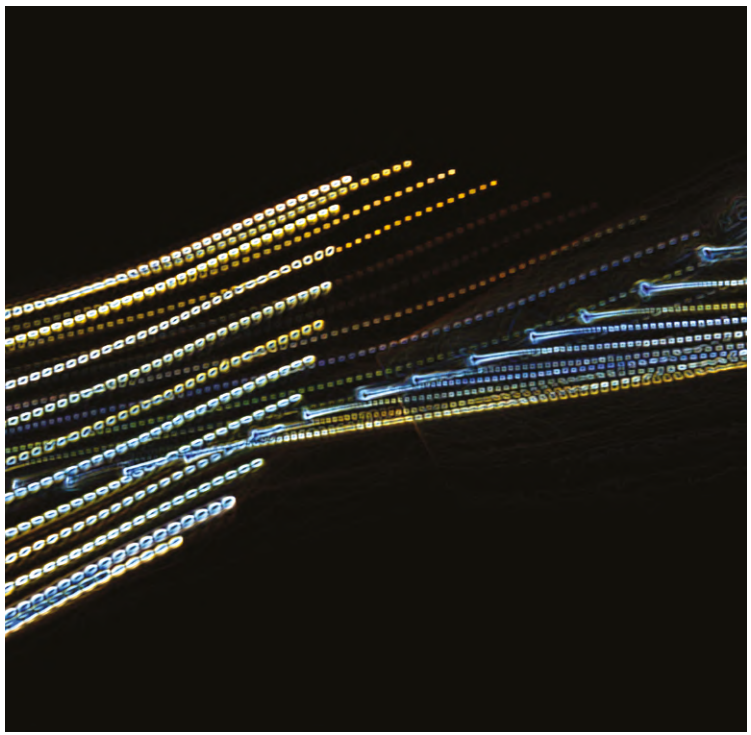
Intelligent apps that complement products open important channels of communication with customers and the information collected also feeds future R&D initiatives and helps shape both physical and digital product design.

Dr. Andreas Schroeder, Reader in Information Systems at Aston University, comments: *"We all agree that servitization is tightly linked to digitalization. I would even say that servitization is the way to monetize digitalization. A lot of IoT investments may not pay off unless they're wrapped in a business model that takes advantage of being able to monitor something at distance."*[25]

Fig.7

Nearly 90% of organizations expect to enjoy revenue from intelligent services in the next 3 years





Source: Capgemini Research Institute, Intelligent products and services survey, April–May 2022, N=1,000 respondents from unique organizations that have or are currently building visions and strategies for a move to intelligent products and services.

Focus on services that customers value most

A recent Capgemini survey in the automotive industry highlights that consumer willingness to pay for connected car services is relatively low: 39% of consumers stated that services are useful but insufficiently developed, while another 23% were unaware of any benefits they offered, and 41% of global respondents said that services currently offered are too expensive.[26] In our current research, 61% of organizations state that persuading customers to pay for services is a challenge. Bidisha Paul from Microsoft adds: *"When you offer fancy services, it might stir up interest in customers, but they won't necessarily bring you business because customers won't be willing to pay for it. So, you should choose services whose value is blatantly visible. There must be a clear proposition that this is the value added when you do it the traditional way versus the* intelligent way."

The following points constitute a guide to improvement:[27]

- Organizations must ensure that the services offered address genuine customer pain points.
- However, organizations also need to consider whether customers will be willing to pay for the additional offering. For instance, while most customers say they would benefit from the added value of using a navigation system in a connected car, they may not be willing to pay for it due to the availability of free systems, such as Google Maps.
- Organizations must identify and evaluate potential candidates for discontinuation. For instance, Google has discontinued a range of services that do not perform well, from Google Bookmarks and Fitbit Coach to Google Public Alerts and Loon.

- It also requires shaping the pricing and sales model according to customer preferences. For instance, a recent survey revealed that 92% of consumers agreed that heated seats in cars shouldn't be a subscription feature.[28] Organizations need to offer a choice of single services or service bundles, different service versions (e.g., basic, or premium), and purchase methods (one-time payment or 'freemium,' as a minimum) and allow customers to purchase services as required.
- Finally, organizations should leverage a loyalty program and an all-digital platform to enable hyper-personalized and frictionless omnichannel experience. With intelligent products and services, organizations can now directly engage with customers and develop a new data-driven loyalty strategy to increase brand awareness, boost loyalty, and strengthen relationships.

03

THE STRUGGLE TO SCALE INTELLIGENT PRODUCTS AND SERVICES

Half of organizations are stuck at pilot or PoC stages

We found that just 7% of organizations implement these use cases at scale (see Figure 8). Many organizations are yet to advance beyond pilots and PoCs for one or two products, let alone achieve adoption across business units, functions, or geographies. The consumer products sector is ahead in terms of scaling, whereas industrial manufacturing lags.

Chief Strategy Officer from a global technology company elaborates: *"Like any trend, it's easy to get caught up in the hype and jump in without specific intent. In other cases, organizations could be trying to embrace technology for technology's sake, and that routinely results in 'pilot purgatory,' because there isn't a clear, practical application for that technology. At the start, organizations should know the use cases they're aiming to address, and the type of investment returns they can expect."*

only **7%**

of organizations have scaled use cases for intelligent products and services.

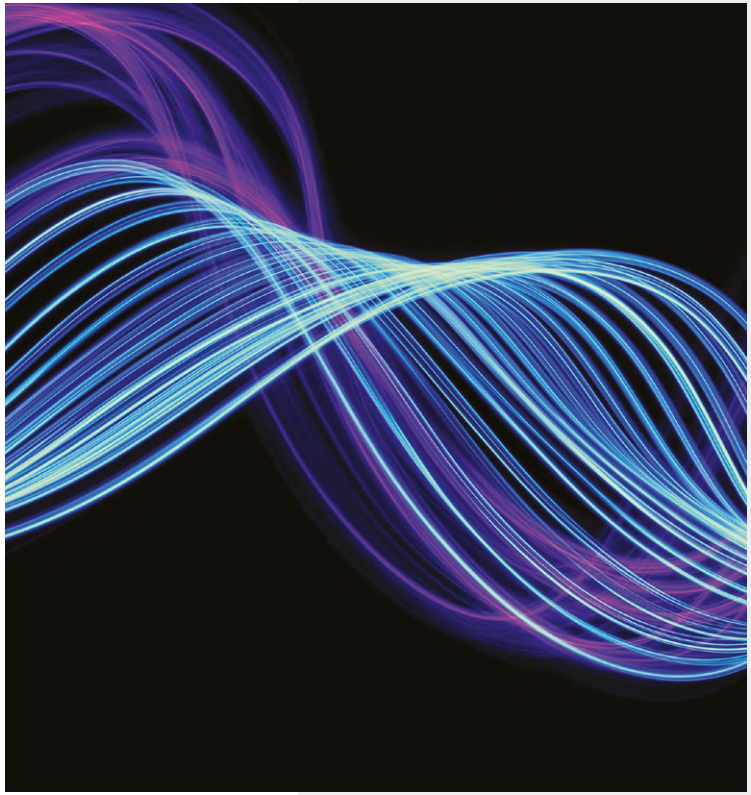
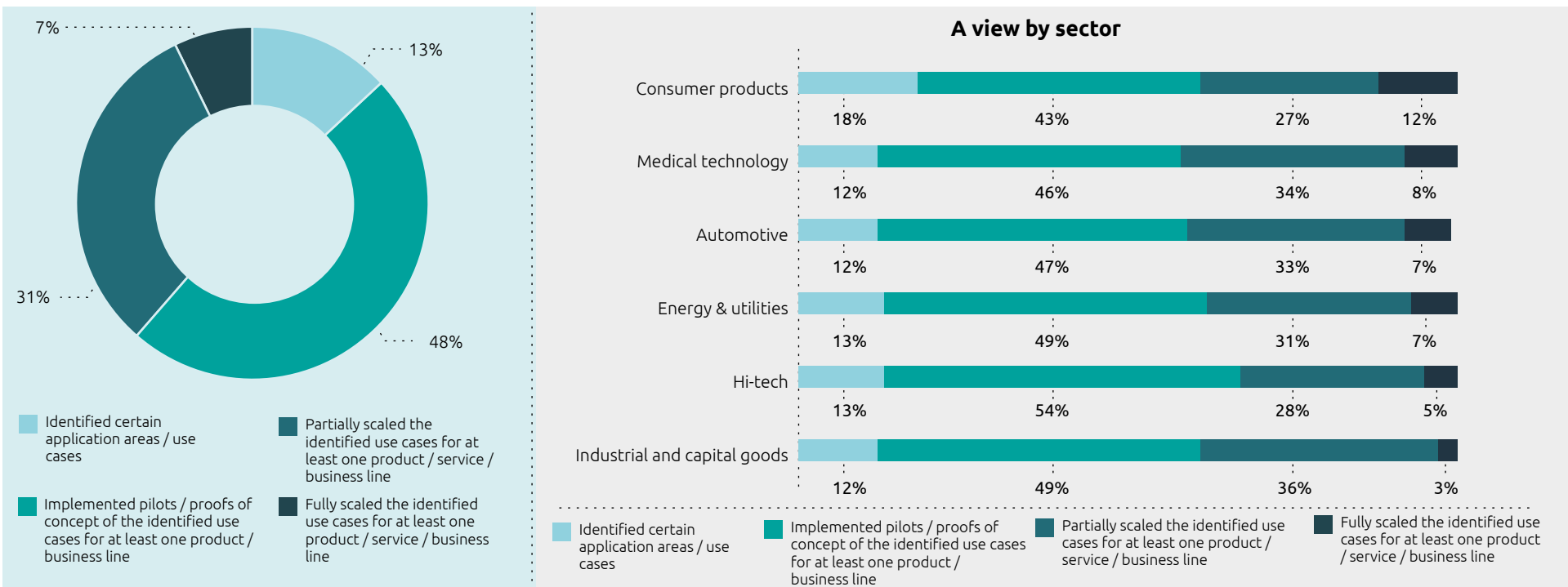


Fig.8

Only 7% of organizations have scaled use cases for intelligent products and services



Source: Capgemini Research Institute, Intelligent products and services survey, April–May 2022, N=1,000 respondents from unique organizations that have or are currently building visions and strategies for a move to intelligent products and services.

Collaboration, skills, data, and technology-related challenges put the brakes on progress

In this section, we delve deeper into the reasons why intelligent products and services stall at PoC or pilot stage. We put the challenges into four broad categories: organizational, skills-related, data, and technological.

Lack of accountability and collaboration is slowing the transition

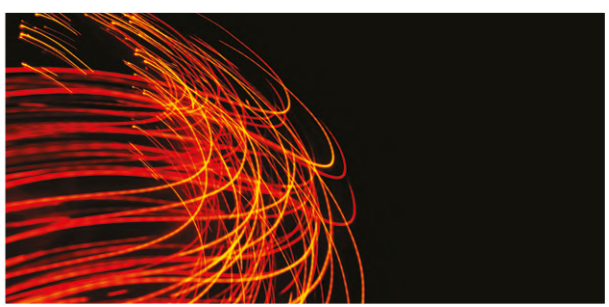
Intelligent software design requires collaboration between functions such as Design, Engineering, Quality, Sales, and Customer Experience. However, our research suggests that, for 66% of organizations, functional teams and units are still working in silos.

Chief Strategy Officer from a global technology company: *"There is an important link developing between intelligent connected products operating in the field and the teams that incorporate real-world product-performance insights into new designs. The tools are there, and we see this happening in pockets, but there's more potential."*

The way organizations are currently structured impedes the construction of an intelligent products and services portfolio. The major challenge is a lack of accountability and planning: nearly 6 in 10 organizations (59%) say they have no central department/unit responsible for planning intelligent products and services for the entire organization.

Moreover, a limited share of organizations employ agile transformation to boost collaboration between core teams (see Figure 9).

59% have no central department/unit responsible for planning intelligent products and services for the entire organization.



These collaborative challenges extend beyond internal teams; more than half (53%) of organizations say that they are facing difficulties in partnering with outside firms to develop intelligent offerings.

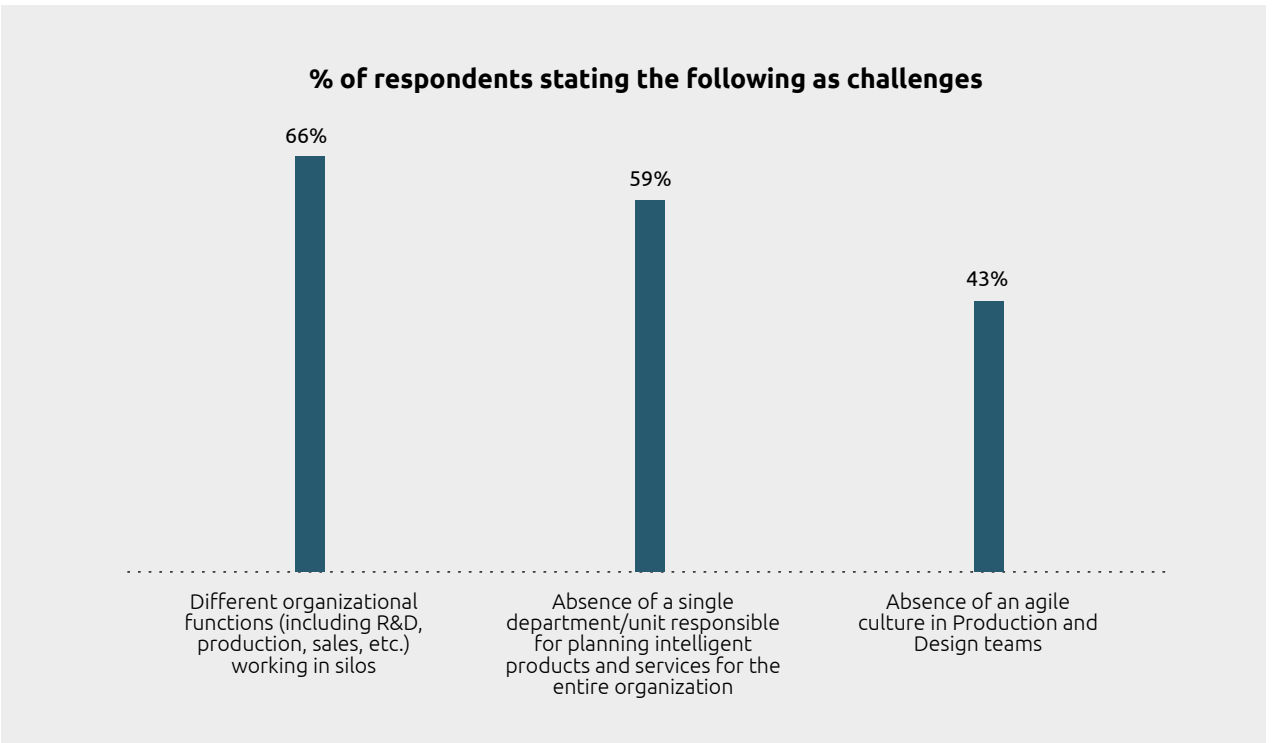
Organizations face critical skill shortages in building intelligent products and services portfolios

More than 7 in 10 (72%) organizations agree that intelligent offerings will become a key proposition for them in the next three years. Consequently, demand is growing for the technology and software capabilities necessary to produce intelligent products and services.

At present, the largest critical talent gap is that of data governance, management, and data-science professionals, followed by product-innovation and agile-methodology specialists. There will also be strong demand for networking engineers and physical product-development engineers (see Figure 10).

Fig.9

Absence of collaboration is slowing the intelligent transition



Source: Capgemini Research Institute, Intelligent products and services survey, April–May 2022, N=1,000 respondents from unique organizations that have or are currently building visions and strategies for a move to intelligent products and services.

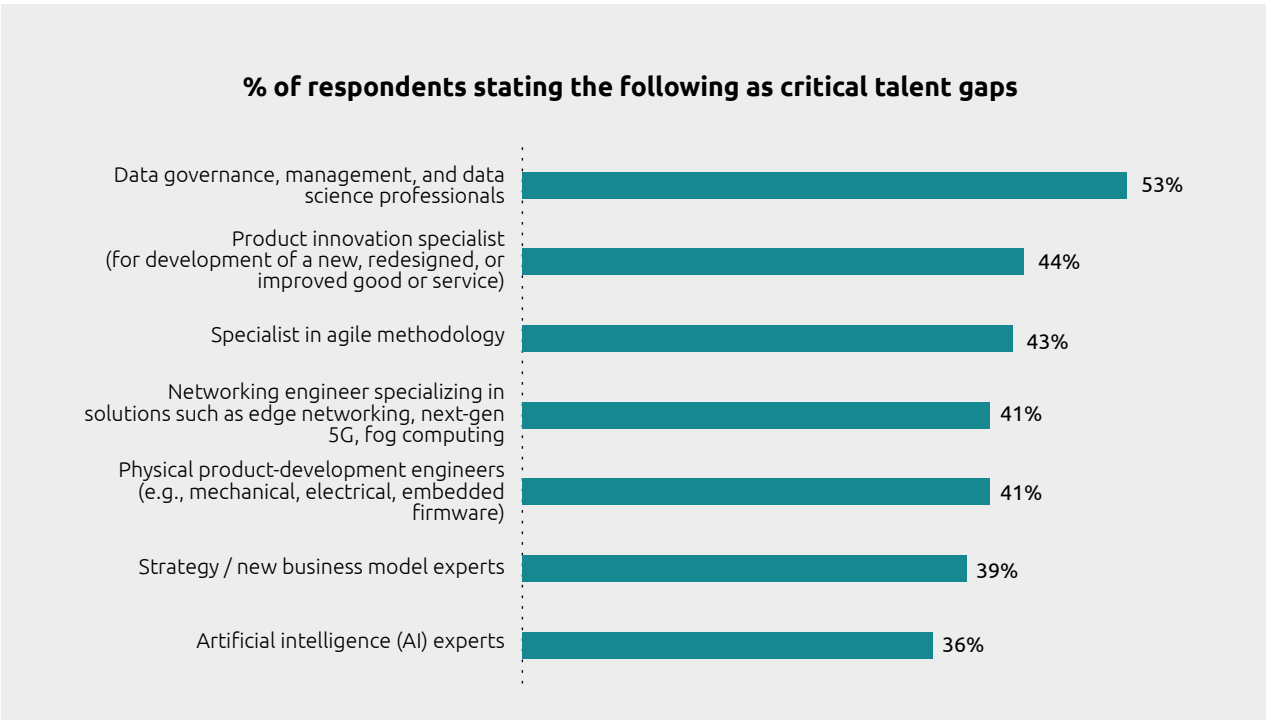
While 65% of organizations agree that it is difficult to recruit the right talent and skillsets, an even larger share (76%) cite difficulties in retention. Moreover, there is a need for organizations to redefine their sales strategies and training to focus specifically on services. This is challenging for nearly half of organizations.

Data-related challenges exist throughout the lifecycle

Ability to capitalize on data assets is key, both for optimization purposes and for creating new value-added services. However, we found that organizations struggle with data challenges, both internally, around their system of management and usage of data, and externally, with customer data.

Fig10

There is a critical talent gap in the capacity to deliver intelligent products and services



Source: Capgemini Research Institute, Intelligent products and services survey, April–May 2022, N=1,000 respondents from unique organizations that have or are currently building visions and strategies for a move to intelligent products and services.

- As we can see from Figure 11, 76% of organizations **do not have a stable infrastructure to store the data** generated by intelligent products and services. Further, only 42% of them perform AI-powered data analysis. Highlighting the importance of having a holistic data-management system, Nicolas Veauville from Philips Domestic Appliances adds: *"Organizations need to use data to learn about their consumers: their behaviors, their usage patterns, their level of interaction with the existing features, etc. Next, they need to understand how to use the data to bring improvement into their product-development workstream. The final element is monetization: how can they make use of the data to create new opportunities? Where is the customer most likely to benefit from additional opportunities? And how can they transform the data into new value streams?"*

76%

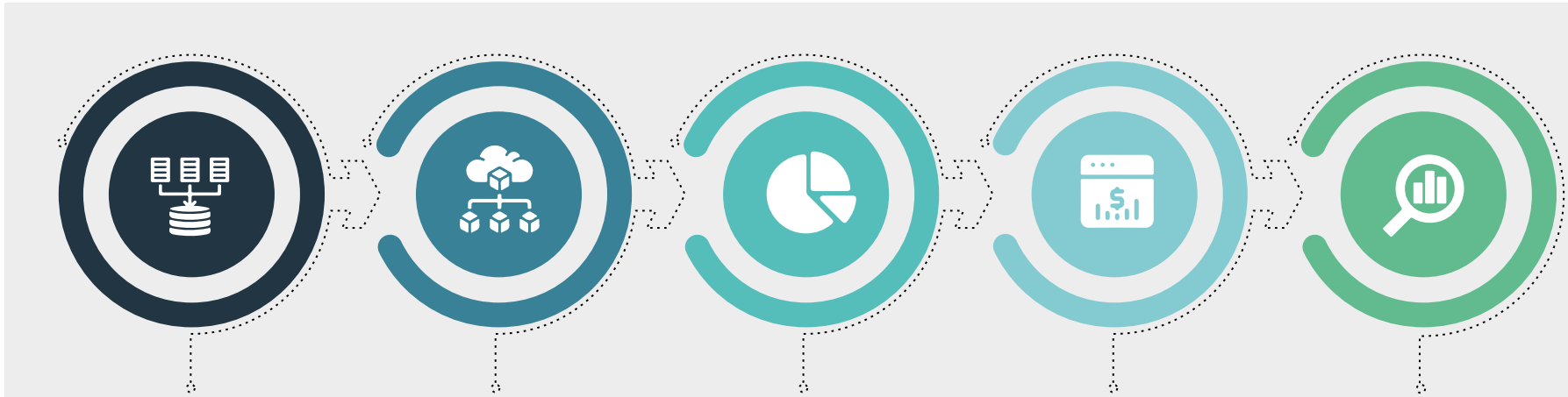
of organizations do not have a stable infrastructure to store the data generated by intelligent products and services.

42%

of organizations perform sophisticated, real-time or near real-time AI-powered analysis of the data.

Fig.11

Organizations are struggling with data management



Source: Capgemini Research Institute, Intelligent products and services survey, April–May 2022, N=1,000 respondents from unique organizations that have or are currently building visions and strategies for a move to intelligent products and services.

“Intelligent products that can adapt their performance based on customer needs will make the competitive difference. I believe that bringing an intelligent product is not the end goal; the end goal is to create a better experience for our customers, so that it drives more revenue over the lifetimes of our brands.”

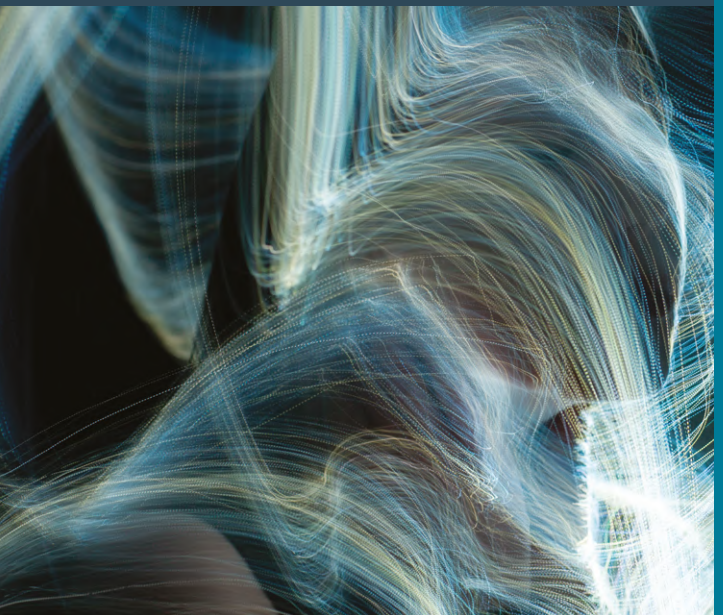
Nicolas Veauville

Senior Director, Philips Domestic Appliances

- Organizations also struggle with challenges related to **external data**. Our research reveals that more than half (55%) of organizations feel that customers are reluctant to share personal information and data while using services. When we look at this by country, we find that a majority of organizations from the UK (60%), US (58%), and Netherlands (58%) cite this challenge.

  In a B2C setting, consumers are willing to share usage or performance data for certain products; for instance, a recent survey revealed that 40% of UK home-insurance policyholders with smart-home devices would be willing to share data with insurers in return for financial rewards.[29] However, in B2B settings, concerns related to security, IP protection, safety, as well as open questions regarding ownership of data, have led to reluctance in certain customer organizations to share data such as output, operating hours, machine performance, etc.

INTELLIGENT PRODUCTS AND CYBERSECURITY



Our previous research highlighted that 62% of the organizations that are struggling to scale up IoT applications cited cybersecurity and data-privacy threats.[30] Below are some examples of best practices:

- **Put security at the core of intelligent products and services design:** In our research, a majority (57%) of organizations say they use a cybersecurity-by-design approach that minimizes risks along the value chain, including implementing secure software and OTA updates.
- **Acquire specialized security skills:** In our research, organizations cited a 25-30% skills gap in key roles such as software architects, cloud-management experts, and cybersecurity experts. More than half (58%) of organizations are planning to build a new system and team comprising highly skilled cybersecurity specialists.
- **Test, secure, repeat:** Today, intelligent products have millions of lines of code. An average Volvo vehicle in 2020 had 100 million lines of code – equivalent to over 60,000 books of 300 pages each,[31] whereas the original space shuttle had 40,000 lines of code.[32] So, ensuring that security is built in at every step of intelligent products and services is no mean feat. Conducting regular risk assessments will help establish strong security frameworks, avoiding inherent vulnerabilities.

Organizations are struggling to migrate from legacy systems

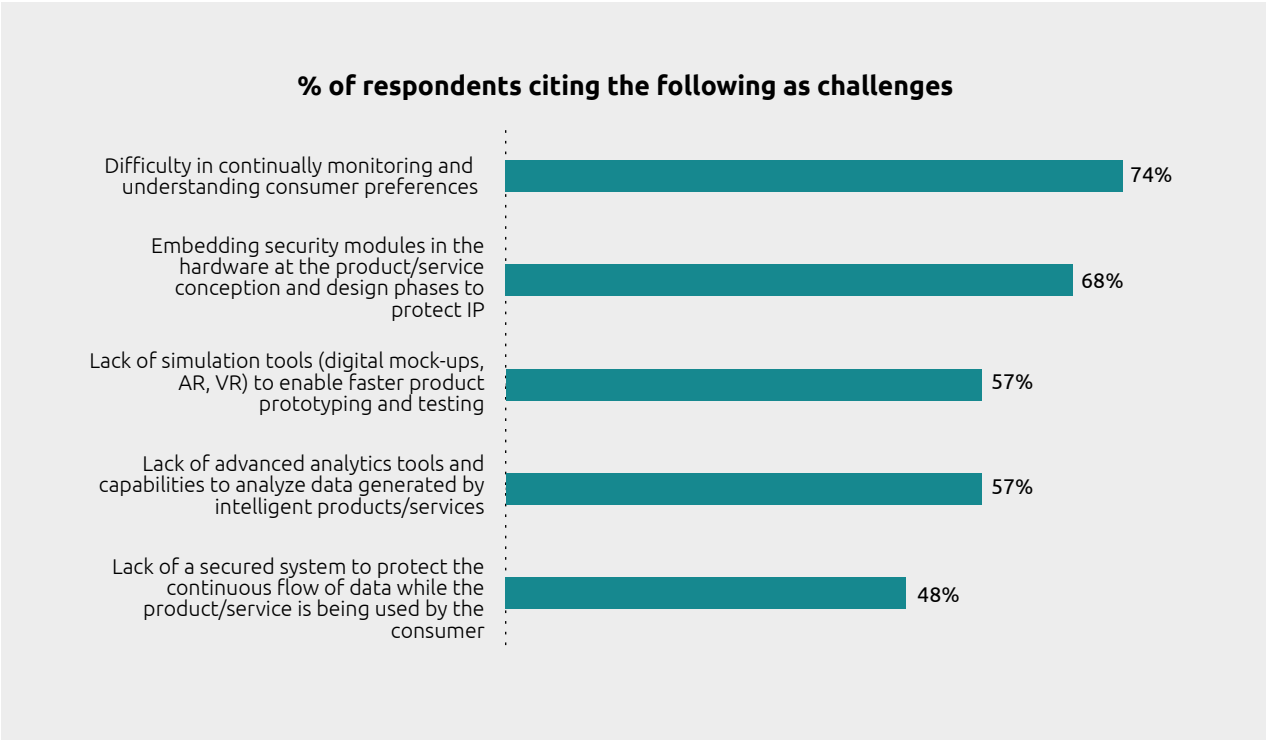
Fifty-six percent of organizations agree that integrating new and existing systems and tools is a significant challenge throughout the value chain. For instance, 68% of organizations agree that embedding security modules to protect IP is an issue. Additionally, lack of tools during the testing stage, as well as insufficient capabilities to store and analyze data generated by intelligent products during the run stage, has been problematic (see Figure 12).

74%

of organizations find it difficult to continually monitor and understand consumer preferences.

Fig12

Several technology-related challenges are hindering progress



Source: Capgemini Research Institute, Intelligent products and services survey, April–May 2022, N=1,000 respondents from unique organizations that have or are currently building visions and strategies for a move to intelligent products and services.

Who are the Leaders?

In order to measure organizations' progress in building an intelligent portfolio, we analyzed a number of elements. As Figure 13 shows, these form the two dimensions of maturity of intelligent products and services: 'intelligent transformers' and 'intelligent enablers.'

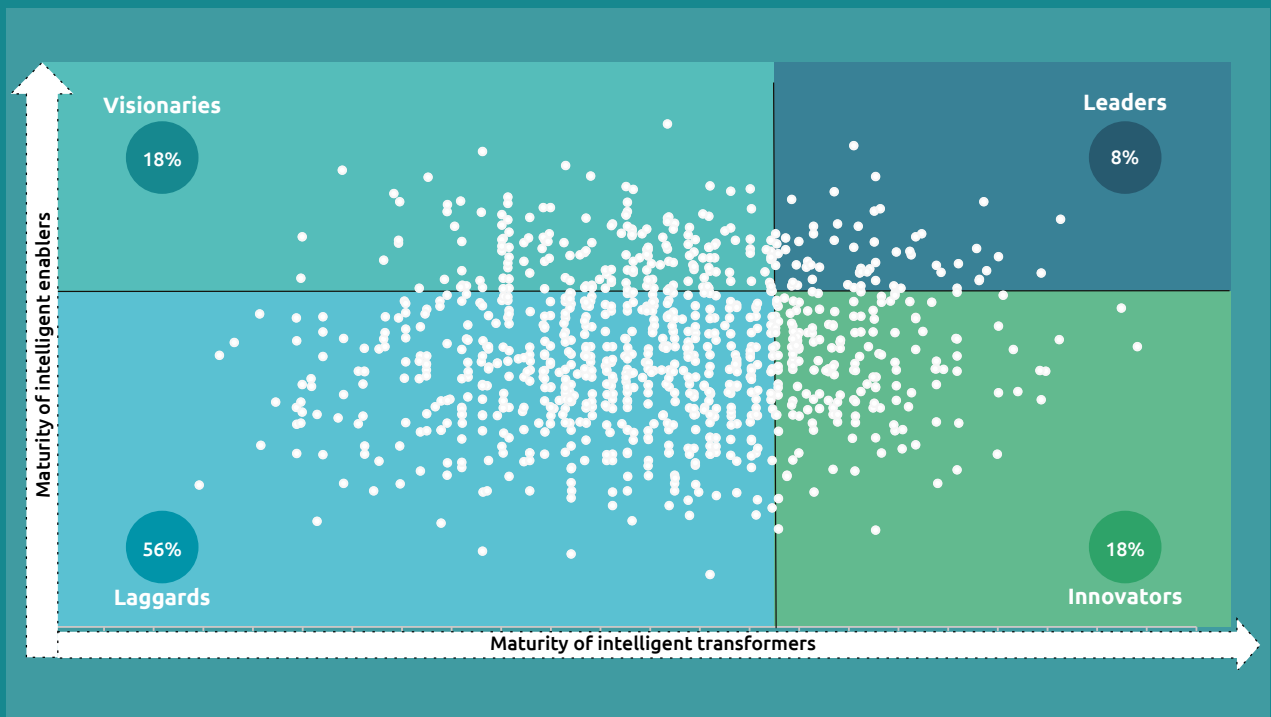
- **Intelligent transformers** measure the maturity of organizations in areas such as level of implementation of intelligent initiatives; use of technology to develop and improve intelligent offerings; adoption of agile development cycles; and data-management infrastructure.
- **Intelligent enablers** measure the presence of necessary resources within organizations that aid transformation, such as end-to-end strategy; new business models; team collaboration and way of working; critical capabilities; and partnerships.

Based on these elements, we identified four different cohorts.

- Only **8% of organizations** fall into the 'Leaders' category – those that lead in both dimensions.
- A majority – **56% of organizations**, fall into the 'Laggards' category, falling behind in both dimensions.
- **36% of organizations** do well in only one dimension.

Fig.13(A)

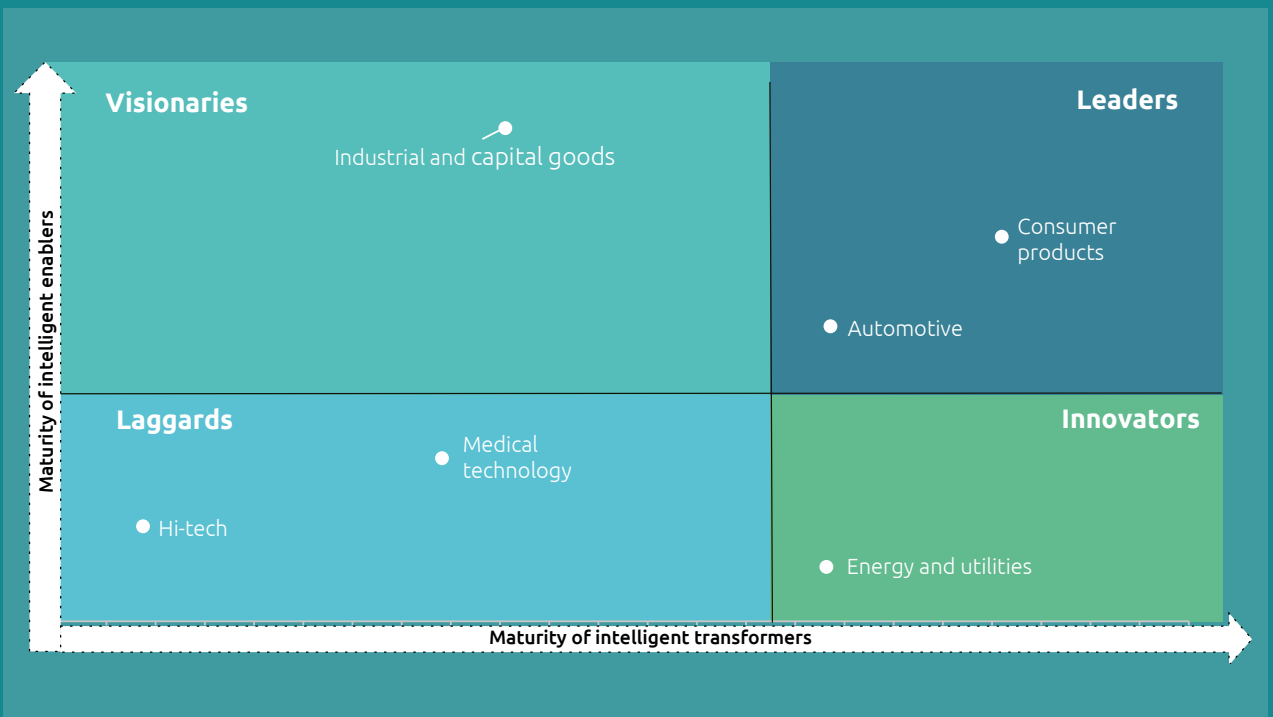
Less than 10% of organizations are mature in building and implementing intelligent products and services



Source: Capgemini Research Institute, Intelligent products and services survey, April–-May 2022, N=1,000 respondents from unique organizations that have or are currently building visions and strategies for a move to intelligent products and services.

Fig.13(B)

Less than 10% of organizations are mature in building and implementing intelligent products and services



Source: Capgemini Research Institute, Intelligent products and services survey, April–-May 2022, N=1,000 respondents from unique organizations that have or are currently building visions and strategies for a move to intelligent products and services.

Looking at the country distribution for Leaders, the highest share comes from the US, followed by the UK, Germany, and Japan.

Further, looking at the sector view, we find that the consumer products and automotive sectors are leading with healthy maturity across both dimensions. While the industrial and capital goods sector has a strong vision, strategy and collaborative culture in place, the energy and utilities sector is equipped with the necessary tools and technology to develop the intelligent portfolio. The medical technology and hi-tech sectors fall behind, comparatively, on both dimensions.

For further details on the classification of Leaders and their characteristics versus the rest of the organizations, please refer to the appendix.

04

HOW CAN ORGANIZATIONS SUCCESSFULLY IMPLEMENT INTELLIGENT PRODUCTS AND SERVICES OFFERINGS?

We have identified a number of factors critical to transitioning to an intelligent portfolio (see Figure 14).

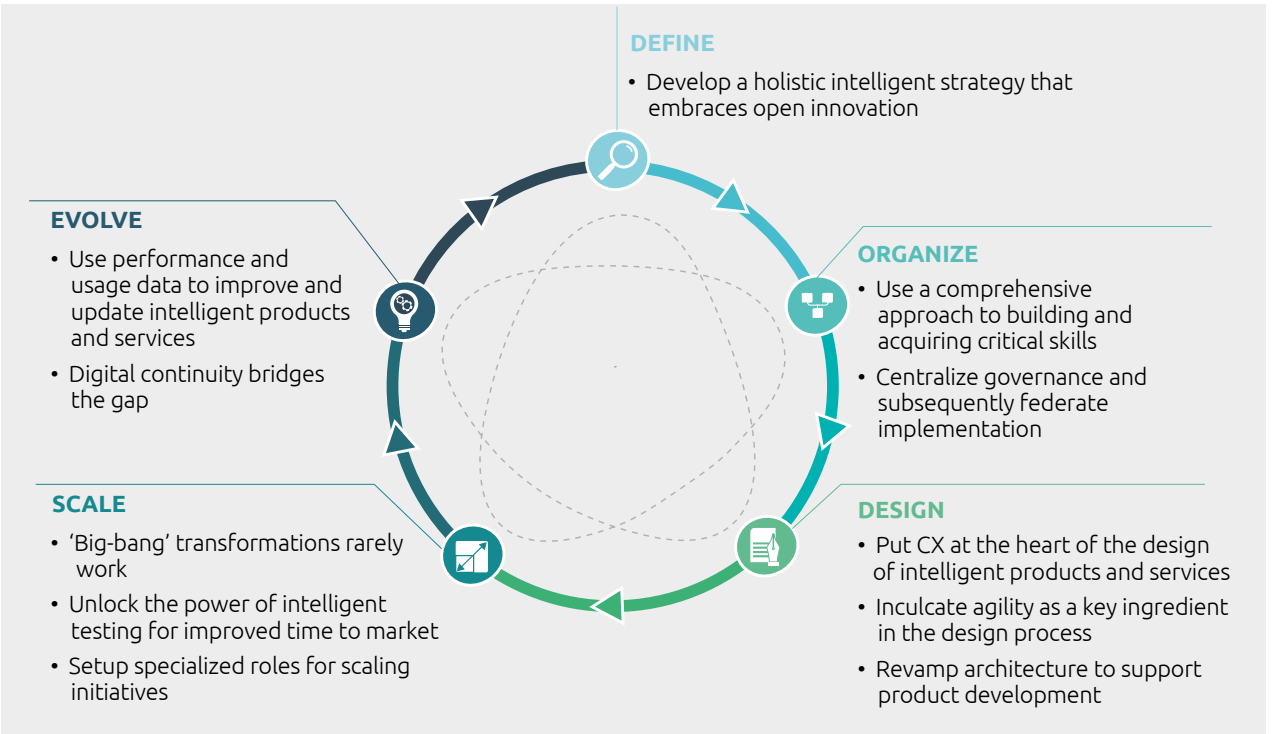
1. DEFINE: Develop a holistic intelligent strategy that embraces open innovation

Technology is revolutionizing products and disrupting value chains, forcing traditional organizations to rethink nearly everything they do. Our research shows that:

- Overall, only 33% of organizations are well prepared to transition from a hardware- to a software-based model.
- In addition, only 39% of them have digital visions and detailed roadmaps with clear milestones to measure the progress of their transformation initiatives.

Fig14

A five-point framework to assist organizations in moving towards an intelligent products and services portfolio



Source: Capgemini Research Institute Analysis.

Organizations must have a strategy to decide **which of their products and services should incorporate smart, connected capabilities.** Nicolas Veauville from Philips Domestic Appliances advises: *"Depending on what it is that you are trying to develop, understand the customer first and then decide if there is a need for a connected or intelligent device or platform."* Organizations should assess whether value to the customer exceeds the cost and reinforces their competitive edge in the market.

Next, as intelligent products and services bring organizations closer to customers, they must formulate a **digital strategy to ensure a steady, continual connect with their customers**. Since it is no longer about simply buying a product or service, organizations should leverage customer interactions and deliver a sustained differentiated value digitally.

Further, with the continuous increase in the number of intelligent products and services offerings in the market, organizations must strategize to deliver even more disruptive services, which would translate into taking further risks. To mitigate the risk of failure, organizations also need to chart out a long-term development plan and roadmap for their intelligent products and services by **continuously evaluating the biggest risks to the success of their products and business** throughout the development effort. This should start with an exploration phase to gain confidence in the viability, feasibility, and desirability of the intelligent product or service before the more cost-intensive detailed design and development effort begins. This not only reduces the total development cost of a program, but also provides better confidence that the project will result in a compelling ROI.

Finally, to transition to an intelligent portfolio, an **organization-wide culture of innovation** must be nurtured, as well as newer, **agile ways of working**. It is important not only to have a coordinating central innovation team, but also an open, continuous innovation strategy across business and functional units.

Learnings from Digital Natives: Innovation culture

On instilling a culture of innovation across the organization, Chad Aronson, Global Head of Intelligent Automation COE at Uber, elaborates: *"We have a central innovation strategy that has streamlined our organization and provided a unified focus on our agenda. The majority of our innovation is driven by the product team: product is essentially a combination of business and IT, and these teams ensure seamless top-down alignment, which makes it easier to introduce new products and services. This really puts us ahead in the market. Whereas, in a lot of other organizations, IT leads the innovation governance."*

2. ORGANIZE: Acquire critical talent capabilities and align governance with operations

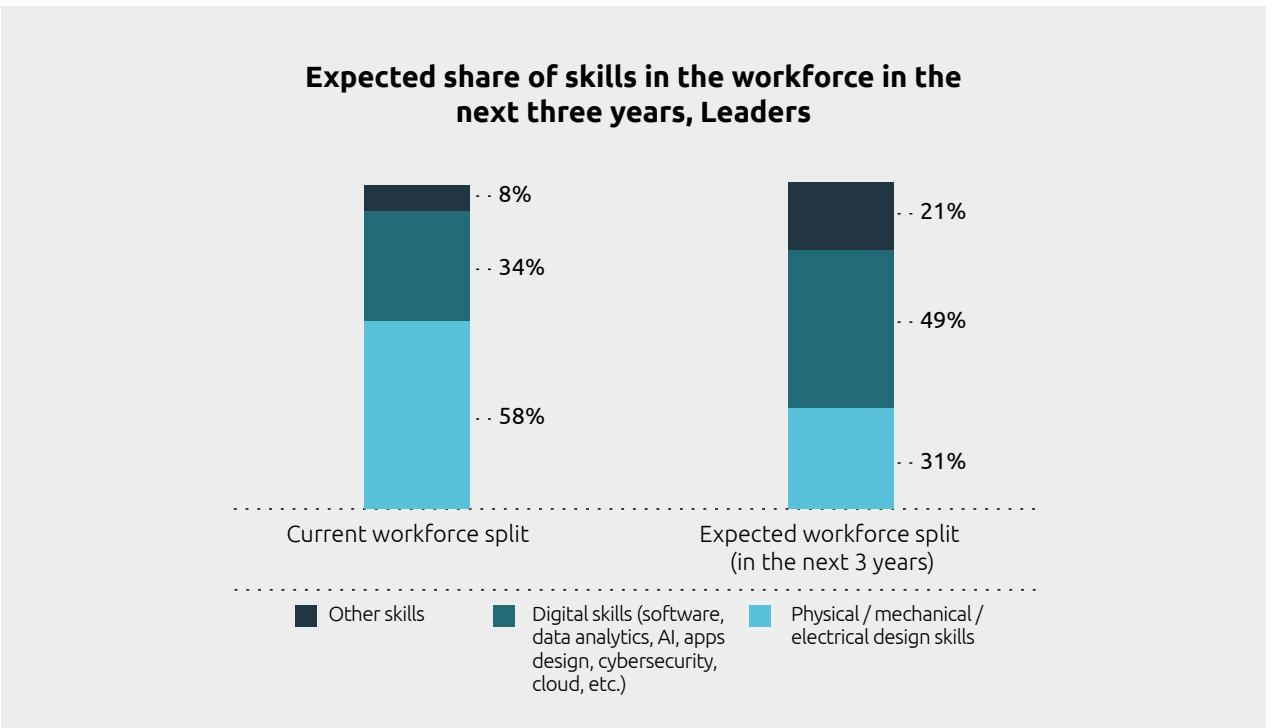
2.1 Use a comprehensive approach to building and acquiring critical skills

Building intelligent products and services requires substantial investment in specialized digital and software skills, technologies, and infrastructure.

- **Digital and software skills will be in huge demand:** 84% of Leaders are transforming their design and engineering teams by adding talent in software development, systems engineering, product clouds, and other areas (compared to only 55% of Laggards). Further, Leaders expect nearly half of their workforces to have such skills in the next three years. At the same time, the share of workers with physical and mechanical skills is expected to fall by nearly 30 percentage points (see Figure 15).

Fig15

The share of digital and software skills in the workforce for Leaders will rise rapidly in the next three years



Source: Capgemini Research Institute, Intelligent products and services survey, April–May 2022, N=1,000 respondents from unique organizations that have or are currently building visions and strategies for a move to intelligent products and services, N=76 organizations who are Leaders.

- **Data governance and management specialists, product-innovation specialists, agile-methodology specialists, and networking / physical product-development engineers** will be in huge demand. It is extremely important to acquire not just the technical skills related to data science, but also to look for professionals who can make business sense of the data. A director at a global energy company headquartered in Germany, observes: *"We have consciously increased the number of data-science professionals in our workforce who can listen to the customer and enable us to bring the features they demand. It involves data gathering, categorizing, analyzing, and concluding where the biggest demand is and consequently tagging this demand with existing products and services or creating new ones."*
  - Our research also reveals that organizations are not forming partnerships that are adequate to build an extensive ecosystem and acquire key technologies; only 23% of organizations have currently partnered with big or small technology firms and start-ups
  - Only 17% of organizations have active partnerships with firms providing data and analytics capabilities
- Organizations **must choose wisely which capabilities and technology to develop and maintain in house and which to outsource to suppliers and partners**. While the balance will differ between organizations, it is judicious to go for a combination. A director at a global energy company headquartered in Germany further emphasizes the importance of partnerships for large traditional organizations: *"Almost five years ago, we believed everything had to be made in house. But, today, we have a partnering approach in place simply for speed. Why reinvent the wheel if somebody already has it out there in the market?"*
- As mentioned previously (see Figure 10), today the talent gap exists in technical skills, such as data science, product innovation, agile, and AI, as well as in behavioral skills, such as design thinking and business modelling. Along with new hiring and partnering, organizations must focus on **upskilling**.

Learnings from Digital Natives: Partnering and hiring for talent

Chad Aronson from Uber adds: *"We are partnering with a spectrum of small to large startups, to established companies, to help propel growth of our intelligent products and services. Particularly, we partner with overseas companies to help us expand [the reach of] our app in their regions, versus building it ourselves. It's an analysis of buy versus build; we could definitely build it, but what we also look at is, what's our return on investment, what's the timeline, and how sustainable is it if we build it ourselves versus buying?"*

"We put a significant effort into educating our business communities and our business users about the importance of data, governance principles, and the importance of having clean datasets. We call this "efforts towards data literacy'." Aleksejs Plotnikovs, Enterprise Data Director, Microsoft.[33]

2.2 Centralize governance and subsequently federate implementation

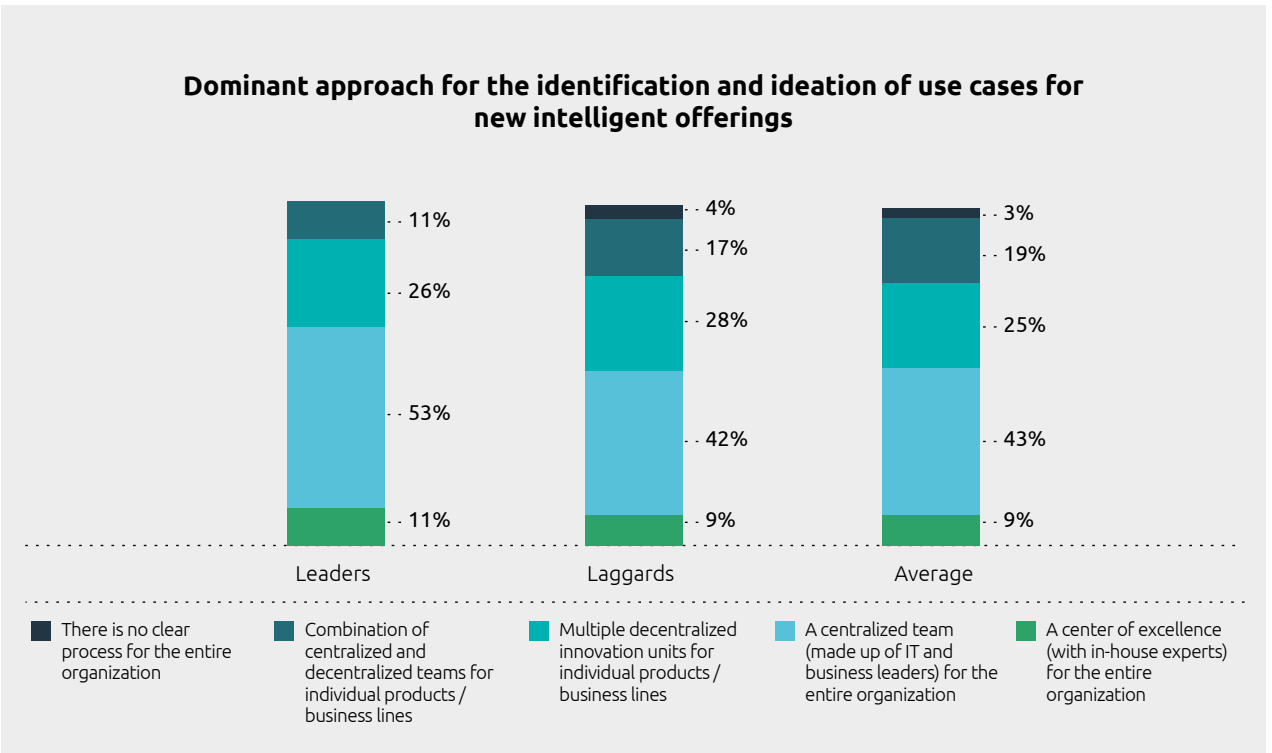
Organizations need to make the leap from a traditional make, sell, ship operating model to an intelligent one that focuses on improved customer outcomes. This will be best supported by adopting a hybrid structure with a mix of centralized teams and multiple small units:

- Firstly, **create a centralized, independent entity** with a mandate for decision making. This will not only provide a unified, coordinated growth strategy, but will benefit from a bird's eye view of all the initiatives in place, and their success rates. As Figure 16 shows, 64% of Leaders have a centralized entity for identification of use cases.
- Thereafter, **multiple decentralized units should be commissioned that will be responsible for building and implementing use cases** for individual function / business lines and testing the value proposition. This will prove beneficial as executives can evaluate niche business requirements, and are in a much better position to evaluate individual customer needs and consequently identify use cases.

It is important to note that a fine balance must be struck between centralizing innovation and providing autonomy to multiple smaller teams. Compared to more mature organizations, those who are just starting their journeys can choose to drive innovation efforts centrally for better alignment and coordination.

Fig16

Leaders have centralized governance for identification and ideation of new use cases for intelligent products and services



Source: Capgemini Research Institute, Intelligent products and services survey, April–May 2022, N=1,000 respondents from unique organizations that have or are currently building visions and strategies for a move to intelligent products and services, N=76 organizations who are Leaders, N=558 organizations who are Laggards.

In some cases, organizations have even created a **separate company** altogether within their group to be responsible for all intelligent products and services, with a dedicated governance system combining centralized and decentralized units:

- Volkswagen has created a separate software company within the group called CARIAD, which works on and expands its software competencies to digitize automotive mobility.
- Ricoh, a Japanese multinational imaging, and electronics company, has set up a separate, centralized service division incorporating all customer-facing service and support teams, including hardware and software, production, product and application support, and IT support centers. This division uses new tools and technology to drive a more holistic CX.[34]
- Bosch, a German multinational engineering and technology company, created an exclusive unit, Software & Digital Solutions, to focus on a portfolio of connected enterprises and products.[35]
- In January 2021, as part of its Renaulution strategic plan, Renault Group announced the creation of the Mobilize brand, which uses AI to optimize the costs of at-home charging of the electrical vehicles for retail consumers.

It is important to note that a separate company or entity should still align itself with the overall objectives of the wider organization.

"We have a central innovation strategy that has streamlined our organization and provided a unified focus on our agenda. The majority of our innovation is driven by the product team: product is essentially a combination of business and IT, and these teams ensure seamless top-down alignment, which makes it easier to introduce new products and services. This really puts us ahead in the market. Whereas, in a lot of other organizations, IT leads the innovation governance."

Chad Aronson

Global Head of Intelligent Automation COE, Uber

3. DESIGN: Focus on adaptive, human-centered design

3.1 Put CX at the heart of the design of intelligent products and services

To remain competitive, organizations must refine their CX. With intelligent offerings, customers not only expect the latest product or service, but also a visible evolution in features and content. To this end:

- Organizations must involve **CX professionals early on in the design process**. This way, organizations can prioritize tactical projects that create significant business value and brand differentiation. However, currently, only 38% of do this.
- Apart from monitoring the performance of the intelligent product/service in real time and providing timely customer care, organizations should **use the insights gained to adapt and customize offerings**, reducing churn rate significantly..
- In addition, they could also provide a **common platform from which customers can choose their services**. As Figure 17 shows, this is a challenge for many organizations today.

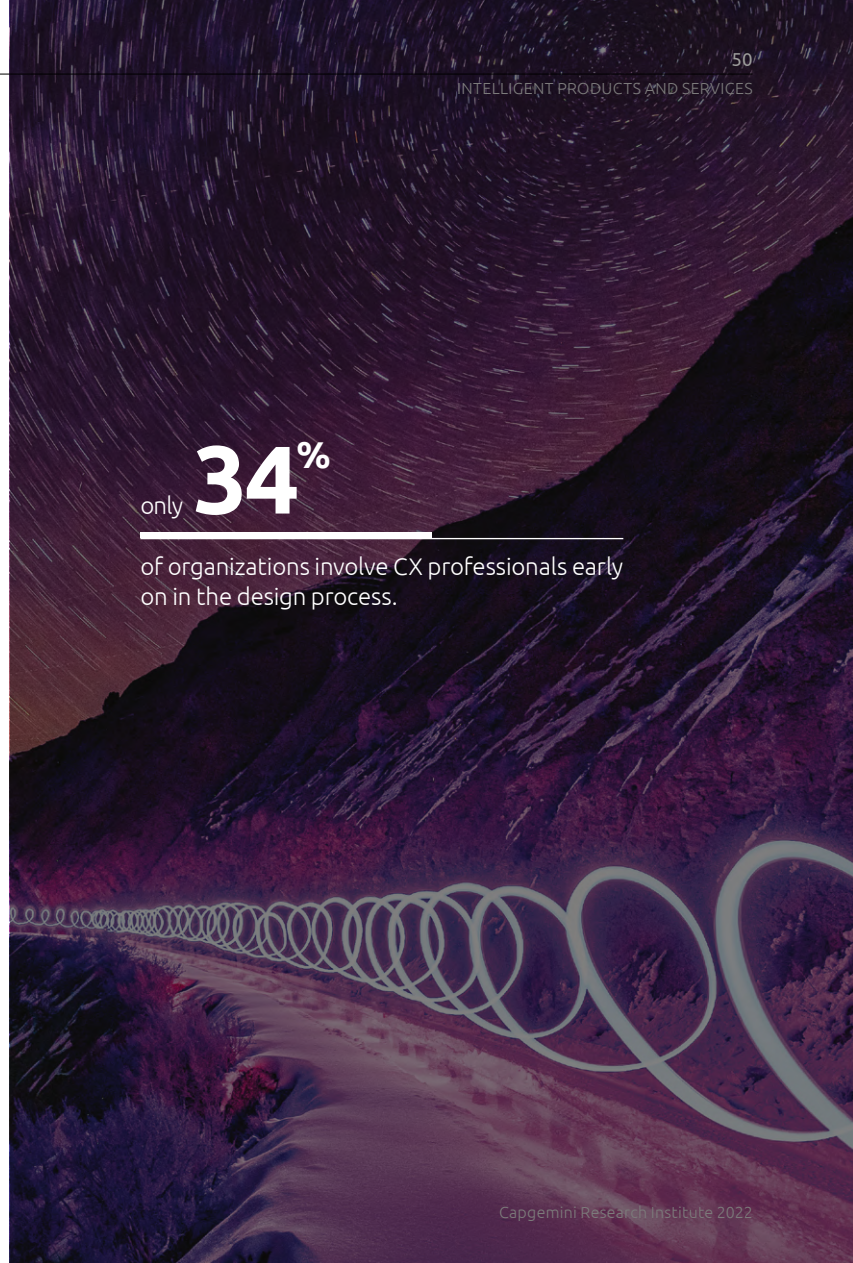
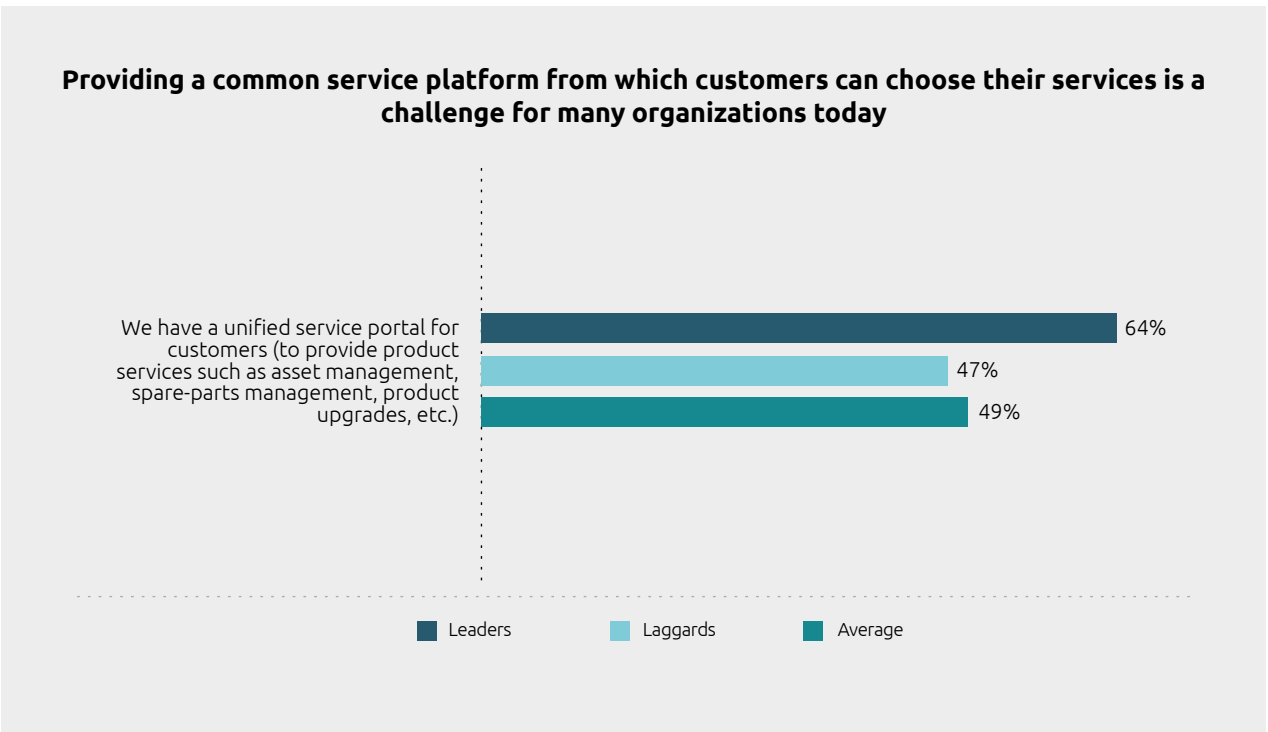


Fig17

More than 6 in 10 Leaders (64%) have a unified service portal for their customers to provide services such as asset maintenance, spare-part management, product upgrades, etc.



Source: Capgemini Research Institute, Intelligent products and services survey, April–May 2022, N=1,000 respondents from unique organizations that have or are currently building visions and strategies for a move to intelligent products and services, N=76 organizations who are Leaders, N=558 organizations who are Laggards.

It is crucial that organizations consider carefully which features to offer for free to tempt customers in, and which to keep gated as incentives to purchase. For instance, Spotify offers users the option of a premium account to get access to certain features; in 2019, this brought in $1.67 billion in additional revenue.

64%

of Leaders offer a unified service portal for their customers to provide services such as asset maintenance, spare-part management, product upgrades, etc., compared to **47%** of the Laggards.

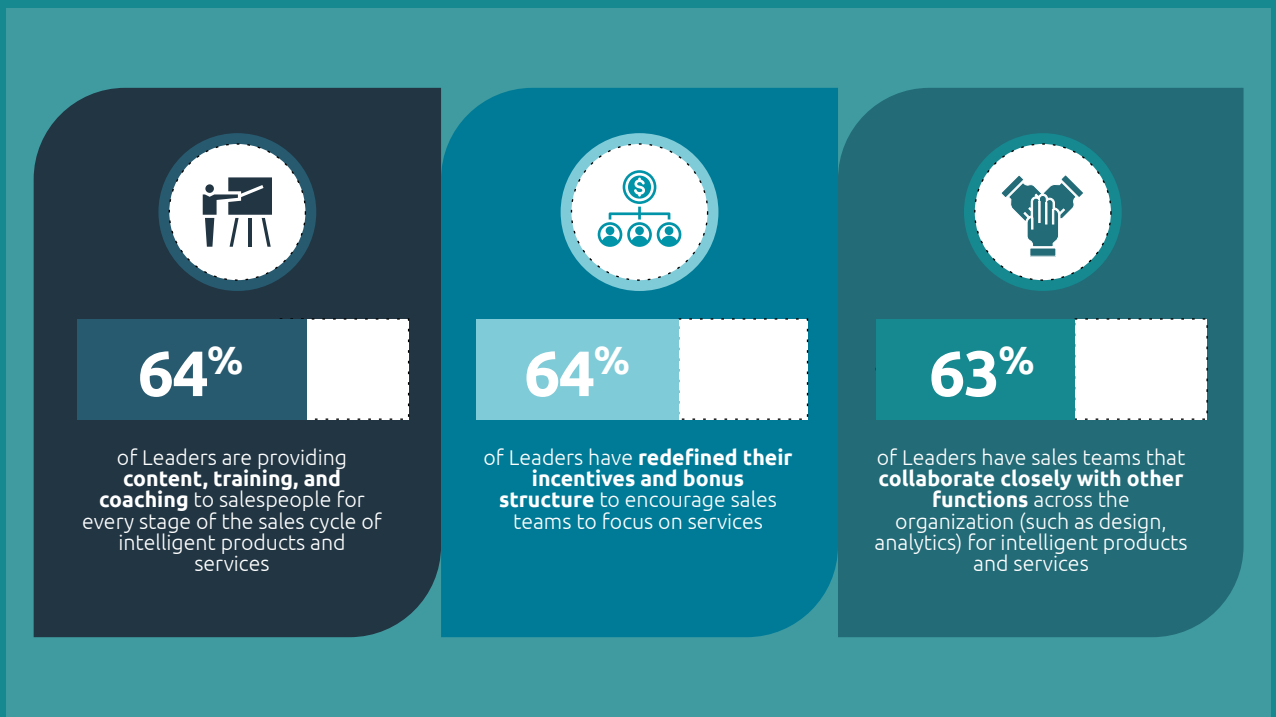
Go-to-market for intelligent products and services

Selling intelligent products and services differs greatly from selling traditional products and consequently requires a different skillset and capabilities. Organizations should consider the following approaches:

- **Build a 360° profile of customers using advanced tools and software** based on preferences and usage. This will help organizations make targeted sales offerings by providing exactly what customers need. Today, just half (52%) of organizations have adequate tools to carry out such customer profiling.
- Sales teams should **collaborate closely with other functions across the organization to fully understand the value proposition**, including predicting customer-demand scenarios. From our research, we found that 63% of Leaders have such processes in place already.
- Further, Leaders also focus on **training sales personnel and providing them with added incentives** to focus on selling services. A director at a global energy company emphasizes the importance of training sales personnel on selling intelligent services: *"Services, more often than not, is a personalized or customized solution that involves more work, patience, and a different mindset on the sales side,"* (see Figure 18).

Fig.18

Leaders have reformed their sales processes and incentive structure to cater to intelligent products and services



"Services, more often than not, is a personalized or customized solution that involves more work, patience, and a different mindset on the sales side"

Director, Global energy company

Source: Capgemini Research Institute, Intelligent products and services survey, April–May 2022, N=1,000 respondents from unique organizations that have or are currently building visions and strategies for a move to intelligent products and services, N=76 organizations who are Leaders.

3.2 Inculcate agility as a key ingredient in the design process

Intelligent products and services will necessitate new design practices; they will not only entail engineering and product teams creating a hardware design, but also creating and embedding software into the product for monitoring and further customization.

- No functional area can exist in a silo; organizations need to adopt a **'systems thinking' approach**, with functions working in coordination. Organizations should begin this agile design process with all internal stakeholders jointly defining the complete product or service. Dr. Saul Reichman, Global Director for Innovation and Corporate Venturing at Maxion Wheels, a division of Iochpe Maxion, suggests: *"If you look at those disrupting competition in any given industry, you will find they are internally aligned – both their operating and supporting functions. They are not only redefining these functions, but they are also coordinating more cohesively."*
- Organizations should do away with cumbersome annual planning cycles in favor of agile, adaptive funding. They can adopt a venture-capital approach by releasing funds incrementally as projects progress against outcome-based metrics. This way, they have optionality as they test and validate each idea using minimal resources.[36] In our research, we found that half of Leaders (51%) are already **funding, setting KPIs, and creating centers of excellence** (CoEs) geared towards agile development and roll-out. Moreover, 61% of them are hiring or contracting agile professionals to guide their teams.
- Finally, organizations must build in some slack during resource planning. As opposed to traditional project management requiring 100% resource allocation on pre-identified projects, organizations should **create an agile resource pool that can be deployed responsively**. This is extremely important for sustainable value delivery and the health of the teams involved, as running a team consistently above capacity is not sustainable.[37]

3.3 Revamp architecture to support product development

As intelligent products and services are designed to learn and evolve, it is paramount that such products are supported by an architecture that allows for this development. To this end, organizations must:

- **Move away from traditional architecture to a service-oriented structure** and start de-linking hardware and software development cycles. Typically, software development and release cycles are fundamentally faster than the hardware development in an intelligent product – as the software system can be handled via OTA upgrades.

- Next, organizations should strive to ensure that various **non-standard and diverse software systems embedded in the intelligent product are run on a single platform** for the operation and can communicate.
- Further, the evolution of software and hardware architecture must **seamlessly incorporate the evolution of 5G/edge computing and cloud technologies**. As the architecture evolves, several non-critical requirements of the product should be offloaded to cloud to take advantage of virtually unlimited storage and computing resources, whereas more safety-critical elements and edge computing use cases should be served by the compute inside the intelligent product itself.

Finally, the development of any intelligent product should be broken up into discrete phases tailored to provide strategic evaluation points along the development path. This will give organizations visibility and control over the development investment.

4. SCALE: Start small, augment with technology, and foster a culture of autonomy

4.1 'Big-bang' transformations rarely work

Organizations need to take a **'toe-in-the-water' approach**, by building only a few intelligent products and services at one time, testing those out, and then slowly scaling them. Dr. Saul Reichman from Maxion Wheels elaborates: *"For organizations, especially traditional incumbents, and legacy players, it is crucial to recognize customer demand. This leads to analyzing their value chains and determining how they can monetize this demand, either from their current products/services, or new ones. Understanding the product market fit can be challenging, but is critical to gain long-term growth potential."*

Learnings from Digital Natives: Start small

Many Digital Natives made their names with a minimum viable product (MVP) that offered maximum value with minimum noise. They know exactly who their target audience is and tested the product on them, absorbing and acting on the feedback. For instance, music-streaming service **Spotify** started by launching a simple app, with a legally sound, affordable offering. Slowly, it expanded its market, added new features, and developed the Spotify mobile app to cater to the growing mobile user base. Osman Hosan, Director of EMEA Partner Sales at Spotify, confirms: *"Moving towards intelligent products and services is a big change for a traditional organization. It would be best for them to test and try with one or two products at first. Changing the mindset and making significant investment into initiatives is a long-term plan and making huge changes overnight won't be very effective."*

"For organizations, especially traditional incumbents, and legacy players, it is crucial to recognize customer demand. This leads to analyzing their value chains and determining how they can monetize this demand, either from their current products/services, or new ones. Understanding the product market fit can be challenging, but is critical to gain long-term growth potential."

Dr. Saul Reichman

Global Director for Innovation and Corporate Venturing,
Maxion Wheels- a division of Iochpe Maxion

4.2 Unlock the power of intelligent testing for improved time to market

To ensure successful implementation of intelligent products and services requires a reliable architecture that will enable smooth, effective, and secure data-related processes, that can be adapted and upgraded as required. **Organizations need to implement intelligent testing** to build durability and detect weaknesses, saving on costs, staying compliant, and allowing for continuous innovation. This requires teams to develop comprehensive testing capabilities using AI and ML to predict and rectify issues before the software is deployed.

A leading global automobile manufacturer automated the testing of the electronic functionality of its cars and implemented mixed-mode validation to simulate missing parts that would arrive late due to unforeseen supply-chain issues. The solution realized a positive return on investment within four months.[38]

only **46%**

of organizations use AI/ML-backed intelligent testing to cut time to market and increase the volume of new releases.

However, our research shows that only 46% of organizations use AI/ML-backed intelligent testing to cut time to market and increase the volume of new intelligent products and services releases.

4.3 Set up specialized roles for scaling initiatives

Organizations need to set up **specialized roles within individual business units dedicated to scaling**, which, with the help of business, will accelerate scaling ideas rapidly within new or existing markets. Further, **cross-training teams around scaling** should be a focus. Key skills required for scaling are an operator mindset; effective cross-functional collaboration and partnering; and understanding technical requirements.

Finally, depending on changing business priorities, market forces, or consumer demand, organizations should **actively consider killing or scaling back projects** that have been scaled up successfully.[39]

5. EVOLVE: Harness the power of data to improve continuously

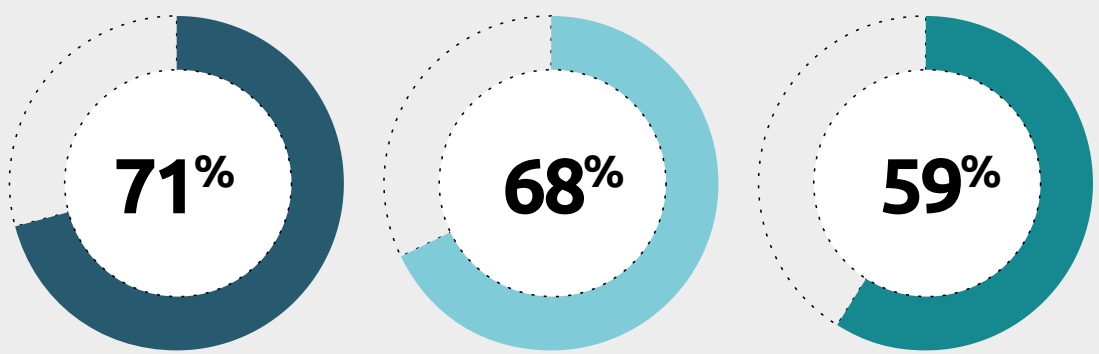
5.1 Use performance and usage data to improve and update intelligent products and services

The new intelligent offering will no longer focus on one-off sales of a product or service but will involve regular software upgrades and improvements. Traditional manufacturing organizations need to **shift to a model where the data is seen as a core asset and product in its own right.**[40]

- Organizations need to build a **comprehensive data strategy and establish a dedicated unit** or function to govern, remotely collect, analyze, and secure product usage and performance data. Organizations must improve data-collection processes and bring products onto a common network. A **unified data platform** will enable continuous flow of information,

Fig19

Leaders integrate data about product, usage, and customer behavior into ongoing product improvements



Source: Capgemini Research Institute, Intelligent products and services survey, April–May 2022, N=1,000 respondents from unique organizations that have or are currently building visions and strategies for a move to intelligent products and services, N=76 organizations who are Leaders.

where all functions and departments have access to all types of relevant data.

- Organizations must **identify and list all the data assets they can draw on**, who owns the data, and when it should be deleted in order to comply with regulations. In addition, they should have well-defined access policies, including regarding who can access the data and for what purpose. Further, organizations should ensure that business teams take ownership of various aspects of quality, rather than it being an IT-driven exercise.

An Innovation Senior Director at a US cloud-based software company says: *"Data is the lifeblood of how organizations create great competitive advantage. Data used should be clean, relevant, and structured. Everyone needs to have a common understanding of what the data field is; you can have all the data in a single pool, which can then be accessed and analyzed."*

Further, organizations need to **invest in data-analytics capabilities to activate the insights into action**. Currently (as shown in Figure 19), Leaders are ahead in terms of activating this data for software updates, product improvements, or creating new business models. For instance, organizations such as Schneider Electric are using product-performance data and integrations with their CAD systems to inform their next generation of products.[41]

Learnings from Digital Natives: Continuously improve and personalize the customer experience

Bidisha Paul from Microsoft emphasizes the importance of continually monitoring and improving intelligent offerings: *"Be prepared to have a plan for monitoring your products, because we generally develop products and put a lot of attention on the development and implementation phase. But when it comes to after sales service and monitoring for intelligent products, it is not that great. You have to constantly take ownership of the intelligent products and services that you provide to your consumers."*

5.2 Digital continuity bridges the gap

To ensure digital continuity, organizations must **embed the most helpful new technologies into their existing operations**. All systems must be interconnected in the new ecosystem, and all teams working on a given product or design must have the same versions of data and models available to them at all times. Organizations need to build a common digital thread to gain full visibility of data across the product or services lifecycle.

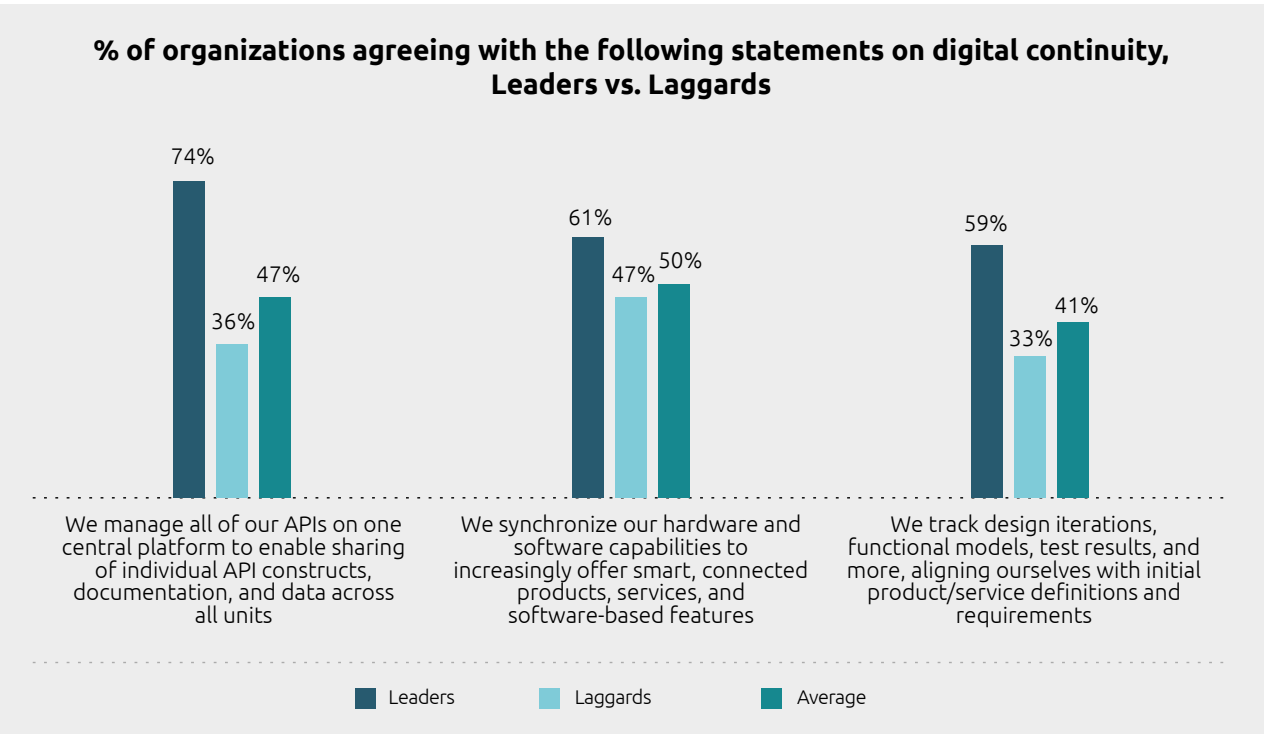
Leaders are able to coordinate various disciplines and functions, as well as ecosystem partners. For instance, 61% of Leaders are able to synchronize hardware and software capabilities, and 59% are able to track design iterations, functional models, test results, and more, aligning themselves with the initial product/service definitions and requirements (see Figure 20).

Russell Masters, former Vice-President, Digital Services at Rolls-Royce, says: *"Through our Blue Data Thread service, we're able to connect to the aircraft performance and engineering data we need to drive our care services, both directly and with service providers. All that data comes into our analytical platform, and we use it both to model aspects of performance and asset behavior and service, but also to forecast maintenance."*[42]

However, from a lifecycle perspective, data-visibility challenges persist. Our research shows that 64% of organizations struggle to ensure digital continuity throughout the lifecycle of product/service design and development.

Fig20

Leaders are ahead in implementing a common digital thread



Source: Capgemini Research Institute, Intelligent products and services survey, April–May 2022, N=1,000 respondents from unique organizations that have or are currently building visions and strategies for a move to intelligent products and services, N=76 organizations who are Leaders, N=558 organizations who are Laggards.

Our survey findings show that 61% of Leaders use software tools to redefine their manufacturing process for improved productivity and reduced design iterations (e.g., digital twin, AR/VR, predictive maintenance, etc.). **Digital twins** can be used to improve product/service design, reduce time to market, and maintain engineering-manufacturing continuity. Tesla, for example, creates a digital twin of every car it sells; data from sensors is fed into each car's simulation and, using AI, Tesla can determine whether the car is working as intended or requires maintenance.[43]

74%

of Leaders manage all APIs on one central platform to enable sharing of individual API constructs, documentation, and data across all units.

+ Conclusion

A shift from 'traditional' product offerings to smart, connected products and services is altering the basic value proposition and opening up new frontiers for organizations today. Organizations must transform not only their business models, but all facets of their value chains: engineering, manufacturing, supply chain, marketing, and customer interaction. However, most are still stuck at the experimentation stage grappling with challenges, including a lack of skills and partnerships; difficulty in integrating new technologies with existing systems; and a lack of data management and analysis tools. To turn the tide, they need to embrace the best practices from industry leaders across sectors by:

- developing a holistic intelligent strategy
- fostering an agile and innovation culture
- focusing on adaptive, human-centered design
- starting small, augmenting with technology, and scaling fast
- harnessing data to drive new sources of value.

At the same time, organizations need to maintain the delicate balance between connected digital ecosystems and growing privacy and security challenges. Also, identifying when not to store or discard data becomes crucial for better privacy, higher data-access speed, and a sustainable footprint.

The future of Industry is Intelligent – it is time to seize the intelligent products and services opportunity to transform your business models, unleash innovation, and improve CX, thereby crafting a profitable and sustainable path forward.

Research Methodology

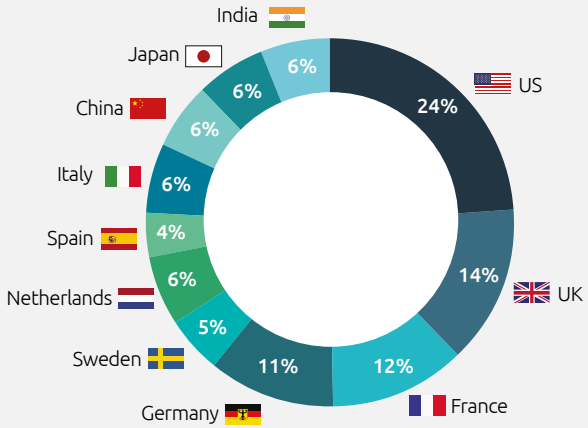
To understand the journey of manufacturing organizations in transitioning towards an intelligent products and services portfolio, we carried out extensive research, with both qualitative and quantitative components.

In-depth interviews
We conducted 12 in-depth interviews with industry executives from various organizations, which included the traditional manufacturers, as well as digital natives. Interviewees comprised those who are involved in the development of intelligent products and services working across all functional areas, such as strategy, product/service development, engineering, IT, and customer management.

Executive survey
We surveyed 1,000 respondents from unique organizations (only traditional manufacturers) with more than $1 billion in annual revenue, across 11 countries. The respondents were at Director level or above, responsible for either driving intelligent products/services strategy in their organizations or being closely associated with it. The distribution of respondents and their organizations is provided in the following figures.

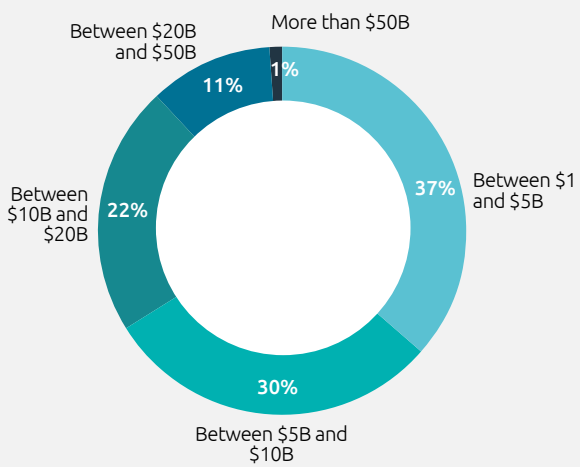
The study findings reflect the views of the people who responded to our online questionnaire for this research and are aimed at providing directional guidance. Please contact a Capgemini expert listed at the end of the report to understand specific implications.

% OF RESPONDENTS BY ORGANIZATION HEADQUARTERS

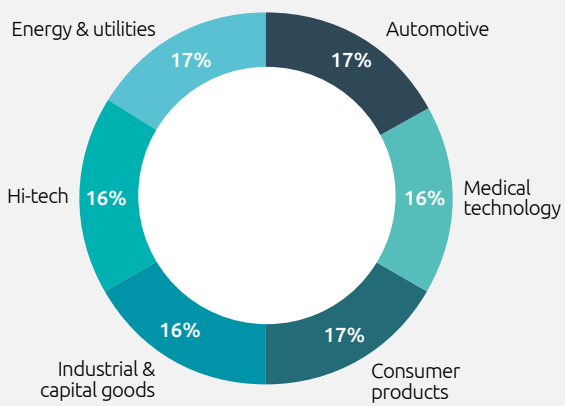


Source: Capgemini Research Institute, Intelligent products and services survey, April–May 2022, N=1,000 respondents from unique organizations that have or are currently building visions and strategies for a move to intelligent products and services.

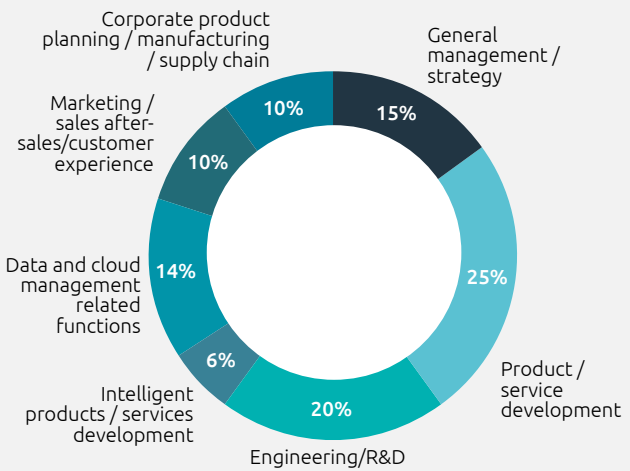
% OF RESPONDENTS BY ORGANIZATION REVENUE



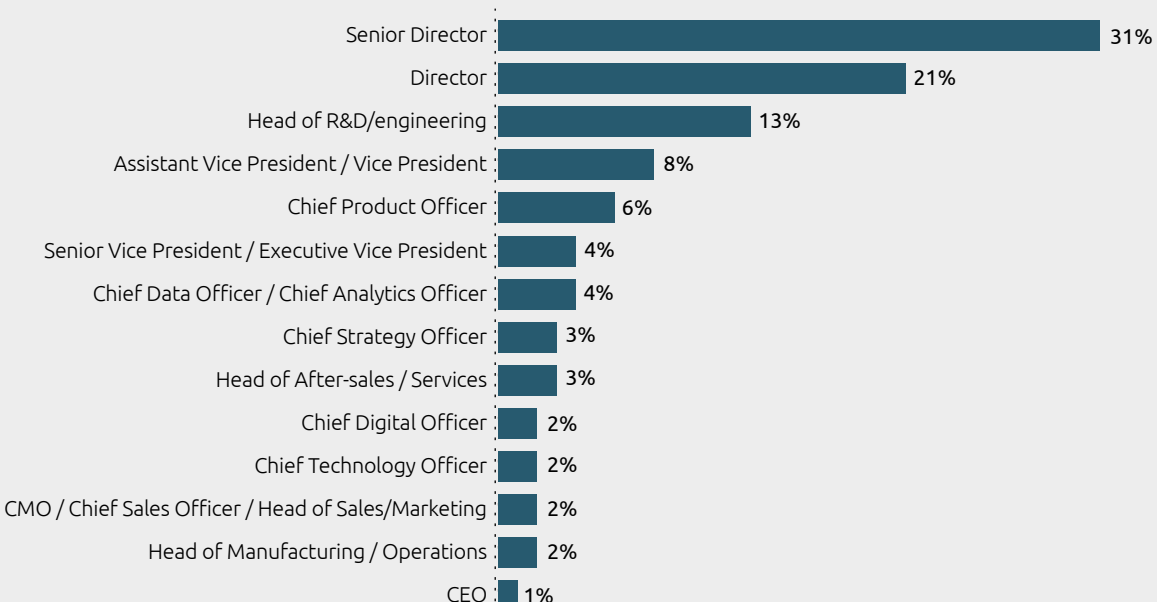
% OF RESPONDENTS BY ORGANIZATION INDUSTRY



% OF RESPONDENTS BY DEPARTMENT / FUNCTION



Source: Capgemini Research Institute, Intelligent products and services survey, April–May 2022, N=1,000 respondents from unique organizations that have or are currently building visions and strategies for a move to intelligent products and services..



Source: Capgemini Research Institute, Intelligent products and services survey, April–May 2022, N=1,000 respondents from unique organizations that have or are currently building visions and strategies for a move to intelligent products and services.

Appendix

Elements on which the analysis for the x-axis, i.e., 'Maturity of Intelligent Transformers' was based

- **Investment:** Level of investment as a percentage of revenue for the organization over the last financial year
- **Digital continuity:** Adoption of a digital thread to gain full visibility into all data across the full product lifecycle
- **Agile:** Focus on closed loop and agile product/service development cycle for intelligent products/services
- **Implementation:** Organization's state of implementation of intelligent products and services initiatives – pilot/PoC, partially scaled, or fully scaled
- **Technology:** Support for OTA updates to push new features and product upgrades
- **Data-analysis techniques:** Sophisticated, real-time (or near real-time) analysis powered by AI on the data collected from intelligent products
- **Self-service for customers:** Provision of self-service capabilities via unified dashboards and virtual agents to empower customers with easily accessible information

Elements on which the analysis for the y-axis, i.e., 'Maturity of Intelligent Enablers' was based

- **Strategy:** Presence of a vision and strategy for intelligent products and services
- **New business model:** Implementation of 'Product-as-a-Service' models for at least some intelligent products
- **Collaboration:** Involvement of customer experience (CX) professionals early on in the product/service design process
- **Go-to-market strategy:** Continual feasibility analysis of complete products/services portfolio and reconfiguration of go-to-market strategies
- **Skill building:** Focus on building software, hardware, and CX skills among product managers
- **Data-analysis capabilities:** Presence of data scientists in marketing teams to analyze the consumer product/service data and formulate sales strategies
- **Monetization initiatives:** Monetization of product performance and usage data to provide this as a service to the consumer
- **Sustainability:** Make optimum design choices that allow products to consume fewer resources during their lifetimes (such as minimizing energy usage, ensuring a high degree of repairability, etc.)

Key cohort characteristics

Upon analyzing the Leaders, Innovators, Visionaries, and Laggards, we found distinguishing characteristics for each cohort in relation to developing an intelligent offering.

Cohort	Laggards	Innovators	Visionaries	Leaders
Vision and strategy	No dedicated strategy or vision in place	Strategy and vision in place, but no clear targets by which to measure progress	Have started developing a holistic strategy	Dedicated strategy, digital vision, and a detailed roadmap in place, with clear milestones to monitor the progress of transformation initiatives
Innovation structure	Absence of a defined process/ structure for innovation; ad-hoc innovation driven by immediate business needs	Multiple labs across geographies in place for product/service innovation; planned specific investments; however, organizations still lack integration of ongoing innovation into business strategies	Innovation process is actively aligned with strategic goals; optimization of innovation governance, processes, and infrastructure required	Open innovation strategy with a combination of centralized unit (comprising IT and business Leaders) reporting to the board of directors and multiple decentralized units, to use internal and external networks to identify and scale ideas rapidly
Scale of implementation	Only identified certain application areas / use cases; many stuck at pilot/PoC stage	Implemented several pilots/PoCs; a few use cases partially scaled	A majority of use cases are partially scaled	A majority of use cases are taken to scale
Talent and skills	Minimal focus on transforming design and engineering teams	Starting to upskill technical skills such as software, cloud, data capabilities, AI, agile, product engineering, etc.	Along with technical skills, starting to focus on developing skills such as design thinking, and new business models for a select few	Along with hiring and partnering, continuous focus on upskilling throughout the organization; developing hardware, software, agile, design thinking, new business models, and CX skills among product managers; also focusing on developing data-science skills among sales and CX teams

Cohort	Laggards	Innovators	Visionaries	Leaders
Digital continuity	Struggling to ensure digital continuity throughout design and development	Able to synchronize hardware and software efforts; able to co-ordinate the various disciplines of engineering across mechanical, electrical, and software to improve product development; however, struggling with co-ordination across functions	Co-ordinated efforts of various internal functions (such as design engineering, production, customer-services, etc.) to provide access to data across the product/service lifecycle	End-to-end digital continuity across the entire product lifecycle by seamlessly integrating ideation, engineering, manufacturing, and aftersales, as well as ecosystem partners, into one unified digital collaboration; scaled digital twins for closed-loop decision-making
Agile culture	At the initial stages of agile transformation	Focus on agile tools, DevOps, and hiring/skilling agile professionals; yet to incorporate agile mindset, culture, and governance structure	In addition to skills and ongoing training, in process of setting KPIs and creating agile CoEs (centers of excellence)	Has created a closed-loop agile culture at every stage of intelligent products and services development; reacting to customer feedback
Technology	Struggling with challenges of integrating new tools and technologies	Self-optimization; interaction with closed ecosystems; using cloud and AI/ML-backed software tools and technologies in many areas	Integration challenges prevail; using AI/ML and other tech in a few areas; lack of simulation tools (digital mockups, AR, VR, etc.)	Focus on OTA updates; open ecosystem; using AI/ML-backed software tools and technologies to redefine each stage of the product/service lifecycle
Services	Offering product-backed services (such as maintenance, condition monitoring, etc.)	Offering services (product- or use-oriented) without a set strategy or roadmap	Exploring new strategies and roadmaps for services related to use-oriented, sharing, subscription models, etc.	Actively focus on outcome-based or as-a-service business models

Source: Capgemini Research Institute Analysis.

References

1. The Verge, "Samsung and LG go head-to-head with AI-powered fridges that recognize food," January 2, 2020.
2. Synapse, "Propeller Health: Inhaler Sensor," accessed September 4, 2022.
3. HBR, "How smart, connected products are transforming competition," November 2014.
4. FutureBridge, "Over-the-Air software updates – reaping benefits for the automotive industry," January 22, 2020.
5. Forrester, "From grease to code: Industrial giants must bet their futures on software," October 19, 2021.
6. Biopharma (biotechnology and pharmaceutical) firms are excluded from the sample for this research, as we covered them in our latest report on connected health. Please read more in our report: Unlocking the value in connected health.
7. Circular X. (2020) Case study: Signify Light-as-a-Service. Accessed from www.circularx.eu.
8. Businesswire, "Schindler launches ElevateMe mobile app, touchless elevator operation made simple via smartphone," January 26, 2021.
9. Atlas Copco, "Connected compressors and Industry 4.0 – From then to now," accessed June 19, 2022.
10. Borescope is an optical device used to inspect narrow, inaccessible spaces (such as the interior of an engine cylinder).
11. Rolls-Royce, "Harnessing the power of AI to deliver more intelligent engine inspections," 2021.
12. SITSI market analysis, "Digital factory: Use cases and maturity," July 26, 2019.
13. Capgemini, "Going green intelligently: How connected services unlocks profitable sustainability," January 7, 2020.
14. Future of Field Service podcast, "Tim Baines of Aston Business School on Advanced Services Transformation," August 5, 2020.
15. Capgemini Research Institute, "Rethink: Why sustainable product design is the need of the hour," September 7, 2022.
16. WEF, "This year's e-waste to outweigh Great Wall of China," October 18, 2021.
17. Capgemini, "What part of your intelligent product is worst for the environment?," August 17, 2022.
18. Future of Field Service podcast, "Panasonic sets its sights on service," March 24, 2021.
19. South Florida Hospital News, "Philips and Jackson Health System sign ground-breaking 11-year agreement for enterprise monitoring as a service," June 28, 2018.
20. Oliva, R., Kallenberg, R. (2003), "Managing the transition from products to services." International Journal of Service Industry Management, 14, 160-172. ttp://dx.doi.org/10.1108/09564230310474138.
21. Schneider Electric website, accessed August 1, 2022.
22. Microsoft 365 website, accessed August 1, 2022.
23. Protocol, "Forget buying a Peloton bike upfront. The company now wants a monthly subscription," March 10, 2022.
24. Tech Crunch, "How Hardware-as-a-Service will save IoT," July 7, 2016.
25. Future of Field Service podcast, "Using data to drive your services-led business model," March 3, 2021.
26. Capgemini, "Connected Vehicle Trend Radar 2: The road towards profitability for automotive connected services," September 9, 2020.

27. Capgemini Invent, "Connected Services Health Check," March 2022.
28. Cox Automotive, "Car buyers balk at paying monthly fees for features and services," April 21, 2022.
29. Life Insurance International, "39.7% of UK home insurance policyholders with smart home devices would be willing to share data with insurers," February 4, 2022.
30. Capgemini Research Institute, "Unlocking the business value of IoT in operations," March 3, 2018.
31. Vard Antinyan, Volvo Car Group, "Revealing the complexity of automotive software," July 2020.
32. World Economic Forum, "Google runs on 5000 times more code than the original space shuttle," July 21, 2016.
33. Capgemini Research Institute, "Data Mastery", September 23, 2021.
34. Future of Field Service podcast, "Ricoh's Centralized Services Strategy," July 2020.
35. The Hindu, "Poised to build 'fit-for-future' technologies, products, says Bosch Global Software Technologies MD," April 2022.
36. Capgemini Research Institute, Agile at scale, November 19, 2019.
37. Capgemini Research Institute, Agile at scale.
38. IOT Analytics, "The top 10 IoT Use Cases," October 2021.
39. Capgemini Research Institute, Scaling Innovation Research, September 24, 2020.
40. Capgemini Research Institute, Data Mastery, September 23, 2021.
41. Forrester, "Reimagine the product innovation cycle for connected products," February 26, 2019.
42. CXOTalk, "Digital transformation and servitization at Rolls-Royce," December 1, 2020.
43. Industry Week, "Taking digital twins for a test drive with Tesla, Apple," April 29, 2020.

Capgemini can help you unlock new sources of value

We are a leader in sustainable breakthrough product innovation, co-creating next generation services and business models that delight customers and disrupt markets. We deliver end-to-end product lifecycle services, from concept to market, underpinned by full stack design and development capabilities.

By orchestrating best-in-class design, strategy, technology, engineering, data science and operational excellence and overlaying that with industry and domain-specific assets and insights – we drive meaningful client outcomes that enable them to leapfrog their competition.

We help clients solve for where to play, how to organize, what to design, how to build and run leveraging our five-pillar approach:

Business strategy & Innovation	Operating model & organization	Product & service design and build	Delivery at scale	Run & continuous improvement
WHERE TO PLAY?	**HOW TO ORGANIZE?**	**WHAT TO DESIGN?**	**HOW TO BUILD?**	**HOW TO RUN?**
• Continuous Business Reinvention Strategy • Develop Portfolio Strategy & Business Plans • Define Ecosystem Partnerships	• Define Organization and Digital Talent • Develop Operating Model/ Governance • Process and Technology Enablement	• Value Proposition, User Experience, Design • Business Model, monetization & Go-to-Market Strategy • Design, architect and build product	• SaaS/PaaS Platform architecture • Ecosystem integration • Intelligent Testing	• Continuous Innovation with Data Insights • Product Sustenance • Intelligent Support Services

Sustainability by design / Cloud-enabled services / Insight-based company / End-to-end Cybersecurity

Software-driven enterprise

For more information, please visit:.
https://www.capgemini.com/solutions/intelligent-products-services/

Authors

Lisa Mitnick
EVP, Group Offer Leader -Intelligent Products & Services, Capgemini Invent
lisa.mitnick@capgemini.com

Nicolas Rousseau
EVP, Group Offer Leader - Intelligent Products & Services, Capgemini Engineering
nicolas.a.rousseau@capgemini.com

Leonardo Weiss F. Chaves
VP, Intelligent Products & Services,
Capgemini Invent
leonardo.weiss@capgemini.com

Eric Dalla Vecchia
VP, Global Lead Connected Product and Services, Intelligent Industry
eric.dalla-vecchia@capgemini.com

Jeff Hebert
President, Synapse Product Development
jeff.hebert@synapse.com

Eric Cohen
VP, Connected Consumer, Intelligent Products & Services
eric.cohen@capgemini.com

Jerome Buvat
Head of Capgemini Research Institute
jerome.buvat@capgemini.com

Subrahmanyam KVJ
Senior Director, Capgemini Research Institute
subrahmanyam.kvj@capgemini.com

Nancy Manchanda
Program Manager, Capgemini Research Institute
nancy.manchanda@capgemini.com

Hiral Shah
Manager, Capgemini Research Institute
hiral.shah@capgemini.com

The authors would also like to thank Adrian O. Penka, Jones, Broderick, Sebastian Marschall, Jean-Marie Lapeyre, Vikas Kumar, Thierry Batut, Sergey Patsko, Olivier Zitoun, Geoff McCleary, Julien Fowler, Laetitia Grozellier, Holger Lips, Frédéric Arquier, Guru Shankar Muthu Raj, Arnaud Bouchard, Rajashree Damle, Ozlem Bozyurt, Lars Boeing, Anne-Laure Thieullent, Eliza Silvester, Igor Barkalov, Francois-Xavier Reodo, Moise Tignon, Louise Barbolosi, Hugo Luckas, Gert-jan Schoppert, Ralf Bus, Payal Roy, Aurélie Derché, Julian Fowler, Vaishnavee A, Manik Agarwal, Manish Saha, and Rupali Chakraborty for their contribution to the report.

About the Capgemini Research Institute

The Capgemini Research Institute is Capgemini's in-house think tank on all things digital. The Institute publishes research on the impact of digital technologies on large traditional businesses. The team draws on the worldwide network of Capgemini experts and works closely with academic and technology partners. The Institute has dedicated research centers in India, Singapore, the United Kingdom, and the United States. It was recently ranked number one in the world for the quality of its research by independent analysts.
Visit us at www.capgemini.com/researchinstitute/

For more information, please contact:

Contact

BY GEOGRAPHY:

Global
Lisa Mitnick
lisa.mitnick@capgemini.com

Nicolas Rousseau
nicolas.a.rousseau@capgemini.com

North America
Lisa Mitnick
lisa.mitnick@capgemini.com

Adrian Penka
adrian.penka@capgemini.com

France
Nicolas Rousseau
nicolas.a.rousseau@capgemini.com

Germany
Leonardo Weiss F. Chaves
leonardo.weiss@capgemini.com

Europe
Roshan Gya
roshan.gya@capgemini.com

BY KEY THEMES:

Intelligent Industry
Roshan Gya
roshan.gya@capgemini.com

Sustainability
Martine Stillman
martine.stillman@capgemini.com

BY INDUSTRY:

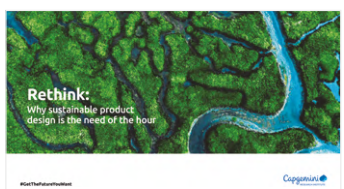
CPRD
Eric Cohen
eric.cohen@capgemini.com

Life Sciences
Geoff McCleary
geoff.mccleary@capgemini.com

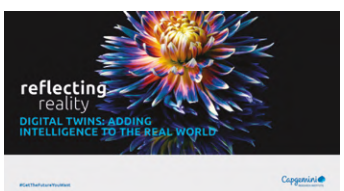
Automotive
Jean-Marie Lapeyre
jean-marie.lapeyre@capgemini.com

Manufacturing
Adrian Penka
adrian.penka@capgemini.com

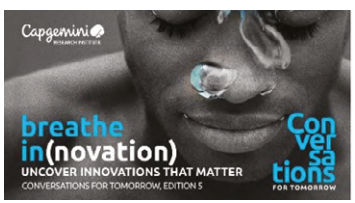
+ Discover more about our research



Rethink: why sustainable product design is the need of the hour



Digital Twins: Adding Intelligence to the real world



Conversations for tomorrow #5: Breathe (in)novation – uncover innovations that matter

Next Destination: Software How automotive OEMs can harness the potential of software-driven transformation

Unlocking the value in connected health

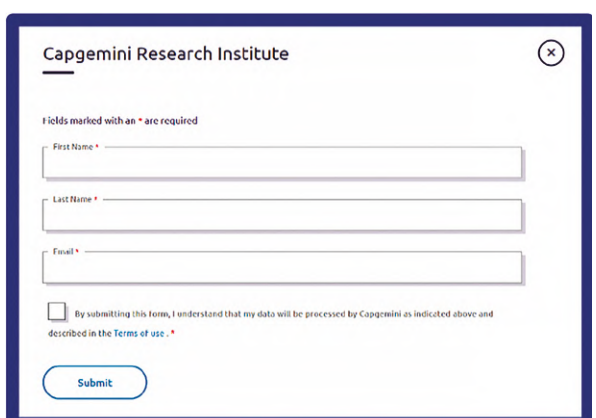
Conversations for Tomorrow #3: Intelligent Industry

Data mastery: How data-powered organizations outperform their competitors

Sustainable Operations: A comprehensive guide for manufacturers

Subscribe to latest research from Capgemini Research Institute

Receive copies of our reports by scanning the QR code or visiting
https://www.capgemini.com/capgemini-research-institute-subscription/



About Capgemini

Capgemini is a global leader in partnering with companies to transform and manage their business by harnessing the power of technology. The Group is guided everyday by its purpose of unleashing human energy through technology for an inclusive and sustainable future. It is a responsible and diverse organization of over 340,000 team members in more than 50 countries. With its strong 55-year heritage and deep industry expertise, Capgemini is trusted by its clients to address the entire breadth of their business needs, from strategy and design to operations, fueled by the fast evolving and innovative world of cloud, data, AI, connectivity, software, digital engineering and platforms. The Group reported in 2021 global revenues of €18 billion.

Get the Future You Want | **www.capgemini.com**