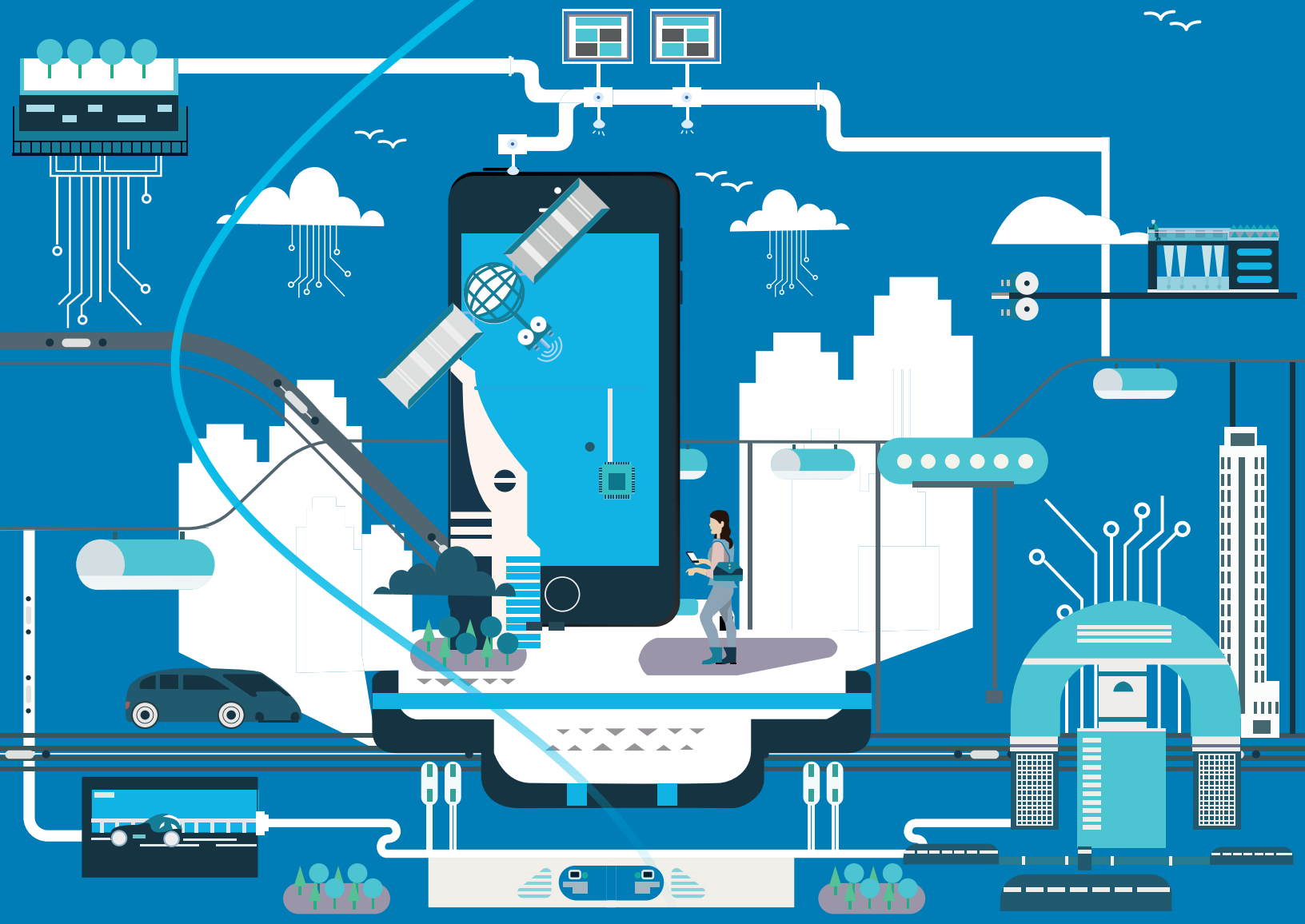
Capgemini engineering

ENGINEERING NEXT-GENERATION DIGITAL PRODUCTS



FOREWORD

Softwarization can provide a wealth of opportunity. There are, however, challenges that must be overcome.

Software is rapidly becoming the foundation for most of the ways we work, live and play — a trend known as "softwarization." Software isn't new, of course. But what's changed is the degree to which it determines a product's user experience, revenue opportunities, longevity, competitiveness, market differentiation and more.

Softwarization enables products to become "smart," connected and even autonomous — capabilities that they didn't have when software was a limited part of their DNA. For example, passenger vehicles and trucks have relied on software for decades to keep their engines running properly and efficiently. With softwarization, they now can drive themselves and upload granular information about the health and performance of every key component, helping avoid expensive breakdowns.

Vehicles also are an example of how softwarization enables new revenue opportunities and user experiences, especially when it takes advantage of 5G mobile networks for over-the-air (OTA) software delivery. For instance, owners of Telsa's Model S and Model X can purchase a $2,000 OTA software upgrade for the infotainment system that adds streaming video, more games and a faster user interface. And Model S60 owners can get a $9,000 OTA software upgrade that extends their existing battery's range by 40 miles.

Softwarization also provides engineers with unprecedented ways to get information about the performance of their products in the real world and how customers really use them. These invaluable insights enable engineers to refine existing products and develop new ones.

But there's a catch.

To achieve these and other benefits, businesses must overcome four major challenges, starting with finding enough people with the necessary skills to develop software-center products. As Everest Group notes, "While 90% of enterprises are actively thinking about integrating software and digital technologies in their products, only about 25% have managed to scale their initiatives."

In this paper, my team at Capgemini Engineering is pleased to bring you a six-point framework developed by Everest Group to overcome these challenges. It also includes success stories from businesses well into their softwarization transformations, such as Abbott Laboratories, John Deere, Nike, and other blue-chip brands so that you can learn from their experiences.

We hope you find this whitepaper useful.

Jiani Zhang
EVP and Chief Software Officer,
Capgemini Engineering

Everest Group®

Engineering Next-Generation Digital Products

The Role of Software in Modern Smart, Connected, Autonomous Products

Nishant Udupa, Practice Director

Contents

Introduction

Software is the most critical component in the product engineering ecosystem today. The number of lines of code in products such as automobiles, airplanes, electronic devices, and medical devices, has increased to unprecedented levels. Across industries, next-generation software-enabled technologies such as Artificial Intelligence (AI), Machine Learning (ML), Internet of Things (IoT), 5G, and Augmented / Virtual Reality (AR/VR), are being embedded into physical products to convert them into smart, connected, and autonomous digital products.

The twin levers of connectivity and data are also increasingly critical for enterprises developing new, as-a-service revenue streams. As software is key to product transformation as well as engineering and R&D processes, it is critical to understand the increasing use of software across industries and the steps that engineering enterprises need to take to avoid common pitfalls in their softwarization journey.

In this research, we explore these issues and answer the following three questions:

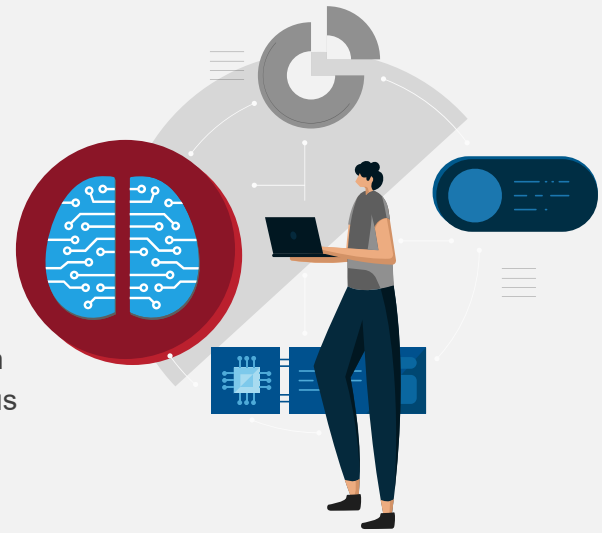
1. What are the drivers of softwarization?
2. What are the common pitfalls for enterprises as they integrate software into their products?
3. How can enterprises ensure success as they start and then sustain their product softwarization journey?

What we mean by softwarization of products

Several terms and nomenclatures are used to describe the emergence of software as the most significant component in products across industries. Softwarization of products, software-defined transformation, digital transformation, and digital products have all been used interchangeably to describe the same phenomenon.

Everest Group take

We define digital transformation as the software-driven transformation of the whole enterprise, encompassing the transformation of various internal processes, IT systems, and operations, as well as the integration of software and platforms in engineering and manufacturing processes. For the purposes of this research, however, we will talk primarily about the softwarization of products, which refers to the increasing share of software and digital technologies in physical products that add smart, connected, and autonomous features and convert them into digital products.



This conversion of physical products to digital products via softwarization has enabled four key capabilities:

- **Monitoring** – Connectivity enabled by the integration of sensors, communication gateways, and the cloud, facilitates data transfer from the product, allowing for continuous monitoring of the product's condition, environment, and for alerts and feedback regarding usage
- **Control** – Software integrated in the product enables more control – often remotely – of the product functions as well as personalization of the user experience and feature enhancement via OTA upgrades
- **Optimization** – The use of software algorithms and data analytics can be used to optimize product performance and enable predictive and preventive maintenance, diagnostics, service, and repair
- **Autonomy** – Digital products can be made autonomous by integrating intelligent technologies with sensors, connectivity, and analytics for autonomous operations, self-diagnosis and service, and autonomous interactions with the product environment

Current state of the market

The conversion of physical products into digital products via softwarization has accelerated across industries over the last few years, with multiple factors driving enterprise engineering teams' investments.

Drivers of softwarization

- **Rapidly evolving customer expectations:** Softwarization of products is a key enabler in converting them into smart, connected, and autonomous digital products. Today's end users are digitally savvy and demand a hyper-personalized experience and immediate feedback that can only be generated through these smart and connected products; for example:
  - Across the fitness and healthcare verticals, the need for immediate feedback has resulted in the birth of the smart wearables industry, with devices configured to monitor user data and provide customized insights and recommendations in real-time

Furthermore, integrating autonomous features can significantly reduce the cost of running these products; for example:

- At the Consumer Electronics Show 2022, John Deere unveiled a fully autonomous tractor that will enable farmers to till their land without the need for expensive labor

- **Faster product upgrades and releases:** The advent of connected products has enabled enterprises to roll out updates and upgrades Over-The-Air (OTA), shortening the product life cycle and eliminating the need to recall products when they fail; for example:
  - The widespread prevalence of connected cars has enabled most automotive OEMs to roll out updates OTA. Tesla, for instance, which has been a leader in OTA software, releases software updates remotely to improve in-car and ownership experiences. Updates to the infotainment systems and vehicle safety, enhancements to vehicle parts and functionality, and new driving modes are often released OTA. The significant software improvements that can be added to the vehicle often results in an increase in the post-purchase value of the car
- **Enabling alternate revenue streams:** Connected products enable enterprises to generate revenue via as-a-service business models. The servicization of products generates a continuous revenue stream for enterprises, while also reducing their customers' capital expenditures. With user consent, by taking advantage of data privacy protection safeguards such as differential privacy to enable sharing information at an aggregate level, data generated by connected products can also be sold to third parties, sometimes creating a significant income stream; for example:
  - Kaiser Compressors, which manufactures compressed air and vacuum products, introduced a business model in which their customers do not purchase air compressors, but instead make payments based on the volume of compressed air. The manufacturer installed sensors on their machines, which captures data regarding the volume of air compressed and other metrics for predictive maintenance, while retaining the ownership of the machine and retaining responsibility for installations, operations, and repairs
- **Generate insights for engineering teams:** Embedding connectivity and smartness into products benefits both the end user and the enterprise by generating data about product performance and breakdowns to improve the R&D process; for example:
  - Amazon continually reviews its smart home devices' (such as Alexa-enabled Echo) usage data to modify or delete features that may not be popular. In November 2021, for instance, Amazon removed the Alexa integration with third-party email services that could be activated by voice, due to lack of customer interest
- **Advances in technology:** Advances in chipsets, AI/ML, AR/VR, IoT, and connectivity standards such as 5G have enabled many new use cases across industries that were not feasible until a few years ago, leading to the introduction and integration of these digital technologies into products. Exhibit 1 provides a perspective on various digital products' enabling technologies and the key capabilities they support (monitoring, control, optimization, and autonomy).

EXHIBIT 1

Key technology enablers

Source: Everest Group (2022)

RELEVANCE OF TECHNOLOGIES

High

Low

	Optimization	Control	Monitoring	Autonomy
Connectivity Improvements in communication protocols and network standards (Bluetooth, 4G/LTE, Wi-Fi, 5G, etc.) have enabled the monitoring of physical products and allowed them to connect and interact with other products, external systems, and users, exchanging data at extremely low latencies and enabling a multitude of use cases.	✓	✓	✓	✓
Internet of Things (IoT) The rise of IoT has enabled products to collect data via sensors, while software and communication technologies embedded in the product itself enables the processing and transfer of data with other devices and systems over the internet.	✓	✓	✓	✓
Cloud Advances in cloud computing have made the product cloud a critical component of all digital products. Product clouds host the entire product database and provide a platform to build software applications that support the physical product, allowing for greater personalization and control via data analytics and smart technologies. Cloud-based interfaces also allow enterprises to roll out updates and upgrades OTA.	✓	✓	✓	✓
Intelligent technologies – AI/ML and computer vision Technologies such as AI and ML that bring about the smart component within a product are supported by algorithms embedded within the product or on the cloud. Advances in these technologies are addressing user demand for greater customization, improved feedback and recommendations, enhanced product performance, and more autonomy.	✓	✓	✗	✓
Data engineering Data analytics is the key enabler for increasing personalization and improving feedback for users, while also increasing product control.	✓	✓	✗	✓
Digital twins / simulation Digital replicas of products (twins) are increasingly being used in industries such as automotive, aerospace, CPG, and industrial products for product design, shop floor optimization, and gathering real-time data on performance to improve predictive maintenance and make operations safer.	✓	✗	✓	✗
Haptics and biometric technology Improvements in touch and other biometric technologies (voice and gesture recognition) enabled by intelligent technologies are key to enhancing the user experience across products.	✓	✓	✗	✗
Immersive technologies (AR/VR/MR) Use cases involving immersive technologies such as augmented reality, virtual reality, and mixed reality are on the rise, primarily as a means to improve user experience and remote user assistance/support.	✓	✗	✗	✗
Others Applications of technologies such as blockchain in products have not taken off yet, although some of these technologies are used extensively in areas such as payments optimization.	-	-	-	-

Advances in these key digital technologies has driven investments in digital products to unprecedented levels, with enterprise spending on smart, connected, and autonomous products reaching about US$250 billion in 2021, with expectations of a 15-20% Compound Annual Growth Rate (CAGR) through 2025.

Enterprise digital product engineering adoption

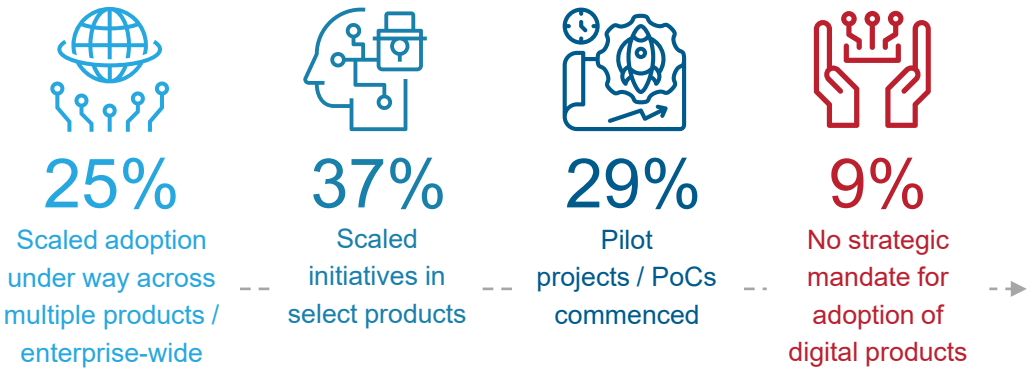
Despite the fairly significant scale and investments in the digital product engineering space in recent years, the market is still in its adolescence. Data from Everest Group's enterprise surveys and Digital Product Engineering PEAK Matrix® Assessment 2022 indicates that, while more than 90% of enterprises are actively thinking about integrating software and digital technologies in their products, only about ~25% have managed to scale their initiatives across multiple product lines and geographies, indicating the huge potential for future growth, as Exhibit 2 indicates.

EXHIBIT 2

Digital product engineering maturity across enterprises

Source: Everest Group (2022)

Percentage of respondents



Enterprise imperatives for success

Softwarization and the integration of digital technologies in products is a trend that's here to stay – enterprises that have been able to brand themselves as software companies have realized extremely high valuations compared to traditional enterprises with products centered around hardware. For instance, Tesla has a market cap that is 10X that of Volkswagen's, despite Volkswagen selling almost 5X the number of vehicles. As a result, enterprises are pivoting toward software and investing an increasing share of their R&D budgets in software-driven concepts. While some of this is net new spend, reduced focus on traditional products is also driving investment. In the automotive industry, for example, OEMs such as Stellantis, Audi, and Mercedes-Benz have announced that they will no longer invest in new internal combustion engines, shifting the bulk of that budget to electric, autonomous, and connected vehicles.

> We will no longer develop a new internal combustion engine but will adapt our existing engines to new emission guidelines.
>
> – Ralf Brandstätter, CEO, Audi Volkswagen

Similarly, connected wearables, smart home devices, and the integration of voice, AI/ML, and analytics in devices are driving spending in the medical devices and consumer electronics industries. Even in asset-heavy industries, products such as smart meters and smart grids, and connecting industrial equipment to enable use cases such as remote monitoring and asset tracking, are driving engineering spend. Exhibit 3 offers a view on key software-enabled use cases in which enterprises plan to invest based on Everest Group's Digital Product Engineering PEAK Matrix® Assessment 2022. Softwarization is likely to have the greatest impact in the automotive and medical devices industries, followed by telecom, consumer electronics, and industrial products.

EXHIBIT 3

Growth outlook for digital products and key use cases by industry

Source: Everest Group (2022)

Low – High

Aerospace and defense	Retail	Energy and utility	Industrial products
Connected aircraft and digital cockpits	Autonomous stores and smart refrigeration	Smart grids and meters	Remote monitoring
In-flight entertainment systems	Use of AR/VR for buying and personalized experiences	Predictive maintenance	Asset tracking
Autonomous flight support for pilots	Digital price tags and signs	Asset tracking	Predictive and preventive maintenance

Consumer electronics	Telecom	Medical devices	Automotive
Smart home systems	Virtualization of network functions (SDN/NFV)	Smart wearables and Software as a Medical Device (SaMD)	Connected cars and telematics
Gesture and voice recognition	Smart routers and gateways	Value-based care – patient monitoring and connected care delivery	Autonomous vehicles
AI-integrated devices, such as cameras	Development of cloud-native core for 5G networks and RAN transformation	Image analytics for treatment	Infotainment systems

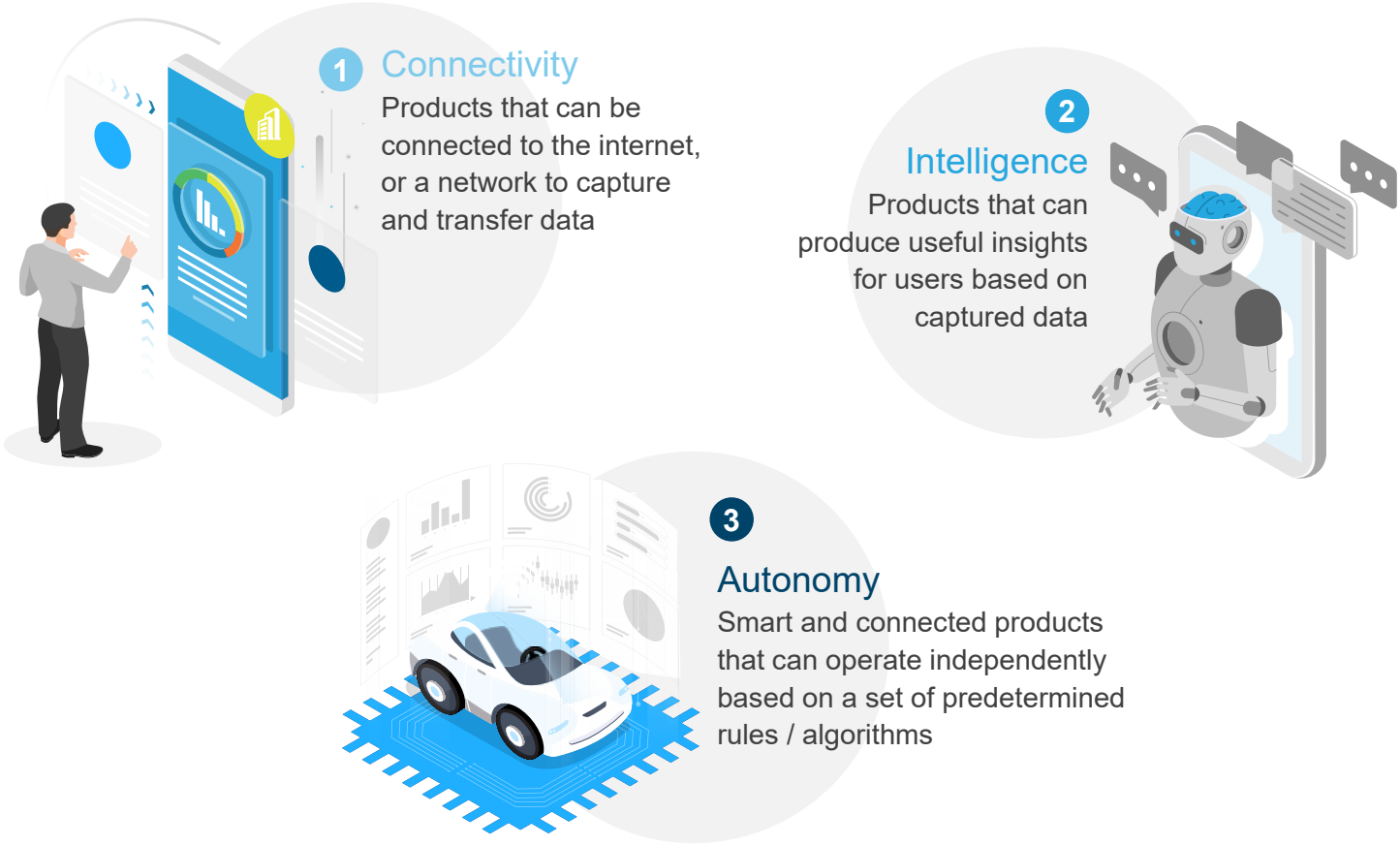
Digital productivity maturity curve

As Exhibit 4 shows, the digital product maturity curve has three stages: stage 1 brings elements of connectivity to the products; stage 2 integrates smart technologies; and stage 3 adds a layer of autonomy to these products.

EXHIBIT 4

Digital product maturity curve

Source: Everest Group (2022)



Most industries have advanced beyond connectivity (stage 1) and are now integrating smart features in their products, driven by technologies such as AI, ML, and analytics (stage 2). The automotive industry is a frontrunner, with significant progress in autonomous products as well (stage 3). As enterprises mature and these digital features gain widespread acceptance from end users, both connected and smart features will become ubiquitous, and enterprise spend will start to concentrate on developing autonomous features.

Irrespective of the pace of adoption across industries, however, there is little doubt that digital products are the future. Enterprises should seriously consider mapping their digital product investments, while also appreciating that there are potential pitfalls on the softwarization journey.

Key enterprise challenges

The key challenges enterprises face in softwarization fall into four broad categories.

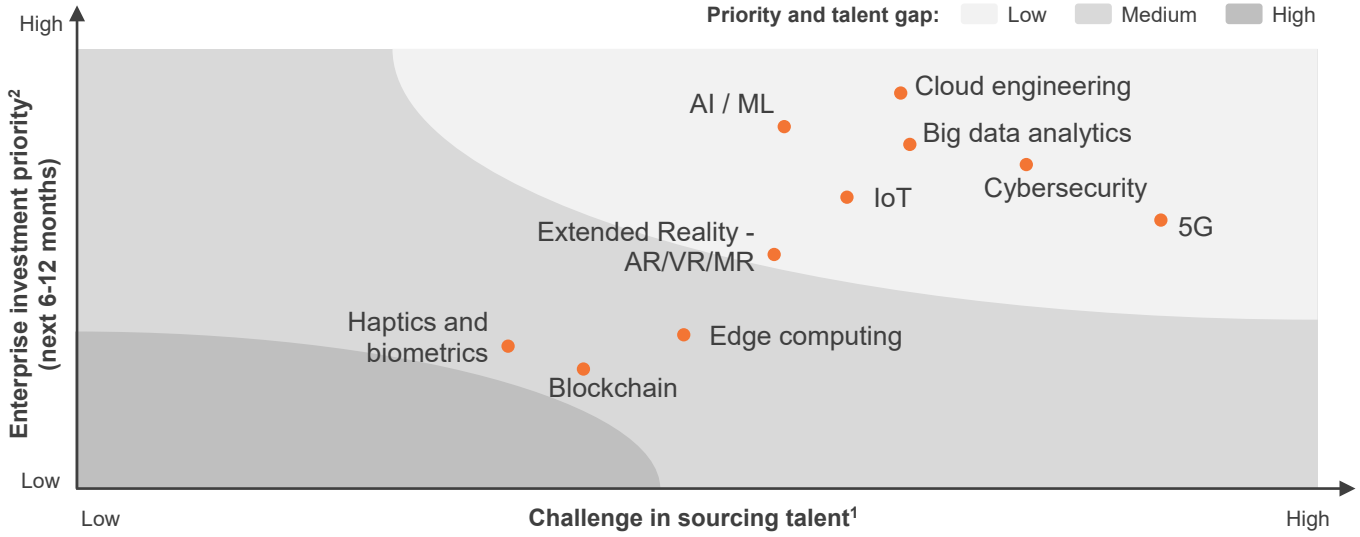
Talent

- The pace of softwarization across industries has led to a significant **talent shortage** and a consequent increase in talent costs in the engineering market, as OEMs now compete directly with pure software providers and the Big Tech firms
- The need to integrate hardware, embedded, software, and connectivity aspects with the requisite domain knowledge requires enterprises to access **diverse skill sets at scale**, which is a significant challenge given the demand-supply gap. Exhibit 5 compares technology skill sets and their relative degree of criticality based on enterprise investment priority and talent sourcing challenges

EXHIBIT 5

Key technology skill sets: talent sourcing challenges versus enterprise investment priorities

Source: Everest Group (2022)



1 X-axis reflects the relative positioning of the digital engineering themes that enterprises find the most challenging from a talent sourcing standpoint
2 Y-axis denotes the digital/next-generation technology priorities of enterprises in the next 6-12 months
Source: Everest Group 2022 Key Issues Study

Organization

- The shift toward a platform-centered approach and the increasing mix of software demands a **cultural shift within engineering teams** away from legacy systems and processes. Hardware-centric enterprises are often risk-averse, whereas software – by its very nature – demands enterprises to be more agile, perform quicker iterations, and fail faster. The **lack of a change management strategy** to address this focus limits management buy-in of digital and is often an impediment to full-scale adoption of digital technologies
- **Lack of budgets** for experimentation often inhibits enterprises and makes them wary of investing up-front in digital technologies

- The complex nature of digital products requires close collaboration between engineering teams to accelerate time to market and new product architectures to enable scalability, upgradability, and safety. The **siloed nature of traditional engineering teams**, however, makes collaboration across the value chain difficult, delaying product cycles

Technology

- **Uncertainty regarding new technology viability** is often a concern for enterprises. As a result, organizations often do not keep pace with latest advances and evolution taking place across technologies
- Engineering teams are often challenged to determine how much of the product needs to be digitalized. Too little accelerates time to market at the cost of value add for the end user; too much results in higher costs and delayed rollouts
- **Legacy code base management** – Typically, multiple engineers write software within a product, and – over time – the engineers working on the product change, resulting in innumerable layers of code. Any new feature enhancement needs to be built on top of the existing code base, considering all the complexities that have already been built in. Maintenance and improvement of this legacy code is often challenging, delaying the release of new features, and increasing product life cycle costs

CASE STUDY

The healthcare industry has evolved to the degree that software is now an integral part of most medical devices. Electron microscopes and medical scanners from enterprises such as Thermo Fisher Scientific and Philips Healthcare may contain tens of millions of lines of code, built up over years by engineering teams that change over time. As this legacy code base grows, it is increasingly challenging to maintain an overview of the code and keep it well-structured, a necessary activity given that all feature enhancements and new software need to be developed on top of the existing code base. This complexity generally inhibits software engineers' efficiency and hampers new product development and maintenance activities for legacy software in most legacy medical device enterprises.

Ecosystem

- The need to quickly roll out products and accelerate time to market to retain customer mind- and wallet-share puts **significant pressure on engineering teams, especially when competitors are also upgrading and rolling out new features** in products
- Increasing levels of software also requires **compliance with evolving regulatory standards** around software development processes, cybersecurity, and data control and privacy, especially in industries such as medical devices, automotive, and aerospace. Enterprises often overlook cybersecurity aspects that have emerged as a result of the proliferation of software in digital products, leading to product recalls and negatively impacting a firm's brand image

CASE STUDY

In 2019, the EU recalled a children's smartwatch manufactured by a German electronics enterprise over concerns that hackers could access data captured by the device and locate the whereabouts of children wearing it.

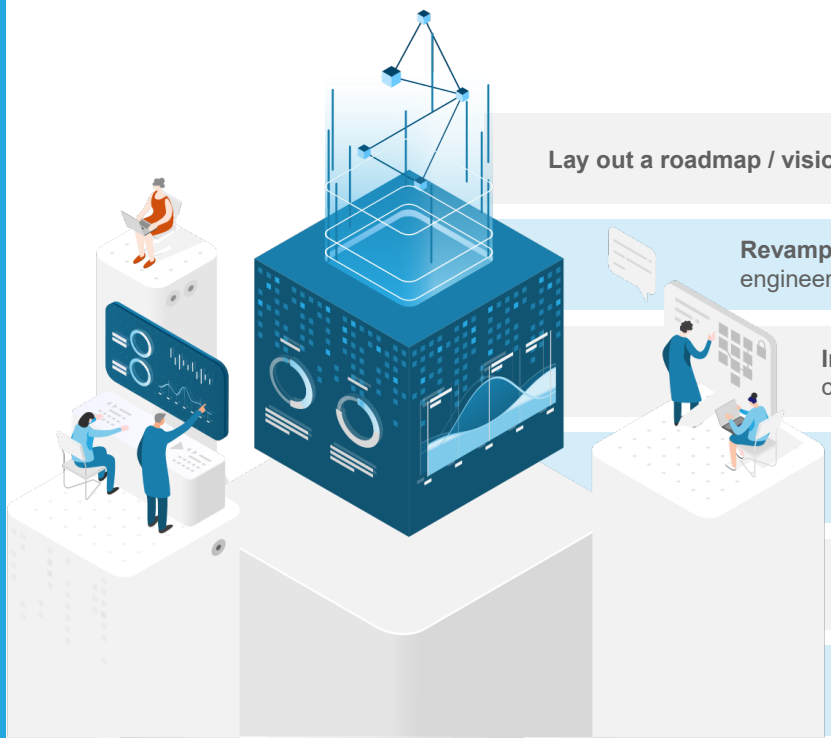
Framework for engineering enterprises to harness the full potential of digital products

A framework-based approach to engineering that addresses all the above pitfalls is key to achieving success in transitioning to digital products. Exhibit 6 offers a six-point framework that enterprises can adopt to address these challenges and unlock the full power of software in smart, connected, and autonomous digital products.

EXHIBIT 6

Six-point framework to support enterprises in transitioning to a more digital product-centered market

Source: Everest Group (2022)



Lay out a roadmap / vision for your softwarization and digital product engineering journey

Revamp engineering processes to ensure closer collaboration between engineering teams and the rest of the business

Invest in organization change management and demonstrate clear RoI to achieve management buy-in

Build a robust people strategy to ensure availability of skilled talent to implement the product vision

Reinvent customer experience across multiple touchpoints by leveraging digital technologies extensively

Engage with ecosystem entities to build capabilities, fill white spaces, and accelerate time-to-market

Layout a roadmap/vision for your softwarization journey

- Create a roadmap for each product in your portfolio as well as your overall engineering organization that lays out goals and objectives for the softwarization journey
- Invest in market research at an early stage to determine which digital features to implement and which to let go based on customer interest

CASE STUDY

Abbott Laboratories set up a new group internally within its diabetes care business called the New Analyte Ventures Team to research and identify new use cases for its sensor-based monitoring technology outside of diabetes. Its efforts led to the launch of the world's first glucose sport biosensor, the Libre Sense Glucose Sport Biosensor, for athletes, in September 2020.

Revamp engineering processes to ensure closer collaboration between engineering teams and the rest of the organization

- Encourage more communication between engineering teams and other business functions such as marketing and post-sales support to integrate customer use data and potential design flaws into the product development process. Design teams, especially, need to collaborate closely with other teams to achieve hyper-personalization and hardware standardization through software-based customization, and enable remote services
- Ensure that product security remains integral to the development process across the engineering life cycle to avoid expensive recalls at a later stage
- Eliminate silos within engineering teams to avoid waste and rework. Hardware development, for instance, takes 10X as much time as software development, and lack of coordination between the two functions could result in development of software features that are not compatible with the current hardware piece

CASE STUDY

John Deere's push to become a software-centric organization began with the realization that it was rapidly becoming more of a software company than a hardware manufacturer. While it rolled out hardware upgrades once per year, software updates could be as frequent as once per week, and putting out new features to adjust to older pieces of hardware was not easy. The improvement in processes came about after making software the central piece of the development process and decoupling hardware and software engineering processes, after which significant feature updates, new capabilities, and technologies such as computer vision and machine learning were integrated to enable autonomous operations without the need to change the hardware.

Invest in organization change management and showcase clear Return on Investment (RoI) to ensure management buy-in

- Invest significantly in organization change management to communicate across the organization the criticality of software in the product engineering life cycle and the possible transition from a product-centric to an as-a-service business model
- Consider bringing in a leader with experience in leading large-scale softwarization initiatives from outside to drive the change internally
- Consider investing in smaller pilot programs or Proofs of Concept (POCs) to exhibit a clear RoI to achieve management and wider organizational buy-in

CASE STUDY

When Stanley Black & Decker began its softwarization journey and decided to use AI algorithms to design products, it chose a simple crimper for the pilot project, with the idea that even if the project failed, the effort and resources involved would not be significant. Although there were many sceptics within the organization who believed that computer-generated designs would not survive physical stress tests, the pilot was a success, and the company today uses AI as an integral tool in product design.

Build a robust people strategy to ensure availability of skilled talent to implement the product vision

- Prioritize digital technologies of relevance and hire aggressively to meet engineering teams' requirements
- Invest significantly in upskilling and reskilling existing the talent pool to combat the talent shortage – consider partnering with external ecosystem entities
- Be prepared to pay a premium to access and retain talent with software engineering and digital technology skillsets. Explore alternate sourcing models (non-traditional locations, hackathons, offshoring/nearshoring, and outsourcing to third-party service providers or contractors) to augment the existing talent pool at low cost

BMW collaborated with AWS to train as many as **5,000 software engineers** on cloud technologies and data analytics.

CASE STUDY

John Deere emphasized the creation of a software culture internally – for example, the company maintains a list of languages employees can speak, to which they added programming languages as they ramped up software developer.

Reinvent customer experience across multiple touchpoints by leveraging software and digital technologies extensively

- The software app accompanying the physical product is emerging as the most significant touchpoint with consumers. Leverage data analytics and smart technologies to provide hyper-personalized omnichannel experiences across both usage statistics and product condition to end users
- Keep an eye on emerging technology trends and explore the relevance of exponential technologies such as AR/VR and the metaverse

CASE STUDY

Nike uses a software application to deepen its relationship with customers by offering them access to their rewards program, early access to new products, and customized recommendations based on the sport someone plays. The app also enables the use of AR to help users find the right fit for their shoes. In 2019, Nike launched a pair of self-lacing IoT-enabled shoes that could adapt to the user's foot and be controlled by a smartphone. In 2021, Nike started exploring potential use cases around the metaverse and began hiring for virtual design roles to make and sell virtual branded sneakers and apparel.

Engage with ecosystem entities to build capabilities, fill whitespaces, and accelerate time-to-market

- Ecosystem entities comprise multiple stakeholder groups – chipset providers, hardware and sensor vendors, cloud and platform providers, connectivity providers, testing and certification agencies, cybersecurity service providers, etc. Identify internal capability gaps and engage with ecosystem entities to cover these whitespaces via partnerships, acquisitions, or other arrangements
- Accelerate innovation by collaborating with startups, academia, and industry consortia
- Collaborating with third-party service providers and engaging in strategic partnerships can both augment the talent pool and introduce the necessary expertise, excellence, and agility, in a systematic way

CASE STUDY

Stellantis has entered into partnerships with multiple ecosystem entities such as Foxconn Technology Group, Waymo, and Amazon. The partnerships are a part of an effort to generate EUR20 billion in additional revenue from software-driven features in its vehicles by 2030, across use cases such as energy efficiency, charging, battery services, OTA updates, and increased leverage of data and AI. In March 2022, CTO Ned Curic announced that Stellantis will continue to onboard other technology partners, especially on the electronics side.

Role of third-party service providers

Third-party service providers can add value to enterprises undertaking softwarization in multiple ways:

- **Competency in digital technologies:** Service providers invest significantly to build competencies across various digital technologies via upskilling initiatives, aggressive hiring, and Centers of Excellences (CoEs). Enterprises can explore ways to engage with vendors that have expertise in areas such as cloud engineering, analytics, IoT, AI/ML, and cybersecurity
- **Access to skilled resources at scale:** Third-party service providers can add significant value to enterprise engineering teams by providing access to skilled talent at scale and contributing chip-to-cloud expertise. Enterprises that want to retain the core engineering IP in-house can contract third-party vendors for non-core workstreams such as product testing and technical publications
- **Agility:** Most global service providers develop IP, frameworks, and other solution accelerators to support enterprises in accelerating product time-to-market, while reducing cost and effort. These solution accelerators could range from anything pertaining to adopting a framework-based approach for the verification and validation of IoT systems, to IP dedicated to specific domains such as ADAS and patient monitoring. In addition, over time, experienced service providers have been able to evolve a holistic approach along with SOPs for global service delivery, ensuring consistency and the utilization of best-in-class frameworks, methodologies, processes, and tools across teams
- **Cost savings and innovative commercial constructs:** Service providers can leverage their global presence to serve as a low-cost talent augmentation partner for enterprises. Additionally, service providers often provide flexibility in pricing models and can engage in a managed services model or via innovative constructs such as revenue sharing, risk-reward pricing, milestone-based constructs, and outcome linkages to demonstrate shared risk

- **Partnership ecosystem:** Large-scale service providers that have a presence across industries have robust partnership networks that they can leverage to accelerate service delivery and deliver end-to-end engagements. These providers can also leverage their partners to develop tooling that can help in the automation of maintenance and improvement activities for software and legacy code bases
- **Physical infrastructure:** Tier-1 engineering service providers have invested in physical infrastructure such as labs to enable certification services and test for hardware-software co-integration
- **Advisory services and ideation support:** Larger service providers can leverage their experience of working in other industries and with other enterprises to offer consulting and advisory services to enhance the product and provide recommendations on areas in which enterprises need to invest. Proactive initiatives and ideation support on the part of service providers often result in pilot programs and PoCs to indicate RoI and achieve wider organizational buy-in

Conclusion

There are multiple factors driving softwarization of products, including evolving customer demand, the need to develop new business models, and advances in key enabling technologies. Softwarization essentially is enabling physical products to develop attributes of connectivity, intelligence, and autonomy, thus converting them into digital products. As a result, enterprises are investing significantly into adding digital features to their products, growing the digital product engineering market to about US$250 billion in 2021 with the potential to continue to grow at 15-20% CAGR through 2025. The automotive, medical device, telecom, and consumer electronics industries are likely to drive a large chunk of this growth over the next few years.

Despite its fairly significant scale and investments in recent years, the digital product engineering market is still in its adolescence, as evidenced by the low proportion of enterprises that believe they have achieved softwarization scale and maturity. Enterprises face numerous challenges in their softwarization journeys across areas such as talent, technology, organization, and ecosystem orchestration.

Hence, we believe that a framework-led approach that addresses a product roadmap, engineering processes, organizational change management, people, the ecosystem, and technology leverage can help enterprises make the transition to becoming a digital product-centric organization. Third-party service providers are poised to be serve a vital role, as they can be crucial in supporting enterprise teams across digital product engineering workstreams.

Everest Group®
With you on the journey

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Capgemini engineering

About Capgemini Engineering

World leader in engineering and R&D services, Capgemini Engineering combines its broad industry knowledge and cutting-edge technologies in digital and software to support the convergence of the physical and digital worlds. Coupled with the capabilities of the rest of the Group, it helps clients to accelerate their journey towards Intelligent Industry. Capgemini Engineering has more than 55,000 engineer and scientist team members in over 30 countries across sectors including Aeronautics, Space, Defense, Naval, Automotive, Rail, Infrastructure & Transportation, Energy, Utilities & Chemicals, Life Sciences, Communications, Semiconductor & Electronics, Industrial & Consumer, Software & Internet.

Capgemini Engineering is an integral part of the Capgemini Group, a global leader in partnering with companies to transform and manage their business by harnessing the power of technology. The Group is guided every day 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.

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