BEYOND TOMORROW

SCENARIOS 2030

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SCENARIOS 2030

THE FUTURE OF PRODUCT DEVELOPMENT

Copenhagen Institute for **Futures** Studies
Instituttet for Fremtidsforskning

Brüel & Kjær
BEYOND MEASURE

BEYOND TOMORROW
Scenarios 2030: The future of product development
www.beyondtomorrow.dk

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BEYOND TOMORROW

I remember when Google first appeared. And it changed everything.

It was the late 1990s. I was living in New Jersey and on a business trip to New York I saw a large advertising banner that displayed a single word: "Google". The next day I tried it out and, in a flash, this confusing invention called "the Internet" suddenly made sense.

In the years that followed, Google dramatically changed business models and structures – and arguably the way in which we all live today. It is a perfect example of how quickly the world can evolve in a moment and how products and services we didn't realize we needed can suddenly dominate and disrupt our lives. In such an environment, foresight and vision become highly valuable commercial assets.

After 75 years in business, Brüel & Kjær has witnessed many changes fundamental to virtually every industry. Only by staying agile and with a continued focus on forward thinking have we been able to retain our leading position within sound and vibration measurement and management.

To mark this important milestone, we are celebrating the future with our valued partners and customers through the Beyond Tomorrow project – a vision study initiated with the Copenhagen Institute for Futures Studies. For this we have gathered together some of the foremost experts in our industry and based on their insights, as well as megatrends and surveys we have developed four realistic scenarios for product development towards 2030.

I am proud to present these scenarios and I hope they will serve as a catalyst for discussion across the entire sound and vibration community, helping businesses worldwide to form robust, winning product development strategies for the coming decades.

Just as Google opened the door to a whole new world of possibilities, we must all be ready for the next big change. I hope you find the report as interesting and enlightening as it was to create, and I look forward to continuing the discussion with you soon.

SØREN HOLST
PRESIDENT, BRÜEL & KJÆR

BEYOND TOMORROW – SCENARIOS 2030

Welcome to the Beyond Tomorrow report on the future of product development. The team at the Copenhagen Institute for Futures Studies (CIFS) together with Brüel & Kjær are proud to present to you the result of the Beyond Tomorrow Scenarios 2030 vision study.

Beyond Tomorrow is a scenario study that aims to identify important strategic focus areas that product developers should consider when planning for the future. The ambition of CIFS is to give you - the reader - a study which maps key trends, critical uncertainties and plausible scenarios shaping the future of product development as well as the role of sound and vibration in product development across sectors and countries.

In the report you will find key insights, ideas and strategic perspectives on product development towards 2030 that will inspire and help you think strategically about your future and the future of the product development team you are part of.

THE FUTURE!

The future is important to all of us. Looking at technological development, market changes and emerging new business models, it is safe to say that most companies and teams most likely will see a huge amount of changes in the way they work, use technological tools and platforms, communicate with key stakeholders, etc.

Looking at the accelerating world today we see shorter product life cycles, shorter product development cycles, as well as shorter expected lifespans for companies. Today we are in a situation where the average company has a much shorter lifespan than the average human being.

We all need to be agile. And we all need to think about how we can participate in creating positive futures for ourselves, our teams and our organizations – because the future is not just something that "happens to us" – we all play a key role in realizing the future we want to happen. A proactive mindset is vital.

Sometimes one might feel that it would be nice to get the blueprint for the future – a solid forecast based on which we can make strategies and execute. Unfortunately, there is no single blueprint for the future. Changes happen – some we can predict while others present themselves as surprises.

In the Beyond Tomorrow vision study, we have developed multiple possible "blueprints" for the future of product development across three different, but interrelated project phases:

1. Key megatrends shaping the future of societies, markets, and businesses;
2. Interview insights from a number of leading experts on the future of product development and sound and vibration; and
3. Four scenarios created by CIFS on the future of product development.

It is important to remember that the three phases are not standalone projects. The first two phases, the key megatrends and interview insights, provide the required foundation on which the Scenarios 2030 have been developed. And the scenarios have been informed by strategic issues and critical uncertainties that emerged during the trends analysis and interview phases of the vision study.

We hope that you find inspiration and insights from each of the phases individually, as well as a deeper understanding for how they relate to each other and build a foundation for the future.

The four scenarios play out around two critical uncertainties that should have high priority for product developers in the coming decades:

- Will technological adoption change organizations in a radical and disruptive way, or will we see a more gradual adoption of technology?
- Will product development change radically due to the emergence of end-to-end product development platforms or will product developers have to navigate in more decentralized value networks, characterized by multiple independent development systems?

Throughout the report you will find a number of ideas, questions and insights that you might be able to use in your daily work, in relation to your own trends and insights from the context of your specific company and market. The advice is to explore all four scenarios and look into strategic consequences in order to explore robust strategies for product development in your company. The scenarios can also be used for strategic discussions for individual companies and product development teams and inspire a more future-oriented discussion around strategies for product development. In this report we have tried to cover as broad a scope as possible in order to distill insights that all will find inspiring.

Changes will happen, and they will happen fast. The future belongs to companies with the right skill sets and competencies, the right understanding of market developments, the right set of technologies and, probably most importantly, the right mindset in an accelerating and complex world.

CIFS would like to thank Brüel & Kjær for initiating the Beyond Tomorrow project. The report has been designed and written by CIFS with contributions from several stakeholders, which you can find at the end of the report.

We wish you the best of luck with creating your future. Happy reading!

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TREND ANALYSIS FRAMEWORK

Predicting the future for product development processes can be difficult. Just think about the following seemingly simple questions:

- *What will end users in the future demand from your products and services?*
- *How will technological shifts change product development processes?*
- *How will people work and collaborate in the future when they are developing new products and services?*

To create a comprehensive, global and future-oriented foundation for discussing the future of product development processes, this section will focus on trend analysis. Trend analysis is highly useful in the beginning of future-oriented processes, because it provides a framework that companies need to consider in their processes.

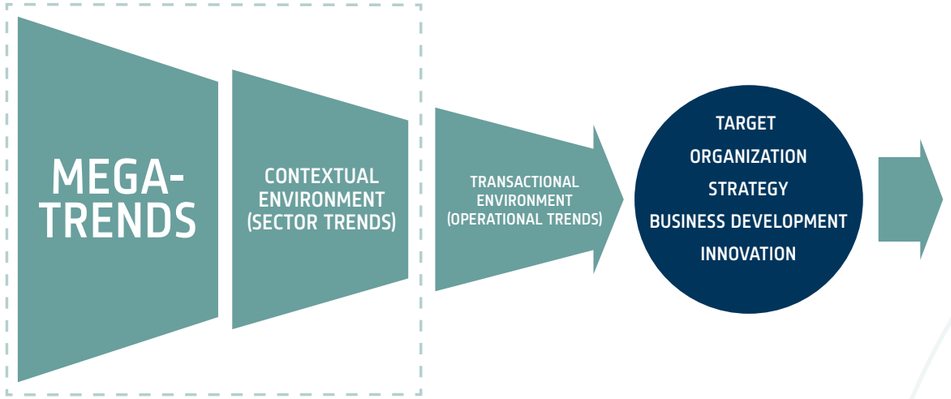
Below the trends are clustered into two groups:

A. MEGATRENDS that influence all companies, markets and societies over the coming 10 years. Megatrends cannot be influenced or changed by individual companies.

B. CONTEXTUAL ENVIRONMENT affected by sector trends that will influence individual industries and companies but not necessarily all companies, or all of society. Sector trends in the company's contextual environment are difficult to change for the individual company, but sometimes companies have the possibility to do so (Netflix, Apple, Tesla etc.).

The trend hierarchy is outlined in the figure below. Note that the hierarchy also includes the transactional environment of companies (trends that are specific to individual markets or companies and can be influenced by individual companies). Transactional trends are not included in this report.

TREND ANALYSIS FRAMEWORK



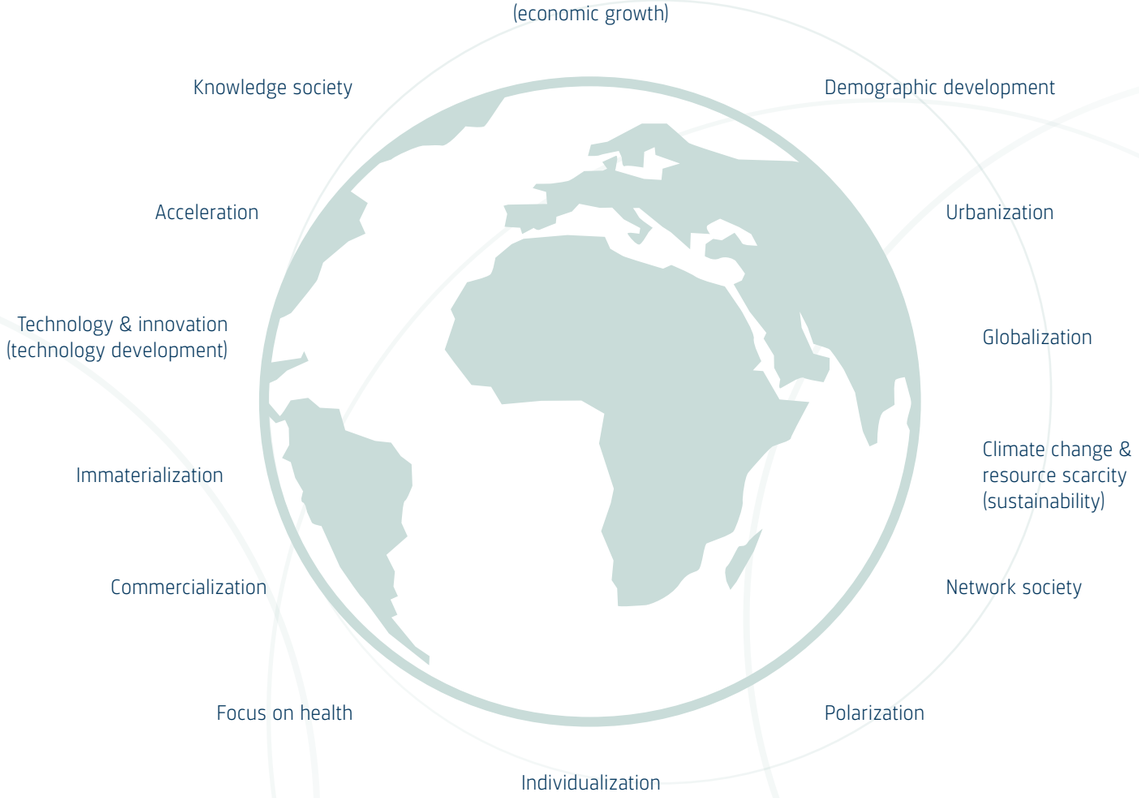
Examining this broad universe of trends allows companies to gain a broader understanding of future developments in their competitive landscape. For strategic purposes in product development, it is important to consider the implications of each trend individually as well as in combination.

Though some of the trends – whether they are megatrends or contextual trends – might seem familiar at first glance, it is often the case that when working with trends, the implications can be extremely challenging or disruptive for companies and product development teams.

GLOBAL MEGATRENDS

Megatrends are the major pathways of development. They help make sense of the complexity of the surrounding world and provide a platform for taking action and developing strategic responses (such as new product development). Megatrends represent global trends, which are transformative, world-changing patterns that impact business, economy, society, culture and individuals.

Megatrends do not exist or develop in isolation; they are characterized by interactivity and feedback loops. Changes in one megatrend or various interrelated trend ecosystems can impact the development of numerous other trends.



Megatrends represent the best assumed knowledge about the most probable future, given the following three key characteristics: (1) time horizon of at least 10 – 15 years (quite possibly much longer), (2) broad in scope, and (3) large-to-global in effect.

Megatrends shape the future and provide a basis for understanding and anticipating changes in contextual and transactional environments. They are the most fundamental changes in societies and markets. All products, services, business models, etc., will need to integrate a megatrend perspective in their product development processes in order to be successful in a future full of changes.

The following table provides a summary description of global megatrends identified and developed by the Copenhagen Institute for Futures Studies. All the megatrends will influence the future of product development – as illustrated by the Future Tip attached to each megatrend.

Technological Development Technological development is perhaps the most fundamental and influential driving force of the 21st century, even though it is often difficult to predict timing, pace and impact. Technologies and digitization create new opportunities and businesses, as well as new ways to handle existing challenges.	**Future Tip** Consider how your products, services and activities can be part of IoT.
Globalization Global flows of information, technology, products, services, and capital continue to expand. The world is interconnected economically, environmentally, politically, socially and technologically.	**Future Tip** You should be able to scale faster than ever before on the global market.
Sustainability The rise of the global middle class and economic growth has increased the need for sustainable solutions, products and services. The rapid population growth on earth will require a major reshuffle of all kinds of production.	**Future Tip** Make your products part of a sustainable future with a circular economy approach.
Economic Growth Economic growth continues in most parts of the world. Additional demand will come from the rising global middle class, especially in Asia.	**Future Tip** Create products that cater for the needs of the many new consumers belonging to or aspiring to enter the global middle class.

GLOBAL MEGATRENDS

Knowledge Society

Populations across the globe gain increasing access to more knowledge, information and education. Data and knowledge are becoming extremely important economic assets.

Future Tip

Make sure you are able to communicate about your products to a customer/consumer base with more knowledge and/or access to data.

Acceleration & Complexity

The world is changing at a faster pace than ever before and, at the same time, often adding to the complexity of societies. Business, innovation and product life-cycles are shortening.

Future Tip

Instant gratification is becoming expected in many contexts, so never let anyone wait!

Commercialization

The global market is expanding to all countries and all sectors. Commercial organizations are increasingly offering services that used to be in the domain of the public or voluntary sector.

Future Tip

New global markets are opening in education, the social sector, etc. If possible: Be prepared to enter these new types of markets.

Network Society

Organizations, people and societies are increasingly being influenced by a multitude of different networks. Some of the networks are created by big companies (such as FaceBook). Others are created bottom-up on the Internet.

Future Tip

Be ready to collaborate with people organized in all kinds of networks – including people you do not necessarily collaborate with today.

Demographic Development

Key trends are: ageing population in Europe and parts of Asia; population growth in parts of the Americas, EMEA and Asia; population decline in Europe and parts of Asia; and, lastly, continued urbanization. Family structures will change, and female empowerment will increase – from different outsets.

Future Tip

Closely examine the needs of end users – how will they change and how will the physical environment around them change?

Individualization

There is an increasing desire for personalized products and services that directly conform to the needs and interests of any particular user or business.

Future Tip

End users will expect more tailor-fitted services and products. As end users deliver data back to the supply chain they will expect the data to be used for their benefit.

Polarization

Polarization will be seen in societies between the haves and the have-nots. Also, polarization will be seen in individual markets with high-end and low-end solutions growing at the expense of the middle market.

Future Tip

Low-end, cheap solutions will be more important as will the high-end market demands. Make sure your brand is clearly positioned.

Immaterialization

Changes in our perceptions and our values that includes a greater focus on post-materialism – authenticity through a consideration of design, aesthetics, fashion, culture, storytelling, values and experiences will emerge.

Future Tip

Make sure the emotional and immaterial aspects are clearly communicated and make a difference for end users and customers.

Urbanization

Urbanization is a multi-decade process where billions of citizens are moving from rural areas to cities, which represent the growth engines of socio-economic development for most nation-states. City centers and suburbs will continue to grow.

Future Tip

As the vast majority of activities will take place in urban environments, new paradigms will emerge that your company should be a part of. New paradigms will be seen in transportation, retail, office spaces, leisure activities, etc.

CONTEXTUAL ENVIRONMENT

Based on analysis of global megatrends as well as input from expert interviews, a questionnaire answered by around 1,000 product development specialists across the globe, desktop research, and discussions with Brüel & Kjær management, CIFS has identified the following key trends that are critically relevant for the future of product development processes. These key trends form the contextual environment for product development across sectors and geographical areas. They consist of megatrends – described above – as well as other trend material. Please note that some of the trends in the contextual environment overlap and interact – for example: Internet-of-things and 4th Industrial Revolution, which are interconnected, but also stand-alone trends.

TRENDS FOR PRODUCT DEVELOPMENT

4th Industrial Revolution

New technologies and broader technology diffusion on a global basis create new opportunities and new businesses, as well as new ways to tackle existing challenges in production, product development and services. Driven by exponential progress in multiple areas of technology, the 4th Industrial Revolution is defined by groundbreaking advances breakthroughs in the areas of artificial intelligence (i.e., machine learning and deep learning algorithms), advanced computing, robotics (i.e., automated manufacturing, industrial robots, self-driving cars, etc.), everything digital and connected (i.e., IoT), additive manufacturing (i.e., 3D printing), big data analytics, advanced biosciences, advanced materials (i.e., nanotechnology, smart materials, etc.) and new forms of energy. The 4th industrial revolution will disrupt all processes – including product development processes – and business models.

Internet-of-Things (IoT)

IoT is a trend reflecting the increasing number of physical objects that are connected to, and communicating over, the Internet. IoT is enabled by the small size and falling cost of sensors that can be attached to almost any product, which enables new ways of tracking and coordinating a variety of processes and products, thus changing the way product development teams can access data. IoT will enhance productivity and develop new products and services by capturing data, aggregating information and allowing for real-time reaction. Some of the initial application areas are within automobiles, medical devices, industrial systems and a growing number of consumer electronics devices.

Acceleration & Complexity

Acceleration and complexity is a global phenomenon that refers to the fact that change is happening faster than before, which in turn increases complexity – both in relation to business environments and society in general. Some of the key challenges for product developers include shorter business cycles, innovation cycles, product development cycles and product life-cycles and the increasing penetration rate of new products.

Smart Cities

A smart city is an urban ecosystem that uses digital technology to drive efficiencies in existing social, economic and environmental processes, while simultaneously opening avenues for new, data-driven processes and innovations. A central aspect of smart cities is the use of sensors (IoT) in roads, buildings, sewers and more, allowing for real-time analysis of bottlenecks in a given system and subsequent reactionary or preventive measures to relieve the problem. The infrastructure of a smart city extends to autonomous vehicles and logistics, drone delivery, and even down to the consumer level.

Co-Creation & Maker Culture

Technological platforms and universal connectivity allow consumers to co-create products, driving a deeper integration of all parts of the value chain. This does not mean that all end users will become co-creators, but it does reflect a future where consumers can take part in and even drive co-creation processes. The Network Society results in the linking of organizations, teams, resources, and products and consumers in a kind of vertical and horizontal connectivity.

Business-Model Innovation

Product development processes will broaden their strategic reach and fit to remain relevant in a future where innovation is more about new business models and processes than new services and products, requiring more diverse product development teams. New and innovative business models will redefine future business propositions and influence technology and product development. Advances in technology, more efficient business processes and a willingness to pay for additional services are causing a shift away from mass production towards deeper levels of customization amid rising user expectations for tailored products, processes and services that satisfy unique customer needs.

Open Innovation

Processes characterized by open innovation (incorporating external ideas in the innovation phase), decentralized collaboration, and crowdsourcing (i.e., open sourcing) will grow in importance as models for value enhancement, innovation and ideation.

Servitization

Servitization is where a service is placed on top of a product. We will see more of this trend within product development, which will significantly impact how products are designed during the development phase as well as thinking around how to develop services on top of products sales to better serve the customer base. When products become smart via sensors and IoT, companies can produce a 'digital twin' to any physical system. The digital twin is provided with all product data, enabling constant monitoring and proactive maintenance. Digital twins can also cover entire production lines.

CONTEXTUAL ENVIRONMENT

Simulation

Simulation is the imitation of the parameters and expected operation of a real-world system, process or physical product in a virtual, augmented or digital environment for the purpose of assessing performance, resiliency and failure rates over a given time period. The trend of increasing simulation during product development enables greater efficiency and lower costs across many different contexts, such as technology for performance optimization, safety engineering, testing, training, education and video games.

Control of the Physical Environment

The physical environment including sound and vibration will continue to be steered by official guidelines and policies and will be met with tighter regulatory and compliance demands, particularly in work environments and with respect to employee/end-user demands. Consumers will also demand more control over what they see and hear and when and where, particularly due to increasing information overload and the proliferation of products and services that allow consumers to control their physical environment.

Acoustic Environments

The importance of quality acoustic environments to everyday human well-being continues to grow. People around the globe are more aware of the impact that acoustics have on their daily life and make higher demands for quality acoustic experiences, which is reflected in the way e.g. urban environments, buildings, means of transportation and other products are designed.

Changing Consumer Preferences

Companies must gain a deeper understanding of the individual needs and requirements for customers and end users. The rise of new consumer classes through the rise of the global middle class, generational shifts, and new 21st century lifestyles is changing the marketplace. Individualization will gain in importance as customers increasingly demand unique solutions, services and products to cater for their individual needs, while the urge for instant gratification demands shorter product-development cycles.

Customization & Personalization (Individualization)

There is a growing need for deeper levels of customization amid rising user expectations for individual attention and tailored products, processes and services that satisfy unique needs. As a result, mass markets are fragmenting and shifting to micro markets with niche offerings – a focus on local needs, new lifestyles and changing demographics. Consumers/end users always want more and they will demand solutions that cater to specific individuals and situationally shaped needs. At the same time: Give people what they did not imagine they needed. Sound and vibration that can create new types of use/interaction with the product.

Sustainability

Increased focus on climate change and resource scarcity as well as growing global consciousness drives us towards managing our consumption and emissions to a much larger extent than before. Trends in sustainability, recycling and circular economy will require less throughput of physical materials and more focus on minimizing waste in consumption and product usage. This manifest itself in changing consumer preferences and requires a move away from closed-circuit solutions and towards cross-linked intelligent solutions that impact product development and product lifespan.

Not all product development processes will be influenced by the above trends in the contextual environment, but most will, with a high probability be influenced by a number of the trends. Please note that one key element in working with these trends in product development processes is related to the speed of change.

PERSPECTIVES FROM THE HIGHEST LEVEL

The interview insights are the result of a series of interviews with a panel of visionary experts in the field of product development and sound and vibration. The expert insights have been supplemented with additional insights from an online survey completed by almost 1,000 people working with sound and vibration in product development.

The insights are based on a qualitative assessment of ten interviews with leading experts working with sound and vibration in relation to product development across a variety of sectors. The expert panelists can be found at the end of the report.

The main interview highlights have been grouped into four categories: Society, Market & competition, Product development process, and People skills. The intention is to create an overview of how the experts see the future of product development with a special focus on sound and vibration. For each highlight, you will find a question that might be useful for your team and organization to reflect upon.

SOCIETY

SUSTAINABILITY A PRIORITY IN PRODUCT DEVELOPMENT

The pursuit of sustainability and the trends accompanying this require new products to be developed in smart ways with adapted business models. Trends in sustainability, recycling and circular economy will require less throughput of physical materials and more focus on minimizing waste in consumption and product usage. For instance, in the future, car ownership will increasingly be shared, which would present new user requirements and preferences for auto manufacturers to consider in the product development process.

Question: What trends should your company consider concerning sustainability in its product development process?

"It is becoming a nuisance to own a vehicle in a city. There is a clear focus towards vehicles that can be shared and have multiple uses."

Dr. Marco Ballatore
Functional Manager NVH
Bentley Motors

SOUND AND VIBRATION CRUCIAL TO OUR URBANIZED LIVES

The growing importance of sound and vibration to everyday human well-being is an important trend identified across all interviews. Noise pollution is increasingly seen as harmful in people's everyday lives, and therefore more and more products will be designed to minimize their acoustic impact or mitigate noise pollution. With growing and ageing populations, as well as demographic shifts and urbanization, more people will live in denser environments. This will increase the demand for transport, infrastructure, and industry to reduce unwanted sound and vibration levels.

Question: How can your products enable consumers to experience better acoustic and vibrational environments?

"The importance of sound and vibration keeps increasing. End users are definitely getting more and more aware of acoustic environments."

Dr. L Venkatakrishnan
Head of Experimental Aerodynamics Division
National Aerospace Laboratories

MARKET & COMPETITION

CUSTOMIZATION DRIVING PRODUCT DEVELOPMENT

Technological advancements enable greater customization to meet the demands of consumers with high expectations. Consumers will increasingly be able to select configurations, individual designs and tailored functionality out of a pool of standardized options. Greater individualization leads to mass markets fragmenting and shifting to micro markets with niche offerings – a focus on local needs, new lifestyles, and changing demographics. In accommodating customers' individual needs, end users will be integrated into the product development process from an earlier stage and will have a greater input into the creation of future products.

Question: In what way can your company engage with customers and end users in the early phases of product development?

"There is a high level of individualization in consumer demands that we need to accommodate. This, in turn, means that companies customize or mass-customize totally normal products and services."

Dr. Marco Ballatore
Functional Manager NVH
Bentley Motors

COLLABORATION KEY TO PRODUCING INNOVATIVE NEW PRODUCTS

Collaboration and strategic partnerships have been repeatedly mentioned as critical aspects of future product development. Partnerships can create new opportunities for funding, new customers, access to technological resources as well as rare skills and competencies that may be lacking within the organization. The businesses that collaborate with external partners are also more agile and more efficient, which in effect can foster innovation and shorten time to market for new products. Collaboration also allows for exciting new products to be brought to market through co-branding partnerships.

Question: How can you make sure that your company gains access to needed resources and competencies through collaboration?

"If there are areas that are not covered by our core competencies, we collaborate with others. This is a trend that I see continuing in the future."

Bo Littau
Portfolio Director
Oticon

MARKET & COMPETITION

NAVIGATING TIGHT COMPLIANCE REGIMES DEMANDS INDUSTRY KNOW-HOW AND AGILE LEADERSHIP

Industry understanding includes having the necessary expertise to quickly comply with industry and government regulations. Most experts anticipate increasing amounts of consumer and environmental protection regulation in relation to product development. To navigate these changes, it will be crucial to possess industry expertise that will allow organizations to manoeuvre and implement tighter compliance regimes.

Question: Is your organization prepared to adapt to the future standards of your industry´s compliance regime?

"Our main markets are being more strictly regulated. Navigating these changes takes significant time in our development process."

Bo Littau
Portfolio Director
Oticon

TECH GIANTS NEED INDUSTRY EXPERTISE TO DISRUPT

In spite of the many incoming technological innovations, understanding the industry and its subtext will remain vital to a company's success. Tech giants are looking to disrupt multiple industries and the vast amount of data they have access to allows them to make huge advancements in digital signal processing. However, before these companies can achieve this, they still need to develop relevant industry experience. Tech giants therefore require a core of industry experts who are not strictly innovators, but have the industry knowledge to implement the company's disruptive ideas.

Question: Are the tech giants an opportunity or a threat to your company and your product portfolio?

"TESLA was built in the mould of Apple and Google, yet it is still full of people from Detroit. They still need these executives because they understand industries that the new players are yet to understand."

Jianmin Guan
Director Vibration and Acoustic Solutions
Altair

BALANCING BRAND IDENTITY WITH INNOVATION

Companies will be faced with the challenge of developing and innovating products, services and brands whilst at the same time staying true to their brands, services and products DNA. In a world of rapid and disruptive change this challenge can prove difficult, especially for those companies with a strong identity. They will need to ask themselves how to evolve their brand, services and products in a future market that is radically different from today.

Question: Is your product and service portfolio able to adapt to technology that might radically change your market?

"How should product DNA evolve in the future to prevent stagnation whilst remaining true to its roots?"

Dr. Marco Ballatore
Functional Manager NVH
Bentley Motors

PRODUCT DEVELOPMENT PROCESS

ARTIFICIAL INTELLIGENCE (AI) EMPOWERING EXPERTS IN PRODUCT DEVELOPMENT

Product development could see the implementation of AI that will allow for constant enhancements to be made. In addition, monitoring product performance will help ensure higher product quality. Increasingly, product development organizations are looking to automate complex testing and data analysis processes. This will not only enable companies to have more precise insights into customer's demand, but also to ensure product reliability. AI will also empower experts by automating some tasks or managing portions of a given process, allowing them to free-up valuable staff.

Question: Do you see AI entering into or altering your product development processes?

"We will see much more AI in product development processes alongside humans. This will result in the decision-making of a product becoming more nuanced."

Per-Olof Sturesson
Senior Director for Driving Dynamics
Volvo Sweden

BIG DATA, INTERNET OF THINGS (IOT) AND CLOUD COMPUTING INNOVATING PRODUCT DELIVERY

Companies are increasingly dealing with larger data sets and implementing new systems to interpret this information. IoT allows for an enormous number of devices to remain connected and cloud computing will provide the power to analyse the data. Combining power and connectivity with the analysis of Big Data will provide an unprecedented degree of insights which can be funneled back into the product development process. In order to generate such insights, data from monitoring of consumers and end users will have to be integrated into the product development process from an early stage. Many companies will need to re-think how they integrate their existing product portfolio into the world of Big Data and IoT.

Question: How can your company leverage the massive deluge of data streaming back to the product development teams in order to create more value for the end user?

"Connectivity, IoT and cloud computing will totally redefine the world we live in."

Ivan Tashev
Head of Audio and Acoustics Group
Microsoft

SIMULATION REDUCES PROTOTYPING AND SHORTENS DEVELOPMENT CYCLES

Companies are increasingly competing on shortening development cycles and reducing costs in order to push new products to markets faster and more cheaply. Simulations help achieve this by reducing the number of prototypes in the product development process, which reduces the cost and time of development. In the future, product development will become increasingly digitized, with the potential for physical prototypes to become increasingly scarce. Hybrid modeling, where measured data is used in a simulation environment, will continue to play an important role in areas where it is challenging to make simulation models.

Question: Are there any parts of the product development process in your company that will be simulated in the future?

"Product development could be 100% digital before you ever manufacture a prototype. Simulation allow for almost an infinite number of iterations. The prototype will become more or less the final product."

Dr. L Venkatakrishnan
Head of Experimental Aerodynamics Division
National Aerospace Laboratories

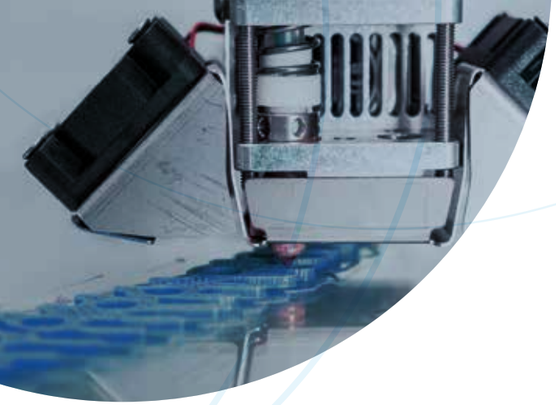
SOUND AND VIBRATION CRUCIAL FOR VIRTUAL REALITY ENVIRONMENTS

As the demand for virtual reality environments increases in the future, so will the demand for the sound and vibration aspect of these environments. In augmented and virtual reality, acoustics will be key to driving immersion and comfort within the virtual space. Making sure that the brain is not confused and that augmented objects and sounds are believable holds great potential for sound and vibration technologies.

Question: What role could your products and services play in the virtual world?

"In the future virtual and augmented reality will grow immensely. This will require audio and acoustics to make virtual environments sound 'right'."

Ivan Tashev
Head of Audio and Acoustics Group
Microsoft



PRODUCT DEVELOPMENT PROCESS

VALUE-ADDED SERVICES CHANGE THE DEVELOPMENT MODEL

New products are increasingly being designed with value-added services (i.e., servitization) being built upon the core product. An example would be monitoring cars to predict breakdowns before they have to go to the auto workshop. These services can adapt to the customer's use of the product and help keep the product functional for longer. The emergence of digital twins as a concept – a virtual model of a process or a product – also allows for effective data analysis and system monitoring to head off problems before they even occur. This helps to prevent downtime, develop new opportunities, and even plan for the future. In general, software development is playing an increasingly important role in the development of a wide range of physical products.

Question: How do you foresee the development of the service offerings your company provides for consumers following a product purchase?

"With frequent field reports on vehicles, we are able to implement product improvements before customers even bring their car back to the dealer for repair."

Piero Aversa
Chief Engineer Global Powertrain NVH
Ford Motor Company

DIGITAL PLATFORM ECONOMY WILL FRAGMENT PRODUCT DEVELOPMENT

To accommodate rapid industry change, companies could start adopting to digital platform economics. Platform economics are based on networked ecosystems that connect multiple companies/players, provide tools for them to contribute and interact, and rules that govern participation (Amazon, Google, AliBaba, etc.). This allows for different parts of the product development process to be crowdsourced from several, smaller specialized companies or individuals with the optimum technology and specialist skills in the field. This could lead to a more fragmented supply chain within product development and a larger role for niche companies. It is not about owning certain assets, but prioritizing access to them.

Question: What is your company's world-class specialty?

"We could see a lot more platform economics in relation to product development. This would allow for greater specialization and a wider variety of technologies to be used in the development field."

Claus Erichsen Kudsk
Head of Center for Product Development
Danish Technological Institute

PEOPLE SKILLS

NEW SIMULATION AND DATA ANALYSIS SKILL SETS DRIVING PRODUCT DEVELOPMENT

In the future, there will be an increased demand for engineers with knowledge of simulation and data analysis. Competencies between specialist fields will continue to blur and overlap with each other, requiring individuals to be more multifaceted. Workers will require a greater general understanding of the market/customer as well as the whole product development cycle. This could lead to an increased number of individuals who tap into diverse backgrounds to come up with answers to problems, by looking at things both specifically and generally.

Question: How will the composition of your organization's future optimal product development team change?

"Not all the 'experimental' people are replaced overnight with mechanical engineers. But there is an increasing demand for engineers who know more about simulation and data analysis."

Ivan Tashev
Head of Audio and Acoustics Group
Microsoft

The insights from the interviews paint a challenging future for product developers across sectors and industries. The processes, tools and organizational structures of today will change significantly by 2030 and there are a vast number of ways for organizations to deal with the developments highlighted in these interview insights. The following section elaborates on such developments using four scenarios that are meant to inspire your strategic thinking about the future of product development in 2030.

SCENARIOS 2030

SCENARIOS FOR THE FUTURE OF PRODUCT DEVELOPMENT

The scenarios developed in the Beyond Tomorrow process are designed to provide four qualified and possible futures related to product development, including the role of sound and vibration. The scenarios should challenge and inspire organizations and product development teams to anticipate and plan for multiple, plausible futures.

WHAT SCENARIOS ARE…	…WHAT SCENARIOS ARE NOT
• Scenarios are compelling, plausible narratives on potential futures helping and guiding leaders and teams to plan for the future • Scenarios focus on potential change in the external environment influencing the strategic environment • Scenarios are guiding and informing organizations and teams about future threats and opportunities • In an age where forecasts are not enough, scenarios help to foresee potential outcomes that are beyond numbers	• Scenarios are not predictions of the future. Nor do they generate futures to which we should assign probabilities • Scenarios do not focus on operational options created from an inside-out perspective • Scenarios are not strategies in themselves, but they do provide insight for planning • Scenarios are not the same as trend analysis, empirical forecasting or other foresight methodologies

HOW TO USE THE BEYOND TOMORROW SCENARIOS

The scenarios are meant to inspire your strategic thinking about the future. They are meant to open minds and foster discussions on future strategies for product development.

Organizations and companies often operate on assumptions that are ‘the conventional wisdom around here’. Scenarios can help to challenge conventional wisdoms and to make assumptions about the future more explicit.

The scenarios can help you in guiding decisions about the future. One way to do that would be to see if a decision or strategy would work in all four scenarios. In which case, it is robust. And if the strategy only works in one scenario, should the strategy be changed, or do we believe that the strategy is still robust?

The scenarios can also be used before strategies are formulated. Which scenario or scenarios are most likely in your market, and what strategic consequences will that have on your organization, your team and yourself?

And most importantly, it is important to remember that scenarios are not intended to ‘predict’ the future, but to rather highlight the importance of certain critical uncertainties in a way that helps organizations make decisions today about how to respond to a variety of developments.

The four scenarios have been developed around two critical uncertainties, which CIFS and the Brüel & Kjær Project Advisory Board have determined will have decisive influence on product development processes towards and beyond 2030.

The trends and interview insights provided crucial guidance on selecting the most relevant critical uncertainties for the future of product development, as well as addressing important areas during the scenario building process. The criteria for critical uncertainties are 1) that there should be close to 50/50 uncertainty about the direction of the development, and 2) the uncertainty should have critical influence on the future of product development.

The first uncertainty, which constitutes the horizontal scenario axis, is the rate of **adoption of automation technology in product development**. The emergence of advanced technologies such as internet-of-things, artificial intelligence, big data analytics, advanced computing and simulation will significantly impact the future of product development. The accelerating technological development holds the potential for a radical step-change in product development processes in terms of engineering automation. The pace and nature of adoption depends on, among other things, the convergence of technologies, people and regulation. The two polarities of the horizontal axis are:

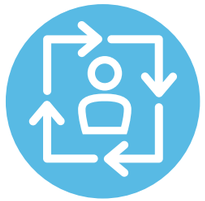
- **GRADUAL TECHNOLOGY ADOPTION**
  Gradual adoption of advanced technologies will increasingly enable, rather than displace, human expertise in product development processes.
- **EXPONENTIAL TECHNOLOGY ADOPTION**
  Exponential adoption of advanced technologies will rapidly displace human expertise, or radically alter the role of human expertise, as product development processes are automated.

The second uncertainty, which constitutes the vertical scenario axis, is related to **product development ecosystems**. Global tech companies with access to vast amounts of data (existing companies or new and today unknown entrants) are increasingly using business model innovation to disrupt a variety of industries and processes, including areas related to product development. Traditional product development ecosystems could experience significant disruption due to new innovations from global tech 'outsiders'. The two polarities of the vertical axis are:

- **END-TO-END DEVELOPMENT PLATFORMS DOMINATE**
  Global tech companies succeed in creating integrated, centralized, end-to-end platforms that stretch across the entire product development value network. Specialized companies likely face commoditization and disruption.
- **MULTITUDE OF INDEPENDENT DEVELOPMENT SYSTEMS PREVAIL**
  Specialized companies are able to maintain agility and competitive advantage by focusing on decentralized, flexible digital platforms, with increased collaboration across the entire product development network.

These two scenario axes create the canvas on which the four scenarios emerge. The following section will present each of the scenarios as a potential future for product development. The selected scenarios should not be viewed in isolation or assumed to be the only possible 'futures'. The future of product development may encompass significant features from multiple scenarios, including scenarios that have not been captured by the two identified critical uncertainties. from multiple scenarios, including scenarios that have not been captured by the two identified critical uncertainties.

SCENARIO MATRIX



End-to-end development platforms dominate

SCENARIO A
THE GATEKEEPERS

- Disruption slowed by technology adoption lags
- Platforms control access to development processes
- Human expertise, with machine collaboration

SCENARIO B
TAKE-OFF

- Disruption turns world upside down
- Radical innovation and new business models
- Accelerating change, rise of the machine automation

Gradual technology adoption

Exponential technology adoption

SCENARIO D
STAY COOL

- Disruption limited by organizational inertia
- Traditional business models maintain advantage
- Incremental change – adapt, adjust, digitize

SCENARIO C
THE MESH

- Disruption by collaboration in unexpected ways
- Specialist companies use radical technologies
- Decentralized ecosystems, agile value networks

Multitude of independent development systems prevail

SCENARIO A – THE GATEKEEPERS

Gradual technology adoption / End-to-end development platforms dominate

Throughout the past decade, digitization has continually changed society and tested peoples' adaptability. However, the world anno 2030 is not in a disrupted state. Politics, regulations, human ingenuity, and lack of technological convergence have all played a part in preventing exponential technologies from steamrolling across society, thus forming a world where humans and technology to a large degree go hand in hand.

THE WORLD AROUND US

Ten years ago, most 'experts' expected the take-off of many exponential technologies that were deemed to fundamentally change the way we live our lives, such as artificial intelligence, advanced robotics and additive manufacturing. The reality, however, is that there are still substantial 'adoption lags' for major new technologies in society.

Technological advancements do mean that most companies have access to advanced technologies. Disruptive technologies with the potential to radically change the way products are developed, produced and delivered, such as artificial intelligence and big data analytics, have been showcased with exciting applications across most industries. In general, however, behind the promising use cases, the readiness and adoption of each technology often tells a different story.

Throughout the 2020s, the world experienced a slow but steady revival of globalization. However, the 'state-of-the-world' in 2030 is still characterized by regional differences and non-conformity in terms of e.g., consumer preferences, regulatory regimes, and other market dynamics. Political considerations have maintained the world in a rather fragmented state. Rock solid regional and national champions with long experience and local knowledge are in control in most markets.

The global consumer has changed a lot in the past decade. Especially demographic development and new technologies have made consumers savvier and more demanding than ever before. No industry has been immune to this change. However, there are still pronounced regional differences in consumer preferences and behavior, which continues to require strong local knowledge to navigate.

PRODUCT DEVELOPMENT

Rather than automating product development processes, new technologies have an important role as an enabler in relatively traditional processes, complementing and improving them. Hence, human expertise, enabled by more advanced technologies, has maintained a pivotal role in product development processes. Even though increased human-machine collaboration has made product development cycles more lean and effective, there are still many areas in the non-linear world of product development and testing, where humans are superior to machines.

However, the model by which most companies now operate has changed over the past decade, and consequently so has the entire paradigm around product development. At the center of this transformation is the emergence of digital platforms that acts as a 'one-stop-shop' across the entire product development process. In essence, these platforms facilitate an extensive crowdsourcing approach, where product developers can obtain needed services, ideas, or content by soliciting contributions from a large group of companies and people. Thus, it allows product developers to plug and play services from a wide resource pool.

This has completely disrupted traditional value networks in product development, leading to much more transactional ecosystems. This allows product developers to tailor product development solutions which enables them to eliminate cost inefficiencies and reduce time-to-market for new products.

In the platform-dominated world of product development, competition among product development service providers is fierce. Service providers face the very real threat of their services being commoditized, and are forced to rethink a much narrower value proposition in which they specialize deeply. On the other hand, entry barriers for new service providers to enter the mix is significantly lowered, creating a much more fragmented marketplace for service providers, where the market consists of several smaller companies competing with each other.

As the global marketplace continues to be difficult to maneuver, several such end-to-end platforms have emerged specializing in different regional and/or industrial contexts. There are no 'one-size-fits-all' solutions.

Human-machine collaboration allows specialists and machines to combine their strengths and compensate for each other's limitations. Advanced technology is extending human capabilities. However, specialists have evolved a lot in the past decade as well. To capture synergies between humans and machines, companies increasingly demand skills and competencies based on deep knowledge in specific expert domains and knowledge of e.g., simulation and data analysis.

Winners

1. End-to-end platform providers
2. National and regional market specialists
3. Companies who master synergies between humans and machines

Recommendations for product developers

1. Understand how you leverage end-to-end platforms to tailor product development solutions
2. Secure agile and flexible processes to cater for local needs and requirements
3. Consider how collaboration between humans and machines can create synergies

Recommendations for professionals

1. Develop skill sets that compliment and can be complimented by machine abilities
2. Understand how technology and digital platforms enables new ways of working
3. Specialize deeply or become multifaceted

SCENARIO B – TAKE-OFF

Exponential technology adoption / End-to-end development platforms dominate

The world of 2030 is characterized by a single word – "disruption", and disruption is happening very, very fast. Change is exponential and still accelerating. Automation technologies have radically changed the game, and traditional business models have been turned upside down.

THE WORLD AROUND US

The hyper-convergence of key technologies such as universal sensors, internet-of-things, big data analysis, advanced computing, and artificial intelligence has led to wide and deep technological penetration across all components of society and industry. The world is globally interconnected and information and disruptive innovation travel to all corners of the globe at the speed of light.

There is no hiding. The world and markets are transparent, and it is a winner-take-all economy. Whoever can come up with great products and services will win. And to depend too much on legacy, history or even brand is a big mistake. New entrants pop up all over the place, competition is global, and companies need to constantly remain vigilant, agile, resilient and flexible.

Consumers are sophisticated in tastes and global in aspirations. They demand instant gratification of their needs and desires. The world is at their fingertips with the push of a button, a spoken voice command, or possibly even a thought. Predictive analytics often know what consumers want before they do, and consumers often trust suggestions from algorithms more than their own social circle.

The provision of products and services becomes an exercise in finding solutions to customer needs before those customers even identify such needs. Consumers are also now in a position to meet their needs increasingly through access to services, based on better technologies and increased convenience (via the network society), lower costs (via the sharing economy) and common values (i.e., sustainability, limited resources, pollution concerns).

PRODUCT DEVELOPMENT

The rapid pace of technology adoption has led to widespread engineering automation. This is driven by artificial intelligence moving to the epicenter of all work processes, including product development. Digital signal processing, instant computer-aided design (CAD) and powerful simulation technologies have significantly compressed the product development cycle as well as improved product quality, and lowered costs through optimal use of materials. In many instances, the first physical prototype is essentially the final product.

In addition, generative design algorithms allow product developers to input design goals along with parameters and constraints for new products, and then allow an evolutionary computing process to generate and optimize design alternatives, sometimes hundreds or even thousands of possible design iterations. Human experts and teams find it very difficult to optimize the design process using large numbers of variants or options. Such algorithms are powered by deep learning neural networks that enable radically new forms of experimental design based on interactive, automated exploration. This means that optimal configurations and parameters are developed largely without human direction or engineering expertise.

Product development now centers around a few strong end-to-end, digital platforms offered by large, multinational or even global technology companies, who has disrupted traditional processes and established niche players. Even smaller technology startups are sometimes able to create new platforms 'out of the blue' – similar to the historical, disruptive platforms such as Airbnb and Uber.

Platforms increasingly offer integrated, one-stop shop services across the design, development, testing, and operational phases. They are based on key technologies, economies of scale and better access to the client, whether customer or end-consumer. Digital platforms own the world of 2030, and provide the critical link between product developers, design specialists and end-consumers.

The result is the commoditization of many specialist players, as platforms either expand access to a larger set of service providers, or even fully disrupt specialists by digitizing and simulating their services using technology platforms. Platforms are moving aggressively into all aspects of product development, even developing their own products where the economics make such endeavors profitable and provide a strategic advantage over more established industry incumbents.

Platform companies are also requiring that service providers share proprietary information (i.e., intellectual property) as a form of pay-to-play to gain access to the digital platform and potential new customers that use the platform for product development. Differentiation by smaller design and testing specialists becomes very difficult to achieve and maintain in the digital platform world.

While no single platform will dominate the entire world, very large digital platforms will gain competitive advantage and dominant market share based on geographic (i.e. China, Europe, USA) or industrial (i.e., consumer retail, automotive, telecom) competitive dynamics in this winner-take-all world.

Human expertise continues to be relevant only in very select, highly complex domains, while machines have taken over an ever-increasing share of work processes within product development. Where human expertise continues to be relevant, organizations face challenges associated with mastering the interface and mechanics of product developments platforms. While there is still a need for a few domain specialists, many traditional specialists have been displaced. Competencies within advanced simulation, large dataset analysis and other skills relevant to interactive, digital platforms are in high demand.

The world is extremely challenging for product developers across all parts of the value chain. Radical, disruptive change means that not all players will survive, but the ones that do have the opportunity to thrive in the digital, global world of the future.

Winners

1. Platforms and aggregators
2. Companies and professionals with highly specialized skill sets or access to automation technologies
3. Companies who understand and manage fast adaptation

Recommendations for product developers

1. Be proactive, adapt to the digital future by embracing a change mindset
2. Consider how automation technologies can disrupt your business offering
3. Integrate your organization into digital platforms in a seamless and easy-to-use manner for all your clients and stakeholders

Recommendations for professionals

1. Develop skillsets relevant to an exponential, AI-driven world
2. Understand the complexity of end-user demands
3. Challenge everything, take nothing for granted

SCENARIO C – THE MESH

Exponential technology adoption / Multitude of independent development systems prevail

In 2030, the accelerating pace of technological development has exerted profound shifts in societies at large. Technological capabilities have increased exponentially and new ways of organizing markets, developing products, making decisions, communicating etc., have proliferated. Organizations operate in a more complex world. They compete and cooperate in innovative and unexpected ways.

THE WORLD AROUND US

A number of major technological breakthroughs have altered society and we live in a truly digitized world. As the Internet-of-Things encompasses almost all products, all infrastructure, and to some degree all human bodies, we live in a world of true big data.

At the beginning of this revolution most companies still struggled with the deluge of data without really knowing how to act upon it. This has changed. Deep learning machines are now making sense of the unimaginable amounts of big data that has piled up during the past decade. Technology understands and anticipates our needs and our emotional state-of-mind and it suggests solutions which we might never have thought of ourselves.

The network society, where organizations, people and societies are interconnected, has now fully risen on a global scale.

Anyone can chip in. As the digital systems connect everybody with everything, it does not have to be the big brands or companies that deliver the solutions. It can just as easily be solutions created in a bottom-up style by small start-ups, entrepreneurs, or passionate people organized in temporary networks. Markets and competition are global, and companies need to be agile and flexible to stay on par with the development.

In a world defined by technology and hyper-connectivity, even the most innovative companies are worried about how to better connect with consumers, who are simultaneously more informed than ever before. Delivering rewarding consumer experiences puts pressure not only on individual companies, but the entire value networks that they are part of.

PRODUCT DEVELOPMENT

Breakthroughs in key areas and convergence in technologies have revolutionized the way companies develop, produce, and deliver products and services. Artificial intelligence, capable of handling tasks that we once thought required uniquely human abilities, has widely been adopted across virtually all industries. This has dramatically reduced the number of people involved in traditional product development processes.

Compared to a decade ago, machines no longer simply answer the questions posed by people. Now they guide people to ask better questions in the first place, and offer faster and more insightful answers.

AI platforms for businesses – like IBM's Watson – have enabled a much more agile product development paradigm with reduced development cycle times and better products. This allows product developers to respond faster – in 'near real-time' – to changing market preferences, creating the right products more quickly.

New technologies and digital platforms have also removed many obstacles to collaboration among organizations. Value chains has been replaced by highly collaborative, often temporary, value networks, where product developers, service providers, partners, competitors, freelancers, customers, and volunteers all contribute to innovation.

Companies have traditionally been protective of their innovation activities, as they saw these activities as part of their crown jewels. That thinking, however, has changed. For the most part there is no longer a distinction between outsourcing and standard business practice, and product development generally happens in much more distributed networks, enabled by technology. As open-source and consumer-driven innovation and product development have moved to center stage, the network you are part of, more than anything, defines your company's success. The less-innovative companies who are not part of the right networks are left behind to perish.

Companies that have been too protective around IP - which was the case for many large companies - tend to struggle. On the other hand, more nimble companies willing to relinquish control in order to be part of the right networks prevail.

The combination of automated product development processes and highly collaborative value networks enables companies to lower their development costs, shorten development cycles, gain access to specialized skills and resources and improve their ability to deliver more individualized product content. And most importantly, it allows for much more radical innovation.

In a reality with fewer traditional specialists involved in product development processes, it is the hyper-specialists who thrive. At the same time, there is an increased demand for multifaceted generalists to work alongside hyper-specialists to serve as connectors between disciplines, to help create the bigger picture and to bring meta skills like combinatorial creativity, systems thinking and pattern recognition into play. The development has created ample opportunities for the 'few' who are proactive and capable of constantly adapting to the new skills requirements. 'Learning how to learn' for 'just in time learning' has become a widespread mantra.

Winners	Recommendations for product developers	Recommendations for professionals
1. Technology and artificial intelligent experts	1. Be part of the right networks	1. Learn how to learn!
2. Agile networks	2. Be prepared to relinquish control	2. Be proactive in adapting and seizing opportunities
3. Companies that are able to anticipate needs	3. Strong focus on agility and flexibility	3. Be able to exploit and contribute to your network

SCENARIO D – STAY COOL

Gradual technology adoption / Multitude of independent development systems prevail

The world of 2030 is defined by gradual, incremental change. The pace of change is manageable for societies, consumers, and businesses. Disruption may happen eventually, but the future is taking longer to arrive than many originally expected. Exponential change has not yet taken over the world as most companies struggle to handle the complexity of new technologies, and traditional business models have maintained their competitive advantage. Core expertise in specialist roles prevails and while technological and digital tools have vastly improved, they are still 'tools, and not masters'!

THE WORLD AROUND US

Key automation technologies around the internet-of-things (IoT), artificial intelligence and big data analysis are finding their way into established industries, but the adoption has been mostly gradual for the majority of players and processes. While selective disruption has occurred, the world is progressing at a manageable pace and remains highly decentralized. Robots are increasing in numbers and capabilities, as are other digital technologies. But such technologies are mainly being integrated into systems and markets that are not fundamentally changing.

Markets are mostly regional or national, and a variety of companies have developed successful strategies within their existing market, industry or area of expertise. Local champions rule in local markets. While agility and flexibility is desirable, the companies who win are the ones with a strong corporate DNA, focusing only on doing what they do best, and maintaining the focus on that core.

Consumers and end-users really care about individualized solutions and a focus on local production. They continue to focus on product ownership as a means of differentiating themselves from their peers. The expanding global middle class provides the target market for a growing selection of product types and categories.

An economy based on shared services and assets continues to develop in certain markets, but has not revolutionized the world as once expected. Sustainability is important when it is also affordable, but consumers mostly care about conspicuous consumption. The symbolism around sustainability is based on individual values and what consumers feel that sustainable products say about them personally, rather than a sense of collective or common values.

PRODUCT DEVELOPMENT

Despite advancements across a broad class of technologies, barriers from regulation, legislation and cultural resistance to automation and job destruction have resulted in the gradual adoption of many automation technologies. New technologies are being introduced and used – but most organizations continue to struggle to make sense of the vast amount of complex, incompatible data, which significantly slows down adoption of advanced technologies. Human expertise and capabilities remain at the epicenter of most work processes, including most product development processes. Engineering and design processes are controlled and directed by teams of human experts using such technologies in a more limited fashion. Engineering automation is implemented in-house by specialists within their area of core expertise.

Simulation in product development continues to gradually play a bigger and bigger role and the number of physical prototypes per product has been dramatically reduced. However, as more and more products are being developed, driven by customization and individualization, physical prototyping is still widespread. Hybrid modelling, where measured data is used in a simulation environment, is central in areas where it is challenging to make simulation models of non-linear parameters, such as in sound and vibration. Deep learning machines assist human experts in certain areas with sufficiently available data, but human abilities to solve problems are still needed. And the ability to understand end-user and customer needs requires creative solutions made by teams of human experts.

Global technology companies have been limited in their ability to offer fully integrated product design, development and testing services. Global technology companies may disrupt certain areas by capturing 'low-hanging fruit', but most product development centers around specialization, agility, and a strong focus on core value propositions. Where they exist, digital platforms have a niche focus – similar to historical examples such as Uber (mobility), Amazon (consumer retail) and Airbnb (accommodation). But most markets have not been disrupted and most new technologies are still more hype than actual bang-for-the-buck.

Product development is highly flexible and based on decentralized, organic ecosystems around diverse digital platforms. Collaboration is very important for developing high quality products, as well as to lower costs and compress development cycles. There are many different systems and standards, but there is also a demand for open systems and flexible interfaces. Getting key stakeholders to be part of the product development process is very important and requires an individualized set-up that caters to the needs of each individual company and process. However, competitors are unwilling to completely merge their respective digital platforms, and focus on protecting their proprietary intellectual property.

The result has been a high level of differentiation. Specialists focus on their core of doing what they do best – which is helping to create best-in-class products within their area of expertise. Smaller, more agile players possess a strong competitive advantage by being flexible and adaptable, with the ability to thrive in highly specialized silos.

Human expertise is the main limiting factor in product development, and engineering expertise with specific domains is often more important than highly creative, interdisciplinary thinking. There is significantly more outsourcing of previously in-house capabilities, as fragmentation enables diffusion of relevant people skills across digital ecosystems to more dynamic, increasingly specialized, often smaller and more innovative external teams.

The world is digitizing and technology adoption around automation is steadily advancing, but disruption remains somewhere in the distant future. The players who specialize in their core area, work collaboratively across the value chain, and retain organizational agility will thrive and succeed.

Winners

1. Open systems and platforms
2. Organizations who specialize while remaining agile
3. Strong organizations

Recommendations for product developers

1. Do what you do best and maintain focus on your core expertise
2. Develop organizational capabilities around teams of human experts
3. Build best-in-class products to meet diverse individual demands

Recommendations for professionals

1. Work in small teams
2. Specialize in core areas of engineering expertise
3. Focus on meeting end-user demands

CONCLUSION

The Beyond Tomorrow Scenarios 2030 vision study has covered a wide range of topics across global megatrends and contextual trends, industry expert interview insights, selected critical uncertainties, and four plausible scenarios on the future of product development. Each of these areas is part of building the foundation to understand the future of product development.

TRENDS

Megatrends and contextual trends highlight that one critical element in product development is the speed of change – how quickly a highlighted trend progresses, and how that trend intersects with and affects the pace of development of other trends.

For example, think about cities of the future; they will be more sustainable, smarter, and have sensors almost everywhere. But will smart cities (including related products and services enabled by smart cities) communicate and interact on the same digital platform or will we see many different systems and platforms competing against each other in the smart city of the future?

There are numerous examples of products and services that have been developed in response to specific key trends – Tesla automobiles (changing consumer preferences, sustainability, IoT), Wikipedia (Co-creation and maker culture, network society, knowledge society, open sourcing innovation), IBM Watson (simulation, 4th industrial revolution, AI and machine learning), Facebook (Co-creation and maker culture, network society) and Netflix (shift in innovation, new business models).

The main takeaway is that evaluating a range of global megatrends and contextual trends should be of concern to product development teams, and a key part of the initial stages of all product development efforts. While this may sound easy and straightforward, it is often quite challenging to do in real life. Trends interact in complicated ways and sometimes directly contradict each other. Ignoring trends is not an option, and trend analysis should always be a core part of new product development.

EXPERT INSIGHTS

The expert panel that has participated in the Beyond Tomorrow project represents a diverse group from differing backgrounds and professional responsibilities. The insights gained from the one-on-one interviews during this vision study paints an uncertain, yet exciting and challenging future for product developers across sectors and industries.

Digitization will be a large driver of future developments in societies and markets. Most of human activity in the 2030 future will have a significantly greater digital dimension than today. And one could argue that the physical world will continue to integrate and merge with the digital world, thus creating new markets and opportunities for product developers.

New technologies around automation and simulation will transform product development processes, and some of these technologies are already on the market today, while others still linger in the laboratories of the world.

Organizations and product development teams will have to evolve to deal with an uncertain future, and new skills and competencies will be required in addition to flexible ways of collaborating with internal and external stakeholders.

The product development processes of today will change significantly by 2030 and there is likely to be a lot of trial-and-error over the coming years. Just think about the many ways augmented and virtual reality could change peoples' and organizations' lives.

SCENARIOS

The four presented scenarios portray a range of plausible futures for product developers, and raise numerous questions for organizations and professionals about how to best respond. Technology adoption, engineering automation, product development platforms and the related people skills and organizational capabilities highlight critical issues that all stakeholders must consider and engage.

The pace of technology adoption, including whether the speed of adoption is linear and gradual or exponential and accelerating, will have a huge impact on the broader future of product development processes.

In addition, the emergence of digital platforms, and whether those platforms can offer an integrated, end-to-end product development solution or whether decentralized ecosystems will provide the most flexible and organic solutions across industries, sectors and geographic regions, will have a large impact.

In considering the four scenarios, we invite you to contemplate the following questions for inspiration about your organizations future:

- What do you think will happen to broader product development processes?
- Do you expect your product development ecosystems and value networks to become more fragmented or more integrated? More regional or more global?
- How will automation technologies and simulation affect how you think about developing new products?
- How will the emergence of digital platforms affect your value chain?
- What is the opportunity for disruption in your product development processes, and where will it come from?
- What organizational capabilities do you need to develop to strategically respond? What skill sets would you require in-house?
- How do you think about the trade-offs associated with insourcing vs. outsourcing?
- Finally, what will your customers want, and how do you think you will involve end-user needs?

Exploring and finding answers to these questions will help position your organization for the best possible outcome regardless of how the future develops.

IN SUMMARY

We sincerely hope that the Beyond Tomorrow Scenarios 2030 vision study has both inspired you and challenged you to think more broadly about the exciting possible futures for product development.

Your future and the future of your company depends on keeping an open mind, being willing to accept uncertainty and risk, and embracing change by adapting toward whatever future you eventually find yourself living and working in.

Start your journey into the future by having your team acknowledge all the possible changes and begin to reflect on some of the questions asked in this report.

Be honest.
Be prepared to fail.
Create your future.

EXPERT PANEL LIST

NAME	POSITION	ORGANIZATION
Ivan Tashev	Head of Audio and Acoustics Group	Microsoft
Arnaud Talon	Head of Vibration and Dynamics Measurement Group	SAFRAN
Dr. L. Venkatakrishnan	Head of Experimental Aerodynamics Division	National Aerospace Laboratories
Dr. Marco Ballatore	Function Manager NVH	Bentley Motors
Piero Aversa	Chief Engineer Global Powertrain NVH	Ford Motor Company
Jianmin Guan	Director of Vibration and Acoustic Solutions	Altair
Bo Littau	Portfolio Director	Oticon
Per-Olof Sturesson	Senior Director for Driving Dynamics	Volvo Sweden
Koji Watanabe	Senior Researcher	Railway Technical Research Institute
Claus Erichsen Kudsk	Head of Center for Product Development	Danish Technological Institute

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