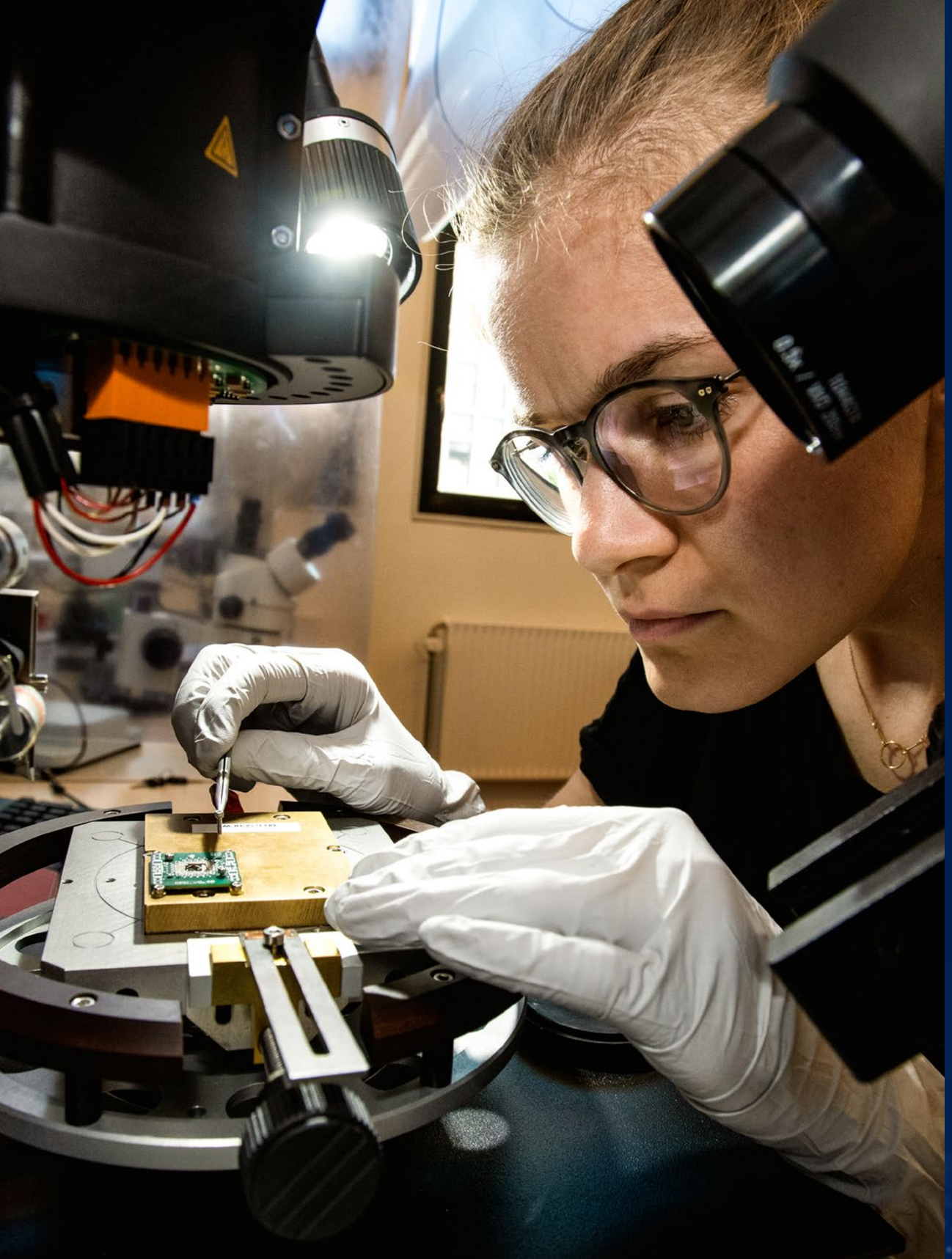
Building on brilliance

Product innovation at the speed of digital

Microsoft

Empowering organizations for what's next



> "Innovation is serendipity—you don't know what people will make."

Tim Berners-Lee
Inventor of the Worldwide Web



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Shedding some light

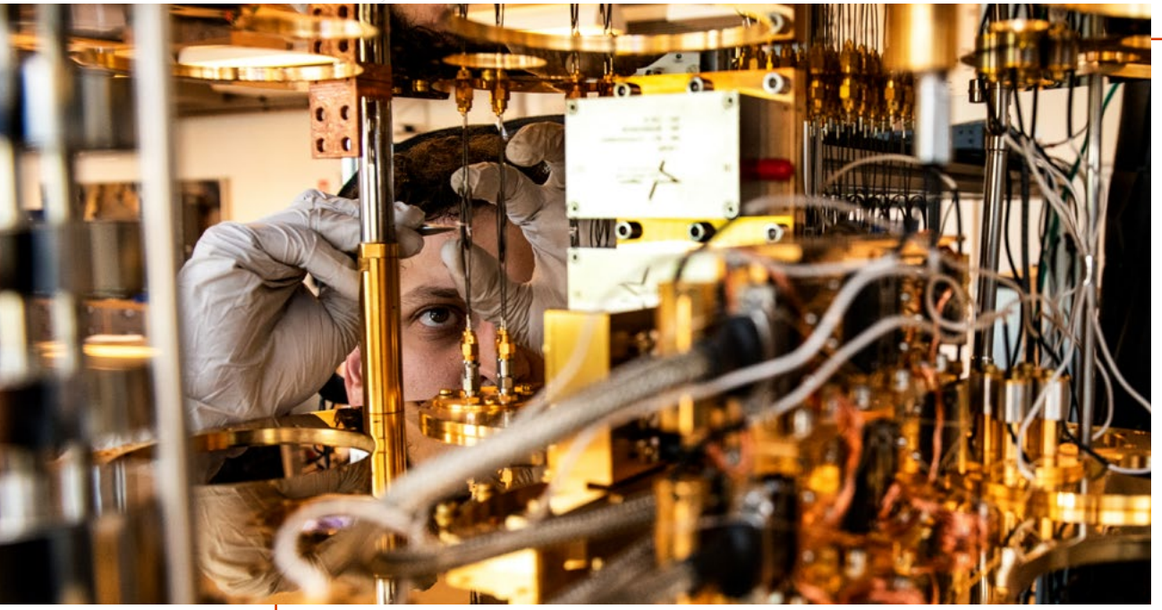
For most of recorded history, the primary driver of innovation has been the automation of certain elements and processes, the creation of different combinations of underlying components, or the definition of new value chains. These innovations were often created by visionaries—romanticized as lone geniuses working in obscurity—who pioneered breakthrough products and processes that now define modern life.

But near the end of the last century, the global connectivity ushered in by the internet, the blurring of lines between industries, and the growing concern about physical input scarcity and sustainability shifted the locus of innovation. Digital, led primarily by the software innovations over the past 20 years, has revolutionized the world and increased the pace of innovation to a break-neck speed.



As the lines between physical and digital blur, the production and development of manufacturing goods need to be reconsidered: not only are customer expectations shifting much more quickly but product adoption—or rejection—is moving at a pace never seen before.

This change is not without opportunities. Digitally powered business models are opening new avenues for innovation: firms can redefine value chains, production processes, and the very nature of products and their lifecycles. Though faced with some daunting challenges, manufacturing—perhaps more than any other industry vertical—is well positioned to control its own destiny.



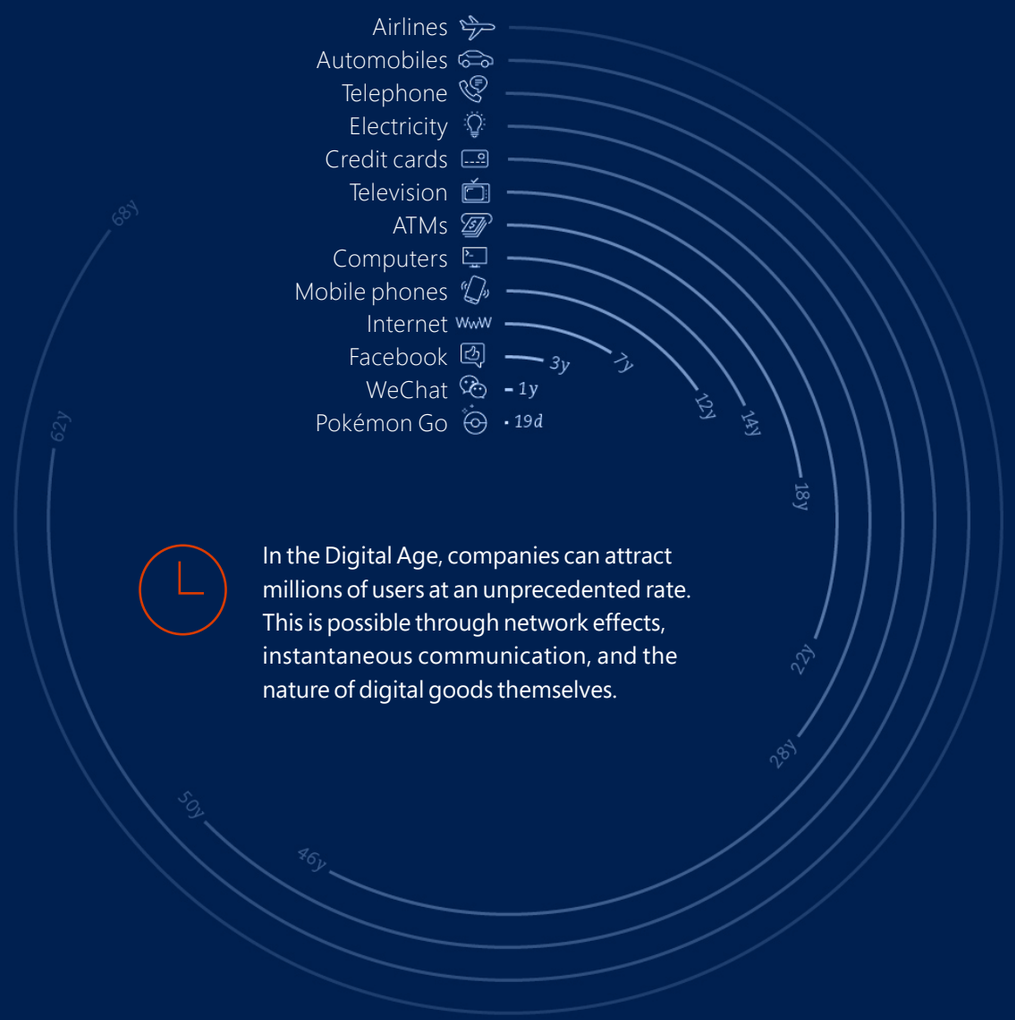
The next bright idea

In the past few decades, companies, facing pressure from industry, marketing, and the bottom line, have shifted resources away from traditional research and development activities, which have an unknown payoff, to cost controls and incremental innovation. Why reinvent the wheel—and endure an expensive retooling—when you can release a product that is a slightly improved, less-expensive variation of the original?

But in a digital world, where physical constraints rarely apply and the barrier to entry is increasingly low, multiplicative innovation has become far more common, emerging from unexpected places and changing fortunes virtually overnight.

How long does it take to hit 50 million users?

The impact of the shift to digital and the power of network effects.



In the Digital Age, companies can attract millions of users at an unprecedented rate. This is possible through network effects, instantaneous communication, and the nature of digital goods themselves.

www.visualcapitalist.com/how-long-does-it-take-to-hit-50-million-users/



Time to shine

The dizzying speed at which new products, services, and business models are launched has left many legacy industries struggling to keep up. Innovation cycles and monetization windows are no longer measured in years but in days. The ability to sense and respond to demand shifts with agility becomes paramount in an era when customers have near-zero switching costs. Nowhere is this struggle felt more acutely than on the manufacturing floor. And though the benefits of automation are undeniable, the process can be both expensive and inflexible: one poor product launch or production bottleneck can have lasting effects.

In addition, the expectations of end users—whether consumers or businesses—have risen dramatically in the Digital Age. From push-button access to around-the-clock updates, the product and service offerings that have taken hold are making an impact on nearly all verticals. We live in a fully connected, on-demand, and increasingly agile world, and if a company cannot live up to these heightened expectations, their competitors, on a global scale, will.

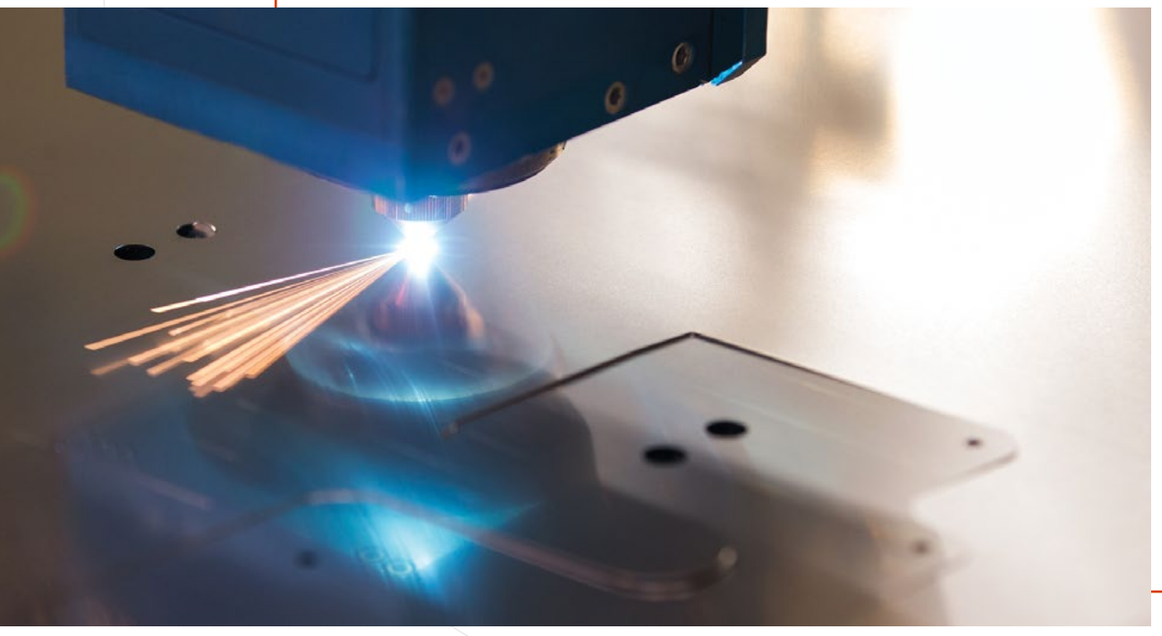
How might connectivity-by-design affect the growth of new product prospects, or the ability to go from idea to experiment to full production within hours? Rapid product launches, global market adoption, and real-time feedback become the standard in the race to capture attention in an ever-widening array of goods and services, rendering traditional product development frameworks and methods of production irrelevant.

> "Strike while the iron is hot."

Richard Edwards
Playwright, 1564

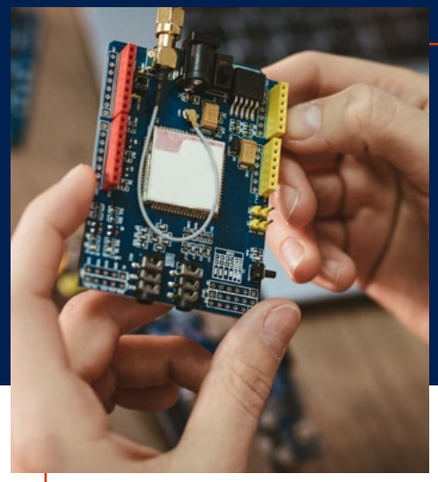
The flicker of inspiration

Meeting customer needs has always been at the forefront of product-driven enterprises, yet discovering those needs, or properly capturing the data that underlies them, has often proved easier said than done. How will new experiences be delivered? Will they be relevant? How do we get feedback? The key lies in more than just clever or well-designed products; the first step to accelerating innovation is building in connectivity.



Real-time, ongoing feedback can provide the direct insights to influence both engineering and design. Insights into market trends or feature roadmaps can be used to monitor human interactions and other devices within the ecosystem. The data generated can provide a far more complete picture than antiquated focus groups. Imagine products that provide data-driven insights *by design*—rather than as an afterthought—monitoring usage, interaction, and performance to help uncover latent requirements that customers did not know existed. With connectivity, products of today can not only monitor but also evolve with the user, extending the product lifecycle and delivering new experiences and benefits.

Though the concept of Internet of Things (IoT) has been around for many years, most of the information gathered by IoT devices has been focused on predictive and preemptive maintenance. And for good reason: we all want our jet engines, elevators, and washing machines to work without interruption. But, what happens when you use IoT for more than just observation? What happens when you design connectivity into the product? As the number of connected devices and sensors grows by orders of magnitude, the value of their data and the ability to process that data will be key drivers of innovation cycles.



DATA POINT

By 2025, there will be **more than 80 billion** IoT devices, a compound annual growth rate of 28.5 percent.

IDC, 2018

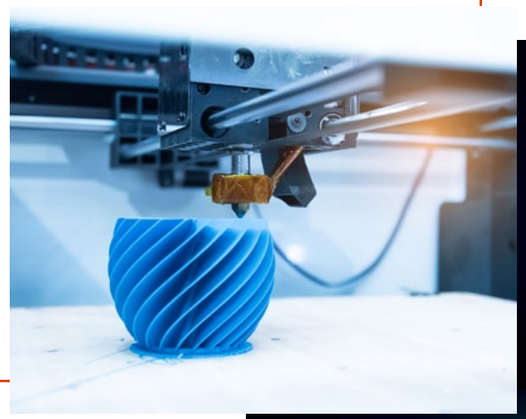


In a flash

Armed with connectivity and leveraging the high-performance computing power of the cloud, physical goods now have many of the advantages that were once the purview of digital goods, in particular a rapidly shrinking time to market. Just as in the world of software, where applications can be deployed within days, if not hours, hardware is quickly gaining the ability to slash development time and reach the intended market quicker.

The testing process was once long and painstaking. Engineers had to build models and prototypes in order to test the performance of components against the required specifications, make adjustments, and then repeat the cycle until they got it right. But we have moved far beyond the days of clay models and wind tunnels, or on-premises mainframes. With enough data—gathered from both real-world sensors and computer simulations—combined with the high-performance computing power of the cloud, the design processes that used to take months can now be reduced to minutes. Regulatory requirements are ushering in this change: in the U.S., certain federal government agencies either accept or mandate purely digital submissions of system designs.

Freed of the restrictive costs associated with physical testing, product development has greater opportunities to make more creative—even remarkable—designs a reality. Engineers and designers are often guided by "best practices," building upon years of previously shared experience, helping to reduce time to market by using proven designs. But what if those constraints no longer applied? With cloud-based high-performance computing, the previously infeasible can become commonplace in the innovation process.





DATA POINT

Modern video cards have **over 50,000 times the computing power** of the first commercial supercomputer.

Cray-1 Hardware Reference Manual, 1977

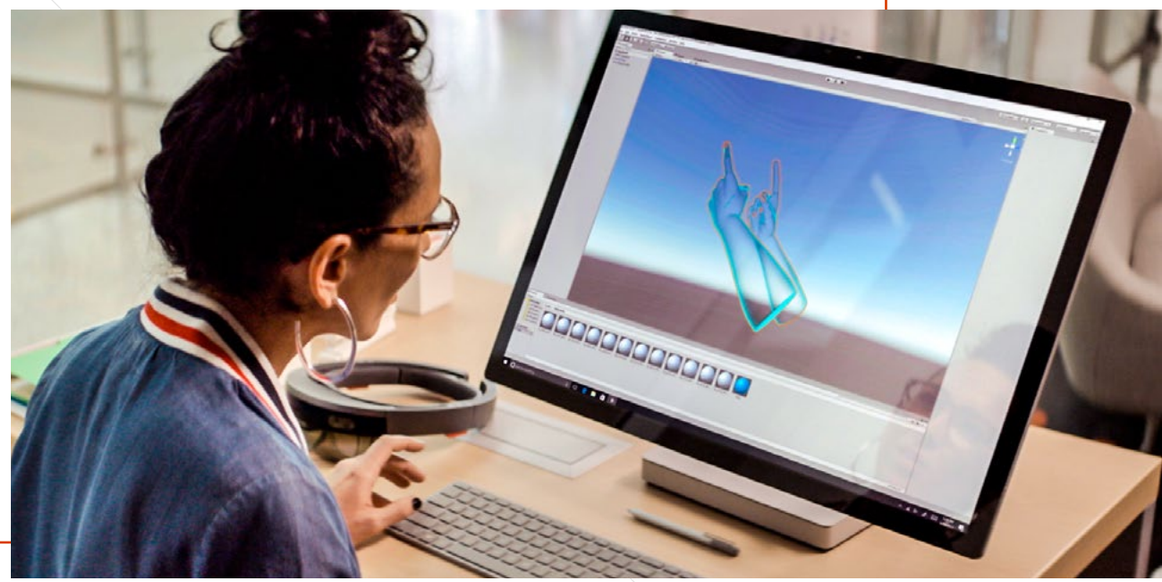


Highlighting opportunities

High-performance computing is also making other innovation strategies possible, enabling both collaboration and a better holistic approach to product lifecycle management through a process known as digital twin. Originally pioneered by NASA, digital twin has become more widely available due to advances in cloud technology, augmented reality, and cloud-based IoT platforms. These tools are enabling the creation of comprehensive digital models and spatially aware solutions that can be applied to a physical environment.

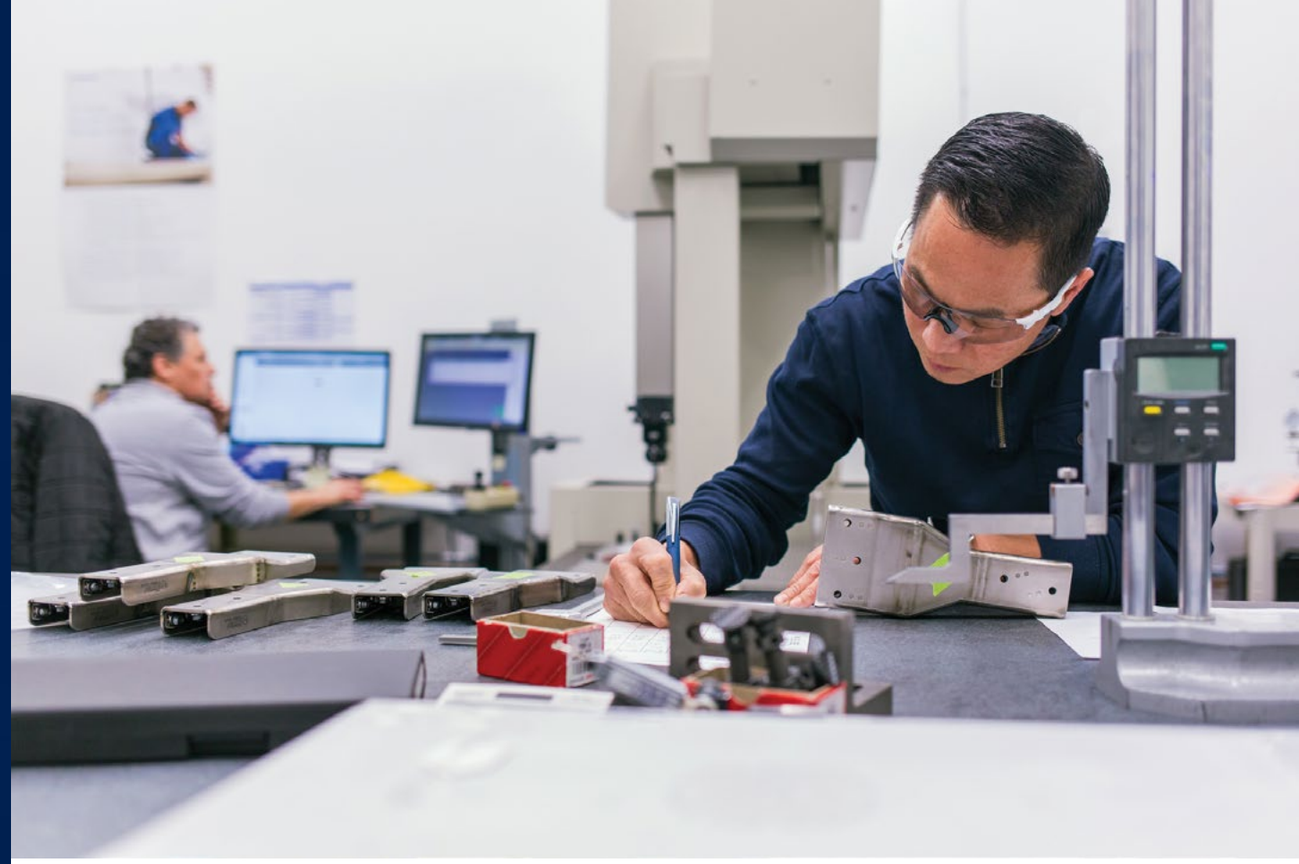
These developments mean that products can not only get to market faster but also continue to evolve and deliver value to both the manufacturer and the owner. The powerful combination of connected products and advanced analytics is now being used to view every device's state—in real time. The pairing of physical and digital can be used for preventative maintenance and optimization, or to develop new product and service offerings for the future.

Further, the level of collaboration available through the blend of digital twin and technologies such as cloud architecture and augmented reality is unparalleled. Experts from around the globe can analyze an up-to-date 3D model that is an exact copy of a unique physical asset, including the object's properties and telemetry. In places where it would be physically impossible to survive—from the bottom of the ocean to the top of the atmosphere—experts can observe and collect the needed data to drive future innovation.



> "Digital transformation is not about writing a better application; it is about fundamentally rewriting your company."

Aaron Levie
CEO, Box



Illuminating innovation

Digital transformation is about more than the technological breakthroughs in hardware or software.

It's not a story of perfectly automated, "lights out," robotic factories, but rather one about removing obstacles and empowering employees to better engage with customers and deliver value. The business models currently being developed might seem like the stuff of science fiction, but they are rapidly becoming a reality, powered by technology ranging from 3D printing to practical applications for quantum mechanics. As the world becomes more digital, concepts like supply chain or the Theory of Constraints take on new meanings or even face irrelevancy—how will manufacturing change as the definitions blur?

A longer-lasting lightbulb

For many years, the efficiency and cost benefits of a centralized manufacturing strategy had promoted the construction of large-scale monolithic factories, spawning a complex web of operations and supply chains that wrapped around the globe. But the constraint of the factory floor may soon be a thing of the past. Just as the internet enables distributed business models, additive manufacturing facilitates the distribution of the factory floor and will forever change the manufacturing business and its operating models.

The rapid pace of technology has made additive manufacturing systems that were once the purview of large-scale industrial companies far more accessible to small and medium-sized businesses, as well as to consumers. And it's not just making plastic figurines anymore: modern, commercially available 3D printers use steel, cement, even food, and more specialized machines with the ability to print living tissue are on the horizon. The U.S., E.U., and Japan have invested billions in exploring potential applications for fabricating on an atomic scale, opening doors to astonishing new materials.

With digital, the need for connectivity increases by orders of magnitude. The ability to observe, simulate, and design becomes one of the foremost concerns in a world where the factory floor becomes widely distributed—or completely virtual.

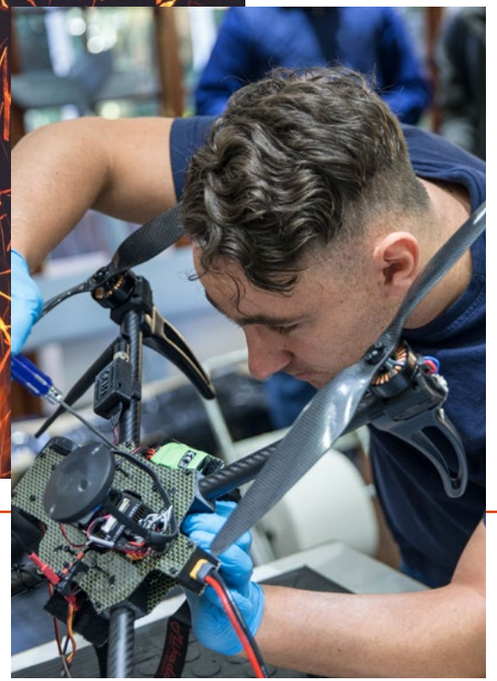


DATA POINT

HP releases a commercial-grade 3D printer **capable of printing steel.**

Engadget, 2018





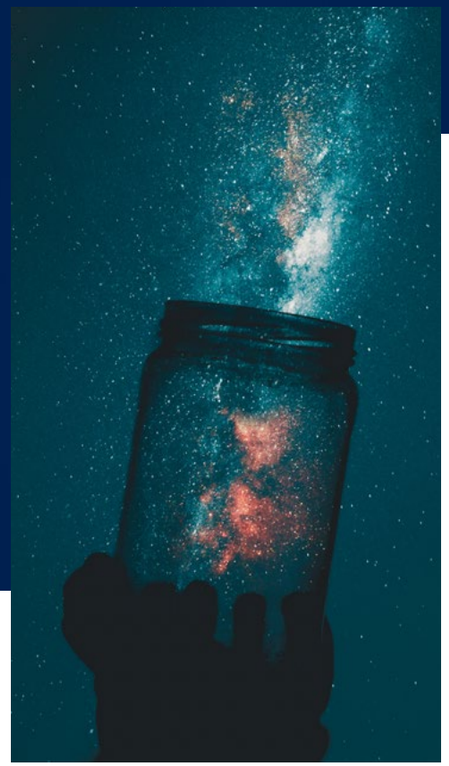
Kindling creativity

As the progress of technology continues unabated, the innovation cycle could develop a bottleneck never before seen: the ability of human designers and engineers to develop ideas.

There is already a shortage of science, technology, engineering, and math (STEM) professionals, with concerns about access to developers and engineers outpacing global competition or access to capital. One solution is artificial intelligence (AI), which has the potential to become a force multiplier. If used effectively, AI can both perform more mundane tasks to free up time for creativity and analyze data beyond human capability.

When the future of connected product innovation relies upon diverse ideas and points of view, there is an opportunity for AI to enable creativity or remove restrictions that directly influence product innovation. And AI has the potential to evaluate concepts that may have been overlooked or to create products for underserved markets.

By employing ethical principles when developing and training AI systems, enterprises can avoid the unconscious biases that influence humans, allowing them to both streamline operations and expand their product markets, simultaneously.



DATA POINT

61 percent of C-suite executives believe **restricted access to STEM talent** is an existential threat.

Stripe.com, "The Developer Coefficient," 2018

Spotlight on the future

There are problems known today that conventional computing cannot solve in a realistic timeframe: the factoring of massive numbers (cryptography), the three-body problem (simulation), and protein-folding problem (biochemistry).

It's not that scientists don't understand the equations, but rather the computations are so complex that by the time a supercomputer gave us an answer, the sun will have burned out. But developments in the next generation of computer architecture have the potential to solve these problems, delivering real-world practical solutions that will directly affect both the digital twin strategy and the ability of agrichemical and biotechnology firms to create and analyze new molecules—virtually.

DATA POINT

Intel announces a **49-qubit chip** dubbed Tangle Lake at CES.

IEEE, 2018



> "The task is, not so much to see what no one has yet seen; but to think what nobody has yet thought, about that which everybody sees."

Erwin Schrödinger

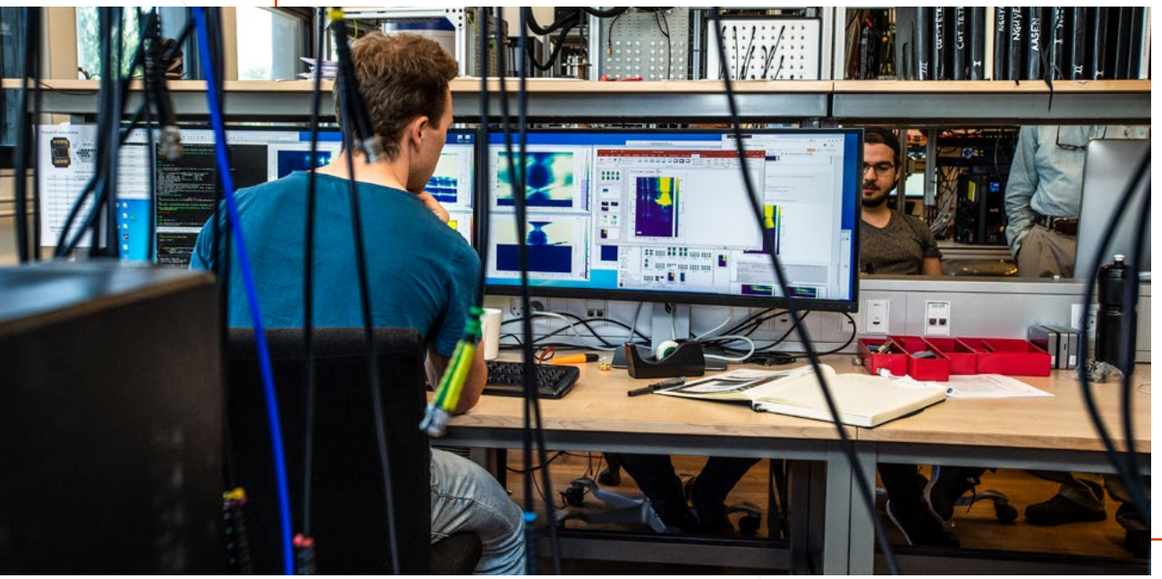
Nobel Laureate, 1952

Many technical challenges lie ahead, but universities, tech giants, and governments are racing toward a goal of "quantum supremacy," the point at which a new kind of computer can outperform the most powerful conventional computers. Such lofty goals are not merely incremental innovations—each new stable qubit added to this experimental computer can increase its processing power by an order of magnitude.

Blazing forward

The future of product innovation is simultaneously exciting and bewildering. As the lines between physical and digital blur, the benefits of one are quickly being realized in the other. The combination holds immense promise. From slashing time to market to delivering disruptive products, the four pillars of connectivity, cloud computing, digital twin, and AI will fundamentally change how we look at product development, and how we deliver experiences to end users.

Imagine a world where new components, new processes, even new materials could go from ideation to production in a matter of minutes; where products could be designed, tested, and distributed to a production facility across the globe, and be delivered at a speed and scale that were once unthinkable.





The potential of epiphanies

At Microsoft, our mission is to enable every person and organization on the planet to achieve more.

Microsoft Services is a proven partner that can both inspire digital transformation and make it real by accelerating organizations on their journey to become a digital business. We apply our imagination, inspiration, strategies, and technology to help you maintain leadership, advance innovation, and accelerate growth.

We know what's next and what's possible to fuel your dreams and turn ideas into micro-revolutions for your business, your employees, and your customers. We design with people at the center to focus on human needs and unlock your team's ingenuity to create a digital-ready culture. In partnership, we deliver unforgettable experiences that differentiate.

The engine that drives innovation is simple: **Dream it. Do it.**

Let's get started

Envision the Business You Dream Of: Collaborative workshop to ignite new or accelerate existing innovation

Digital Advisory Engagement: To help you dream, design, and deliver your digital transformation

microsoft.com/services



Credits

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