

Industry 4.0 Implementations

Companies understand the promise of Industry 4.0: faster, smarter, more sustainable productivity. What's hard is making that promise come true. Management thinker and 'father of Industry 4.0' Henrik von Scheel describes three key drivers for Industry 4.0 success: think value,

In a large open office in western Australia a team of engineers pore over the 3D image of a nickel and cobalt mine on a screen. It is 100% accurate – a complete digital replica of its physical counterpart – and means issues can be solved before they become life threatening.

This is the face of the 4th Industrial Revolution which has been taking place since the start of the 21st century. Its transformational power comes from marrying advanced production and operations techniques with digital technologies to create connected enterprises that use data to drive intelligent actions in the physical world.

“It's the biggest structural change of the past 250 years — a transformation of scale, scope and complexity unlike anything humankind has experienced before,” says von Scheel.

Smart and connected technologies are being embedded in organizations, assets and even people in the case of wearable devices, taking advantage of emerging capabilities from robotics and artificial intelligence (AI) to quantum computing, additive manufacturing and the Internet of Things (IoT). Yet for companies that want to capture the true potential of Industry 4.0, technology is the means, not the end, according to von Scheel.

“All those technologies ultimately have one purpose only,” he says, “and that's to create value.”

Cyber-physical systems

Defined as the merge of our physical, virtual and digital systems into an intelligent system, cyber-physical systems create a tighter integration between humans, machines and information technology systems.

- **Promise:** growth and productivity within manufacturing through automation, integration and optimization.
- **Challenge:** manufacturing is always a difficult late adopter – e.g., it was last to adopt electricity over the steam engine.

- **Implementation:** “In my experience digital transformation initiatives are notoriously difficult to scale up across factory networks - manufacturers may need to slow down to get ahead in the race to implement Industry 4.0,” says von Scheel.

Think value, not tech

Combining the digital, physical and virtual worlds creates unparalleled opportunities for growth and productivity while reframing the competitive landscape with smart products and new service models. Production systems stand to become as much as 35% faster and 30% more efficient through Industry 4.0 capabilities, according to von Scheel, enabling “mass customization” — the ability to create tailored products at high speed and on a scale never before possible.

In other words, the benefits of Industry 4.0 is multidirectional, extending out to the end customer as well as deeply into manufacturing operations and across the value chain.

“It’s about creating the next generation of operational excellence,” says von Scheel, “with smart automation, connectivity and operational alignment, transforming the design, manufacturing and servicing of products and production systems. What will come out of all of this are connected ecosystems. We’re seeing that already. And companies that take advantage of them will gain a competitive edge.”

A seismic shift in manufacturing

The digitally enabled factory of today looks very different from the leading factory of ten years ago - while manufacturers in 2025 will look very different still. This makes digitalization a requirement and Smart Manufacturing an evolving to do list. Yet the companies that get it right can harvest the huge – scalable – benefits across the entire manufacturing value chain such as:

- Reduced material losses
- Improving customer service
- Better delivery lead times
- Higher employee satisfaction
- Lower environmental impact

Think people, not tools

- Related to his first precept that Industry 4.0 is more about value creation than technology, von Scheel says it’s also about people. “Manufacturing is the stage on which Industry 4.0 is playing out, but human beings are at the center.”

- This is not only because human beings are affected by the outcomes and outputs of Industry 4.0, but also because they're responsible for implementing and guiding the change. That requires top-down management support inside manufacturing companies and capacity-building throughout teams to effect the practical and cultural changes needed to see transformation through. Going Industry 4.0 is a strategic organizational endeavor.
- "It's people who have to manage the evolving environment through these new tools," von Scheel explains. "It's been this way ever since the first caveperson shaped a flint, only now the tools are emerging from the fusion of the digital, physical and virtual worlds into cyber-physical systems."

Know your stage, focus on your target

It would be impossible to do Industry 4.0 transformation all at once and so von Scheel strongly advocates for a strong digital agenda setting clear, achievable goals and aspiring to incremental changes. For example, he recommends concentrating on local operations before scaling globally, getting value out of on-premises infrastructure and use cases first. With that in mind, he suggests there are essentially three progressive stages of Industry 4.0 transformation, each with its own strategic driver:

STAGE 1: Digital connectivity and sensors

Your target is pursuing operation excellence

At this first stage, the opportunities are to improve productivity, quality and efficiency and better manage risk through integration and automation, IoT solutions, AI, cloud and advanced analytics.

STAGE 2: Digital engineering

Your target is improving growth

Once the foundation is laid, companies can then start looking for advantages farther afield, using Industry 4.0 technologies to enhance their product design and supply chains, develop smart products and cultivate upstream and downstream connected ecosystems. This full digital engineering process, including increasingly intelligent automation and blockchain-based smart contracts, can all come into play.

STAGE 3: Digital operations

Your target is increasing differentiation

The final stage is when you're fully digitalized and requires using Industry 4.0 capabilities to carve out greater differentiation, which von Scheel considers to be the "true competitive advantage". Differentiation isn't just about demarcating a company from rivals but can also develop whole new

markets, services and business models, which is being seen today in fields involving bioinformatics, nanotechnology and quantum technologies.

So where specifically can manufacturers focus their efforts today? Small-lot manufacturing is one area with immediate potential, according to von Scheel, with value driven by end-to-end integrated product data, digital worker enablement and data-driven overall equipment effectiveness (OEE) optimization.

Mass customization comes in here as well as a low-hanging opportunity. With the deployment of Industry 4.0 technologies, manufacturers can make gains by introducing degrees of product variance with high throughput and consistent quality. Closed control loops enabled by sensor-based, inline quality inspection and flexible routing, scheduling, load balancing and performance management all contribute to this, along with the extension of automation to final assembly.

The high-volume production piece is a third area deserving focus all on its own: fully automated production and maximized overall equipment effectiveness with flexibility to adapt to a given product mix.

Riding the waves of disruption

According to von Scheel, there will be multiple waves of disruption associated with Industry 4.0, and the world is currently in the midst of just the second one. Companies that get in on the action now will be well positioned to take advantage of the future disruptions in store to 2050 and beyond. “We’re talking about seismic changes here,” says von Scheel.

“We’re just at the start and already industry is beginning to be reshaped beyond recognition. The most important thing for any manufacturer today is just to start.”

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