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Operations Practice

The manufacturers lighting a path to sustainable growth

Amid disruption, lighthouses have unlocked hidden capacity, widened new revenue streams, and gained market share—all while engaging workers and increasing sustainability. And at surprisingly low cost.

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Digital innovation is no longer optional. Global disruptions and instabilities impose a pressing need and opportunity for quantitative and qualitative growth amid shifts in supply, demand, and customer expectations for digital-first experiences. Companies must find pathways to extend value through novel customer experiences to remain competitive; indeed, scalable technology that supports business goals is a requirement to become an industry-leading digital organization.

Lighthouses—the leading-edge manufacturing sites whose achievements have made them part of the Global Lighthouse Network—show the way, demonstrating how digitally infused operations extend beyond productivity gains to create a base for sustainable, profitable growth. By deploying Fourth Industrial Revolution (4IR) technologies at scale, lighthouses are creating new revenue streams. Their use of flexible production systems yields increased speed to market through customizable product development, which is informed by a better understanding of customer demands; meanwhile, it boosts productivity of both assets and people.

It is now clear that lighthouses are driving business-model innovation through 4IR technologies, and ushering in new levels of customer-centric value. By shifting to models that leverage greater transparency into customer needs, advanced companies are implementing new use cases, such as those enabling mass customization with unprecedented speed to market. Through these efforts, they are positioning themselves at the forefront of a competitive marketplace where customers are looking for individualized products tailored to specific preferences.

While conventional wisdom might presume this kind of transformation would come at exorbitant cost, lighthouses are showing the opposite. They are achieving growth and higher productivity rates by unlocking capacity through 4IR technologies, with little to no capital expenditure. By coupling state-of-the-art digital tools with flexible production systems, they achieve measurable growth without the costly physical-facility expansion and infrastructure investment such growth might have required in the past. Put simply, leading companies are discovering new ways to achieve growth without a larger footprint.

Accordingly, these forerunners are seeing firsthand that, far from coming at the expense of environmental responsibility, growth (including higher productivity) and eco-efficiency are intertwined. Indeed, productivity improvements drive resource-efficiency gains and are tied to environmentally conscious impact.

Implementing 4IR technologies at scale is key to long-term growth. But what is the secret to scaling? The great majority of companies remain in pilot purgatory, held back by outdated working modes or insufficient innovation.

How have lighthouses successfully scaled the Fourth Industrial Revolution? The answer is twofold: agility and workforce development.

First, these companies have fully embraced agile ways of working. This has enabled them to scale 4IR technologies quickly across their production networks and value chains. By transforming their operations to maximize flexibility and adaptability, lighthouses allow for innovative thinking and dynamic approaches. This supports close attunement to shifts in supply, demand, and customer expectations.

Second, lighthouses take a keen interest in workforce development. Training, reskilling, and upskilling—teaching new skills for future jobs—keeps their workforces prepared and optimized in a 4IR environment. Lighthouses keep people at the center of their 4IR transformations with a focus on inclusive growth, thus ensuring operators have the opportunity to realize their full potential to build the innovative, creative future at the heart of reimagined industry. This workforce engagement is essential to successful scaling, and scaling is essential for 4IR technologies to accelerate growth.

The Global Lighthouse Network comprises a steadily increasing group of leading organizations—beacons that can inspire other companies striving to deploy 4IR technologies across their entire operations. By embracing agile working modes to scale across the production network and value chains, as well as prioritizing workforce development for scaling, lighthouses demonstrate what is possible as they achieve sustainable growth. Other companies willing to make similarly bold, courageous decisions can become beacons themselves.

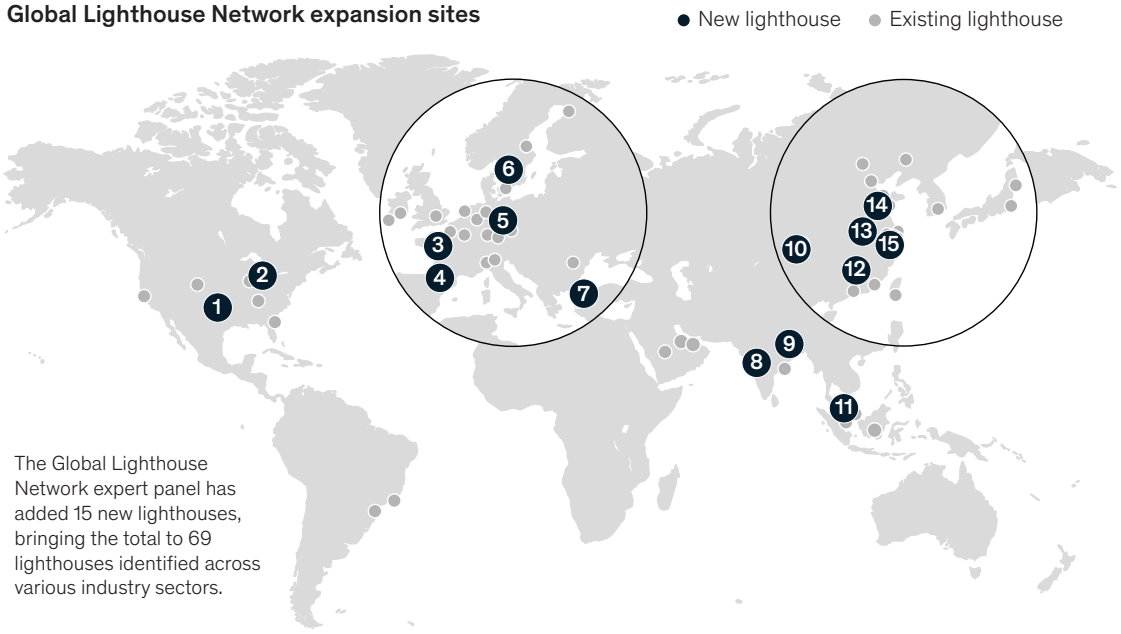
Growing the network: Welcoming 15 new lighthouses

Aiming to help close the gap between frontrunners and laggards in accelerating the widespread adoption of advanced manufacturing technologies, the World Economic Forum, in collaboration with McKinsey, launched the Global Lighthouse Network in 2018. The network comprises a community of manufacturers showing leadership in using 4IR technologies to transform factories, value chains, and business models to generate compelling financial, operational, and environmental returns. In February 2021, the Global Lighthouse Network welcomed 15 new lighthouses, bringing the total number of lighthouses to 69 across a wide range of sectors (Exhibit 1).

Exhibit 1

The Global Lighthouse Network includes 69 sites as of March 2021.

Global Lighthouse Network expansion sites



- **1** Ericsson, Electronics, United States
- **2** Procter & Gamble, Consumer goods, United States
- **3** Procter & Gamble, Consumer goods, France
- **4** Henkel, Consumer goods, Spain
- **5** Siemens, Industrial automation products, Germany
- **6** Johnson & Johnson Consumer Health, Self-care products, Sweden
- **7** STAR Refinery, Oil and gas, Turkey
- **8** ReNew Power, Renewable energy, India
- **9** Tata Steel, Steel products, India
- **10** Foxconn, Electronics, China
- **11** HP Inc., Electronics, Singapore
- **12** Midea, Home appliances, China
- **13** Wistron, Electronics, China
- **14** Tsingtao Brewery, Consumer goods, China
- **15** Bosch, Automotive, China

Note: Details of previously selected lighthouses are available in *Four Durable Shifts for a Great Reset in Manufacturing,* September 2020, World Economic Forum.
Source: Global Lighthouse Network

Lighthouses are identified through a comprehensive, independent selection process that has assessed more than 1,000 companies across the globe on the bases of objective results and use cases. Final selection is delegated to an independent panel of 4IR experts. Network members today are actively engaged on a cross-industry learning journey that finds its core value in developing and sharing insights on top use cases, road maps, and organizational approaches to deploy advanced technologies at scale, while supporting the transition to a more human-centered, inclusive, and sustainable form of manufacturing.

The scope and variety of sectors represented within the network, including among its newest members, show that the decisions, shifts, and strategies that enable companies to succeed in scaling 4IR innovations are relevant not only in traditional manufacturing but also beyond. These strategies are not sector-specific. Whether companies focus on customized consumer goods, advanced electronics, energy production, or biopharmaceuticals, they are committing to the same principles to succeed in scaling, leading to sustainable growth. Furthermore, because the network represents manufacturing locations of all sizes, from plants exceeding 10,000 employees to others with 100 or fewer, it demonstrates that the adoption of 4IR technologies is critical and achievable for manufacturers of all sizes.

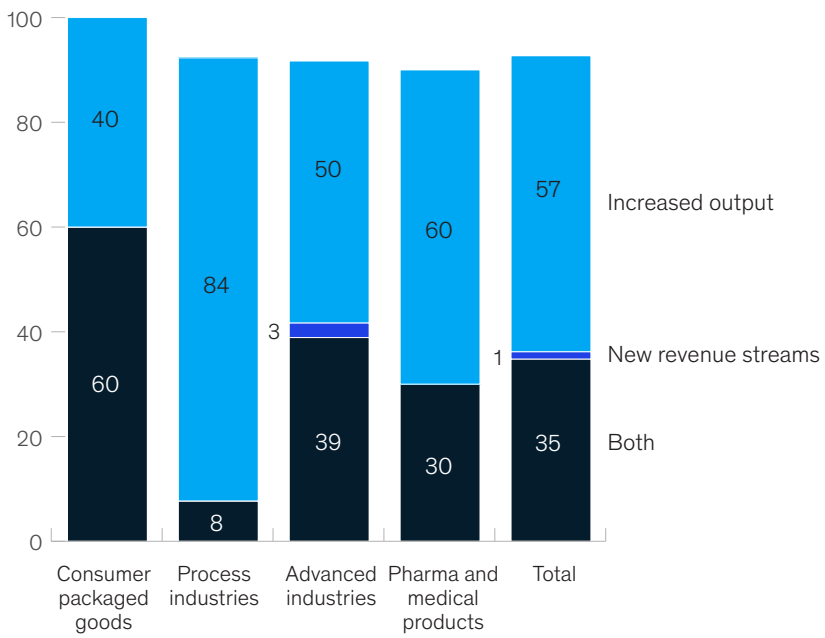
Driving growth through 4IR technologies

Lighthouses are demonstrating how digitally infused operations go beyond productivity improvements to create sustainable, profitable growth (Exhibit 2). To be sure, the productivity gains are there, resulting from digital machines and management applications driving output increases at the factory level. Looking past productivity, two ways to drive growth stand out: by engaging new business models and unlocking capacity in the people and production processes.

Exhibit 2

Lighthouses are boosting growth with little or no capital.

Lighthouses using Fourth Industrial Revolution technologies to enable growth, % of lighthouses citing growth-related KPIs



Source: Global Lighthouse Network

Engaging new business models

Through efforts that deploy 4IR technologies at scale, lighthouses are creating new revenue streams through new business models. Their flexible production systems allow customizable product development informed by a better understanding of customer demands. Put simply, these companies are more in touch with what their customers want, even as these desires change—and they have built the capability to respond rapidly and gain market share in the void left by others that cannot.

So, for example, Alibaba Xunxi (which joined the network in September 2020) pairs a sophisticated consumer-intelligence system with an array of digital tools to deliver efficient, highly customizable design and production, reducing minimum-order quantities by 98 percent compared with the industry average. Meanwhile, Johnson & Johnson Vision Care (which joined in January 2020) has created a hyperpersonalized end-to-end user experience, through mobile- and web-based platform applications that connect patients to professionals, retailers, and the manufacturer. The platform then leverages advanced analytics to customize orders, resulting in a double-digit new-customer conversion rate.

Unlocking capacity

Lighthouses are unlocking capacity to drive growth and profitability as every additional throughput accessed by 4IR technologies contributes to what can be produced and sold. These measures optimize resources and infrastructure while enabling workers to realize their potential equipped with powerful digital applications—all without massive capital investment or significant negative environmental impact.

At Novo Nordisk (which joined in September 2020), digital scheduling and work-management apps combine with production-line optimization, automated overall-equipment-effectiveness (OEE) monitoring and digital performance management to release capacity. Bosch's combination of digital shift-performance management with a digitally enabled, automatic material call-off system—along with cycle time and changeover optimization powered by machine vision—have improved worker and machine capacity while boosting quality and reducing costs. Procter & Gamble has used digital twins and advanced analytics to increase speed-to-market tenfold.

Realizing sustainable growth

Defying conventional wisdom that businesses must choose between environmental responsibility and productivity (and, by extension, profitability), leading companies are discovering that measures yielding productivity improvements actually drive resource-efficiency gains—and environmentally conscious impact.

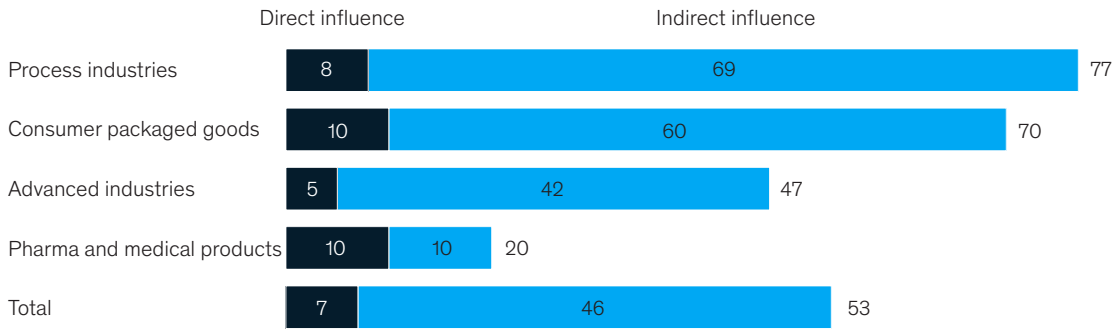
The majority of lighthouses are driving sustainability through 4IR technologies (Exhibit 3). While much of the positive sustainability impact to date has resulted indirectly from 4IR transformations aimed at different goals, companies are increasingly focused on measures that aim for it explicitly, such as carbon abatement and water-usage reduction. Digitally enabled use cases, such as process and machine optimization, predictive maintenance, and production planning, can continue to improve eco-efficiency through resource optimization. Meanwhile, emissions-reduction efforts and other green-specific measures are leading to cleaner production.

Leading companies are discovering that measures yielding productivity improvements drive resource-efficiency gains—and environmentally conscious impact.

Exhibit 3

Lighthouses are reducing resource utilization through Fourth Industrial Revolution efficiency gains.

Lighthouses citing sustainability KPIs, %



Common use cases driving sustainability improvements across various industry sectors

	Indirectly driving sustainability	Eco-efficiency shift
Process industries	Digitally enabled process and machine optimization Digitally enabled predictive maintenance Digitally enabled production planning	Stricter regulations drive investment in energy-saving and emission-reducing technologies to upgrade production lines
Consumer packaged goods	Digital quality management	More eco-conscious consumers require companies to deploy advanced analytics to maximize the yield from raw materials and minimize energy consumption
Advanced industries	Fleet performance management Digital performance management Flexible automation	Consumer perceptions regarding different kinds of mobility and electronics usage are beginning to shape how organizations prioritize investments
Pharma and medical products	Smart asset optimization	Mindset to exceed regulatory requirements drives the need to minimize energy consumption by digitally connecting and optimizing assets and facilities

Implications toward increased sustainability

- Certain industry sectors, like process industries, have already done much to increase their operations' overall sustainability. This is due to the fact that many of their Fourth Industrial Revolution implementations focus on process improvements normally aimed at enhancing yield, energy, and throughput.
- Improving quality management in consumer packaged goods companies helps to reduce waste and therefore the overall environmental footprint.
- Various fleet-performance- and direct-production-related measures have been shown to reduce resource usage by generally increasing efficiency.

Source: Global Lighthouse Network

Achieving long-term growth through 4IR at scale

The growth that lighthouses have achieved—both before and since the pandemic took hold—makes clear that integrating 4IR innovations at scale is central to long-term growth. In particular, some of the success stories are scaling not only across the entire production network but also through the entire value chain. They stand in sharp contrast to the majority of organizations: in a late 2020 McKinsey survey, about 74 percent of global manufacturers reported being stuck in pilot purgatory, compared with 56 percent in 2019.

The truth is, what it means to scale has "re-baselined" and proven to be more difficult than initially thought. Market disruptions and upheavals have pressure tested industrials' investments, leading to a new realization that many companies had not scaled as much as they thought.

So how have the leaders in that thriving 26 percent scaled successfully, despite disruption? The secret lies with two key elements: agility and workforce development.

Agile ways of working are at the heart of successful scaling. In order for 4IR advances to reach their potential across the production network and value chains, companies must build on agile principles to innovate and transform in an iterative manner. This means they can collaborate and manage change continuously—enabling them to anticipate technical limitations and move quickly to surpass them. Lighthouses are able to iterate quickly, fail fast, and learn continuously. This plays out in the creation of minimum viable products in two-week sprints. Likewise, it allows for bundled use cases that facilitate rapid transformations in several waves of a few months each. This agile mode is a radical departure from older models involving yearlong pilots aspiring for perfection, with continued technological innovation rendering the completed pilots irrelevant by the time they are finished.

Taking a keen interest in workforce development

Of course, agile ways of working reach their full potential only with a skilled, 4IR-ready workforce. The adoption of 4IR technologies has introduced many changes to the tasks workers undertake, and companies do well when they understand the importance of keeping human workers at the center of their transformations. Strategies like tiered pathways for upskilling ensure workers remain connected, integrated, and directly involved in transformations—moreover, they equip workers with the expertise needed to contribute to future innovation.

Workers are also a critical focus: lighthouse organizations place a high premium on workforce development because they know it is vital to engaging agile working modes and maximizing the power of digital transformation. Training, reskilling, and upskilling keep their workforces prepared and optimized in a 4IR environment. By keeping people at the center of their 4IR transformations with a focus on inclusive growth, they enable people at every level of the company to take part in building the innovative, creative future at the heart of the 4IR's reimagined industry. Scaling is a team effort, and people are the team.

At Siemens in Amberg, Germany, a robotics-enabled logistics execution has improved labor efficiency, while digital engineering rationalized efforts and artificial-intelligence-powered process controls boosted work in progress. A predictive maintenance system improved OEE, and an analytics platform for remote-quality optimization raised process quality. And HP Inc. in Singapore, facing increased product complexity and labor shortages—and resulting quality and cost challenges—sought to shift from labor-intensive, reactive, manual work to highly digitized, automated work. This reduced its manufacturing costs while boosting both productivity and quality.

Embracing agility to scale 4IR solutions across production networks and value chains

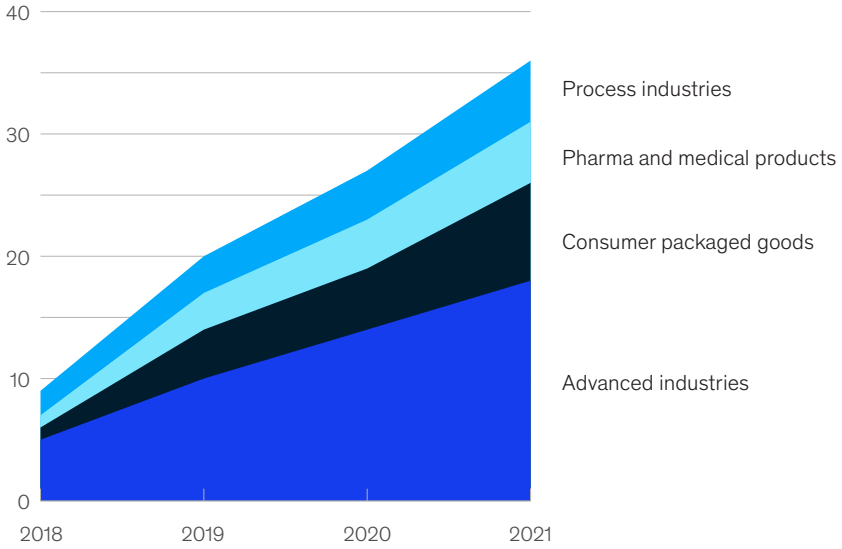
By fully embracing agile working modes, leading companies have been able to unlock new levels of growth and sustainability as they scale 4IR solutions quickly across their production networks and value chains (Exhibit 4). Lighthouses have made room for innovative thinking and dynamic approaches by prioritizing flexibility and adaptability in their operations. As a result, they are able to remain closely attuned to shifts in supply, demand, and customer expectations.

This growth is extending beyond individual sites across the production network and value chains. There is evidence of such growth in the more than fourfold increase in lighthouse sites from companies in advanced industries, consumer packaged goods, pharmaceuticals and medical products, and process industries, increasing from just nine in 2018 to 36 in 2021. These firms are reimagining themselves—and, by extension, their industries—across production networks and supply chains.

Exhibit 4

Lighthouses embrace agile ways of working.

Lighthouses associated with a company that boasts more than two sites in the Global Lighthouse Network,
number (cumulative)



Main ways companies are reimagining themselves across production networks and supply chains	Benefits derived
Transparency of capabilities, capacity across the network, and dynamic network-scenario planning improve companies' ability to …	… prepare for demand and product-mix shifts driven by rapidly changing customer preferences (eg, new product categories, far-reaching customization) … respond to supply-chain disruptions, unplanned events (eg, plant closures, distribution-channel disruptions, supply issues)
Better transparency and traceability across the network (eg, by leveraging common data models across the value chain) allows the company to …	… manage production and supply chain to achieve sustainability commitments … give consumers visibility on product origin, composition, CO_2 footprint, etc, thereby aiding conscious buying decisions
Scaling digital solutions and capabilities rapidly across sites enables companies that usually have dispersed manufacturing networks to implement technologies that would not have a positive return on the single-site level, and …	… enables faster opening of production bottlenecks across the network (eg, to address shifts in demand) … captures further productivity gains at individual sites

Source: Global Lighthouse Network

By developing transparency of capabilities and capacity across the network, along with dynamic network scenario planning, leading organizations are able to prepare for shifts in demand driven by rapidly changing customer preferences. They can introduce new product categories and achieve high levels of customization. Likewise, this equips them to respond to unexpected disruptions related to supply issues, distribution channels, or facility closures. Agility is a hallmark across the organization—it permits speed and flexibility without loss of quality.

Lighthouses are also prioritizing better transparency and traceability across the network. By leveraging common data models across the value chain, they are able to manage production and supply chains to meet their sustainability commitments while giving consumers insights into product origins, composition, and CO_2 footprint. These enable customers to make conscious buying decisions.

Finally, by scaling digital solutions and capabilities rapidly across their sites, companies with dispersed manufacturing networks can implement technologies that would not show positive returns at any single site. This also permits unlocking production bottlenecks across the network faster and increasing productivity at individual sites. These companies empower themselves through the smart and coordinated dispersal of 4IR technology and working modes—thus each site's strength and agility is effectively enhanced by the strength and agility of the others.

Organizations aiming for this level of successful 4IR deployment at scale are aspiring to transform themselves completely at the broad company level and, as such, to be the true leaders in a reimagined future of advanced industry. These lighthouses will be the brightest beacons of all, showing the way for others in a redefined manufacturing landscape in which people and processes realize their full potential through the power of 4IR engagement.

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