

In collaboration with
McKinsey & Company



The Global Lighthouse Network Playbook for Responsible Industry Transformation

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Preface



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In the current geopolitical context, local manufacturing and supply chain resilience are becoming increasingly important. At the same time, organizations face new obstacles as they strive to engage their workforce and sustain operations amid international unrest and economic headwinds. Furthermore, there are new pressures related to the need to maintain sustainability commitments and accelerate the transition to renewable energy, while addressing more immediate energy market disruptions. These concurrent challenges call for innovation, leadership and inspiration – indeed, manufacturers need a playbook to guide responsible industry transformation now more than ever.

The Global Lighthouse Network includes 103 members from across the planet, including manufacturers and other organizations along the value chain. From the initial idea four years ago – that embracing digital technologies and new working modes would enable an evolution in manufacturing – to where we are today, the network has made a compelling case for the power of Fourth Industrial Revolution technology to boost productivity, growth and sustainability.

As remarkable as the initial value proposition was, little did we know then just how soon this information would become vital. As world events upended conventional methods and pushed supply chains to the brink, the lessons of what we can confidently now call the Lighthouse Playbook became even more relevant. Core enablers – innovative approaches driving successful Fourth Industrial Revolution transformation – have proved crucial as companies have endured unprecedented strains.

Those strains have radically changed everyday experiences, including how people work. As companies have grappled with remote work, distancing and attrition, they have also been affected by the social and emotional toll of such stressors. Lighthouses have addressed these difficulties by fostering community through a shared sense of purpose. They have invested in their people through learning and development, building a culture of empowerment and ownership among people who believe in what they are doing. In so doing, they have prioritized genuine workforce development – a true source of resiliency and a strategic advantage.

Exacerbating the complexity of the past two years is the fact that the pandemic emerged amid the ongoing climate crisis. Yet, even while confronting so many other trials, leading companies have responded, stepping forward to set new benchmarks and put innovation to work in the name of environmental sustainability. Defying the conventional wisdom that good stewardship of the planet and profitability are at odds with one another, they have shown how responsible changes can boost eco-efficiency, yielding sustainability benefits while achieving business goals – and even realizing competitive advantages.

As the world grapples with many challenges, Lighthouses continue to illuminate the way forward into a future of responsible manufacturing. Read on to explore this newest set of insights from the Global Lighthouse Network, the Lighthouse Playbook. This new guide presents the insights of 103 leaders about responsible transformation at scale through workforce engagement and environmental sustainability measures – that is, transformation that prioritizes people and the planet.

Executive summary

The Global Lighthouse Network, which has grown from 16 to 103 sites since 2018, offers insight, guidance and inspiration for a world facing numerous challenges, including recent geopolitical turmoil. Since its inception, the experience of this diverse network has shown what is possible through digital transformation at scale. The accumulation of this knowledge informs this Lighthouse Playbook, a guide for organizations that wish to be part of the future of manufacturing through responsible production that prioritizes productivity, sustainability and people.

New Lighthouses have confirmed the lessons of early sites while offering more detail about what works; and this confirmation grows stronger as the network diversifies while proving value capture across key performance indicators. Meanwhile, the new designation of “Sustainability Lighthouse” has been conferred upon leaders in environmental responsibility.

The lessons of the Lighthouse Playbook were already emerging before the pandemic. The first is that two modes of successful scaling exist across production sites and along value chains. The second is that six enablers lie at the core (this report takes a closer look at two of them, the agile approach and the transformation office). Lighthouses have a proven set of commonalities manufacturers can look to; indeed, the trends of Lighthouses today will become the standards of tomorrow.

Pandemic challenges and climate imperatives have boosted environmental, social and governance (ESG) concerns, putting a focus on environmental sustainability and workforce engagement. Pragmatic efforts can reduce energy consumption, water impact, carbon emissions and waste generation. Lighthouses defy conventional wisdom, showing that sustainability and competitiveness can be interwoven.

Genuine workforce engagement emerges when companies create communities of committed people who believe in what they are doing. Lighthouses foster this through the pursuit of learning and development, building a culture of empowerment and ownership, emphasizing collaboration and connections, recognizing and celebrating the impact of people and products, and prioritizing workers’ voices. Fourth Industrial Revolution technologies have accelerated this engagement in various ways, such as by reducing repetitive tasks and involving workers in higher-level tasks, including creative problem-solving.

The Lighthouse Playbook calls for responsible scaling that prioritizes the planet and people. This dual challenge means aiming at genuine workforce engagement while focusing on environmental stewardship. Companies who wish to join the front-runners are called on to embark on this transformational journey into the sustainable future of manufacturing.

1

103 Fourth Industrial Revolution front-runners are showing what is possible

The World Economic Forum, in collaboration with McKinsey & Company, acted in 2018 to recognize, encourage and accelerate the at-scale digital transformation of manufacturing through the Global Lighthouse Network. This initiative explored how exceptional companies were demonstrating operational and financial impact through digital transformation at scale. Meanwhile,

it sought to build a collaborative network willing to share insights to benefit industry, people and the Earth itself. An additional aim was to explore how manufacturers could keep people at the centre of a better future for workers. Likewise, it embraced the recognition that on a planet confronting climate change, achieving digital transformation at scale would be the key to sustainability.



1.1 A growing network focused on the future

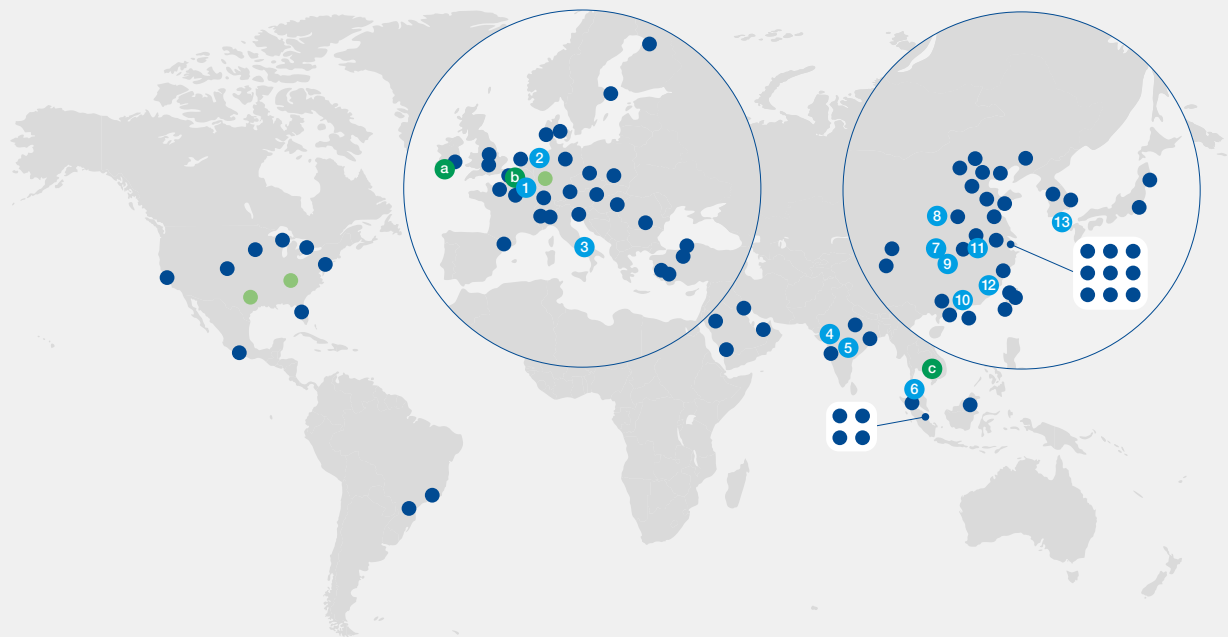
As the Global Lighthouse Network has grown to 103 members from just 16 sites in 2018, resilience, sustainability and workforce engagement have emerged as top priorities. New sites have confirmed the lessons of the early Lighthouses while offering even more granular detail through many more use cases. Lighthouses are harnessing Fourth Industrial Revolution technologies to accelerate scaling through enablers, such as agility and strong transformation governance while ensuring environmental sustainability and boosting workforce engagement.

Sustainability Lighthouses

The new designation of “Sustainability Lighthouses” was introduced in September 2021 to recognize environmental responsibility leaders. They have achieved impressive eco-efficiency: their operations are yielding sustainability returns that are good for the planet while also achieving business goals. This brings the total number of designations to six.

FIGURE 1 The Global Lighthouse Network comprises 103 Lighthouses as of March 30, 2022

Since the Lighthouse Network was presented in the *Reimagining Operations for Growth* white paper, it has grown by **13 new and 3 sustainability awarded Lighthouses**. These have been added by the network’s expert panel, bringing the total to **103 Lighthouses** identified across different industry sectors. All these have joined a unique, collaborative learning journey across organizations to share insights and experiences while incubating potential new partnerships. This white paper explores the latest achievements of the network, with a focus on sustainability.



● New Sustainability Lighthouses
 ● Existing Sustainability Lighthouses
 ● New Lighthouse
 ● Existing Lighthouse

a Johnson & Johnson Janssen Cork, IE	2 Teva Pharmaceuticals Amsterdam, NL	6 Johnson & Johnson Consumer Health , Bangkok, TH	10 Procter & Gamble Guangzhou, CN
b Schneider Electric Le Vaudreuil, FR	3 Johnson & Johnson Janssen Latina, IT	7 Midea Jingzhou, CN	11 Midea Hefei, CN
c Western Digital Penang, MY	4 Unilever Dapada, IN	8 Haier Zhengzhou, CN	12 BOE Technology Group Fuzhou, CN
1 Sanofi Paris, FR	5 Schneider Electric Hyderabad, IN	9 Bosch Automotive Changsha, CN	13 LG Electronics Changwon, KR

Note: The network’s last white paper, *Global Lighthouse Network: Unlocking Sustainability through Fourth Industrial Revolution Technologies* (September 2021), provides details of previously selected Lighthouses

Source: World Economic Forum Global Lighthouse Network, 2022



1.2 Increasing network diversity and proven value capture

Part of what makes the Global Lighthouse Network unique is that it is not centred on any one type of manufacturing. Rather, the shared knowledge and experiences play out in the manufacture of diverse products ranging from the cutting-edge microchips

powering digital devices to the cars people drive and the batteries and fuels powering them to the pharmaceuticals that help keep people healthy and the detergent used for washing clothes.

FIGURE 2 The Global Lighthouse Network is growing in size and diversity across all industry sectors



Consumer packaged goods

Alibaba
Apparel, CN

Henkel
Consumer goods, MX

Procter & Gamble
Consumer goods, CZ

Tsingtao Brewery Co
Consumer goods, CN

Unilever
Consumer goods, IN

Henkel
Consumer goods, DE

Procter & Gamble
Consumer goods, CN

Procter & Gamble
Consumer goods, FR

Unilever
Consumer goods, CN

Unilever
Consumer goods, UAE

Henkel
Consumer goods, ES

Procter & Gamble
Consumer goods, CN

Procter & Gamble
Consumer goods, US

Unilever
Consumer goods, CN



Process industries

Baoshan Iron & Steel
Steel products, CN

Petkim
Chemicals, TR

Renew Power
Renewable energy, IN

Saudi Aramco
Oil and gas, SA

Tata Steel
Steel products, IN

DCP Midstream
Oil and gas, US

Petrosea
Mining, ID

Saudi Aramco
Oil and gas, SA

STAR refinery
Oil and gas, TR

Tata Steel
Steel products, NL

MODEC
Oil and gas, BR

POSCO
Steel products, KR

Saudi Aramco
Oil and gas, SA

Tata Steel
Steel products, IN

FIGURE 2 | The Global Lighthouse Network is growing in size and diversity across all industry sectors (continued)



Advanced industries

AGCO Agricultural equipment, DE	De'Longhi Home appliances, IT	Groupe Renault Automotive, FR	Micron Semiconductors, TW, CN	Schneider Electric Electrical components, CN
Arçelik Home appliances, TR	Ericsson Electronics, US	Haier Appliances, CN	Midea Home appliances, CN	Schneider Electric Electrical components, FR
Arçelik Home appliances, RO	Fast Radius with UPS Additive manufacturing, US	Haier Home appliances, CN	Midea Home appliances, CN	Schneider Electric Electrical components, ID
AUO Optoelectronics, TW, CN	Flex Electronics, AT	Haier Home appliances, CN	Midea Home appliances, CN	Schneider Electric Electrical components, IN
BOE Technology Group Optoelectronics, CN	Ford Otosan Automotive, TR	Haier Home appliances, CN	Midea Home appliances, CN	Schneider Electric Electrical components, US
BMW Group Automotive, DE	Foton Cummins Automotive, CN	Hitachi Industrial equipment, JP	Nokia Electronics, FI	Siemens Industrial automation products, CN
Bosch Automotive Automotive, CN	Foxconn Electronics, CN	HP Inc. Electronics, SG	Phoenix Contact Industrial automation, DE	Siemens Industrial automation products, DE
Bosch Automotive Automotive, CN	Foxconn Electronics, CN	Infineon Semiconductors, SG	Protolabs Additive manufacturing, US	Weichai Industrial machinery, CN
Bosch Automotive Automotive, CN	Foxconn Electronics, CN	Innolux Optoelectronics, TW, CN	Rold Electrical components, IT	Western Digital Electronics, MY
CITIC Dicastal Automotive, CN	Foxconn Industrial Internet Electronics, CN	LG Electronics Electronics, KR	SAIC Maxus Automotive, CN	Western Digital Electronics, TH
Contemporary Amperex Technology Electronics, CN	Groupe Renault Automotive, BR	LS ELECTRIC Electrical components, KR	Sandvik Coromant Industrial tools, SE	Wistron Electronics, CN
Danfoss Industrial equipment, CN	Groupe Renault Automotive, FR	Micron Semiconductors, SG	Sany Industrial equipment, CN	



Pharmaceuticals and medical products

Bayer Division pharmaceuticals, IT	Johnson & Johnson Janssen Pharmaceuticals, IE	Johnson & Johnson DePuy Synthes Medical devices, CN	Johnson & Johnson Vision Care Medical devices, UK	Teva Pharmaceuticals Pharmaceuticals, NL
GE Healthcare Medical devices, JP	Johnson & Johnson Consumer Health Self-care products, SE	Johnson & Johnson DePuy Synthes Medical devices, IE	Johnson & Johnson Vision Care Medical devices, US	Zymergen Biotechnology, US
GSK Pharmaceuticals, UK	Johnson & Johnson Consumer Health Self-care products, TH	Johnson & Johnson DePuy Synthes Medical devices, US	Novo Nordisk Pharmaceuticals, DK	
Johnson & Johnson Janssen Pharmaceuticals, IT			Sanofi Pharmaceuticals, FR	

Source: World Economic Forum Global Lighthouse Network, 2022

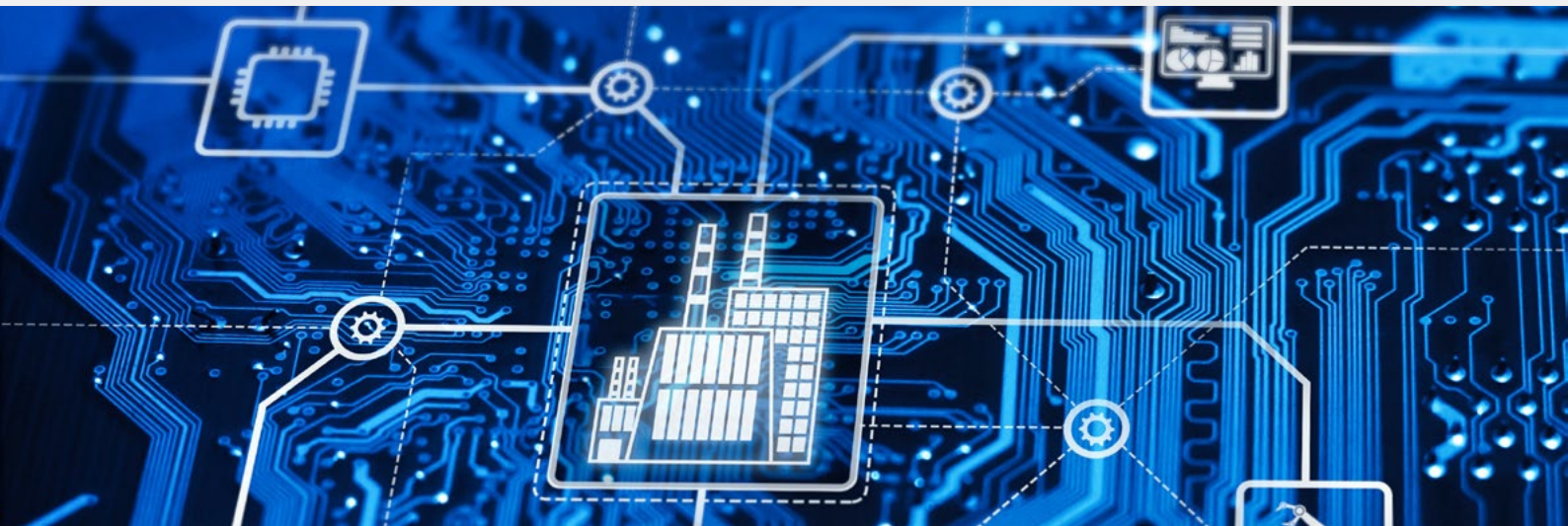


FIGURE 3 | The Lighthouses show a variety of new use cases

Site	Change story	Top 5 use cases	Impact
Asia			
LG Electronics Changwon, Korea	Facing the growth of its product portfolio complexity by 70%, rising quality expectations from customers and labour shortages, LGE re-designed an old factory in Changwon into a digital Lighthouse plant leveraging flexible automation, digital performance management and AI to improve productivity by 17% and field quality by 70% while reducing inventory by 30% and energy consumption by 30%.	Digitally-enabled end-to-end material transport system	▼ 42% Logistics labour cost
		Digital twin of material transport system	▼ 96% Line downtime
		Digitally-enabled flexible manufacturing	▲ 17% Overall plant productivity
		Predictive maintenance aggregating data based on historical and sensor data	▼ 50% Equipment downtime
		Democratization of quality inspection automation through AI platform	▼ 96% False detection rate
Unilever Dapada, India	Driven by the need to accelerate the pace of innovation and speed of response to consumer demand while augmenting cost competitive in an increasingly challenging market and acting on sustainability goals, Unilever Dapada deployed digital, automation and AI machine learning across its end-to-end value chain to shorten product development lead time by 50%, and to reduce manufacturing costs by 39% and energy use by 31%.	Consumer-centric Agile innovation using Digital Voice of the Consumer	▼ 50% Product development lead time
		Predictive analytics to eliminate chronic quality defects in product formulation changes	▼ 78% Manufacturing defects
		Machine-learning-enabled demand planning and customer replenishment	▼ 50% Lead time to retailers
		Digitally-enabled man-machine matching and AI-enabled skill building	▲ 39% Productivity increase
		AI-guided machine performance optimization	▲ 10% OEE
Midea Jingzhou, China	Due to consumer expectations with higher product complexity, Midea Jingzhou, as a 30-year-old factory, adopted flexible automation, IoT and AI at scale to transform their manufacturing system, increase labour productivity by 52%, reduce production lead time by 25% and eliminate 20% utility consumption per unit.	Lights-out injection moulding plant enabled by AI	▲ 20% Injection workshop OEE
		Production planning optimized by advanced analytics	▼ 25% Production lead time
		Digitally-enabled flexible manufacturing	▼ 99.9% Changeover time
		AI-powered process control	▼ 76% Defect rate foaming
		Smart workforce upskilling tool	▲ 30% Labour productivity
Schneider Electric Hyderabad, India	Facing changing customer demands and 54% business growth, Schneider Electric implemented Fourth Industrial Revolution technologies such as IIoT Infrastructure, predictive/prescriptive analytics and AI deep learning. This resulted in a reduction of field failure by 48% and lead time by 67%, while manufacturing efficiency improved by 9%.	End-to-end real-time supply chain visibility platform and control tower	▲ 33% Reliability on delivery on time
		End-to-end critical process monitoring and digital process capability measurement	▼ 68% Supplier issues occurrence
		Production planning and capacity management optimized by advanced analytics	▼ 67% Lead time
		AI-powered optical inspection	▼ 18% Field failure rate
		Digital manufacturing performance management	▼ 6% Energy consumption
Bosch Automotive Changsha, China	Facing a 20% labour wage increase, a YoY 10%+ price reduction request from customers and a high fluctuation in customer orders, Bosch Automotive Changsha implemented 45 Fourth Industrial Revolution use cases with automation and AI to increase competitiveness, maintaining their market position with 100% new energy vehicle (NEV) customer portfolio penetration and reaching carbon neutral.	Integrated end-to-end physical logistics platform	▼ 36% Production lead time
		Algorithm-based consumable lifetime extension	▼ 50% Changeover time
		Predictive maintenance aggregating data based on historical and sensor data	▼ 25% Maintenance cost
		Transparent shop floor management	▲ 20% Labour productivity
		AI-enabled production energy management	▼ 18% Electricity consumption
Johnson & Johnson Consumer Health Bangkok, Thailand	Facing agility, profitability and cost-to-serve challenges, Johnson & Johnson's Bangkok site adopted Fourth Industrial Revolution technology such as a collaborative supply chain control tower, computational fluid dynamics, AI energy optimization and advanced data analytics on logistics. The value chain delivered 47% revenue growth with a 25% inventory reduction and reduced 43% end-to-end supply chain lead time, improved productivity by 42% and resulted in 20% carbon footprint optimization.	Digital twin for speed to market and productivity improvement	▼ 83% Speed to market
		IoT-based advanced analytics energy management system	▼ 23% Electricity consumption
		AI-powered optical inspection	▼ 66% Lead time
		End-to-end real-time supply chain visibility platform	▼ 25% Inventory reduction
		Cloud-based data analytics and robotic process automation to optimize container booking and loading	▼ 22% Logistics cost
BOE Technology Group Fuzhou, China	To pursue premium product market share with high quality expectation, BOE Fuzhou has widely adopted AI and advanced analytics in their fully automated production system to achieve best-in-class quality excellence, equipment efficiency and energy sustainability with a new product yield ramp-up period shortened by 43%, cost per unit decreased by 34% and output increased by 30% without major capex investment.	AI-enabled close loop quality	▼ 75% Defect rate
		Repair process automation	▼ 20% Inspection direct labour
		Digital dashboards to monitor OEE performance	▲ 66% OEE
		Dynamic scheduling with auto dispatching	▼ 11% Cycle time
		AI-enabled energy management	▼ 38% Utility consumption

FIGURE 3 | The Lighthouses show a variety of new use cases (continued)

Site	Change story	Top 5 use cases	Impact
Asia continued			
Procter & Gamble Guangzhou, China	In order to meet 45% increased e-commerce demands, P&G Guangzhou leveraged AI, flexible automation and digital twins to integrate multi systems across the value chain to serve omni-channel consumers. This increased the responsiveness of their supply chain with a 30% reduction in inventory, 15% reduction in logistics cost and 99.9% on time delivery within 3 years.	Digital integrated business planning	▼ 30% Inventory level
		Dynamic delivery optimization	▼ 15% Logistics cost
		Dynamic delivery optimization	▼ 90% Lead time
		Digital twin orchestrated warehouse operations	▲ 25% Warehouse throughput
		Automated change over optimization in one click	▲ 6% Warehouse throughput
Midea Hefei, China	Targeting domestic high-end product segments and overseas market expansion, Midea Hefei Laundry widely deployed AI and IoT technologies across end-to-end value chains to form a faster response and higher efficiency supply chain, resulted in lead time reduction of 56%, a customer report defect rate reduction of 36% and labour productivity improvement a 45%.	End-to-end real-time supply chain visibility platform	▼ 56% Delivery lead time
		Blockchain-enabled logistics execution	▼ 30% Warehouse labour
		Digital tools to enhance a connected workforce	▼ 45% Assembly failure rate
		AI-powered noise inspection	▼ 36% Defect rate
		Connected devices to track and measure product performance	▼ 67% Service lead time
Haier Zhengzhou, China	Facing a booming water heater market and the increasing requirement of high-end product and service, Haier Zhengzhou, as a newly built plant, leveraged big data, 5G and edge computing and ultra-wideband solutions to build close connections with the suppliers, plant and customers, which sped up order response lead time by 25%, increased production efficiency by 31% and improved quality performance by 26% between 2020, when it started, and 2021.	Digital supplier performance management	▼ 23% Raw material delivery lead time
		Real-time asset performance monitoring and visualization	▲ 17% Productivity
		AI-powered optical inspection	▲ 24% Assembly efficiency
		Intelligent test communication platform	▲ 22% Test efficiency
		Connected devices to track and measure product performance	▼ 14% End customer energy usage
Europe			
Johnson & Johnson Janssen Latina, Italy	Janssen Latina deployed Fourth Industrial Revolution solutions that deliver faster, competitive and Agile launches of new products and quality release to reduce non-conformance by 30% and increase product release lead time optimization by 84% while reducing energy costs by 10% and logistics labour costs by 72%.	Digitally-enabled flexible manufacturing	▼ 60% Process time
		Digitally-enabled batch release	▼ 84% Quality control lead time
		Value chain digital twin	▼ 13% Lead time
		Robotics-enabled logistics execution	▼ 72% Logistic labour cost
		Energy optimization by Analytics as a Service	▼ 15.5% GHG emissions
Sanofi Paris, France	With the ambition to accelerate saving generation, two years ago Sanofi embarked on a digital and analytics transformation of its procurement operations. To date, it has built and deployed six products: a data platform, should-cost modeling and input cost monitoring, smart tender analytics and a supplier performance tracker and cockpit, which have delivered 10% savings on addressed spend and transformed the way the company works.	Should-cost modelling for "make vs buy" decisions	▼ 10% Category spend
		Analytics platform for tenders	▼ 67% Leadtime for tender
		Digital supplier performance management	▼ 100% Reporting time
		Digitally-enabled negotiations through an electronic auction	▲ 281% E-auction savings delivered
		Global spend data lake	▼ 13% Labour required
Teva Pharmaceuticals Amsterdam, Netherlands	Global Procurement is the main contributor to TEVA's ambitious gross margin improvement programme and contributes to the free cash flow target, with the aim of delivering 3x historical cost of goods sold (COGS) savings by the end of 2024. To achieve this, Global Procurement implemented Fourth Industrial Revolution technologies within 1.5 years, increased labour efficiency by 30%, upskilled its workforce and optimized cross-functional processes to break down silos. It is leading the way for the Fourth Industrial Revolution at Teva.	Global spend data lake	▲ 47% External spend transparency
		Should-cost modelling to support "make versus buy" decisions	▲ 51 mUSD Category savings
		Analytics-driven procurement supported by spend intelligence and an automated spend cube	▲ 1,583% Supply resilience – material changes planned
		Digitally-enabled negotiations	▲ 400% Negotiations conducted for API ¹
		Smart spend category creation	▼ 90% Time needed for category strategy

¹ Active pharmaceutical ingredient

FIGURE 4 | Sustainability Lighthouses show Fourth Industrial Revolution- enabled sustainability impact

Site	Change story	Top 2 use cases	Impact
Western Digital Penang, Malaysia	Western Digital achieved a reduction in energy of 41%, in water consumption of 45% and in material waste of 16% through a vertically integrated smart factory. Fourth Industrial Revolution technologies, such as IIoT sensors, digital twin modeling, an analytics-powered plant management system and lights-out automation with machine learning increased their sustainability impacts, while the site has grown at a 43% compound annual growth rate (CAGR) in the last four years. This concerted effort enabled the Malaysia Green Building Index certification for the site.	Smart energy usage optimization via real-time IIoT applications	▼ 39.9% GHG (Scope 2)
		Lights-out automation with digital twin capacity optimization for sustainability	▼ 45.6% Energy usage in production assembly
Johnson & Johnson Janssen Cork, Ireland	Janssen Sciences Ireland has been long supporting regional initiatives for sustainability improvement and is now enabling the corporate 2030 pledge of carbon neutrality. Through Fourth Industrial Revolution-enabled real-time release, adaptive process control and other sustainability efforts, the site has optimized its processes and reduced carbon emissions per kg of product by 56%, while the site footprint was expanded by 34% to meet the growing business needs.	Digital twin of sustainability	▼ 32% CO ₂ avoidance
		IIoT real-time sensor-based data aggregation for energy, emissions, waste and water management	▼ 43% Material waste
Schneider Electric Le Vaudreuil, France	Schneider Electric Le Vaudreuil has implemented Industrial IIoT sensors connected to digital platforms, unlocking data to optimize energy management (25%), reduce material waste (17%) and minimize CO ₂ emissions (25%) with the objective to be net zero by 2025 without offset and ahead of the global Schneider Electric pledge. The smart factory is equipped with a zero-reject water recycling station connected to cloud analytics and monitored by an AI model to predict process drifts and to globally achieve 64% water reduction.	Sustainability optimization powered by advanced digital solutions	▼ 27% Energy used for compressed air
		AI-powered process control	▼ 22% Sludge waste

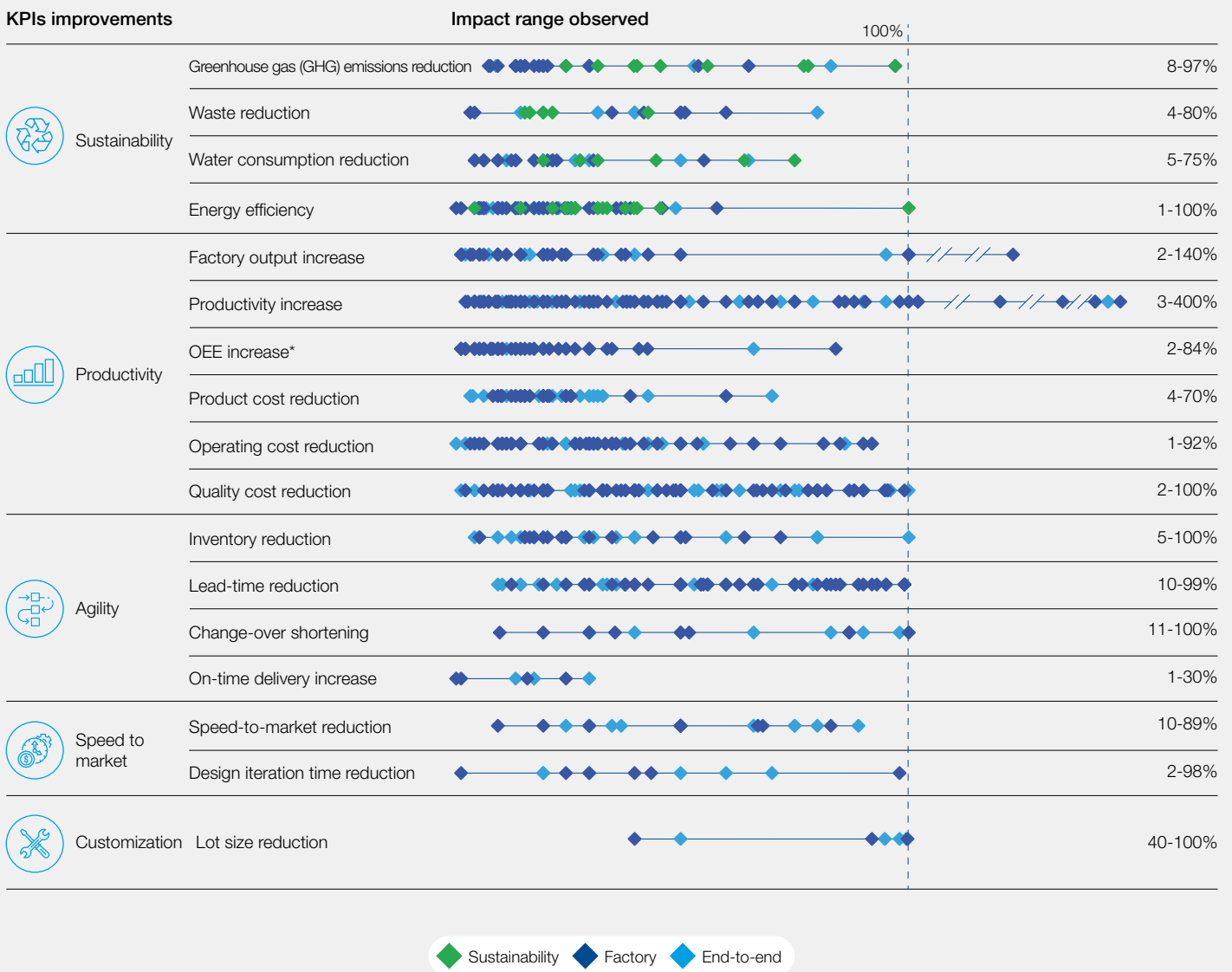


Proven value capture

The diverse network now makes an even more compelling case for how successful Fourth Industrial Revolution transformation creates and captures value across a holistic set of key performance indicators (KPIs) covering sustainability, productivity, agility, speed to market and customization. Lighthouses are proving that their digital journeys bring unprecedented efficiency and effectiveness.

These sites and value chains are experiencing improvements in resource usage, emissions, cost reduction, productivity, speed to market, lot size reduction and on-time delivery, just to name a few. And, as the September 2021 impact paper¹ reveals, the resulting eco-efficiency couples environmental responsibility with the achievement of business goals.

FIGURE 5 Lighthouses' digital journey reveals impact across operational performance indicators and environmental sustainability



*Overall equipment effectiveness

Note: The dots represent the impact level of a given lighthouse against a specific KPI

Source: World Economic Forum Global Lighthouse Network 2022

2

Proven approaches have endured powerful storms

The lessons leading to this Lighthouse Playbook were already materializing before the pandemic. First, two modes of scaling emerged – across production sites vs. along value chains – together with a comprehensive set of KPIs measuring impact. Second, Lighthouses revealed six core enablers as key to successful Fourth Industrial Revolution transformation: an agile approach, agile digital studio, industrial internet of things (IIoT) stack, IIoT academy, technology ecosystem and transformation office.

Despite the disruptive changes since COVID-19 emerged – and perhaps even more so *because* of it – these elements have continued to prove essential. The growing network has reconfirmed these initial insights while detailing how they contribute to business impact and responsible, sustainable growth. Two of the six core enablers – an agile approach and a transformation office – have proven particularly effective.

FIGURE 6 The Lighthouses revealed six core enablers as key to a successful Fourth Industrial Revolution transformation

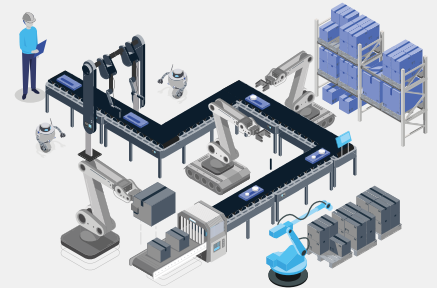
Agile approach



Agile digital studio



IIoT stack



IIoT academy



Technology ecosystem



Transformation office



Source: World Economic Forum Global Lighthouse Network, 2022

Lighthouses help companies set a smart course

When it comes to Fourth Industrial Revolution transformation at scale, there is no silver bullet; no universal prescription; no one absolutely correct course. But Lighthouses have a proven set of commonalities manufacturers can look to as they chart their courses; indeed, the trends

of Lighthouses today will become the standards of tomorrow. They excel at illuminating the path ahead, offering a unique playbook for the future of scaling through responsible production, prioritizing productivity, sustainability and people.

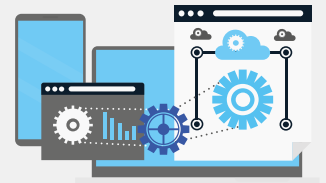
FIGURE 7 The trends of today are the standards of tomorrow

Number of lighthouses in the Global Lighthouse Network by industry and region

Pharma and medical products



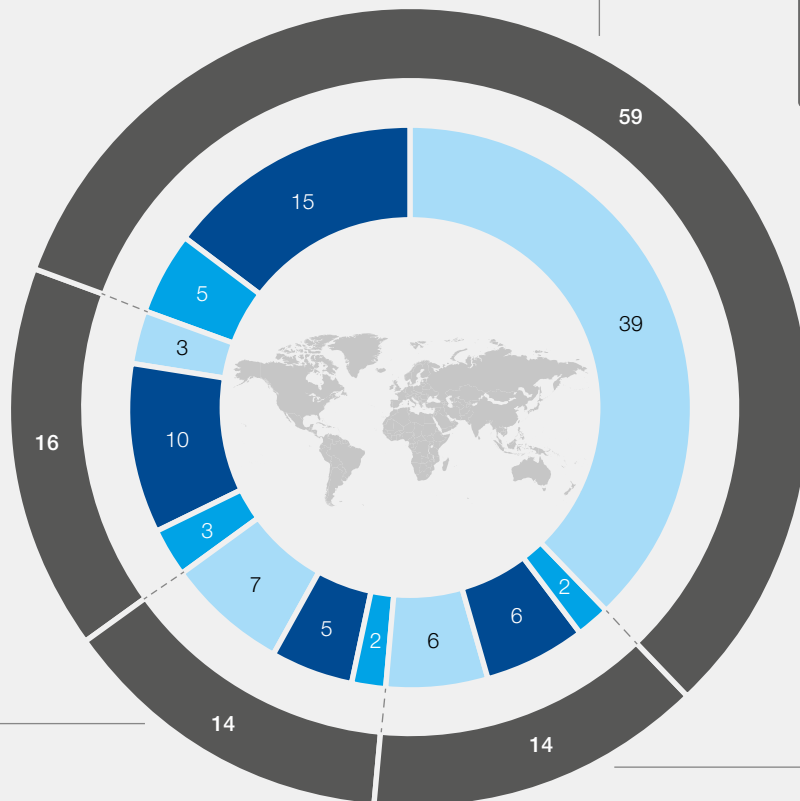
Advanced industries



Consumer packaged goods



Process industries



Source: World Economic Forum Global Lighthouse Network, 2022

2.1 Lighthouses have scaled across production networks and value chains

Some Lighthouse companies scale up across their production networks, implementing four-wall transformations at multiple sites. Previous papers explored how various companies, such as Schneider Electric and Henkel,² have done this. Others choose to scale up across the value chain, extending the

transformation beyond production sites by reaching out to the supply chain (upstream) and their customers (downstream). One example of this is in Johnson & Johnson Vision Care. Sometimes scaling up across the value chain includes expanding the Lighthouse across adjacent functions, such as procurement.

CASE STUDY 1 Value chain: Johnson & Johnson Vision Care



Johnson & Johnson Vision Care, headquartered in Florida, USA, has deployed a range of use cases to achieve Fourth Industrial Revolution scale-up across the value chain, both upstream to suppliers and downstream to customers. It has enabled personalized customer experiences by ensuring readiness to fulfil orders quickly and flexibly. Several use cases have enhanced physical supply flow in parallel with demand flow. Digital customer collaboration enables smart touchless ordering and payment, and E2E visibility and real-time tracking create a digital link to the customer, optimizing

manufacturing, testing and order fulfilment informed by demand. Process automation, robotics and automated guided vehicles utilize smart vision, imaging and scanning to enhance midstream manufacturing, testing and distribution elements. Adaptive process control and vision systems likewise enhance the midstream, while smart material handling and tracking keep supplies moving smoothly. Impacts have been impressive, including a 40% conversion rate increase, 30% cost reduction, 10% overall equipment effectiveness (OEE) increase, a 99% line item fill rate to end customers and an order-to-shipment time under 24 hours.

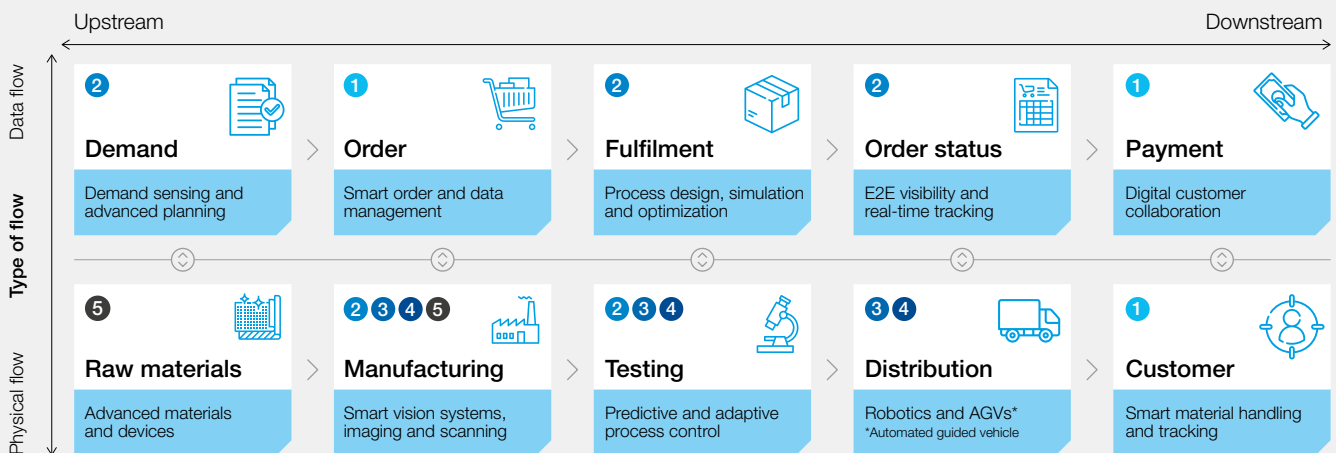


Johnson & Johnson Vision Care scaled up Fourth Industrial Revolution across an end-to-end value chain to deliver personalized customer experiences

End-to-end value chain

Illustrative

Selected examples of solutions Selected use case



Use case types

- | | | | | |
|--------------------------------|---------------------------------------|---------------------------------------|---|--------------------------------------|
| 1 | 2 | 3 | 4 | 5 |
| Digital customer collaboration | E2E visibility and real-time tracking | Process automation, robotics and AGVs | Adaptive process control and vision systems | Smart material handling and tracking |

Description of selected use cases

- | | | | | |
|--|---|---|--|--|
| Connecting consumers in a flexible ecosystem
Creating touchless ordering through e-commerce | Creating a digital link between the customer and supplier
Developing touchless integrated planning | Scaling throughput using intelligent automation
Utilizing the advanced automation system | Deploying open and closed loop control systems
Utilizing digital performance management | Implementing smart material handling systems
Automating pick, scan & ship systems |
|--|---|---|--|--|

Impact and achievements



- | | | | | |
|---|--|-------------------------------|-----------------------------|-------------------------------------|
| 40%+
conversion rate increase | 99%
line item fill rate to the end customers | 30%+
cost reduction | 10%+
OEE increase | <24h
order to shipment |
|---|--|-------------------------------|-----------------------------|-------------------------------------|

Source: World Economic Forum Global Lighthouse Network, 2022

2.2 | Six enablers lie at the core of success

Early Lighthouses revealed six core enablers as fundamental to successful Fourth Industrial Revolution scaling, the importance of which has remained consistent even as the network has more than doubled.

1

An Agile approach employs quick iterations, fast failing and continuous learning. Agile teams bundle use cases to transform in waves for rapid innovation and refinement.

Example: A digital native manufacturing company in North America slashed production lead times from weeks to days by emphasizing minimum viable products (MVPs) and fast iteration, working in sprints (usually 2-4 weeks) with continuously assigned priorities managed by the product owner.

2

An Agile digital studio enables people to work together effectively. Designated spaces with proximity to cross-functional team members allow co-creation among experts and innovation across all levels of the business.

Example: A global consumer packaged goods company headquartered in Europe built a hybrid agile studio that included the virtual co-location of teams within and beyond the business unit. A cloud-based factory digital twin provided access to real-time data, blending experts and future users in sprint teams.

3

An IIoT stack seamlessly integrates legacy and new IIoT infrastructure to build a stable, flexible tech backbone. Smart leveraging of existing systems with efficient investment in the new technology stack limits costs.

Example: A leading appliance manufacturer in Asia established a flexible IIoT stack, integrating dozens of systems to connect “human to human”, “human to machine”, “machine to machine” and “machine to things”, improving quality, safety and efficiency.

4

An IIoT academy uses internal and external expertise, employing best practices for adult learning to reskill and upskill the workforce, building customized learning programmes at the individual level based on unique personnel needs.

Example: An advanced industries company in North America partnered with universities and institutes to upskill 40% of its workforce at its Asian sites. Personalized learning rapidly and effectively upskilled workers, transitioning more than 50 roles from traditional engineering to Fourth Industrial Revolution digital.

5

The technology ecosystem partners with tech vendors, suppliers, customers and related industries, sourcing the latest capabilities and best practices with access to extensive datasets and opportunities for co-innovation.

Example: A global top-100 automotive components supplier based in Asia built up a broad ecosystem with 5 top universities, including Stanford, and more than 30 top tech suppliers to speed up the introduction of Fourth Industrial Revolution technologies.

6

The transformation office creates a governance hub that supports the Lighthouse launch and scale-up. It creates transparency on progress and priorities, ensures ongoing value capture and accelerates change and scale-up.

Example: An electrical equipment manufacturer in Europe followed the set-up of a global digital transformation office as a change agent with regional and local teams. It managed pacing and progress and implemented a global digital strategy prioritizing sustainability, trust, resilience, intelligence and efficiency.



A closer look at two key enablers

Agile approach

Traditional models constrain projects in a triangulation of time, money and a defined scope with particular parameters. An agile approach, while retaining budget and time constraints, instead looks at a project as a set of challenges. It then creates small, specialized teams to engage them in rapid, experimental iterations. Leaders must establish a culture that entrusts workers to experiment with creative solutions, with the freedom to fail fast and recalibrate. It requires pragmatic workflows for iterative problem-solving using MVP designs, with small, dedicated teams developing relevant ideas. Priority management is key and frequent evaluation allows tasks to shift with changing needs. The value-add includes boosted employee engagement, focused training and skill development while workers get creative in their iterative approach to problem-solving. Agile methods let companies scale up quickly while boosting workforce engagement (see the agile case study: Petronas).

Transformation office

Leadership is key because it's hard for companies to undertake any substantial change, let alone one as comprehensive as Fourth Industrial Revolution digital transformation. The smart governance model of a dedicated transformation office provides an internal "change agency" that ensures value capture. While the agile methodology depends on small, specialized teams, those teams must exist in an organizational set-up with clear objectives and effective collaboration. The transformation office defines roles and responsibilities, positioning people for success and ensuring the necessary talents, skills and abilities are in place through assignment, hiring and skills development. It establishes a steering cadence, tracking progress and setting meeting agendas for project management. This enables structured reviews of progress in each workstream. Meanwhile, by employing the capabilities of the latest digital resources, the office embeds the use of new digital toolsets and new ways of working. Ultimately, the transformation office ensures that the company captures the potential value derived from targets and objectives, keeping tabs on measurable, granular KPIs (see the transformation office case study: Foxconn).



Malaysia's fully integrated oil and gas company, Petronas, is a good example of a company using an agile approach as it continues its Fourth Industrial Revolution journey. It has leveraged the key success factors of workforce engagement, iterative development, cross-functional teams and priority management. The company has boosted engagement by coupling targeted upskilling and innovative learning approaches like gamification with a culture that fosters experimentation among empowered workers. Iterative and incremental sprints using MVPs, combined with plentiful feedback and enablement through digital tools leverage the agile methodology, customer experience design and customer journey methodologies to identify pain points for solution development, with technology and people dimensions set up for replicability.

The cross-functional agile team approach has provided a dedicated virtual space for developing and deploying solutions;

meanwhile, teams are dedicated to workflows and sized appropriately for optimal task ownership. Activity planning cards and mural boards provide virtual organization, and multidisciplinary squads, including end-users, enhance the teams. Pods led by agile coaches make for seamless collaboration. Finally, priority management is flexible from the top down and group strategies are designed around value. This allows frequent review of backlogs, along with accelerated resource allocation and review-based decisions within sprints.

This agile team-based approach has led to several positive impacts for Petronas, including 490 employees trained in digital and agile methodology, 130 ideas developed, 7% of average working time spent training and an average 10 out of 10 score for worker engagement. More than 90% of solution recommendations have been adopted and five use cases were deployed and adopted in ten months, then replicated in two other plants in six months.



Petronas managed key success factors actively to drive improvements within an agile approach



Workforce engagement

- All employees, top down, are engaged
- Leadership trusts and empowers workers to drive their own solutions
- Culture of experiments is lived, which allows for failures and learning
- Targeted up/reskilling and development programmes¹ covering 100% employees
- High adoption through gamification (e.g. "Champions League") and Ways-of-working tracking



Iterative development

- Use iterative and incremental sprints using MVPs for rapid testing
- Frequently collected feedback from users for updates to the next sprint
- "Technology" and "People" dimensions set up for replicability
- Enablement through the use of digital tools
- Leveraging Agile and CX* methodologies to identify pain points and develop solutions



Cross functional team

- Agile teams with dedicated (virtual) space to develop and deploy solutions
- Teams are dedicated to workflows and sized in a lean way to foster ownership for each task
- Activity planning card and mural boards to organize teams virtually
- Multidisciplinary squads, including end users, and pods led by agile coaches working together seamlessly



Priority management

- Value focused prioritization driven by group strategy and by applying the max-potential value-hunting methodology
- Flexible priority management is delivered top-down from leadership, allowing rapid changes in transformation initiatives
- Backlogs are structured and reviewed frequently
- Accelerated resource allocation and decision-making process within sprints (review)

Impact and achievements

>90%

adoption of solution recommendation, that is tracked in real-time dashboards

130

ideas developed in agile teams and prioritized down to 6

7%

of average working time spent for training

1,000+

employees upskilled through digital app

490

employees trained in digital and agile

5

use cases deployed and adopted in 10 months and replicated in 2 other plants in 6 months

Notes: ¹ Examples of the programmes: DEC (Digital Engineering Consultancy) and DDS (domain data scientist).

*CX: Customer Experience.

Source: World Economic Forum Global Lighthouse Network, 2022



As a core enabler, the transformation office drives a very clear scale-up strategy that combines and coordinates methodologies and processes to pursue prioritized objectives. It sets up transformation, initiates the first pilots, enables learning mechanisms, presents targets and articulates aspirations – all while capturing value. Foxconn, an electronics producer and Lighthouse member with four sites in China, has shown how a transformation office can optimize collaboration, integration and the utilization of technology to drive high-level impact. By establishing a central transformation office, Foxconn was able to achieve a sustainable model of organizational governance with clear objectives, thus creating a culture well-positioned for change and development.

The office defined the roles and responsibilities for a transparent chain of command and accountability. It also provided the ideal digital tools capable of real-time data capture and accessibility for relevant users, establishing a single source of truth per workstream. Finally, by maintaining the steering cadence, the transformation office kept everything on pace with good communication regarding objectives at regular intervals. With this clear, strategic approach, the company avoided “pilot purgatory” and maintained the development cadence.

The impact was massive, with more than 4,600 global initiatives implemented and over 30 value chains covered in bottom-up initiatives. It also trained more than 1,500 leaders and certified some 200 IoT talents while garnering ecosystem partners and university cooperation.



Foxconn successfully managed its lighthouse journey with a strong transformation office



Impact and achievements

4,600+ global initiatives implemented	1,300+ initiative owners involved	22 digital use cases deployed	200+ talents certified in IIoT	1,500+ leaders trained	30+ value streams covered in bottom-up initiatives
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Source: World Economic Forum Global Lighthouse Network, 2022

3

Responsible transformation at scale

Undoubtedly, the world has changed drastically in the past two years. These challenges, along with ambitious climate goals, have boosted the prominence of environmental, social and governance (ESG) concerns; as such, companies have had to redouble their focus on environmental sustainability and workforce engagement. In the past, sustainability and workforce engagement were aspirational ideals – now, they are essential. Lighthouses have shown that to grow responsibly, companies must scale their transformation with these priorities front and centre.

Accordingly, the Lighthouse Playbook is focused not merely on successful transformation but also

on responsible transformation. Lighthouses are harnessing Fourth Industrial Revolution technologies that enable them to use strong transformation governance to accelerate scaling, ensure eco-sustainability and increase workforce management. Now, with more Lighthouses, more use cases and more data points than before, the network's insights are more compelling than ever, providing the keys to environmentally sustainable growth. This new Global Lighthouse Network Playbook, informed by these front-runner organizations, shows how manufacturing and the supply chain will evolve in the next five years. It also shows how companies can transform at scale in a responsible manner that prioritizes people and the planet.

FIGURE 8

The Lighthouses have proved that impact from the Fourth Industrial Revolution is responsible by tackling ESG elements, including sustainability and workforce engagement

Overview of the ESG components, which have increased in importance in the last two years



Source: World Economic Forum Global Lighthouse Network, 2022

3.1 Sustainability

Manufacturing is a resource-heavy undertaking worldwide. The September 2021 impact paper entitled *Global Lighthouse Network: Unlocking Sustainability through Fourth Industrial Revolution Technologies*³ explored how the climate crisis has pushed environmental responsibility higher than ever on the list of industrial priorities. It illustrates how Lighthouse organizations are setting the bar for environmental stewardship through pragmatic, effective and future-focused sustainability efforts. Commitments to (and execution of) measures that reduce energy consumption, water impact, carbon emissions and waste generation – led through a good governance structure – are at the core of eco-sustainability.

Lighthouses are defying the conventional wisdom that environmental responsibility is inherently at odds with productivity and, by extension, profitability. Even as these front-runners embrace green technology and other breakthroughs, they are also revealing how successful implementation of the Fourth Industrial Revolution transformation can simultaneously augment green measures while bolstering production efficiency. Thus, they are achieving eco-efficiency, wherein sustainability and competitiveness are not only compatible but, in fact, are interwoven. The case study below looks closely at how Western Digital has achieved a major sustainability impact even as the business has grown substantially.

CASE STUDY 4 Sustainability: Western Digital



By implementing a variety of Fourth Industrial Revolution technology solutions such as an IIoT platform and machine learning, American electronics manufacturer Western Digital succeeded in optimizing energy and water consumption while reducing greenhouse gas emissions and waste at its Penang, Malaysia site. Remarkably, the company achieved this impact even as it experienced a 40% compound annual growth rate in volume.

Real-time IIoT applications powered smart energy usage. Key to this was an intelligent, multivariate model-based, self-regulating plant management system incorporating more than 1,000 IIoT sensors across more than 500 pieces of equipment and 15 utility systems. This system has provided flexible adaptation to volatile production scheduling amid a fourfold increase in customer demand over four years.

By transforming high-mix, high-volume production to a lights-out integrated operation with automated processes, robotic transportation, automated storage and material management, along with the integration of an intelligent remote production command centre and factory digital twin, the site reduced machine idling time to gain 15% overall equipment effectiveness (OEE) and a 3.5x unit per hour productivity improvement, thus reducing the energy consumption per machine.

Western Digital has achieved a step-change in sustainability impact. In addition to cutting energy consumption and greenhouse gas emissions each by more than 40%, the site has optimized water consumption by a factor of 44% and reduced material waste by 15%. As a result of this tremendous sustainability impact, the site received certification by the Malaysia Green Building Index.



Western Digital achieved a major sustainability impact through the Fourth Industrial Revolution while business grew 40%+

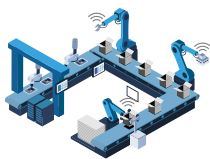
In order to become more **sustainable despite the 40%+ CAGR* business growth**, the site **implemented** a wide range of **Fourth Industrial Revolution technology solutions**, such as an IIoT platform and machine learning, to optimize energy and water consumption and reduce GHG emission and waste

Impact and achievements



Smart energy usage via real-time IIoT applications

An intelligent, multi-variate model-based self-regulating plant management system, architected with 1000+ IIoT sensors, 500+ piece of equipment and 15 utility systems



Lights-out automation with digital twin capacity

Implemented lights-out operations through automation tied with an intelligent remote production command centre and a digital twin for high-mix, high-volume production



40%+
energy consumption reduction



40%+
GHG emission reduction Scope 2



44%+
water consumption optimization



15%+
reduction waste material

As a result, the site is **certified with the Malaysia Green Building Index (GBI)**

*Compound annual growth rate

Source: World Economic Forum Global Lighthouse Network, 2022



3.2 Workforce engagement

A company can have the best tools, the newest technology and tremendous resources at its disposal, but if it lacks genuine workforce engagement, it will be unlikely to scale successfully. In the past two years, the workforce engagement that Lighthouses have achieved has been a critical element of their success. They have shown just how vital it is that companies prioritize their workers, creating a community of involved, committed people with the proper support to meet the challenge of changing labour needs, such as the labour shortages exacerbated by the pandemic. For example, there are nearly double the number of open jobs in US manufacturing compared with a year ago, with unfilled roles in factories jumping 6% in October 2021.⁴

As the labour force have left jobs in record numbers in the turmoil of the pandemic, front-runners are distinguishing themselves with the resilience gained from a concerted focus on their people – on the social element of ESG. Companies that put effort into learning and development, empowerment and ownership, collaboration and connections, recognizing impact, and listening to the worker's voice are realizing the rewards of an engaged workforce.

The Lighthouse Playbook calls for embracing a new understanding of the very nature of work itself and, accordingly, realizing new structures and approaches. It means a move from deploying only existing knowledge to the pursuit of learning and development – a truth growth mindset. Companies need to rethink their training and skills development pathways, beginning with understanding the size and impact of labour opportunities across operations. From there, they can design structural changes that mitigate the risks of unmet labour demand while also creating opportunities for reskilling and upskilling. Leading companies do not consider their workers static; rather, they facilitate their growth and development, empowering them to learn new skills and ways of working to reach their potential in a changing manufacturing landscape.

This means moving away from a top-down hierarchical culture that tends toward micro-management to a culture of empowerment and ownership, leading to creative solutions. This requires results-oriented steering that encourages people to make decisions in a space that allows experimentation and learning. By emphasizing collaborations and connections, siloed teams

and homogenous ways of working give way to interdisciplinary teams with cross-functional collaboration. This creates networks within and beyond the organization while facilitating cooperation with customers, suppliers and partners. Lighthouse companies engage their workforces by recognizing and celebrating the impact of their people and products they create, reinforcing the organization's culture and values. They promote and recognize employees focused on learning who create and develop new ideas. Finally, Lighthouses show that by prioritizing the worker's voice, companies who listen to their people, including through digital channels and using big data, can better understand their employees' needs, even those that aren't immediately apparent.

Digitalization plays an important role in building and accelerating workforce engagement. Fourth Industrial Revolution technologies have transformed the very nature of work, for example, by reducing repetitive tasks and involving workers directly in higher-level tasks. The extended infusion of digital solutions and real-time access to data in day-to-day operations has resulted in more efficient execution of tasks and more effective communications, allowing direct and indirect workers to focus on problem root cause identification and resolution. Advanced technologies such as augmented or mixed reality, artificial intelligence and low-to-no-code software development platforms are [augmenting the workforce](#) and empowering people in the office as well as on the shopfloor – sometimes even without a strong technical background – to come up with creative digital solutions to daily problems while increasing their productivity.

The pandemic has made it clear that people are eager to come together, grow and be a recognized part of a professional community doing something they believe in while creating and delivering value, all while utilizing advanced digital technologies and tools. This is the kind of true workforce engagement seen at Lighthouses: people want to come to a company, and once there, they have a strong desire to stay, learn and contribute. They are happy to be there and be a part of the organization. This genuine engagement lends a company true resilience in the face of the most disruptive shocks. Lighthouses have shown that when people are engaged, they work together to grow, change and adapt, thus seeing their companies through the toughest of times. Workforce engagement usually has five key attributes:

1 Learning and development: extending competencies in a combination of hard, soft and digital skills



- Extended competencies and skillsets
- Combination of hard, soft, and digital skills
- Institutionalized apprenticeship and continuous development

Example: A company gamified learning, clustering workers in teams to compete as they learned digital knowledge topics. It also provided internal sourcing and upskilling programmes to unlock growth opportunities in Fourth Industrial Revolution roles (e.g. from a business or sales agent to a software developer on the Fourth Industrial Revolution team).

2 Empowerment and ownership: moving from a top-down hierarchical culture gives workers the freedom to experiment and innovate



- Outcome- and result-orientated steering
- Encouragement and space to make own decisions
- Ability to raise, experiment and execute innovative ideas

Example: A manufacturer nominated change agents in various parts of the production network to scout and develop relevant new technologies. Meanwhile, the company engaged Fourth Industrial Revolution solution development platforms that enabled technicians and engineers to build solutions with little to no coding knowledge.

3 Collaboration and connections: from silos to interdisciplinary and cross-functional teams for networking and learning



- Working with cross-functional and multi-skilled teams
- Developing own extended network in the organization and beyond
- Cooperation with customers, suppliers and partners

Example: A company built “SWAT” teams of user/operators and Fourth Industrial Revolution experts to evangelize digital technologies. It also created an advanced technology research, training and experience centre for mixed teams with varied technical backgrounds to collaborate and serve as an incubator for use cases across functions.

4 Impact and recognition: accountability for results in keeping with values; affirming and celebrating achievements



- Identification with the company's values
- Accountability for impact and achievements
- Recognition of achievement and celebration of successes

Example: A manufacturer developed AI-backed algorithms to match skills with workplace needs to optimize the allocation of the right workers in the right processes. This improved productivity, safety and quality while creating specific skill matrices and driving competency-building. It also accelerated the ramp-up of new hires.

5 Voice of the worker: listening and gathering data to better understand and respond to workers' needs



- Listening to workers through digital channels and (big) data
- Understanding employees' (hidden) needs
- Defining the action to address workers needs and close the gaps

Example: With digital “kaizen” and other mobile-accessible apps, a manufacturer enabled workers at all levels and in all roles to voice suggestions and propose ideas for advanced use cases based on growing digital knowledge. The effect was magnified with multi-functional teams engaged in agile solution development.



Novo Nordisk, a leading global healthcare company headquartered in Denmark, successfully engaged its workforce by leveraging factors that keep people at the centre of transformation. While the deployment of advanced technology (e.g. digital shop floor apps, digital scheduling and automated OEE data collection) across all use cases has been important, it is a set of cultural elements that lie at the core of the company's high level of workforce engagement. Upskilling is prioritized, with efforts aimed at mindsets, behaviours and digital capabilities. Cross-functional collaboration brings skills and talents together for maximum impact. User-centric designs

and approaches keep the challenges and opportunities of workers at the heart of developments. In addition, workers are empowered with direct involvement in the design, development, piloting and rollout at agile intervals. Finally, communication is constant, from coaching and team sessions to surveys and posters. 80% of the workforce at Novo Nordisk is engaged with these initiatives – clear evidence that workers are eager to learn, stay and deliver value. On average, 10% of a worker's time is spent reskilling and the company dedicates 1% of its annual budget towards this purpose. When workers are this engaged, a company has a strategic advantage.



Novo Nordisk successfully engaged its workforce by leveraging a set of key success factors.

Success factors to ensure high workforce engagement



Upskilling

Extensive training and coaching of operators, technicians and managers on the shop floor to change mindsets, behaviours and build digital capabilities



Collaboration

Cross-functional collaboration between IT, front-line workers, technicians, management and digital change leaders



User centric

Involvement of UX**/UI*** designers and development of "user journeys" with end-users to understand pain points, opportunities and requirements



Empowerment

Technicians, supervisors and operators involved in the design, development, piloting/experiments and rollout solutions in an agile iterative way



Communication

Extensive communication and coaching using daily team sessions, shadowing and feedback surveys with the shop floor operators and technicians to explain purpose, "how to" and benefits

Across all use cases



Production line optimization by AA*



Digital shop floor applications



Digital scheduling



Automated OEE data collection



Digital performance management

Impact and achievements 

80%

of workforce engages in initiatives

10%

of time workforce spends reskilling on average

1%

of annual budget used for reskilling

*Advanced analytics, **User experience, ***User interface

Source: World Economic Forum Global Lighthouse Network, 2022

4

Continuing the journey and expanding the Lighthouse Playbook

The Lighthouse Playbook, even as it continues to evolve with more data, more evidence and more valuable insights to share, makes a compelling case for how to embark on a successful Fourth Industrial Revolution transformation journey and, in particular, how to maintain a steady course even in the face

of the most turbulent storms. Now, in light of all the changes the world has experienced over the past two years, the Global Lighthouse Network has even more to offer to help manufacturing organizations and their ecosystems accelerate responsible transformation and scaling.

Call to action

The global mandate for responsible manufacturing is clear. Organizations must grow in a way that prioritizes the planet and people. Given the recent disruptions affecting daily routines, relationships and modes of working, companies must keep their workers front of mind and practice by taking measures aimed at genuine workforce engagement. As manufacturers face pressing climate imperatives, environmental sustainability is no longer optional.

This is a dual challenge and it requires creativity and commitment across the value chain. It is important for industry to continue focusing on the six core enablers that the Global Lighthouse Network has shown to be essential to successful transformation at scale while emphasizing a particular focus on sustainability and workforce engagement. Lighthouses show the way and the playbook helps to chart the course. The global manufacturing community should learn, be inspired and embark with courage and hope on a transformational journey to be part of the sustainable future of manufacturing.



Setting the goal at the Annual Meeting

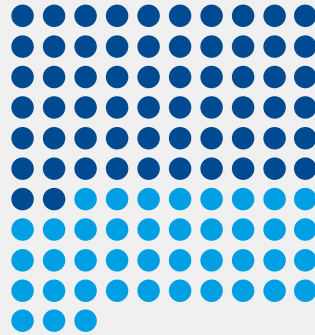
The Global Lighthouse Network at Davos was charged with the goal of uncovering how sites' end-to-end value chains make themselves more sustainable through technology and to identify leaders to act as aspirational examples for other sites to model.

A sustainability lighthouse designation created to highlight pacesetters



A sustainability lighthouse designation reflects the same level of Fourth Industrial Revolution maturity as other advanced lighthouses and highlights a commitment to environmental sustainability through the **intent, impact and scale** of deployed advanced use cases.

The first sustainability lighthouses were identified from across the Global Lighthouse Network



103 lighthouses

Within the Global Lighthouse Network, 60% impacting sustainability through their top 5 use cases



6 lighthouses

Identified as the next group of Sustainability Lighthouses against peers. The latest three are:

Johnson & Johnson Janssen, Cork, IE

Schneider Electric, Le Vaudreuil, FR

Western Digital, Penang, MY

Call to action

The Global Lighthouse Network invites future sustainability lighthouses to join the network.

Together, the network learns and shares insights to advance Fourth Industrial Revolution adoption and generate greater environmental impact.



Source: World Economic Forum Global Lighthouse Network, 2022

Call for applications

Now that the Global Lighthouse Network stands at 103 members, the Forum is eager to welcome more companies into this group of leading organizations. The Forum issues the challenge to existing member organizations to expand with additional sites; likewise, it extends the invitation to potential new members. Companies eager to learn from others while contributing to the evolution of

manufacturing for the new century are encouraged to apply. All members of the network – whether newly recognized or existing – are eligible to be considered for designation as Sustainability Lighthouses. Interested, forward-thinking companies are invited to learn more by emailing LighthouseNetwork@weforum.org.

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Endnotes

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