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Making Industry 4.0 Real

The next wave of economic growth is approaching. Businesses that plan for and act upon rapid changes in technology and processes have much to gain. This guide lights a path to achieving digital transformation in manufacturing, from resolving organisational challenges and cultivating innovation to unleashing human abilities.

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Context

To succeed in this new era of rapid transformation, manufacturing enterprises must recognize the major changes underway and harness digital technology.

What is Industry 4.0?

Every era of manufacturing has built on and been characterised by advances in technology.
The first industrial revolution arose with the steam-powered factory in the later 1700s. About a century later, electricity ushered in the second industrial revolution with mass production and assembly lines. We are currently straddling two eras: the third industrial revolution, marked by digital communications and automation, and the fourth industrial revolution, which utilises data and machine learning to lower costs and boost revenue (Marr, 2018). As with prior revolutions, economic growth and prosperity spring from this fourth wave of manufacturing.

Industry 4.0 is the total integration of manufacturing systems, production processes, digital communications technologies and automated machines. This flexible, intelligent integration provides the means to leverage data and machine learning, empowering manufacturers to sidestep production issues and forecast unique opportunities (Jain and Mondal, 2017).

Industry 4.0 is an umbrella term for the technology and human-led processes that, when seamlessly combined, form the digital backbone of smart manufacturing. It encapsulates IT systems, the internet of things (IoT) and adaptive manufacturing systems. Essentially, it bridges the physical and digital worlds, facilitating sustainable growth while elevating human capacities and restricting production waste. Industry 4.0 is far more than a technical transformation; it is about improving manufacturing for the benefit of people and planet.

Industry 4.0 or IoT: A Clarification

It is common to mix up Industry 4.0 with IoT. Both terms describe the technological advances underlying the next transformation in manufacturing. Yet each maintains its own central tenet: Industry 4.0 refers to optimising advanced technologies to simplify production processes and add value, while IoT pertains to consumers accessing and using digital products and services through a variety of devices connected to the internet (The Unbelievable Machine Company). IoT is one part of a much bigger Industry 4.0 picture.

Present Landscape

Industry 4.0 is based on seamless connections, data-generated insights and workflow automation from the factory floor to product delivery and beyond. It is no surprise that manufacturers strive for digital transformation—more engaged employees, higher revenues and even greater agility loom over the horizon (Antonysamy, August 2019). How does the present reality stack up, though?

There is a stark divide between the vision of Industry 4.0 and the current industrial landscape. Today's manufacturing runs on disconnected, dysfunctional processes with little integration between operational equipment, IT systems and business units. To realize Industry 4.0, manufacturing enterprises must begin the digital transformation at the foundational level (Cognizant, September 2019).

Manufacturers who have already embarked on the road to digital transformation are making impressive advances. They are shifting their organisations, changing how people work and deploying technology to achieve value. As an analysis by McKinsey & Company reveals, these early adopters, or "Lighthouses," are seeing up to 90 percent in productivity spikes. Other major outcomes include slashes in lead times and greater energy efficiency (Betti et al., 2020).

Lighthouses are gaining huge competitive advantages by innovating with suppliers and customers, optimising the entire chain of production rather than just its sole elements. Organisations that have not started the journey to transformation still have time to build the momentum needed to catch up—provided they develop, and scale, with urgency (Betti et al., 2020).

It is important to recognize that change is not easy. The first step to becoming a smart, connected industrial enterprise is to rally management behind the vision so they can facilitate the reskilling of employees and gauge their progress. The next step is to unify, align and integrate operational systems on the factory floor with IT systems, business processes and organisational models (Cognizant, September 2019).

Reality in Numbers

We recently sponsored a survey of 250 executives in large and medium process and discrete manufacturers across Europe. We learned that:

- 72 % plan to increase their IoT spending in the next three years. But many of these Industry 4.0 implementations are often not automated. Collecting and analysing data still requires a lot of manual work (Milojevic, 2017, p.3).

- 60% are already involved in Industry 4.0 initiatives, 45% of which are influencing business outcomes (Milojevic, 2017, p.8).

Solve Problems, Create Value

Manufacturers face unprecedented complexities, from intensifying global competition and changing business models to increased regulation and rising customer needs (Deh Hui and Prasad, 2018, p. 4). At the same time, these driving forces present limitless opportunities for problem-solving and value-creation.

Industry 4.0 dissolves boundaries across the enterprise, opening vast frontiers of innovation. Consider the role of data in establishing key performance indicators (KPIs). At present, a lot of potential crossover value remains undiscovered and unexplored because the data needed to formulate improvements are stuck in silos.

To be clear, there is no shortage of data—manufacturers are swimming in oceans of data. Implementing IoT solutions and sensor-enabling assets and processes only swell the volume. Graphs, charts and other visualisations cannot keep up with real-time data.

Solving problems and adding value necessitates far more than "getting" data—it is about making data actionable in order to monetise it (Antonysamy, August 2019). The fundamental question is: How can organisations gain actionable insights from these massive data flows?

Manufacturers should continue applying artificial intelligence (AI) and analytics to what-if scenarios, since these data contribute to a more predictive and preventive production system. Using AI technologies such as machine learning, businesses are already discovering health and usage patterns that translate into predictive maintenance (if a rotor heats up past a pre-set temperature setting, for example, it can trigger the algorithm to notify a plant worker or even proactively shut the machine down [Antonysamy, August 2019]). The bigger quest, however, is to interpret the data with after-market revenue streams in mind.

Hallmarks of Industry 4.0

Visibility: Silos come down, freeing up previously hidden value.

Transparency: Information is accessible and contextualised in real-time.

Predictability: Production is decentralised and functions autonomously.

Adaptability: Systems self-diagnose and auto-adjust for preventative maintenance.

(Cognizant, 2017).

KPIs at a Glance

Correlating *actionable* data with KPIs leads to notable increases in business outcomes, as illustrated in the following chart (World Economic Forum, 2019, p. 15).

	KPIs improvements	Impact range observed
Productivity	Factory output increase	10-200%
	Productivity increase	5-160%
	OEE increase	3-50%
	Quality cost reduction	5-90%
	Product cost reduction	5-40%
Agility	Energy efficiency	2-50%
	Inventory reduction	10-90%
	Lead time reduction	10-90%
	Time to market reduction	30-90%
	Change-over shortening	30-70%
Customization	Lot size reduction	50-90%
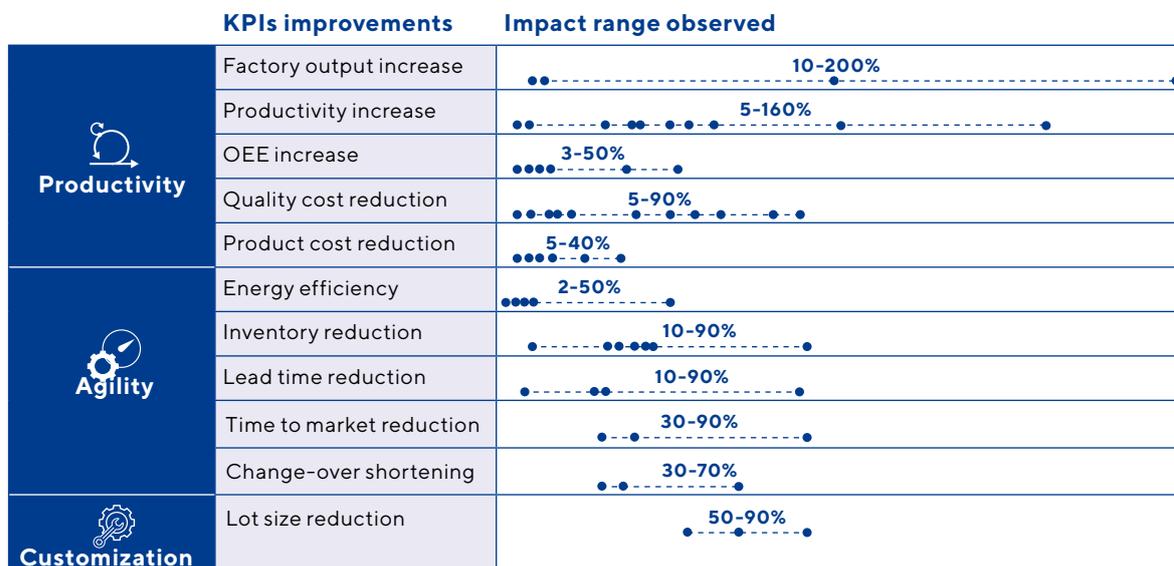
How can organisations gain actionable insights from these massive data flows?

The Digital Advantage

Digitalisation is paving new paths of innovation and sustainability. Yet a successful digital transformation demands more than changes in technology.

Sustainable Benefits

Industry 4.0 revolutionises the manufacturing ecosystem, bringing greater agility through improved data analyses and digitised processes, not to mention far less production waste. Importantly, it also emphasises human agency and skills development. We see three main avenues of sustainable prosperity emerging.

1. **Adaptive supply chains support unlimited innovation**
   The inventive use of qualitative and qualitative data spawns new business models, along with fresh revenue streams. Digital prototyping allows for low-cost explorations in designing customised products and services that are truly human-centered. Enterprises can make the most of data from connected production systems with thorough, precise data analyses. Since the supply chain taps real-time data streams, it is automatically responsive to production flows.Production is planned and scheduled according to the optimal use of resources, eliminating inefficiencies while preventing unnecessary downtime (World Economic Forum, 2019).

2. **Digital transformation opens up entirely new territory for workers**
   Productivity in Industry 4.0 depends on highlighting human ability. While dull and repetitive tasks are automated, work that requires ingenuity is performed by people. Upskilling and repurposing staff is the imperative focus, since technological advances will lead to job changes. Imagine creating a Data Detective role to examine your data streams for ways to increase production uptime. Or maybe you will need to promote an employee to Machine Teaming Manager, to help workers understand how robotic/virtual colleagues will change workflows and what machines can actually do for effective communication. (See our 21 Jobs of the Future guide for more inspiration on hiring and training employees in Industry 4.0.)

3. **Human-machine collaboration accelerates progress in efficiency**
   Expanded capacities in machine learning are distinctive to Industry 4.0. Machines can, for example, detect product flaws. Yet such detections are virtually useless without human intervention—swift decisions and actions will need to be taken by people in charge of production processes. The role of machines in this case is to alert human managers about any production glitches or breakdowns, while managers step up and quickly determine which actions will avert lost inventory and waste (World Economic Forum, 2019).

Addressing the Challenges

While many enterprise leaders are well aware of the benefits and potential of Industry 4.0, they may struggle with rolling out their company's digital transformation. The larger an organisation, the more challenging it can be to get started. Below we identify the most common barriers, and we explain how manufacturers can move forward.

Strategy
Most initial deployments of Industry 4.0 will likely be used to reduce costs and improve efficiencies. The next wave of manufacturing calls for defining business value, which is pivotal to forging new revenue streams and customer experiences. A digital-first strategy takes value generation into account. Impacts on the business cannot be pushed to the background where they go unmeasured (World Economic Forum, 2019). Flexibility means leaping from waterfall development to agile methodologies.

Culture
Organisations that lag in cultivating a digital culture risk stumbling into Industry 4.0 tremendously unprepared. Today's enterprises can be slow-moving, but smart manufacturing calls for constant change. Businesses should create programs that regularly upskill and train employees. Organisations need to envision how they will make their mark in an ecosystem of ongoing innovation (Jain and Mondal, 2017).

Leadership
With a lack of business and IT leadership dedicated to Industry 4.0 and IoT, formal responsibility for digital transformation rarely exists. Diffused accountability is limiting traction and scaling, delaying the time to capture the value at stake. Moving the ball forward requires building cross-functional leadership teams (e.g. Manufacturing Process, IT/Plant Networking, Controls, Digital, Business and Program Management [Deh Hui and Prasad, 2018, p. 9]).

Focus
High-paced change makes it tough for many organisations to set aside time for concentrated thinking and experimentation, resulting in "digital distraction." Initiatives are not aligned with the business strategy and/or applied to areas of maximum value generation. On top of that, there is a tendency to select tools and solutions that are not reliable or architecturally scalable (Deh Hui and Prasad, 2018, p. 9).

Infrastructure
Many people in enterprises adhere to traditional IT structures, approaches and methodologies. Additionally, manufacturers grapple with data management. The volume and variability of data—combined with hybrid vendor environments, data security and the convergence of OT and IT solutions—can seem overwhelming. For example, six out of 10 IT executives say that collecting, storing, integrating and analysing real-time data from endpoint devices is a principal barrier to a successful IoT implementation (Cognizant, February 2019).
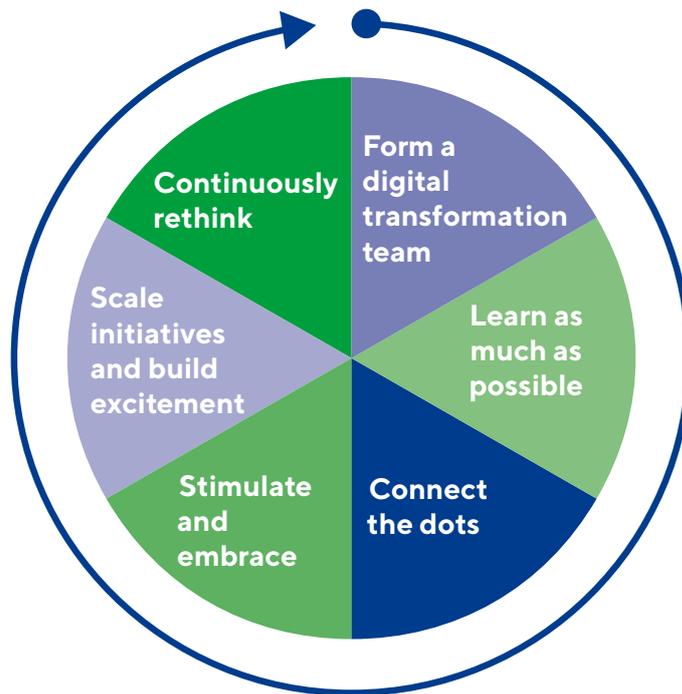
Making It Real, Step By Step

How do we plan? Where do we start evolving our business? How can we influence different stakeholders? Which partners should we work with? What proofs of concept (PoCs) should we industrialise? These questions regularly pop up for enterprises as they look toward Industry 4.0.

Every manufacturing company will have its own business dynamics, digital maturity and appetite for change. We recommend taking a planned Agile approach, since agility allows for incremental advances and helps an organisation identify what works best. An iterative plan with a clear milestone will also give employees at every level and function time to adjust to changes brought on by digital solutions. The following steps are based on numerous best practices, and they should be envisioned as a series of overlapping developments rather than as a linear journey.

Form a digital transformation team to lead the way

Set up a Digital Leadership Lab, a team of front-runners tasked with facilitating transformation. Then establish "digital squads" to focus on analytics, cloud, artificial intelligence, process automation. As "doers," these squads act according to guidance from the Lab. The Lab team is also responsible for sharing project stories and successes across the organisation. (Learn more about the overall purpose of the Digital Leadership Lab in the "Scale Initiatives" and "Reimagine the Goal" sections below.)

Learn as much as possible from an array of digital innovators

Have the Digital Leadership Lab send the digital squads on a discovery tour, to talk to start-ups and visit innovation centers and manufacturing peers. The squads should aim to understand how other companies are succeeding with meeting objectives and observing employee responses to changes. The mission goes beyond learning to seek and build relations with potential ecosystem partners.

Connect the dots between collaboration and value

Take an overarching view of the opportunity areas—Industry 4.0, automation, analytics, mobility, etc. Then, plan them conceptually over time. A clear blueprint will include where to pour the foundation and how to progress with exploring and starting on possibilities. Identify and/or select external partners who can help you navigate the complexities and interdependencies. Cultivate a vibrant mix of partners savvy with connecting organisational dots, from IT networks and talent development to overall business goals. The ideal partners offer fresh perspectives. Bring these interdisciplinary partners together so they can spot their added value and synergies.

Stimulate and embrace experiments within the organisation

Find entities within the company that are interested in trying new methods, and enable them to get started with Industry 4.0. This step comprises several moving parts:

a. **Design Thinking** – Conduct several workshops using design thinking at digital collaboration studios. It starts with the concept of either a problem statement or an opportunity statement. When we host leadership teams at our Amsterdam Digital Studio, the intent is to identify their biggest problems and their real opportunities.

b. **Prioritisation** – The identified opportunities are prioritized based on the leadership team's willingness to engage in a project. Prioritisation is not based on major savings but on the notion of the art of the possible. The team thinks about how technology can help the company and how the company could show things that are tangible to their people.

c. **Execution** – Run selected PoCs for system connectivity, data centralization, shop floor dashboards, analytics solutions, automation, etc. The detailed scope, solutions and acceptance criteria for the respective projects were defined and shared with the help of design thinking workshops or requirement-gathering sessions.

d. **Inclusion** – As new solutions advance, they will inevitably change how people in the manufacturing space perform their jobs. Automating dull, repetitive jobs is a positive change for employees, but people will not automatically adapt. Invite people to participate in reshaping their work by including staff in the creative process as well as the implementation of new solutions.

e. **Change Management** – As noted above, job functions evolve in Industry 4.0. Preparing employees for the future of work requires significant investment in change management. Additionally, we are entering a new era of collaboration across enterprises. Multiple divisions within an enterprise are cooperating, perhaps in a departure from how they operated before an Industry 4.0 initiative. The governance and the engagement models between these diverse groups—whether it is operations, field service or IT— should look and feel like one integrated organisation and not separate organisations with different values (Antonysamy, July 2019).

Scale initiatives and build excitement around success stories

The success of Industry 4.0 initiatives relies to a large degree on effective communication and inspiring storytelling from the Digital Leadership Lab. Along with overseeing the digital squads, this team tracks and broadcasts developmental progress. They also tune into bottom-up initiatives that have not yet involved the Lab and make them visible within the whole organisation. The Lab requests support for viable digital projects that are not yet bankrolled and just need company funding to make headway. The digital leadership team recognises that financial benefits are not a primary importance at the PoC stage, waiting until the amplification stage to actively integrate and promote initiatives. If the company can reap

significant savings with multiple applications, the Lab points that out. Importantly, the digital leadership team realises that reflecting on failures is just as important as noting successes. Our research shows that a lack of strong goals and a clear, long-term governance and ownership model lead to project failure. The project statistics from our research illustrate how failure occurs: just 33 percent sprung from a strong goal; a lack of robust data hampered 57 percent of projects; managers could explain the long-term ownership in only 29 percent of initiatives. As Rouzbeh Amini writes in "Three Reasons That Industry PoCs Do Not Scale," less than 40 percent of Industry 4.0 projects will scale without extensive changes to a program's construct (Amini, 2019).

Continuously rethink the challenges, successes, technology and partners
Industry 4.0 requires continuously rethinking challenges, successes, technologies and partners. Technology will take enterprises to places they probably cannot comprehend right now. Stoking the fires of imagination is a main task for the Digital Leadership Lab—there can be no stagnation. What metrics should help a company experiment and industrialise? Which metrics should gauge the success of projects in the larger organisation? The first group of metrics is based on proven functionality—whether the project or PoC achieved success. If the goal is to automate something, for example, simply measure whether it was automated. The second group of metrics is based on the spread and proliferation of projects. These are softer metrics: the number of mobile applications, connected systems, applications in the cloud, the extent of the data analysed and so on. Financial goals do not factor into success metrics at the initial stage of projects.

Quick Take

Industry 4.0 Case Studies

Grundfos: As one of the world's largest pump and water management companies, Grundfos has installations that span the globe. Thus, the company cannot always source a local Grundfos expert to fix a malfunctioning machine on site. When the enterprise sought a way for non-technicians to repair broken equipment, Cognizant developed a digital solution: an AI-informed, hologram-like display that augments reality and allows a non-specialist to perform maintenance on complex systems. In working closely with Grundfos, we started from a human perspective before combining several technologies to solve the challenge.

A global consumer care products player: With worldwide production facilities for their consumer care products, this enterprise intended to drive their Industry 4.0 roadmap with Connected Factory and Visual Factory initiatives. Enhancing the visibility on the readiness of required parts for planned production runs was a major theme in the Visual Factory track. The enterprise was looking for a means to visualize data from various systems, so that a production line manager could prioritise production runs based on parts availability status. Cognizant applied a human-centric design approach to understand the main pain points. Then we collaborated with the production line team on developing an integrated solution, which provided a timeline and chain visualisation to enable early decision-making and save time on the shop floor.

Industry 4.0 is a marathon, not a sprint.

Achieving Reality

Making transformation real requires action. This section maps out the journey to Industry 4.0, from taking the first step to thriving in a digital paradigm.

Key Take-Aways

Here is a condensed overview of the main points and most vital calls to action.

Cultivate transformation and build your ecosystem
Create a Digital Leadership Lab, a team to facilitate transformation and amplify initiatives across the organisation. Then form your digital squads, agile groups that gather knowledge and act on guidance from the Lab. Select diverse digital transformation partners. Collaborate with management consulting firms, software vendors, IT services firms and start-ups. Seek out a few big partners with 4.0 capabilities who offer trust and fresh thinking—they will represent the transformation core. Partner with niche firms too, since they can bring a short-term competitive advantage through their cutting-edge technologies and solutions.

Scale your PoCs to generate incredible value
PoCs should either solve a pressing problem or cash in on an opportunity. Identify potential PoCs through design thinking workshops with stakeholders. Any PoC should be easy to implement and support scaling for a quick value capture. Frame the initiative as a world of possibilities for the organisation.

Measure beyond the dollar—consider how changes affect employees
Overall, broad financial goals matter. But too much focus on savings at the outset will cause delays. Use realistic metrics that encourage experimentation and usage in the initial stages, then turn to other practical metrics for later stages. New ways of working, along with innovations in technology and data, will naturally produce resistance. As the adoption of PoCs/solutions is crucial, it should benefit the work of humans. Be sure to include softer metrics like job satisfaction and upskilling goals.

Envision the long-term as you persistently evolve
The successful implementation of Industry 4.0 requires buy-in from various stakeholders. It will require extensive communication, meetings with stakeholders and training programs. Showcase the successes of early PoCs to maintain organisational motivation. Industry 4.0 is a marathon, not a sprint. Further advances in technologies, methodologies and standards are bound to emerge. Given the pace of development in Industry 4.0, enterprises cannot afford to stick with legacy technologies and outdated service providers. Flexible enterprises will adopt and implement developments as they arise, guaranteeing sustainability.

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We can support your organisation in evolving its people, talent and know-how for digital transformation. Tap our expertise on bringing Industry 4.0 initiatives up to reality.

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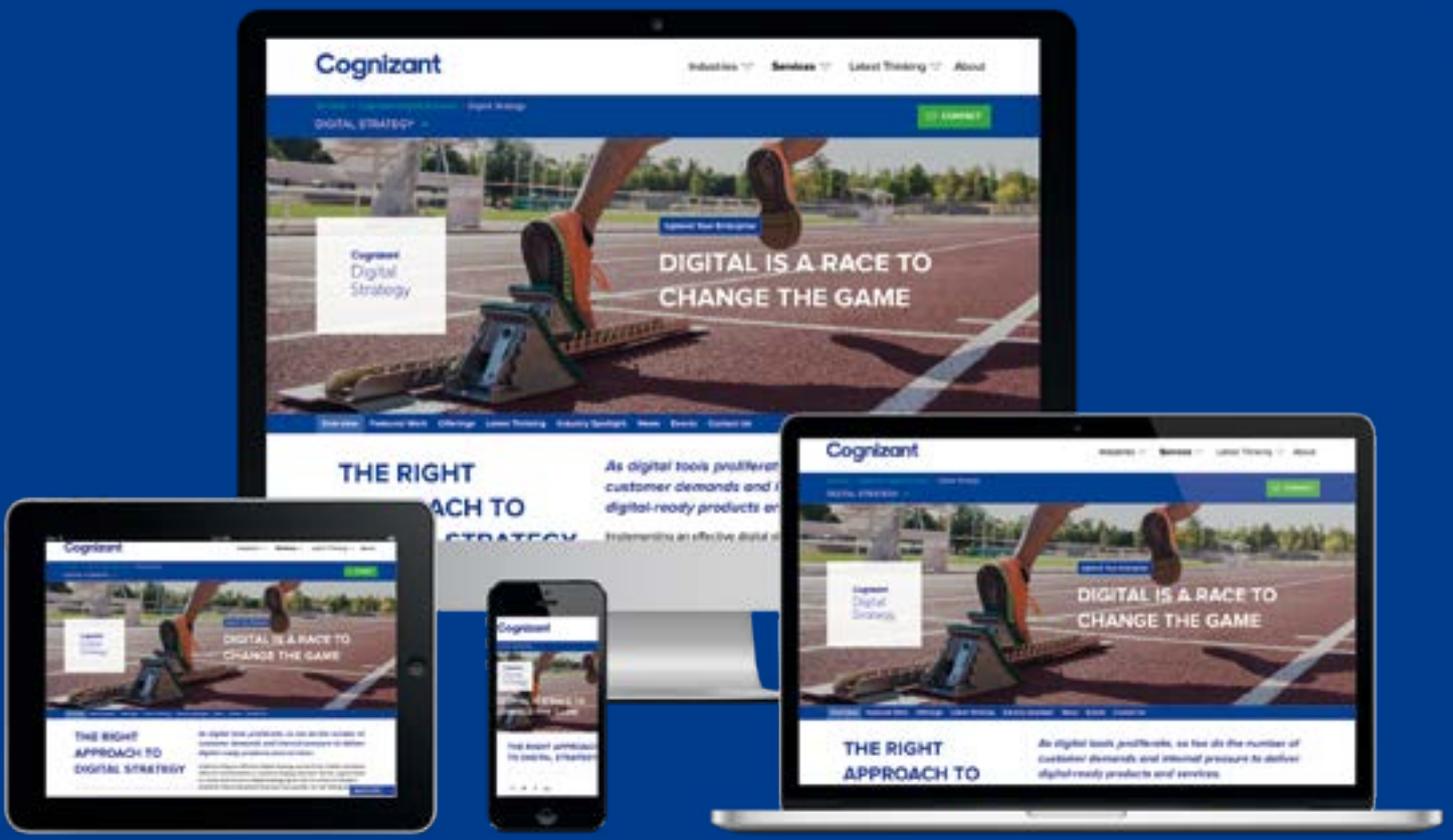
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