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Getting digital transformation right in resource-heavy industries

Eight core principles can help companies in the energy, oil and gas, basic materials, and utilities sectors achieve successful digital transformations.

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With companies operating in a time of unprecedented change, digital leaders are presented with a substantial opportunity. McKinsey research[1] has shown that successful digital transformations can have an impact of up to twice EBITDA, while the lead over digital laggards may increase by a factor of ten in other company performance metrics such as employee productivity, customer experience, or return on investment. Moreover, this competitive advantage grows exponentially once created. Successful players achieve early digital leadership and continue to strengthen as they attract digital talent.

To achieve impact as substantial as a doubling of EBITDA, companies must act across multiple dimensions (Exhibit 1). The impact realized is twofold, boosting both performance and sustainability, which is critical for resource-heavy industries.

Realizing this impact can be achieved by taking steps toward excellence in various functions: marketing and sales, supply chain, operations, and support functions, to name a few. However, while functional excellence can get the organization started on this journey, putting the right technology enablers in place is critical to achieve impact at scale. Research suggests that many industrial players fall into a "pilot trap"—they don't set up these technology enablers and are thus unable to successfully scale digitalization efforts across geographies, functions, and sites.

Exhibit 1

To deliver holistic impact, organizations need to pull multiple levers.

Dimensions for impact, nonexhaustive

	Performance impact	Sustainability impact
Market-backed R&D strategy	20–40% faster product development time	5–10% specific energy consumption (Scope 1 and 2 emissions)
End-to-end (E2E) performance management	Real-time, transparent KPI management	Focused management attention
Support functions	5–15% reduction in indirect spend	Employee engagement through simplified processes
Marketing and sales	3–8% additional net sales growth	Improved brand positioning based on sustainability goals
Logistics	1–3% increase in contribution margin	Up to 85% reduction in air freight
Customer-backed E2E planning and execution	5–15% reduction in fixed costs	10–15% increase in customer satisfaction
Procurement	2–5% reduction in direct spend	5–10% reduction in Scope 3 emissions
Production	5–50% labor productivity increase; 5–20% throughput	5–10% reduction in nonprime material
Technology	15–20% reduction in IT costs; 30–50% faster time to market	Shift to green IT with 30–50% reduction in Scope 1 emissions

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1 "End-to-end digital transformations for chemical companies," McKinsey, August 25, 2020.

Holistic tech-enabled digital transformation delivering end-to-end value involves efforts across three dimensions:

1. *Commercial transformation* with a focus on specific high-impact revenue improvements, such as pricing or reach with current offering, and new product introductions

2. *Operations transformation* centered on operational improvements to decrease costs through, for instance, leaner operations and Six Sigma

3. *Technology transformation* focusing on improvement of core applications and technology stack as the backbone of technology modernization to scale efforts of the commercial and operations transformation

The eight core principles for scaling your transformation

Based on our experience of more than 500 tech-enabled digital transformations, we have identified a set of eight core principles companies need to internalize if they want to harvest the fruits of their technology transformation (Exhibit 2).

1. Leadership clearly sets the direction
To achieve a successful digital transformation, the direction must be very clear from the start. Past experiences show that companies are especially successful when a specifically bold ambition has been set by the CEO right at the beginning.

In 2016, the first companies started to espouse such bold ambitions, discussing "digitization as a lever to drive further value creation" or how to "embed digital technology into every fiber of [their]

Exhibit 2

Asset-heavy companies must address eight core principles for a successful digital transformation.

Set-the-direction leadership CEOs should set a bold ambition as a first step toward achieving a successful digital transformation

United change story backed by action Top team's conviction and actions need to address the challenges specifically seen in resource industries

Focus on capability building Upskill the organization while in parallel attracting outside top talent to increase pace

Treat soft topics with the same emphasis as the hard topics Achieve a culture focused on high performance and organizational health

Modernize the technology backbone Build a strong core technology foundation to scale digital efforts

Visibility of value through digital Create clear value assurance process to demonstrate results early and often

Leverage data assets Combine technical know-how with proven governance principles to develop and deploy data assets

Implement in parallel Run a significant number of high-impact use cases in parallel

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Companies are especially successful when a specifically bold digital-transformation ambition has been set by the CEO right at the beginning.

business." Notably, however, it appears that a specific direction was not the determining success factor; instead, leading by giving strong direction was the key to success.

For example, a major oil and gas player aimed to go down the venture capital route and invest in new-energy businesses. This helped it to achieve an ambition to reduce CO_2 emissions and become more sustainable. Just as important, the company gained preferential access to disruptive technologies for itself, generating synergy effects. Initially, the company had a footprint in creating small start-ups with the required technology but without experience of how to scale and create synergies with the mothership. While the proven R&D capacities within asset-heavy industries can generate and internally pilot new ideas for impact, companies often lack the know-how to develop these ideas into stand-alone businesses. Using a venture capital approach helps to run the full process from idea generation to building large-scale businesses that can become part of the companies' asset portfolio. Such an approach is one potential route to success. As with many other successful paths, it starts with a clear vision in mind that has been set by the leadership.

2. United change story backed by action
To address the challenges specifically seen in resource-heavy industries, the top team of an organization should be aligned regarding their

convictions and their actions. But what exactly is top-team alignment, and why is it so critical for digital transformations in resource-heavy industries?

There needs to be clarity on the benefits to the business of the tech-enabled digital transformation, including specific high-level targets. Recognizing the value at stake requires a truly collaborative approach among business units and functions across the organization. This is necessary because digital improvements may not have a direct impact on the outputs of a particular business unit but along the value chain or due to synergies creating greater value. Silos are more pronounced and harder to break down in resource-heavy industries, as they usually originate further back in time when rigid departmental structures were a movement that improved manufacturing companies' productivity. Today's companies, however, often follow different departmental structures.

Traditional decade-long investment horizons result in a tendency to stay committed to a road map, while a "fail fast" mentality is essential for success in digital transformations. As such, the top team needs to find agreement on both the design principles and success criteria. As part of this, fail-fast mentality, entrepreneurial efforts—which may not have led to success in the "traditional" business metrics of EBIT and cash—should be seen as a success.

The transformation should start with a united rationale and change narrative. Envisioning the benefits from tangible assets is in general much

simpler compared with investment in intangible assets such as "technology." Leadership needs to recognize this challenge and show conviction to invest in these intangible assets in order to reap long-term benefits.

Embracing digital innovation doesn't come naturally for employees, as the benefits could take longer to materialize compared with traditional transformation efforts.[2] Hence, it is critical that leadership demonstrates visible excitement and commitment for a successful holistic transformation.

3. Focus on capability building

Challenges on the organizational side are often to blame for not being able to scale digital transformations.[3] Having the right people is an essential building block of a successful tech transformation. However, there is a well-known shortage of technically skilled people in labor markets globally. Nevertheless, given the technical nature of many employees in a resource-heavy industry, this challenge can be resolved by upskilling internal resources in parallel with recruiting outside top talent. Both measures combined promise a higher pace for tech transformations than most other industries could achieve (see Exhibit 3 for an illustrative example of different upskilling potentials).

In particular, it is necessary for senior management to adopt the role of being digital and advanced-analytics "champions"—involved in and directing

It is possible to upskill internal resources in energy and materials companies.

Upskilling potential in energy and materials companies, nonexhaustive

Existing roles	Digital role	Typical in-house availability
Management team, general managers	Digital and advanced analytics "champion"	Minimum training required; focused on understanding of digital projects
Production/technology managers, function team leaders	Digital and advanced analytics "aware"	Minimum training required; focused on understanding of digital projects
Maintenance and production team leaders, central technologist, continuous-improvement project resources, new hires	Translator	Technical employees can be easily trained to be practitioners
Section managers, technical functions, new hires	Data scientist	Several employees can be upskilled, but additional hiring may be required
Section managers, technical functions	Data engineer	Intensive training for limited employees; complemented by external hires
Central maintenance, local IT	IT architect	Intensive training for limited employees; complemented by external hires
Continuous-improvement project resources, local IT	Agile coach and project owner	Easy-to-train required employees
Nontechnical functions, local IT	UX/UI designer	Some expert hires may be required

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2   Adrian Booth, Nikhil Patel, and Micah Smith, "Digital transformation in energy: Achieving escape velocity," McKinsey, September 3, 2020.
3   "A manufacturer's guide to scaling Industrial IoT," McKinsey, February 5, 2021.

efforts on projects with a significant technology component. The same holds true for operational management, who need to become digital and at least advanced-analytics "aware."

Our experience shows that most job functions in areas like maintenance and production, central technology/maintenance, or technical functions can easily be trained to become "translators" for digital and advanced-analytics topics and thus act as a bridge. Similarly, agile coaches and product owners can be trained from among the existing workforce.

However, digital roles such as data scientists, data engineers, and IT architects require more concentrated effort. Likely, there are just a few employees who can be upskilled with acceptable effort, while very intensive training would be required for some others. Additional hiring is required in most cases, with these new hires largely used to complement the current workforce by bringing additional capabilities. Sometimes, experts in a specific field (for example, UX/UI designers) are needed to enable teams of upskilled designers.

Digital academies represent best practice for providing the workforce with the optimal learning materials, supported by a combination of in-house facilitators and external experts. Defining specific learning groups and curating the learning content into specific learning journeys deliver better outcomes. A variety of learning formats, with a train-the-trainer concept and see-do-teach methodology, have proved to be critical in setting up and scaling such academies. Overall, a track record of more than ten different use cases has highlighted the benefits—and the direct connection to value—of focusing on capability building as a key building block for tech transformations.

4. Treat soft topics with the same emphasis as the hard topics
In the past, many companies conducted a series of continuous improvement measures in individual functions, which helped to improve efficiency.

However, to embrace digital innovation, a shift in organizational culture is needed to focus on the twin aspects of high performance and organizational health.[4]

McKinsey research has shown that the culture of an organization correlates directly with the performance of the company. Top-quartile companies in terms of organizational health have shown on average three times total shareholder returns versus others.

Culture is critical to achieving large-scale change. However, transformations are notably challenging. It's no surprise that our research shows that about 70 percent fail in achieving their stated objectives. Of these failures, about two-thirds can be attributed to culture-related challenges. Moreover, it is inherently hard to replicate culture. The benefits are obvious, though. Organizations that manage to develop the right culture find it easier to attract and retain digital talent.

These cultural transformations are usually conducted in three major phases: goal setting, action planning, and implementation—steps that are simplistic yet powerful.

First, a clear direction is achieved if leaders can communicate their vision—including goals—at regular town halls or via an increased presence. This enables employees to see how their work ties to the mission. Second, leaders must create a clear structure to support their vision, providing clarity with well-defined objectives and goals associated with every individual role. Lastly, specific action plans by priority practice enable the implementation efforts and unlock the impact of the transformation.

For example, a global energy company enhanced its performance within three years of a transformation by embedding cultural upgrades. Outcomes were measured via the McKinsey Organizational Health Index and resulted in double-digit improvements in the areas of direction, leadership, shared vision, employee involvement, and personal ownership.

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[4]   McKinsey Organizational Health Index; McKinsey transformational change survey.

The five pillars for modernizing the technology backbone should not be introduced as a "big bang" but rather as gradual uplifts from starting points that are unique to each organization.

5. Modernize the technology backbone

A strong, modernized core technology backbone is essential to scale digital efforts and is built around five pillars:

1. A common data and AI platform to ingest, store, access, process, and govern information technology and operational technology (IT/OT) data across the enterprise helps to reduce complexity and to accelerate deployment of initiatives by reducing tech debt.[5]

2. A modernized data and application integration layer with new platforms like APIs, and its extension into the plant zone, helps to rapidly deploy functionality for a consistent user experience across multiple channels.

3. Enhanced cloud services, via a multicloud approach and self-service provisioning of a private cloud, support an enhanced security posture for data for the organization.

4. Integration of plant and corporate initiatives via intersection of IT/OT systems enables availability of quality data throughout the enterprise, eliminating silos and improving the quality of solutions.

5. Definition of key capabilities that need to be standardized, as well as reuse of key foundational and digital platforms that are used to simplify and enhance the application landscape—for example, enterprise resource planning (ERP) and manufacturing execution systems (MES)—are essential to support value realization of at-scale implementations and to achieve improved ROI from the reuse of core tech components.

We recognize that modernizing the entire IT landscape can be a challenging task, as many organizations are faced with legacy IT systems with difficult-to-mine business rules. The five pillars we outlined above are usually introduced not as a "big bang" but as gradual uplifts from starting points that are unique to each organization. Taking a business-focused use-case approach would be a good starting point for the modernization.[6]

6. Visibility of value through digital

A clear value assurance process needs to be created to demonstrate results often and early. This means that all actions of the technology transformation must be translated into financial shareholder value.

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[5] Tech debt refers to the off-balance-sheet accumulation of all the technology work a company needs to do in the future: for example, complications created by old and outdated systems can make integrating new products and capabilities prohibitively costly; challenges hidden in the architecture can spring surprises that make projects run over budget and miss deadlines.

[6] Ani Bhalekar and Karel Eloot, "A scalable IIoT tech stack starts with business-focused use cases," McKinsey, July 16, 2019.

While nobody would doubt that technology delivers enablers for the digital transformation, initial funding is needed to kick-start the transformation. Then, as soon as value creation begins, the transformation itself will fund future investments. This leads to a closed-loop reinforcement mechanism whereby technology modernization enables business value, which in turn funds further investment in technology to create additional business value.

As such, it is critically important to make the impact of technology visible by demonstrating business value delivery: the front line takes ownership of linking individual initiatives to digital transformation to demonstrate benefits; a focused transformation management team takes responsibility for facilitating stakeholder visibility across the organization.

A rigorous value assurance approach will be able to deliver and sustain value by ensuring a steady pipeline of use cases. Furthermore, transparency on the achieved impact is provided, clear rules are set (baselining, benefits counting), and KPIs are tracked in a continuous fashion.

Best practice for value assurance is via a stage-gate process as the core governance element to locate high-impact cases while derisking delivery. A well-managed transformation management approach enables delivery of "one source of truth" to track the performance of initiatives and provide clear accountability to initiative owners, with automated reporting against KPIs and clear guidance to teams.

7. Leverage data assets
Our core beliefs on the best approach to data is to combine technical know-how with proven governance principles and a focus on upskilling.

A central data platform should drive all data integration, carefully managing the entire data life cycle from ingestion to analysis. The accompanying data governance needs to be managed holistically, covering key dimensions including security, controls, and prioritization across all data domains.

The delivery approach and capability building should be at the heart of any data platform, with embedded agility and talent management as key goals, to reduce risk and ensure architecture can be properly maintained. This usually includes a data office that coordinates design choices on operating models and technology and helps scale the effort across the organization.

Successful examples have usually consisted of one "assetization" center-of-excellence team that owns the development of standards and assets. Additionally, there were smaller site squads that tailor and deploy assets to market specifics. The central team and the local teams constantly exchange data by publishing code to the code repository. The code is locally tailored to meet the deployment specifics. Feedback, improvement, and innovations are relayed back to the central team that iterates the assets.

The most successful examples used a federated data office and a central data platform with clear governance. The embedded teams used an agile approach and were highly focused on generating impact.

8. Implement in parallel
Gathering up-front momentum is important to the success of a digital transformation. Companies usually launch and develop multiple initiatives simultaneously. While only a few become successful, others still represent a meaningful step in the process for other, more successful use cases.

Resource-heavy industries need to show value through digitization across multiple assets and domains in parallel to create organization-wide support. To do this, a significant number of high-impact use cases needs to run in parallel, with failure of some of those use cases factored in.

To illustrate this approach, let's consider a typical World Economic Forum Lighthouse[7] project (Exhibit 4). This typically delivers 50-plus use cases to realize digital innovation.

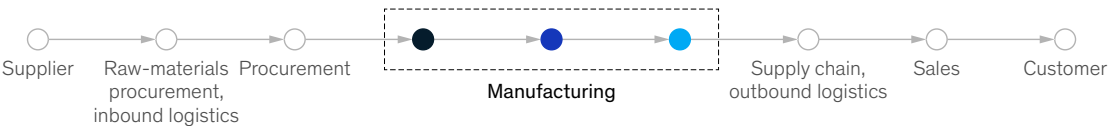[7]   Global Lighthouse Network, World Economic Forum.

The aim is to operate with one company operating system that implements the new way of working across value chains, people, assets, and functions. A wave approach covering these different areas allows the building of momentum across the organization.

Exhibit 4

Digital-transformation themes focus on both functions and value chain steps; digitalization of manufacturing has great potential in asset-heavy industries.

Digital-transformation themes

Supplier — Raw-materials procurement, inbound logistics — Procurement — **Manufacturing** — Supply chain, outbound logistics — Sales — Customer

Manufacturing themes

● Technical (process, quantity, yield)
- *Raw-material optimization*
- *Plant productivity and working conditions*
- *Process stability*

● Production
- *Yield and throughput*
- *Optimization of consumables*
- *Energy efficiency*

● Maintenance (OEE,[1] availability, uptime)
- *Prescriptive maintenance*
- *Recipe optimization*
- *Product quality optimization*

Themes in functions

Contractor management and contract compliance	*Workforce planning*	*Safety compliance*	*Environmental impact transparency/ optimization*	*Cost transparency*

[1]Overall equipment effectiveness.

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