Leading the digital transformation toward “Made in China 2025”

McKinsey&Company
Companies around the world are engaging in digital transformations that create substantial impact across the value chain.

**Connectivity**

Connectivity groups Digital Manufacturing solutions that improve and facilitate operational performance, management, and everyday collaboration of employees (such as augmented reality and digital performance management).

**Intelligence**

Intelligence refers to applications around analytics and prediction models as well as digital twins of products and processes (such as predictive maintenance or demand forecasting).

**Flexible automation**

Flexible automation is associated with automation solutions that use new digital equipment to increase efficiency through its flexible deployment in the production system (such as autonomous guided vehicles or exoskeletons).
Digital transformation creates business values, increases productivity, and gets/stays competitive

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Description</th>
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<tbody>
<tr>
<td>10-30%</td>
<td>Reduction in design and engineering cost</td>
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<tr>
<td>20-50%</td>
<td>Decrease in cost for inventory holding</td>
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<tr>
<td>20-50%</td>
<td>Reduction in time-to-market</td>
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<tr>
<td>10-20%</td>
<td>Reduction in cost for quality</td>
</tr>
<tr>
<td>3-5%</td>
<td>Increase in overall productivity</td>
</tr>
<tr>
<td>45-55%</td>
<td>Increase of productivity through automation of knowledge work</td>
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<tr>
<td>30-40%</td>
<td>Reduction of total machine downtime</td>
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<tr>
<td>85% +</td>
<td>Increase in forecasting accuracy</td>
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However, many transformations have failed due to inadequate preparation

Key challenges faced by companies

**Operating System**
- Lack of strategies to decide which technologies to prioritize
- Lack of a clear business case to justify investments in technologies

**Management System**
- Lack of coordination across different organizational units to implement digital strategy
- Lack of courage to push through radical transformation
- Lack of necessary talent and capability, e.g., data scientists

**Ecosystem**
- Difficulty in data integration and ownership concerns with third-party providers or disparate sources especially used to manage performance
- Cybersecurity concerns with third-party providers

![Performance Chart]

- As % of total transformation projects
- Performance over time
To help tackle these challenges, McKinsey has set up a global network of Digital Capability Centers (DCCs).

**Digital Capability Center**

**Aachen**
Collaboration in the advanced textile field, with partners in machine manufacturing and IoT platforms

**Beijing**
Partnership with Tsinghua University and active collaboration with IoT technical providers

**Chicago**
A major manufacturing hub with 290 members:
- Leading universities
- Government and agencies
- World-class industry leaders and SMEs

**Venice**
Joint venture with industrial associations and active collaboration with IoT partners

**Singapore**
Public-private partnership with 44 industry members mainly from the aerospace and machinery sectors, with expansion towards IoT
In China, DCC partners with Tsinghua University to create a best-in-class showroom and factory enabled by digital tools and use cases.
Key features

Physical showcase of end-to-end digital thread from product development, supply chain and manufacturing
Safe testbeds for piloting industry 4.0 technologies on a real-life example
Capability centers for experiential training from lean to industry 4.0

Key objective: accelerate adoption of digital transformation in China
Specifically, the center is equipped with state-of-the-art disruptive technology & end-to-end digital tools for digital transformation.

End-to-end Digital Showroom (100 m²)

We demonstrated one gearbox company’s digital transformation through cutting edge disruptive technologies and digital tools introduction.
The center also includes digitalized lean production and smart manufacturing lines.

Digital Factory Shop Floor (650 m²)

The center depicts the smart manufacturing concept through simulation to create impactful learning and experiment opportunity.
The Digital Capability Center in Beijing offers a unique way to prepare clients for their digital transformation journey

1. **Customized Training Modules with Experimental Learning**
   - Illustrate the Industrial Revolutions changes at different configuration of the gearbox production lines
   - Incorporate global curriculum system into 30+ digital modules & provide tailored courses for all levels from CxOs to frontline managers
   - Establish the digital transformation essential courses to not only focus on digital technologies but also management system
   - Achieve clarity in digital strategy through field visits and exchanges with best-in class companies

2. **Advanced End-to-End Digital Solution**
   Collaborate with Tsinghua University by harnessing its strong R&D capability and leverage McKinsey’s global digital IPs to offer:
   - An IoT vertical stack solution that transfers hardware infrastructure to digital applications
   - Digital Factory Solution Suite, an end-to-end digital manufacturing solution
   - 100+ hands-on digital use cases across the value chains to realize solid business impact

3. **Impact Oriented Holistic Digital Transformation**
   Support clients at each stage of the digital transformation journey by:
   - Diagnosing pain points
   - Designing transformation roadmap
   - Piloting to prove concept
   - Rolling out digital modules across the organization
Various stages of the industrial revolution are illustrated at the DCC Beijing through gearbox production lines.
McKinsey’s capability building learning modules capture the essence of the digital transformation

Technology System

**Essentials**
- IoT stack configuration, platform and tools
- Cybersecurity for integrated network
- E2E product traceability and automated flow
- Digital Transformation Program to maximize impact

**Resources**
- Yield, energy and throughput optimization
- Energy optimization with big data and advanced analytics

**Planning**
- Application of additive manufacturing
- Process and layout design using digital twin
- Batch size determination and design for line flexibility
- Production planning, scheduling and demand levelling

**Quality**
- Optimization of equipment working parameters
- Adaptive new sensing and measuring technologies for defect identification

**Assets**
- Line balancing and smart routing in real time
- Predictive maintenance with big data and advanced analytics
- Remote maintenance to improve labor and maintenance efficiency
- Use of AR and VR support to improve maintenance efficiency

**Labor**
- Use of wearables during assembly and production
- Use of autonomous vehicles (AGV)
- Introduction of human / robot collaboration
- Workforce management

**Inventory, Time to market, S/D match**
- Intelligent material storage
- Use of E2E digital thread

Management Infrastructure

- Digitalization of standard work
- Integrated digital performance management
- Digital root cause problem solving
- Manufacturing Organization of the future

Capabilities, Mindsets, and Behaviors

- Digital skills of the future and capability building
- Mindset shift to enable Industry 4.0 transformation in the workplace
- Virtual showcases on Supply Chain, Procurement, CapEx and Product Development
The center provides a wide range of digital manufacturing learning modules to meet the needs of leaders at various levels.

<table>
<thead>
<tr>
<th>Needs</th>
<th>Courses</th>
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<tbody>
<tr>
<td><strong>Architect Digital Transformation (0.5-1 day)</strong></td>
<td>- Lead digital transformation essentials</td>
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<tr>
<td></td>
<td>- Digital transformation essentials</td>
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<tr>
<td></td>
<td>- Digital technology overview</td>
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<td></td>
<td>- Industry best cases/practices</td>
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<tr>
<td><strong>Promote Digital Transformation (3 days)</strong></td>
<td>- Lead digital programs and initiatives</td>
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<td></td>
<td>- Digital transformation essentials</td>
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<td></td>
<td>- Digital technology overview</td>
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<td>- Selected digital technology modules deep dive</td>
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<td>- Design agile digital organization</td>
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<tr>
<td><strong>Execute Digital Transformation (5-10 days)</strong></td>
<td>- Ensue the execution of digital program on frontline</td>
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<tr>
<td></td>
<td>- Digital transformation essentials</td>
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<td></td>
<td>- Digital performance management</td>
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<td></td>
<td>- Selected digital technology modules deep dive</td>
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<td></td>
<td>- Transformation leadership</td>
</tr>
<tr>
<td><strong>Lead Digital Transformation (5-10 days)</strong></td>
<td>- Support digital transformation strategy</td>
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<tr>
<td></td>
<td>- Digital transformation essentials</td>
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<tr>
<td></td>
<td>- Digital technology concept</td>
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<td>- Selected digital technology modules deep dive</td>
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<td></td>
<td>- Digital waste elimination</td>
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<td>- Digital performance management</td>
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<td></td>
<td>- Advanced analytics</td>
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<td>- IoT infrastructure</td>
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<td></td>
<td>- Automation overview</td>
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<td>- Transformation leadership</td>
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Industry 4.0 “Go&See”: Get unparalleled clarity on digitalization strategies through field visits and on-site interactions with benchmark companies

Why join us at Industry 4.0 “Go&See”?

Seeing is believing! Industry 4.0 “Go&See” is for you if:

Your company is embarking on a journey of digital transformation and smart manufacturing upgrades.

You are uncertain about the impact of digitalization.

You would like to get a crash course on getting started in the digital world.

You find it difficult to find alignment on the strategic direction of digitalization within your organization.

The best way to win in the world of digitalization is by going out and meeting the forerunners of digital transformation, listening to their success stories and learning from their pitfalls.

Different options available in this program:

Visit Industry 4.0 benchmark companies in Europe and the US:
1 week | Open to participation from Chinese companies
— Get valuable takeaways from leading European and US companies on their path to successful digitalization
— Get access to forward-looking insights from top leaders and scholars

Made in China 2025 Experience Day:
1-2 days | Open to participation from Chinese companies
— Experience select Chinese smart manufacturing model enterprises and demonstration centers in action
— Get to know what smart manufacturing is all about and where it is heading

Visit lean benchmark companies in Japan:
1 week | Open to participation from Chinese companies
— Learn how you can upgrade your lean management practices in the birthplace of the concept—Japan
— Experience craftsmanship and learn the nuances of focusing on tiny details

Industry 4.0 “Go&See”: Get unparalleled clarity on digitalization strategies through field visits and on-site interactions with benchmark companies

Expected objectives
— Deepen your knowledge on Industry 4.0 and smart manufacturing to understand the benefits and risks associated with digital transformations
— Participate in experiential case studies to comprehend how digitalization (smart manufacturing) can deliver real financial impact for your company
— Learn about McKinsey’s Digital Diagnostic Methodology to understand how you can take the first step towards your digital transformation journey

Core features
— Take advantage of high-quality experience and learning—McKinsey has partnered with Tsinghua University for this program
— Access McKinsey’s powerful digital transformation insights, and analytic and diagnostic tools
— Benefit from immersive learning and hands-on experience opportunities with advanced digital use cases
— Stand on the high ground of the industry and gain an understanding of Industry 4.0 and smart manufacturing

〉 Participant composition: 15-20 senior executives
The Digital Factory Solution Suite has 7 modules and 27 use cases to enable remarkable efficiency improvement of a digitalized lean plant:

- Digital Performance Management (DPM)
- Electrical Production Management (EPM)
- Organizational Health Index (e-OHI)
- Digitalized Way of Work (e-WoW)

- Electronic-SOP (e-SOP)
- Electronic Debottleneck (e-debottleneck)
- In Door Position UWB System
- Electronic Skill Matrix
- Electronic Labor Performance Management
- Electronic 5S Score Record (e-5S)

- Electronic-OEE (e-OEE)
- Electric Preventive Maintenance Checklist (e-PM)
- Electronic Auto Alarm (e-alarm)
- Remote Experts Support (Remote expert)
- Predictive Maintenance (PdM)
- AR Enabled Maintenance Works

- Online SPC
- Automatic Problem Escalation
- Product Full Traceability

- Electronic Material Pull System
- Advanced Planning System (APS)
- Auto Guided Vehicle (AGV)

- Cloud-based Benchmarking
  - Yield, Energy & Throughput (YET)
- Real-time EE Management
- Real-time Energy Load Curve
- Real-time Energy Bridge
The Digital Capability Center in Beijing helps to create significant business impact through 100+ digital use cases across the value chain.

<table>
<thead>
<tr>
<th>Key Levers</th>
<th>Impact</th>
<th>Total Impact</th>
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<tbody>
<tr>
<td>- Customized co-creation</td>
<td>30-50%</td>
<td>5 -10%</td>
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<td>- Customized orders</td>
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<td>- Customer insights and interactions</td>
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<td>- 3D printing prototype</td>
<td>20-50%</td>
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<td>- Rapid experimentation &amp; simulation</td>
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<td>- Product lifecycle management</td>
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<td>- Predictive forecast</td>
<td>20-50%</td>
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<td>- Real-time supply chain performance &amp;</td>
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<tr>
<td>optimization</td>
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<td>- Advanced schedule</td>
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<td>- E-spending analysis</td>
<td>3-10%</td>
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<tr>
<td>- Online supplier list</td>
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<td>- E-bidding platform</td>
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<tr>
<td>- Online ordering</td>
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Revenue increased by 5 -10% and Cost reduced by 10-30%
20-40% Reduction in manufacturing costs
- Digital performance management
- Digital quality management
- Predictive maintenance
- Energy optimization

20-50% Increase of labor productivity
- Human-robot collaboration
- Automation of knowledge work
- Remote monitor & control

10-30% Reduction of total logistics costs
- Warehouse automation
- Live route optimization
- Online platform of trucking fleets

10-40% Reduction in costs for after sales maintenance
- Full product traceability
- Predictive maintenance
- Remote expert supporting

30-50% Quality improved by

Lead time shortened by
20-50%
Chinese companies need to develop a digital roadmap, introduce digital technology, and establish an ecosystem to prepare for their digital journey.

0. Establish digital roadmap

- High variation in capability amongst Chinese players requires tailored roadmap
- 360° assessment and evaluation of status quo to identify key gaps

1. Implement customer value-enabled digital operating system

- Identify key levers
- Benchmark with cross-industries
- Deploy appropriate digital tools for intelligent manufacturing

2. Transform management infrastructure and capability

- Agile organization structure
- Digital business process and performance mgmt
- Invest in talent development
- Drive people change management

3. Build a sustainable ecosystem

- Joint effort among policy maker, academia, supply chain participants for optimal resource allocation and multi-wins
McKinsey plays an indispensable role in all 4 key steps of the digital transformation, leveraging deep experience in developing customized solutions.

<table>
<thead>
<tr>
<th>Success factors for Industry 4.0</th>
<th>McKinsey’s role</th>
</tr>
</thead>
</table>
| **0. Conduct a full assessment to design top-level roadmap** | **Strategy advisor**  
- Top-down design the digital strategy roadmap as well as the corresponding lean, automation, digital and intelligent talent development direction  
- Provide third-party consulting on digitalization for government and main industries |
| **1. Implement client value oriented digital operating system** | **Chief designer & transformation driver**  
- Technical design and management implementation plan  
- Lead & support diagnosis, design, pilot and roll-out to speed up clients’ digital transformation  
- Introduce industry-/process-specific solutions |
| **2. Transform management infrastructure, mindset and capability** | **Capability builder & change implementers**  
- Foster technology experts & change agents at all levels via global resources and training center  
- Provide innovation test field for digital experts and innovative companies |
| **3. Build a sustainable ecosystem** | **Ecosystem integrator**  
- Help bridge clients (government, enterprises & technology providers) and facilitate partnership or M&A via McKinsey’s global network |
McKinsey helps clients to establish their transformation journey through a systematic 4-step approach.

A
Diagnose

Top-down Digital 4.0 On-site Diagnose, to prove digital transformation value

B
Pilot/Build Foundation

Form momentum to demonstrate the key opportunities and proof concept of the Pilot

Organization
Capability Building

- Digital Transformation Roadmap
- Digital Readiness Scan
- Holistic Digital Assessment

Manufacturing
Product Development
Marketing & Sales
Supply Chain Management
Procurement

Organization
Capability Building
Roll-out & expand the methodology to more modules, continuously improve **cross-function value creation**

**C** Establish Modules

**D** Integrate Systems

Automatic close loop integration: data are collected by control center sensors, processed with machine learning, and fed back to automated production equipment

- Real-time data lake operations
- Integrate IT system with data source
- Shop floor tools, e.g. SOP, dashboard
- Impact and performance management
DCC Beijing can provide guidance in the following areas

Visit the digital model factory

– Enjoy the on-site 1 day workshop to experience smart manufacturing overview and observe transformation from lean to Industry 4.0
– Build awareness on Industry 4.0 technologies and understand key approaches to diagnose value-at-stake in your organization

Participate in a digital transformation training at the DCC or at your manufacturing site

– Versatile training modules tailored for your leaders at different levels
– Help managers in your organization to build capabilities on Industry 4.0

Participate in the industry 4.0 experience tour

– Understand the successes and failures of pioneering enterprises on the digital roadmap
– Access the foresight of top entrepreneurs and business leaders

Provide digital transformation advice and services through our DCC experts

– Holistic digital transformation approach
– Tailored digital solution design and implementation
– Overall planning solution for digital factory
Please contact one of McKinsey’s experts to learn more about the DCC Beijing

Karel Eloot
Senior Partner

Arthur Wang
Partner

Forest Hou
Senior Expert

Sonnet Shen
Expert

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