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.

- **Data, computational power and connectivity**
  - Machine-to-machine and machine-to-product connectivity will help realize mass personalization
  - **10-30%** Reduction in design and engineering cost
  - **20-50%** Decrease in cost for inventory holding

- **Analytics and intelligence**
  - Use of advanced analytics enable shift from detect to predict and then to prevent
  - **20-50%** Reduction in time-to-market
  - **10-20%** Reduction in cost for quality

- **Advanced production methods**
  - Additive manufacturing with integrated and accelerated prototyping and manufacturing (i.e., 3D printing)
  - **3-5%** Increase in overall productivity
  - **45-55%** Increase of productivity through automation of knowledge work

- **Human machine interaction**
  - Virtual and augmented reality, industrial automation (e.g., collaborative robots, AGVs)
  - **30-40%** Reduction of total machine downtime
  - **85% +** Increase in forecasting accuracy

Digital transformation create business values, increase productivity, and get/stay competitive.
Key challenges faced by companies

**Operating System**
- Lack of strategy 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

However, many transformations have failed due to inadequate preparation.

To help tackle these challenges, McKinsey has set-up a global network of Digital Capability Centers (DCCs)

- **Digital Capability Center**
  - **Chicago**
    - A major manufacturing hub with 290 members:
      - Leading universities
      - Government and agencies
      - World-class industry leaders and SMEs
  - **Aachen**
    - Collaboration in the advanced textile field, with partners in machine manufacturing and IoT platforms
  - **Beijing**
    - A major manufacturing hub with 290 members:
      - Leading universities
      - Government and agencies
      - World-class industry leaders and SMEs
    - Partnerships with Tsinghua University and active collaboration with IoT technical providers
  - **Chicago**
    - Public-private partnership with 44 industry members, mainly from the aerospace and machinery sectors, with expansion towards IoT
  - **Venice**
    - Joint venture with industrial associations and active collaboration with IoT partners
  - **Singapore**
    - Joint venture with industrial associations and active collaboration with IoT partners

Performance

As % of total transformation projects

Time

Failed

Successful

OS  MS  ES

Digital Capability Center
Aachen

Digital Capability Center
Beijing

Digital Capability Center
Singapore

Digital Capability Center
Venice
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.

The center also includes digitized lean production and smart manufacturing lines.

End-to-end Digital Showroom (100 m²)

- Plant 3D simulation
- Virtual Control Room
- Virtual Model Factory
- 3D Printers
- AR Glass
- Product Demo
- Supply Chain Designer
- IoT Wall
- Cloud Technology
- E-Procurement
- Product Lifecycle Management
- Human Cooperative Robotics

Digital Factory Shop Floor (650 m²)

- Predictive Maintenance
- Digitized Gearbox Assembly Line
- Smart Logistics
- Auto Gearbox Assembly
- Digitized Tea Line
- Digital Quality System
- Robotics & CNC

We demonstrated one gearbox company’s digital transformation through cutting edge disruptive technologies and digital tools introduction.

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

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

The center provides a wide range of digital manufacturing learning modules to meet the needs of leaders at various levels

### 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 leveling

**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

- Digitization 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

### Needs and Courses

<table>
<thead>
<tr>
<th>Needs</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architect Digital Transformation (0.5-1 day)</td>
<td>- Lead digital transformation, define digital strategy and goals</td>
</tr>
<tr>
<td>- Digital transformation essentials</td>
<td></td>
</tr>
<tr>
<td>- Digital technology overview</td>
<td></td>
</tr>
<tr>
<td>- Industry best cases/practices</td>
<td></td>
</tr>
<tr>
<td>Promote Digital Transformation (3 days)</td>
<td>- Lead digital programs and initiatives</td>
</tr>
<tr>
<td>- Promote digital transformation culture</td>
<td></td>
</tr>
<tr>
<td>- Digital transformation essentials</td>
<td></td>
</tr>
<tr>
<td>- Digital technology overview</td>
<td></td>
</tr>
<tr>
<td>- Selected digital technology modules deep dive</td>
<td></td>
</tr>
<tr>
<td>- Design agile digital organization</td>
<td></td>
</tr>
<tr>
<td>Execute Digital Transformation (5-10 days)</td>
<td>- Ensue the execution of digital program on frontline</td>
</tr>
<tr>
<td>- Lead transformation of agile organization</td>
<td></td>
</tr>
<tr>
<td>- Digital transformation essentials</td>
<td></td>
</tr>
<tr>
<td>- Digital performance management</td>
<td></td>
</tr>
<tr>
<td>- Selected digital technology modules deep dive</td>
<td></td>
</tr>
<tr>
<td>- Transformation leadership</td>
<td></td>
</tr>
<tr>
<td>Lead Digital Transformation (5-10 days)</td>
<td>- Support digital transformation strategy</td>
</tr>
<tr>
<td>- Design digital transformation roadmap</td>
<td></td>
</tr>
<tr>
<td>- Promote digital technologies pilot</td>
<td></td>
</tr>
<tr>
<td>- Manage digital initiative</td>
<td></td>
</tr>
<tr>
<td>- Deliver digital training courses</td>
<td></td>
</tr>
<tr>
<td>- Digital transformation essentials</td>
<td></td>
</tr>
<tr>
<td>- Digital technology concept</td>
<td></td>
</tr>
<tr>
<td>- Selected digital technology modules deep dive</td>
<td></td>
</tr>
<tr>
<td>- Digital waste elimination</td>
<td></td>
</tr>
<tr>
<td>- Digital performance management</td>
<td></td>
</tr>
<tr>
<td>- Advanced analytics</td>
<td></td>
</tr>
<tr>
<td>- IoT infrastructure</td>
<td></td>
</tr>
<tr>
<td>- Automation overview</td>
<td></td>
</tr>
<tr>
<td>- Transformation leadership</td>
<td></td>
</tr>
</tbody>
</table>
A classic 1-day workshop allows CxOs to experience the digital transformation along the value chain.

The Digital Factory Solution Suite has 7 modules and 27 use cases to enable remarkable efficiency improvement of a digitized lean plant.

<table>
<thead>
<tr>
<th>Module</th>
<th>Venue</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrival site</td>
<td>Front desk in building</td>
<td>09:00 onwards</td>
</tr>
<tr>
<td>Registration and break networking</td>
<td>B137 meeting room</td>
<td>09:10 (20 mins)</td>
</tr>
<tr>
<td>Introduction</td>
<td>B137 meeting room</td>
<td>09:30 (45 mins)</td>
</tr>
<tr>
<td>GearBox Co. Introduction</td>
<td>B137 meeting room</td>
<td>10:15 (10 mins)</td>
</tr>
<tr>
<td>PLM introduction</td>
<td>B137 meeting room</td>
<td>10:25 (15 mins)</td>
</tr>
<tr>
<td>SCM introduction</td>
<td>B137 meeting room</td>
<td>10:35 (10 mins)</td>
</tr>
<tr>
<td>PSM introduction</td>
<td>B137 meeting room</td>
<td>10:45 (5 mins)</td>
</tr>
<tr>
<td>Plant 3D simulation</td>
<td>B137 meeting room</td>
<td>10:50 (5 mins)</td>
</tr>
<tr>
<td>DFM introduction</td>
<td>B137 meeting room</td>
<td>10:55 (5 mins)</td>
</tr>
<tr>
<td>Disruptive technology demonstration</td>
<td>B137 meeting room</td>
<td>11:00 (10 mins)</td>
</tr>
<tr>
<td>Break</td>
<td></td>
<td>11:10 (15 mins)</td>
</tr>
<tr>
<td>Digital plant overview</td>
<td>B2 shop floor</td>
<td>11:35 (5 mins)</td>
</tr>
<tr>
<td>Digital Factory Suite introduction</td>
<td>B2 shop floor</td>
<td>11:40 (5 mins)</td>
</tr>
<tr>
<td>Production line tour</td>
<td>B2 shop floor</td>
<td>11:45 (20 mins)</td>
</tr>
<tr>
<td>Warehouse AR glass module</td>
<td>B2 shop floor</td>
<td>12:05 (5 mins)</td>
</tr>
<tr>
<td>Quality module</td>
<td>B2 shop floor</td>
<td>12:10 (5 mins)</td>
</tr>
<tr>
<td>Predictive Maintenance</td>
<td>B2 shop floor</td>
<td>12:15 (5 mins)</td>
</tr>
<tr>
<td>Digital tea line introduction</td>
<td>B2 shop floor</td>
<td>12:20 (10 mins)</td>
</tr>
<tr>
<td>Lunch break</td>
<td>B145 cafe</td>
<td>12:30 (60 mins)</td>
</tr>
<tr>
<td>Digital waste observation</td>
<td>B2 shop floor</td>
<td>13:30 (60 mins)</td>
</tr>
<tr>
<td>Digital factory design</td>
<td>B2 shop floor</td>
<td>14:30 (30 mins)</td>
</tr>
<tr>
<td>Break</td>
<td></td>
<td>15:00 (15 mins)</td>
</tr>
<tr>
<td>Way to transform</td>
<td>B137 meeting room</td>
<td>15:15 (15 mins)</td>
</tr>
<tr>
<td>Summary</td>
<td>B137 meeting room</td>
<td>15:30 (30 mins)</td>
</tr>
</tbody>
</table>
The Digital Capability Center in Beijing helps to create significant business impact through 100+ digital use cases across the value chain.

- **30-50%** Increase in customer satisfaction rate
  - Customer co-creation
  - Customized orders
  - Customer insights and interactions

- **20-50%** Reduction in design and engineering lead time
  - 3D printing prototype
  - Rapid experimentation & simulation
  - Product lifecycle management

- **20-50%** Reduction in costs for inventory holding
  - Predictive forecast
  - Real-time supply chain performance & optimization
  - Advanced schedule

- **3-10%** Reduction in procurement costs
  - E-spending analysis
  - Online supplier list
  - E-bidding platform
  - Online ordering

- **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

**Total Impact**
- **5-10%** Revenue increased by
- **30-50%** Quality improved by
- **20-50%** Leadtime shortened by
- **10-40%** Reduction in costs for after sales maintenance
- **10-30%** Reduction of total logistics costs
- **20-40%** Reduction in manufacturing costs
- **3-10%** Reduction in procurement costs
- **20-50%** Increase of labor productivity
- **30-50%** Increase in customer satisfaction rate
- **20-50%** Reduction in design and engineering lead time
- **30-50%** Increase in customer satisfaction rate
- **10-30%** Reduction of total logistics costs
- **10-40%** Reduction in costs for after sales maintenance
- **10-40%** Reduction in costs for after sales maintenance
- **10-30%** Reduction of total logistics costs
- **20-40%** Reduction in manufacturing costs
- **3-10%** Reduction in procurement costs
- **20-40%** Reduction in manufacturing costs
- **30-50%** Increase in customer satisfaction rate
- **20-50%** Reduction in design and engineering lead time
- **30-50%** Increase in customer satisfaction rate
- **20-50%** Reduction in design and engineering lead time
- **30-50%** Increase in customer satisfaction rate
- **20-50%** Reduction in design and engineering lead time
- **30-50%** Increase in customer satisfaction rate
- **20-50%** Reduction in design and engineering lead time
- **30-50%** Increase in customer satisfaction rate
- **20-50%** Reduction in design and engineering lead time
- **30-50%** Increase in customer satisfaction rate
- **20-50%** Reduction in design and engineering lead time
- **30-50%** Increase in customer satisfaction rate
- **20-50%** Reduction in design and engineering lead time
- **30-50%** Increase in customer satisfaction rate
- **20-50%** Reduction in design and engineering lead time
- **30-50%** Increase in customer satisfaction rate
- **20-50%** Reduction in design and engineering lead time
- **30-50%** Increase in customer satisfaction rate
- **20-50%** Reduction in design and engineering lead time
- **30-50%** Increase in customer satisfaction rate
- **20-50%** Reduction in design and engineering lead time
- **30-50%** Increase in customer satisfaction rate
- **20-50%** Reduction in design and engineering lead time
- **30-50%** Increase in customer satisfaction rate
- **20-50%** Reduction in design and engineering lead time
- **30-50%** Increase in customer satisfaction rate
- **20-50%** Reduction in design and engineering lead time
- **30-50%** Increase in customer satisfaction rate
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

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

技术支持

- **Enabling Industry 4.0**
  - Technology and business model break-through

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

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

Provide digital transformation advice and services through our DCC experts
- Holistic digital transformation approach
- Tailored digital solution design and implementation