Building the Supply Chain of the Future
Companies face upstream and downstream challenges across the supply chain, involving external parties and unforeseen events.

<table>
<thead>
<tr>
<th>Suppliers</th>
<th>EXAMPLE</th>
<th>Labor shock at a raw material supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Raw materials cannot be supplied to production on time</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Production</th>
<th>EXAMPLE</th>
<th>Unforeseen demand surge on a specific transportation lane</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Schedule is not adjusted due to a lack of upstream visibility</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Warehousing</th>
<th>EXAMPLE</th>
<th>Unforeseen demand surge on a specific transportation lane</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lines need to keep running, so manufacturing creates unneeded products that fill warehouses</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transportation</th>
<th>EXAMPLE</th>
<th>Unforeseen demand surge on a specific transportation lane</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A lack of product results in low transportation utilization</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Customer</th>
<th>EXAMPLE</th>
<th>Unforeseen demand surge on a specific transportation lane</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Customer is dissatisfied because orders were not fulfilled and they did not receive sufficient notification</td>
</tr>
</tbody>
</table>

Late changes to the production plan cause disruptions, inventory challenges, and rush shipments.

Excess warehouse inventory forces manufacturing to produce a different product.

Orders back up because carriers missed pickup, forcing load prioritization.

Increased demand for a given mode of transportation results in a lack of carrier capacity.

Customer is dissatisfied because the order arrived late.

Source: BCG.
Building a supply chain of the future is a process of continual upward growth

Stagnating
Yet to get digital transformation right; limited value created

Emerging
Executed successful programmatic transformation, but challenged in effectively scaling organization-wide

Scaling
Delivered multiple waves of successful digital transformation, pivoting to innovation-led growth and the ability to absorb supply chain disruptions

Future-built
Continuous innovation at the leading edge of disruption via systematic building of necessary capabilities at scale, such as digital and AI, resilience, and sustainability

UNDERGOING DIGITAL SUPPLY CHAIN TRANSFORMATION
Using a programmatic approach to fix the core and build a foundation for innovation

BUILDING A SUPPLY CHAIN OF THE FUTURE
Embedding and scaling cross-functional attributes to help the company pivot from innovation to growth

Note: Stages of development are based on three years of detailed company research across six key attributes and assessed using a weighted average of strategy and leadership (19%), employee value proposition (19%), tech and data platform (18%), innovation-driven culture (14%), agility and resilience (17%), and AI deployment (13%). Respondents are supply-chain-focused companies, meaning companies operating in the following industries: consumer products, retail, fashion and luxury, medtech, biopharma, power and utilities, oil and gas, transportation and logistics, automotive and mobility, hardware and semiconductors, and materials and processing.
Across industries, most companies are lagging in supply chain capabilities

Note: BFF = Build for the Future; score is based on three years of detailed company research across six key attributes and assessed using a weighted average of strategy and leadership (19%), employee value proposition (19%), tech and data platform (18%), innovation-driven culture (14%), agility and resilience (17%), and AI deployment (13%). Respondents are supply-chain-focused companies, meaning companies operating in the following industries: consumer products, retail, fashion and luxury, medtech, biopharma, power and utilities, oil and gas, transportation and logistics, automotive and mobility, hardware and semiconductors, and materials and processing.
Future-built supply chain companies score high across six key attributes; AI differentiates leaders and laggards

Six key attributes¹

1. Embedding AI for value in the organization
2. Developing a clear people advantage
3. Migrating to modernized tech platforms
4. Establishing an innovation-driven culture
5. Instituting an operating model to enable agility and resilience
6. Aligning leadership around a corporate purpose

Advanced² companies score higher than lagging³ companies by:

- Embedding AI for value in the organization: 54%
- Developing a clear people advantage: 37%
- Migrating to modernized tech platforms: 31%
- Establishing an innovation-driven culture: 31%
- Instituting an operating model to enable agility and resilience: 29%
- Aligning leadership around a corporate purpose: 25%

Note: Supply chain companies are those operating in the following industries: consumer products, retail, fashion and luxury, medtech, biopharma, power and utilities, oil and gas, transportation and logistics, automotive and mobility, hardware and semiconductors, and materials and processing. BCG has empirically identified these six key attributes as attributes shared by companies that are successfully building for the future. Advanced refers to scaling and future-built companies. Llagging refers to stagnating and emerging companies.
With four key transformations, supply chains can become future-built

**Digital & AI**
Digital transformation will be a substantial enabler of all improvements in the supply chain—particularly the use of AI

**Resilience**
A transformation in resilience will be essential because disruptions and crises, while they may be shorter than the COVID pandemic, will likely be much more frequent and consequential

**Sustainability**
Sustainability transformation will be key, given that it is a universal humanitarian challenge—and supply chains are at the core of this challenge

**Cost**
Cost transformation is also critical, given that achieving the other three transformations will have a significant impact on the company’s overall costs

Source: BCG.
The six attributes of future-built companies can be applied in several ways within the four key supply chain transformations:

<table>
<thead>
<tr>
<th>Transformation</th>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Digital &amp; AI</strong></td>
<td>- Integrate digital into the business strategy</td>
</tr>
<tr>
<td></td>
<td>- Create a digital and AI talent ecosystem</td>
</tr>
<tr>
<td></td>
<td>- Decouple digital platforms and deploy modularity</td>
</tr>
<tr>
<td></td>
<td>- Empower management to lead digital initiatives</td>
</tr>
<tr>
<td></td>
<td>- Introduce rapid scalability</td>
</tr>
<tr>
<td></td>
<td>- Boost C-suite digital savviness</td>
</tr>
<tr>
<td></td>
<td>- Use AI for risk prediction in the supply chain</td>
</tr>
<tr>
<td></td>
<td>- Use upskilling and career development</td>
</tr>
<tr>
<td></td>
<td>- Bolster cybersecurity and implement data governance</td>
</tr>
<tr>
<td></td>
<td>- Use open APIs and a proven operating model to integrate third parties rapidly</td>
</tr>
<tr>
<td></td>
<td>- Bolster governance</td>
</tr>
<tr>
<td></td>
<td>- Enhance risk management and crisis response</td>
</tr>
<tr>
<td></td>
<td>- Introduce generative leadership</td>
</tr>
<tr>
<td><strong>Sustainability</strong></td>
<td>- Apply specific AI tools for sustainability and net zero use cases</td>
</tr>
<tr>
<td></td>
<td>- Hire sustainability-focused talent</td>
</tr>
<tr>
<td></td>
<td>- Employ sustainability monitoring tools</td>
</tr>
<tr>
<td></td>
<td>- Evaluate teams over individuals</td>
</tr>
<tr>
<td></td>
<td>- Introduce regulatory adaptability</td>
</tr>
<tr>
<td></td>
<td>- Develop a sustainability vision and roadmap</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td>- Use GenAI for cost optimization</td>
</tr>
<tr>
<td></td>
<td>- Implement a flexible work model</td>
</tr>
<tr>
<td></td>
<td>- Automate supply chain processes</td>
</tr>
<tr>
<td></td>
<td>- Foster an entrepreneurial culture</td>
</tr>
<tr>
<td></td>
<td>- Optimize the work design</td>
</tr>
<tr>
<td></td>
<td>- Use change management for AI adoption</td>
</tr>
<tr>
<td><strong>Resilience</strong></td>
<td>- Use AI for risk prediction in the supply chain</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td></td>
<td>- Introduce generative leadership</td>
</tr>
</tbody>
</table>

Note: GenAI = generative artificial intelligence.
All companies focus on digital, but supply chain leaders are outspending the competition

74% of all survey respondents cited supply chain digitization as one of their top three investment priorities (versus other areas of digitization across the company)\(^1\)

1.7x more is being invested into supply chain digitization by companies with future-built supply chains than by their peers

>50% of future-built companies intend to continue outspending their peers to unlock value in AI-enabled supply chain use cases

Note: Respondents were answering the following questions: Over the past three years, how much has your company invested in supply chain digitization, including infrastructure, services, software, and human capital, as a percentage of sales? In the next three years, how much do you expect your company will invest in supply chain digitization, including infrastructure, services, software, and human capital, as a percentage of sales? How does this investment compare to investments in other areas of digitization across the company? Both “supply chain leaders” and “companies with future-built supply chains” = companies ranked as future-built or scaling.

\(^1\) Includes respondents that selected either “top investment priority” or “top-three investment priority” for digitization.
AI leaders prioritize four steps to achieve stronger results

1. They clearly articulate an AI ambition and chart path to unlocking value

- Value generation is more likely when AI is on the CEO agenda
- Lagging: 50%
- Advanced: 91%

2. They build capabilities in data, technology, and digital talent

- Top differentiating capabilities for advanced companies
  - Data & tech: Modularity, Ecosystem integration, Data governance
  - Talent: Talent ecosystem, Attraction and retention

3. They align AI investments with goals, fueling growth

- Share of digital investments going to AI
  - Lagging: 18% ROI
  - Advanced: 23% ROI

4. They focus early on responsible AI (RAI)

- Companies with strong capabilities across all RAI metrics
  - Lagging: 7%
  - Advanced: 43%

Note: Lagging = stagnating + emerging; advanced = scaling + future-built. Responsible AI (RAI) = the process of developing and operating artificial intelligence systems that align with organizational purpose and ethical values. Supply chain companies are those operating in the following industries: consumer products, retail, fashion and luxury, medtech, biopharma, power and utilities, oil and gas, transportation and logistics, automotive and mobility, hardware and semiconductors, and materials and processing.
Leading companies are also rapidly adopting various GenAI applications for use cases throughout the supply chain

**Vertical supply-chain-specific use cases**

<table>
<thead>
<tr>
<th>Sourcing and procurement</th>
<th>Manufacturing</th>
<th>Supply planning and scheduling</th>
<th>Demand planning</th>
<th>Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplier knowledge base and search engine</td>
<td>Bills of material structuring and management</td>
<td>Pregeneration of new scenarios and schedules to simplify job optimization</td>
<td>Monitoring of consumer and market trends to improve forecasts</td>
<td>Identification of potential supply chain issues based on customer interactions</td>
</tr>
<tr>
<td>RFP and supplier-contract generation</td>
<td></td>
<td>Web monitoring to identify supply disruptions and acquire supply intel</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Horizontal use cases with applications to supply chains**

<table>
<thead>
<tr>
<th>Data enhancement</th>
<th>Human-machine interaction</th>
<th>Workflow automation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synthetic data generation for model training</td>
<td>Code generation for faster implementation of AI use cases</td>
<td>Conversational bots guiding workers on complex tasks and generating narratives to assist decisions</td>
</tr>
<tr>
<td>Identification of product similarity—for example, uses image recognition to support forecasts or new-product introductions</td>
<td>Natural language to query data, extract insights, and create reports</td>
<td>Smart workflow automation—from detecting events to triggering action plans</td>
</tr>
</tbody>
</table>

*Source: BCG.*

*Note: GenAI = generative artificial intelligence. RFP = request for proposal.*
Certain enablers of resilience build competitive advantage and mitigate risk

- A diversified footprint to ensure access to key markets and resources
- Redundant and robust supply across nodes
- Flexible sourcing and manufacturing
- Operating-risk awareness and traceability
- An accelerated response to disruptions

**Potential impact**

- Increased ability to resist and recover from shocks
- Shorter lead times
- Improved service levels
- Market access advantages for early movers
- Cost reductions of up to 15%

**Source:** BCG analysis.

**Note:** Nodes = points in the supply chain through which materials flow, such as factories, warehouses, distributors, and even customers. Traceability = visibility across the suppliers’ own supply chain, allowing risk to be predicted and assessed.
A truly resilient supply chain helps companies absorb shocks and recover from disruption faster, but few companies have reached this stage.

**Resilience**

**Recover**
React faster when a supply chain disruption occurs
(for example, a digital twin of operations evaluates disruption scenarios and prepares the supply chain, minimizing financial impact)

**Absorb**
Handle supply chain shocks more effectively
(for example, they employ a tiered sourcing strategy for custom and critical components via product redesign or alternative sourcing options)

Source: BCG 2022 Supply Chain Resilience Capabilities Survey (N=136).
Note: % denotes approximate percentage of companies in the quadrant. The percentages for absorption and recovery rates in the graph may not match the number of dots because they are rounded based on quadrant cutoffs; exact percentages may vary within each quadrant. Maturity = the ability to absorb supply chain shocks or to recover quickly after a crisis.
External pressures are forcing companies to prioritize environmental sustainability.

- Regulations are taking effect mandating the shift to more sustainable practices.
- Consumer expectations around sustainable products are rising rapidly.
- Investors are directing capital to companies that focus on sustainable practices.
- Environmental changes pose increasingly grave risks to global supply chains.

127 countries with restrictions on single-use plastic

73% of global consumers say they will alter buying habits to reduce environmental impact

$53tn in global AUM is estimated to be allocated to ESG investing by 2025

$300b in annual climate adaptation costs in developing countries by 2023

Sources: United Nations Environment Programme; Nielsen; Bloomberg Intelligence.

Note: AUM = assets under management. ESG = environmental, social, and governance.
The transformation journey is complex and requires a continuous focus on all sustainability enablers.

**COMPLEXITY DIMENSIONS**

- **Breadth of ESG topics**
- **Scope of data availability**
- **Depth of analyses**
- **Timeliness of available data**

**Sustainability enablers**

- **Strategic alignment**
- **Agility & transformation**
- **Sustainability-focused talent**

- **Digital applications**
- **Sustainability funding**

**Future-built/scaling**
- **Emerging**
- **Stagnating**

Source: BCG.

Note: ESG = environmental, social, and governance.
Sustainability leaders are more skilled at using AI and analytics to develop environmental capabilities across the value chain.

<table>
<thead>
<tr>
<th>Sustainability Use Cases</th>
<th>Stagnating and emerging companies focused on foundational “table stakes” capabilities (%)</th>
<th>Advanced companies(^1) advanced people, data, and tech capabilities for environmental maturity (%)</th>
<th>Differential</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI-powered smart emissions tracking</td>
<td>8</td>
<td>25</td>
<td>3.0x</td>
</tr>
<tr>
<td>Improved traceability through control towers</td>
<td>11</td>
<td>27</td>
<td>2.6x</td>
</tr>
<tr>
<td>Predictive maintenance of asset, driven by AI</td>
<td>13</td>
<td>26</td>
<td>2.1x</td>
</tr>
<tr>
<td>IoT for environmental data collection and monitoring</td>
<td>13</td>
<td>28</td>
<td>2.1x</td>
</tr>
<tr>
<td>Waste reduction driven by analytics</td>
<td>17</td>
<td>43</td>
<td>2.6x</td>
</tr>
<tr>
<td>Digital supply chain optimization</td>
<td>18</td>
<td>49</td>
<td>2.8x</td>
</tr>
<tr>
<td>Reduced emissions through optimized operational energy use</td>
<td>18</td>
<td>37</td>
<td>2.1x</td>
</tr>
<tr>
<td>ESG content of products communicated to customers</td>
<td>18</td>
<td>52</td>
<td>2.8x</td>
</tr>
<tr>
<td>Sustainable investment strategy implemented</td>
<td>21</td>
<td>31</td>
<td>1.5x</td>
</tr>
<tr>
<td>Reduced energy consumption in offices</td>
<td>25</td>
<td>44</td>
<td>1.8x</td>
</tr>
</tbody>
</table>

Source: BCG’s Build for the Future Survey 2022 (N = 507).
Note: IoT = Internet of things. ESG = environmental, social, and governance.
\(^1\)Scaling and future-built companies are grouped together as “advanced companies.”
Margins have been compressed, but investors expect companies to solve that soon.

Operating costs have outpaced revenue growth, resulting in greater margin pressure... creating a critical inflection point for CPG companies as they control costs to meet analysts’ margin expectations.

S&P 500 CPG COMPANIES

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenue (Normalized, Index 2020)</th>
<th>Operating costs</th>
<th>CAGR (2yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td>100</td>
<td></td>
<td>12.4%</td>
</tr>
<tr>
<td>2022</td>
<td>110</td>
<td></td>
<td>10.9%</td>
</tr>
</tbody>
</table>

YoY EBIT margin change:
-20bps 2020
-110bps 2021

TOP 100 CPG COMPANIES’ EBIT MARGINS

<table>
<thead>
<tr>
<th>Year</th>
<th>Historic</th>
<th>Actual</th>
<th>Analyst consensus</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2024</td>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2025</td>
<td>22</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sources: S&P Capital IQ; company 10k reports; BCG analysis.
Note: Values converted to indexes, 2020 value = 100%; Q4 2022 excludes additional three companies with earnings results pending (HRL, BF.B, CPB).
1Consumer Staples Select Sector SPDR Fund (XLP) companies, excluding retailers (KR, COST, SY, WMT, WBA).
2Operating costs = cost of goods sold plus selling, general, and administrative costs.
3Reflects change of average EBIT margin across top 100 CPG companies with publicly available data and at least one analyst prediction for 2023 through 2025.
Building “supply chain of the future” winners requires several critical steps at each stage of the journey.

From Stagnating to Emerging
Building foundational capabilities

- Set a clear 3- to 5-year vision for digitizing the supply chain
- Develop a digital, data-driven supply chain strategy
- Identify high-value use cases
- Establish processes
- Create new ways of working and upskill talent
- Deliver value through PoC

From Emerging to Scaling
Building advanced capabilities

- Focus on high-value use cases and processes and the optimal ecosystem
- Adopt a transformation mindset
- Develop new business models
- Create data-driven ecosystems
- Target AI at scale
- Develop key digital channels
- Take on one supply chain transformation at a time
- 360° visibility into the value chain

From Scaling to Future-Built
Innovate continually

- Build an always-on, AI-drive decision intelligence system
- At-scale rollout of organization changes
- AI-and digital-driven orchestration and customization of innovation efforts
- Use digital and AI technologies to support supply chain resilience and sustainability

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Data harmonization through SRM, CRM, TMS, ERP, WMS, and APS solutions

Enabling digital twin for volatility and scenario planning

Enabling end-to-end control tower solution for comprehensive value-chain monitoring and sensing

End-to-end supply chain orchestration and integrated decision-making system

Source: BCG.

Note: SRM = supplier relationship management, CRM = customer relationship management, ERP = enterprise resource planning, WMS = warehouse management system, APS = advance planning system, PoC = proofs of concept.
Case study
Steel company

How do we adjust planning and production to meet more volatile demand?

COMPANY SITUATION
A large European steel manufacturer with a strong European client base in automotive and manufacturing saw a sharp decline in orders owing to the COVID-19 outbreak.

Challenges faced
- Falling demand, rapid cash protection
  Required fast reactions in the changed reality, including reconfiguring the supply chain to reduce costs and inventory based on different demand scenarios.
- Congestion in system due to order cancellations and excess inventory needed to avoid congestion in its complex production and logistics network with more than 100 assets and reduce inventory buffers while ensuring service levels.

Best-in-class solutions
- Scenario-based S&OP planning
  The company quickly evaluated the implications of different market scenarios on the supply chain centrally, while planning details in a decentralized way.
- Digital twin
  A digital twin now allows the business to understand short-term supply chain risk, avoid congestion and service problems, and optimize inventory.
- Cross-functional agile teams
  Agile teams have shortened decision paths and created cross-functional transparency on risks and opportunities.

<table>
<thead>
<tr>
<th>Customer service level</th>
<th>EBITDA margin</th>
<th>Return on investment</th>
<th>Working capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>50% decrease in late orders</td>
<td>+1pp to 3pp</td>
<td>Net positive</td>
<td>10+ days inventory reduction</td>
</tr>
</tbody>
</table>