

IBM Supply Chain Transformation

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 Analytics

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IBM Supply Chain Transformation

In the midst of global disruptions, every element of IBM® Supply Chain has been affected. The IBM cognitive supply chain is positioned to win the future by using the exponential technologies that are inherent to our supply chains, and with flexibility, resiliency, and end-to-end visibility. The constant commitment of IBM to building smarter supply chains over the past decade has primed IBM to quickly and effectively navigate these disruptions and course-correct by using cognitive innovation. As a result, IBM Supply Chain teams were able to deliver exceptional outcomes without client disruption. In addition, this widespread impact inspired numerous new solutions that include exponential technologies that better prepare IBM for future disruptions in constantly changing markets.

Impact of the IBM journey

The IBM cognitive supply chain transformation made IBM an industry leader in supply chains and has given IBM a competitive advantage, especially during the recent pandemic that fueled global supply shortages. IBM concentrates on providing business value to organizations with augmented intelligence that allows IBM Supply Chain professionals to focus on higher value events and enables them to make smarter decisions. IBM embraces agile transformation and enterprise design to develop cognitive applications with purpose, and consistently promote advocacy throughout IBM Supply Chain.

The IBM journey to becoming the first cognitive supply chain has yielded significant benefits. Key indicators such as inventory, cost and cash management, supplier management, client satisfaction, employee engagement, and overall capability to enable revenue have all improved.

As a result of this transformation, IBM experienced significant inventory and structural cost reductions while maintaining top industry serviceability levels. IBM collaborates with and manages the supply base much more effectively, which increases data retrieval and ability to derive meaningful insights with speed. From an overall cost standpoint, there is reduced working capital that drives significant reductions in freight logistics costs. Additionally, IBM implements new capabilities to protect its clients and revenue from supply chain disruptions. Issues are now understood and solved in minutes instead of hours or days, and IBM is 95% more efficient at tackling reoccurring supply chain challenges.

IBM Supply Chain is recognized for this transformation by many resources:

- ▶ Frost & Sullivan: Manufacturer of the year 2018, Large Enterprises
- ▶ Manufacturing Leadership Journal: “Artificial Intelligence (AI) in Supply Chain, Threat or the Game Changer?” April 2019

- ▶ Gartner: High Tech Supply Chain Innovator Award 2019
- ▶ Manufacturing Leadership Council Awards:
 - Engineering and Production Technology 2019
 - Supply Chain Leadership 2019
 - Visionary Leadership 2019
 - Talent Management Leadership 2020
 - Artificial Intelligence and Analytics Leadership 2019, 2021
 - Collaborative Innovation Leadership 2020, 2021
 - Digital Transformation Leadership 2020, 2021
 - Enterprise Integration and Technology Leadership 2020, 2021
 - Next Generation Leadership 2020, 2021

IBM Supply Chain transformation journey

IBM runs a complex and global supply chain with strategic manufacturing facilities worldwide that supports hundreds of thousands of customer deliveries and provides service maintenance in over 170 countries. IBM has supply chain workers across more than 40 countries. To meet the high configurable product demand, the IBM supply chain operates in a hybrid model of build-to-plan and build-to-order. IBM also collaborates with hundreds of suppliers across its global, multitier supplier network.

The IBM Supply Chain transformation journey is focused on building a cognitive supply chain that embraces an agile culture of innovation; invests in our team members' growth and engagement; focuses on clients' needs and successes; and leverages exponential technologies to deliver greater value. We believe in the integration of technologies to enlighten people with actionable insights for quick decision making.

The IBM transformation also involves IBM passionate and committed supply chain professionals to apply these emerging technologies to operations with both speed and agility to achieve the goal of relentless reinvention. From piloting new technologies; becoming a more cognitive supply chain; automating core processes; and leveraging a multi-source, resilient supply chain, IBM is committed to the idea of innovate anywhere and use everywhere data insights to improve processes, people, and technology.

The first step to building a resilient and cognitive supply chain was to listen, learn, and understand key challenges. IBM accomplished this task by using design thinking methodologies and analysis of workflows, and also numerous feedback channels to IBM Supply Chain professionals. Leveraging the experience of the practitioners who work constantly with supply chains was critical to the success in understanding the issues holistically.

Digital transformation

The best supply chains are ones with the highest resiliency; have new ways of working; focus on the right talent; and continually demonstrate the agility to adapt and overcome any kind of disruption with quick reaction times. IBM Supply Chain focuses on delivering a better human experience by adopting exponential technologies, reimagining how work gets done to optimize the value change, and driving the best course of action with speed. Traditional supply chains are built with structured and defined processes. When you think of resiliency, your workflows must be fluid and flexible, and adjust to changing dynamics.

Data platform

The IBM digital supply chain transformation focused on three parallel workstreams that moved IBM from harmonized to transparent to the current cognitive supply chain. IBM started with integration and harmonization of global processes and data in global IT transactional systems (enterprise resource planning (ERP), order management, shop floor control, and others), which IBM normalized and transformed for its users' needs. Transparency of information with a *single point of truth* across the supply chain was a vital step in preparing for analytics and cognitive growth. The IBM platform is based on an IBM Hybrid Cloud using Red Hat OpenShift to build the Enterprise Container Orchestration Platform. This approach improved the availability and scalability of the IBM solutions to support flexible migration without impacting mission-critical applications and the time-to-value. Then, IBM extended beyond internal data into supply chain networks by using blockchain and Track and Trace Internet of Things (IoT) smart sensors.

Blockchain

Visibility beyond IBM data is critical to managing end-to-end operations, but security is often a barrier to sharing data. Blockchain enables trust across your network with security and traceability by delivering transparency to suppliers and logistics providers for key logistics data. Customs Declaration, which is powered by IBM Blockchain, shares customs and shipping documents and in-transit information across the network with suppliers, carriers, and brokers to digitize the data and improve compliance and cycle time through customs, and provide insights to logistics tracking and estimated time of arrival.

Track and Trace IoT

Track and Trace IoT smart sensors are used to monitor shipments and potential in-transit delays or incidents. These sensors are attached to outbound and inbound shipments to provide real-time data on GPS location, temperature, tilt, and humidity, and alerts when conditions are out of tolerance. These insights provide near-real-time updates on customer deliveries and reduce risk of loss and damage.

Augmented intelligence

Being able to access forecast, order, supply, inventory, and engineering data in real time across all manufacturing geographies and functions is critical to the supply chain's decision-making process. Using platforms that are powered by IBM Watson® and cognitive AI capabilities, IBM Supply Chain advisors provide instant data insights that IBM global supply chain professionals can use to monitor and assess global and local supply and demand information, and part number and component detail.

There are three main advisor systems: Cognitive Supply Chain Advisor 360 (CSCA360), IBM Test Advisor, and IBM Quality Advisor, which enable IBM Supply Chain to mitigate potential issues before they impact operations and to adjust workflows as needed.

Dynamic supply chain control tower

A control tower, which is known as CSCA360, provides a real-time assistant and advisor to supply chain professionals that gives recommendations about supply in-house, and multitier suppliers received recommendations about order improvements, inventory levels, and more. Drawing from a data platform of structured and unstructured data within the supply chain and beyond to multitier suppliers, logistics providers, carriers, and IoT Smart sensors, CSCA360 integrates data and insights across all supply chain domains.

With a natural language interface, even less experienced users can easily ask questions across all supply chain areas, such as engineering, planning, inventory, supply assurance, order management, and global logistics.

- ▶ Worried about a part number? Ask “Show me the part number detail for P/N 1234567” to get complete information about orders, inventory, forecasts, commits, alternates, buyers, and suppliers.
- ▶ Short on a part? Click **Supply Advisor** for recommendations about how to address this issue.
- ▶ You can find details about a specific customer order by asking “Where is order number xyz?”
- ▶ The ability to identify changes is key in a constantly changing world, so you can ask “How did the day-to-day order load change for Poughkeepsie site” or “Which orders are delayed?”

Automatic alerts are also generated for delays in transit or out-of-tolerance health indicators on specific shipments.

With the global parts shortage, CSCA360 can quickly assess location disruptions within minutes by asking “Show me all tier 1 suppliers with MFG locations in Japan” or “Show me all the MFG locations for component P/N 1234567.” Clicking suppliers or part numbers can show the supply and demand posture to assess for potential shortages, recommendations to address shortages, associated impacts to customer orders, where the components are used, and demand for the future. We can even investigate alternative sources of supply across available distributors.

This unique supply chain advisor is available to sales, procurement, and global logistics, and transparency has replaced information requests with collaborative problem solving. Built on the expertise of experienced professionals, digitization has democratized the supply chain knowledge for all, which broadens the skills and view of the end-to-end supply chain.

IBM Test Advisor

IBM Test Advisor is a cognitive application that provides repair recommendations with confidence levels that are derived from historical test data. Using machine learning technologies, structured and non-structured data is transformed into insightful solution suggestions to help engineers and technicians. IBM Test Advisor improves repair time, reduces misdiagnoses, and improves manufacturing efficiency with shorter test times. By using system-assisted training and capturing feedback, it improves both the skills learning curve and overall product quality.

IBM Quality Advisor

IBM Quality Advisor uses business analytics to control intelligently the end-to-end supply chain quality data and predict failure rates, and it provides recommended actions to mitigate or improve the impact of failure rates. IBM Quality Advisor uses IBM Watson Human Computer Interaction (HCI) learning capabilities to learn continually with inputs from domain experts. Designed for both data scientists and non-data scientists, IBM Quality Advisor enables the management of the growing complexity of the supply chain while optimizing cost and delivering extraordinary productivity improvements.

Intelligent workflows

Intelligent workflows capitalize on data platform and AI-driven advisors to enable larger transformation plays with bold process changes. They prompt more cultural and organizational changes, crossing domains without manual hand-offs. Collaboration is key, but more importantly it must be digitized to be leveraged effectively across the organization. With intelligent workflows, processes do not run left to right, but are fluid, and they react to the situation. They are supported by key data elements to enable rapid decision making. We are enabling supply chain professionals to transform from performing repeatable tasks by delegating them to “digital workers”, and transforming them into workflow managers with the support of AI-driven workflows. The combination of supply chain expertise to drive the orchestration with a digital worker helping with automation speeds up the time to value by enabling faster decisions. In a resilient and flexible supply chain, the workflows must be fluid and adaptable to changes rather than rigid defined processes.

IBM Continuous Intelligent Planning is the perfect framework for intelligent workflows. Building continuous collaborative workflows by integrating supply and demand planning with fulfillment allows for quicker responses to the supply position. Intelligent workflows digitize existing relationships within the supply chain to provide a new view for demand sensing and conditioning. The electronics industry is experiencing increases in lead times and more supply constraints than in the past. Intelligent workflows enable you to bring the “ends” of a supply chain together much more quickly through the rapid flow of information.

Quantum computing

As the era of quantum advantage approaches, there are already opportunities today for quantum computing to combine with existing advanced technologies to impact dramatically how science and business evolve. IBM Supply Chain has partnered with IBM Quantum in two use cases to demonstrate the value to supply chain. In both use cases (logistics optimization and service parts demand forecasting), combining classical models with quantum algorithms clearly shows the tremendous potential advantages that quantum computing brings to supply chains.

Industry 4.0 and Digital Twins in manufacturing

Industry 4.0 takes manufacturing beyond using IoT, process automation, productivity, and quality improvements by introducing AI to produce analytics and insights for greater business value. Digital Twins deliver the ability to visually model, simulate, and optimize real-world assets, operations, and processes to predict behaviors and simulate execution success before implementation. By integrating AI, IoT, analytics, and other technologies into factory operations, companies can move quickly and adjust to an ever-changing supply chain landscape.

IBM Maximo Visual Inspection

As the complexity of electronic components increases and technology becomes denser, manual inspection of these components might no longer be a viable option, and automated equipment runs the risk of becoming outdated. IBM Maximo® Visual Inspection (MVI) is an AI-powered computer vision solution that applies deep learning models to detect quality defects in manufacturing. MVI is integrated into each of the IBM manufacturing locations to recognize defects at scale with high accuracy. When using MVI, IBM operations realized up to 5x efficiency gains and a 20% reduction in false positives for specific applications.

MVI is deployed on assembly lines at the network edge in IBM plants in Canada, Hungary, Mexico, and the United States, and it is being managed by using IBM Hybrid Cloud and IBM Edge Application Manager. This approach allows AI models and edge devices to be managed from a central location through the cloud by using an automated process that reduces software maintenance costs by 20%. AI models are deployed to the edge devices for inferencing to overcome problems that are associated with bandwidth and latency from running inferencing in a data center.

IBM Maximo Worker Insights

IBM Maximo Worker Insights (MWI) combines advanced analytics and near-real-time access to data from cameras, Bluetooth beacons, mobile phones, IoT wearable devices, and environmental sensors to manage holistically both facilities and workers. In Poughkeepsie, New York, IBM protects essential workers by using IBM Maximo Visual Insights and 44 cameras around the manufacturing and common areas to monitor, detect, and report adherence to COVID-19 protocols for face masks, social distancing, and entry screening of an individual's temperature.

This solution leans heavily on AI and edge technology, which demonstrates the power of an IBM Hybrid Cloud solution. During our implementation, we learned that a robust data privacy plan and security network architecture are required to protect personal information. By designing the solution on the edge by using MVI to process and analyze images, immediately discard them, and send out alerts to the MWI platform, we were able to drive value without human interaction and without saving personal data. This solution made adherence to privacy policy much easier and more secure.

IBM Augmented Reality - Remote Assist (Poughkeepsie, New York; Guadalajara, Mexico; Vac, Hungary)

As part of Digital Twins in manufacturing, IBM Augmented Reality (AR) is used to support maintenance and troubleshooting in manufacturing, which reduces employees' time to complete tasks, and reduces errors and the need for service calls. When a manufacturing technician needs expert assistance, they communicate by using a mobile app with a remote expert through live audio and video streams from any geography or time zone. When the technician directs their mobile device at the physical hardware, the expert can evaluate the problem and give step by step visual instructions to the technicians by overlaying real-time annotations of types of actions and text. The annotations maintain their 3D positions while the technicians move around the scene, comprehensively conveying the expert's instructions. Remote Assist powered by AR results in faster response times and resolution times for issues that are encountered in manufacturing.

IBM Acoustic Insights

Competition continues to drive the need for improved quality and throughput. Some conditions are more challenging than others, which creates opportunities. At IBM wafer dicing operations in Bromont, Canada, we use a 1 mm diamond dicing blade rotating at 45,000 RPM. The blade dices the 300 mm wafer in a wet environment, and this water prevents the usage of optics to check the blade condition. By using a microphone, we can train AI to recognize sounds for indicative or imminent failure. So, we can monitor the blade condition in real time and stop the machine before a failure occurs. This control maximizes the lifespan of the blade and prevents damage to the expensive wafer.

Collaborative robots

Robotics are commonly used to automate manual tasks. Integrating artificial intelligence (AI) with a collaborative robot (cobot) takes robotics a step further. In the server assembly process at the IBM location in Guadalajara, Mexico, processor sockets are inspected for any physical damage before they are installed in the server, which requires high precision and repeatability. We elevated the automation capability by integrating cobots with MVI. The server is first inspected by MVI before the robotics automation starts in the physical assembly process. This integration of AI with robotics automation amplifies the benefits by maintaining consistency in the quality inspection process and precision in the assembly process. By delegating the repetitive and precise movements to the robotic arm, employees can concentrate on complex and higher value tasks. Cobots are also used in D-DIMM assembly automation and Nearstack Connectors assembly automation.

IoT

With operation technology (OT) and information technology (IT) converging, IoT is emerging as a new, innovative concept for smart manufacturing. Integration of IoT with AI-based technologies, including analytics, big data, and cognitive manufacturing, help save time, labor, costs, maintenance, and upkeep. At the IBM location in Vac, Hungary, IoT sensors are built into storage racks, which enable real-time information about the machines' storage and retrieval to be captured. The IoT data and machine configuration are analyzed for occupancy trends. Derived insights are used to augment technicians' decision-making about the optimal storage arrangement.

People transformation

Our supply chain professionals are our most important resource, and we are dedicated to embracing a growth mindset and a culture that empowers employees to be creative risk takers, allowing them to innovate anywhere and use everywhere. Leveraging our current talent through upskilling is a key success factor to meet the needs of a digital future. The roles of data scientist, citizen developer and automator, and workflow manager enable our team to master new technologies, design and train AI and automation, and create intelligent workflows.

The rapid change of technology and business challenges demands that IBM Supply Chain roles evolve, and so has our management approach. We are committed to agile thinking and servant leadership and supporting our multi-disciplinary teams with a culture that is based on collaboration, innovation, diversity, inclusion, and trust. We instilled IBM Enterprise Design Thinking® into our new ways of working, focusing on user experience and needs, and supporting bottom-up transformation with executive governance for guidance and priorities. Our teams use AI for faster insights into the end-to-end supply chain data for rapid collaboration and decision-making. With intelligent workflows, our supply chain professionals can transform from performing tasks to orchestrating the integration of data, events, and collaboration to optimize the supply chain.

Global supply chain challenges gave us the incentive to digitize and democratize our supply chain expertise, capturing the tribal knowledge of our experienced professionals, and making it easier for new talent to learn and for others to broaden their knowledge. Continual communication and emphasis on recommended learning through role-based skill paths, skills and engagement teams, and joint learning offerings with universities provide our professionals with opportunities to fulfill their growth roadmap. The ways in which our team effectively handle the daily challenges, and how they adapt to new ways of working greatly enhance our resiliency and agility.

IBM Supply Chain support with external clients

We also support client engagements with our subject matter experts (SMEs) by using skills that we obtained during our transformation. This action has benefited IBM clients, IBM products, sales, and employee growth. These benefits were not obvious during our initial engagements, but over time they became a part of our strategy and business plan.

IBM Systems Supply Chain uses our offerings in our supply chain, often as IBM first client. In doing so, we can provide real-time feedback to the developers, bring value to our supply chain, provide a reference for IBM Sales, and build skills for client engagements. Our SMEs are excited to accept these new challenges and assignments where they can improve their skills and technical vitality. Our strategic direction uses intelligent workflows, supply chain thought leaders, and an “innovate anywhere” approach (Figure 1 on page 9).

Through client engagements, our team develops new concepts, digitized workflows, and advocates for the client for product enhancements. We can apply these same enhancements in our own supply chain solutions.

Considering all these factors, our clients see a faster time to value in working with our experienced practitioners, whose primary responsibilities support the operations of a global supply chain.

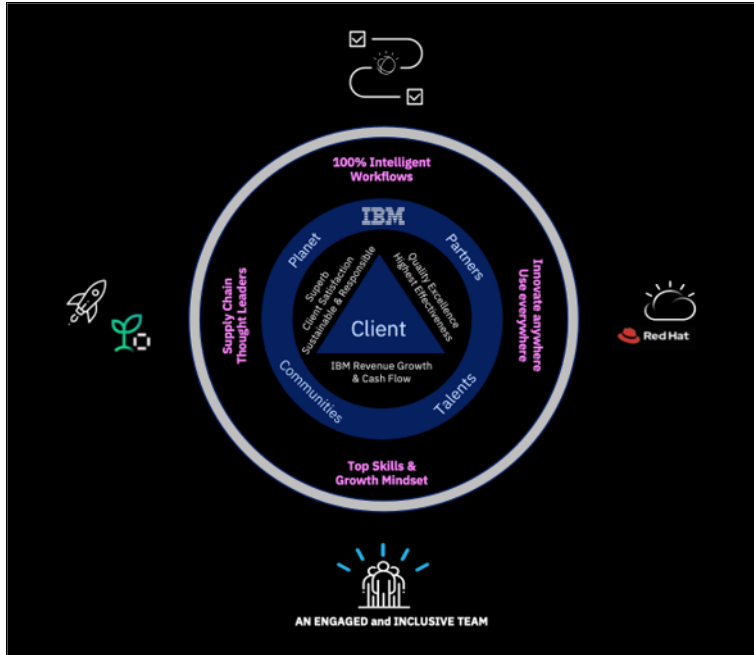


Figure 1 Supply Chain North-Star to guide the team toward strategic direction

What is next

One of the greatest opportunities we have is to leverage new technologies, data, and our people to reimagine the future of supply chain, where end-to-end visibility and intelligent workloads power agility, adaptability, and resiliency.

Managing through a pandemic and global shortages has been a test, and IBM is emerging with the proof that IBM Supply Chain is on the right transformation journey. Exponential technologies are inherent to building supply chains with flexibility, resiliency, and end-to-end visibility. Resilient supply chains must be equipped to adjust quickly and efficiently operations in response to rapid changes. IBM further defines intelligent workflows within IBM Supply Chain and reimagines supply chain processes to be end-to-end and cross-functional, underpinned by a flexible and resilient supply chain. IBM continues to serve as a leader in the supply chain space by providing essential supply chain services both internally and in the market.

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This paper was produced by a team of specialists from around the world working at IBM Redbooks, Poughkeepsie Center.

Galen Smith is a Supply Chain Transformation Leader working in IBM Supply Chain. Galen is an accelerator of transformation in the IBM AI-enabled supply chain, where he uses design thinking, agile, and cutting-edge technology.

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