

Digital Business

Four Ways that Technology is Remolding the Digital Supply Chain

Industry 4.0 ideals challenge supply chains to deliver advanced capabilities beyond those inherent in typical operating functions. Emerging digital technologies are enabling processes, partners, products and services to work harmoniously to enhance today's highly interconnected and networked supply chain.

Executive Summary

Supply chains are a prominent cog in delivering what we need in our daily lives. Almost everything around us has passed through various links in the supply chain. Supply chain efficiency is therefore vital to keeping customers happy – and loyal. And the importance of supply chain excellence is hyper-critical given the growing demand for more personalized products and services, delivered exactly when and where customers specify, quickly and at exceptionally low cost.

In the digital era known as Industry 4.0, the need to create a more holistic and better-connected ecosystem is pivotal.¹ This is particularly true as the physical and digital worlds merge, resulting from solutions that use digital technologies to facilitate their value and yet operate in the real, physical world.

Traditional supply chain models, therefore, must evolve. For starters, supply chains are not linear today; in fact, they have not been linear for a while. Supply chains are often a network of interconnected entities that involve businesses, physical and virtual systems, and people – all conspiring to deliver raw material as finished goods.

The better the supply chain is, the more competitive an organization can be. The better it is able to strategically integrate a modern supply chain model into its operations, the more successful it is. And it leans on technology to help navigate the myriad complexities of supply chains.

Technology encourages organizations to be ambitious about what they want to achieve. This white paper highlights modern technology strategies that help today's highly evolved supply chain meet increasing challenges from the industries that they serve.

An aerial night view of a city with a busy highway. The image is overlaid with a complex network of glowing white lines and nodes, representing a digital ecosystem. The lines connect various points across the city, symbolizing connectivity and data flow. The background shows tall buildings and streetlights, creating a blue-toned urban scene.

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Technology is enabling digital supply chains

The Supply Chain Operations Reference (SCOR) model provides a reference to describe the business activities associated with all phases of satisfying customer demand.²

The model itself is organized around the six primary management processes of plan, source, make, deliver, return and enable. In a challenging business environment, a supply chain is expected to generate great performance attributes, namely reliability, responsiveness, agility, costs and asset management efficiency (see Figure 1).

SCORing supply chain effectiveness



Figure 1

Enabling the supply chain

The ENABLE process manages many elements of the supply chain, including:

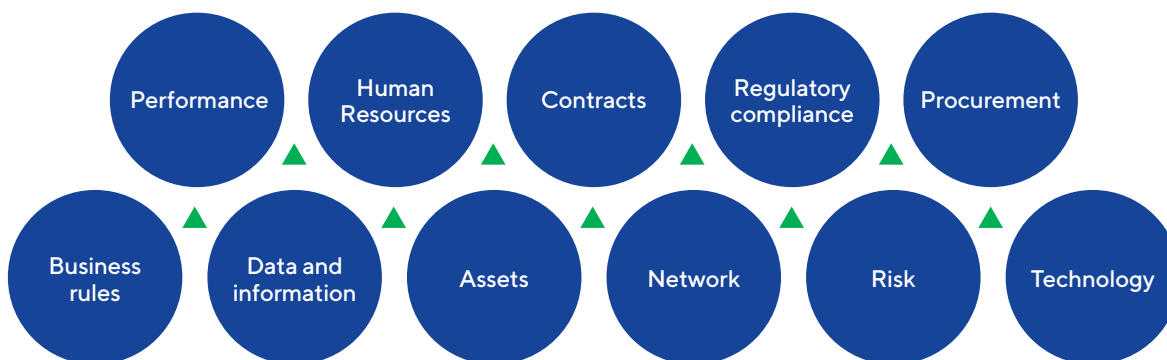


Figure 2

Enable is a broader process that prepares, maintains or manages information or relationships on which planning and execution processes rely. In the digital age, the enable element is highly significant. Managing the supply chain business rules, performance, data and information, human resources, network, risks, etc. is key to delivering and managing a high-performing supply chain. Importantly, organizations are increasingly becoming reliant on technology as a foundational element to help make this happen.

The gamut of technology-enabled solutions available today can be overwhelming, and the path to supply chain enhancement is often multifold and replete with numerous choices. Change can be driven inside-out, starting with internal systems such as payroll, finance and accounting, communication systems, human capital management and employee engagement systems. Or it can be enabled by outside-in elements, addressing aspects of the organization’s interaction with the end customer (e.g., e-commerce portals, customer relationship management (CRM), loyalty and rewards platforms, subscription management, etc.) Prioritizing and balancing these points of entry, while keeping an eye on the eventual goals, is imperative.

Figure 3 examines technology strategies – namely integration platforms, blockchain, robotic process automation and the Internet of Things (IoT) – with some of the industry leaders with whom we work.

Technology strategies that enable the modern, hyper-connected enterprise

The needs of a modern, highly interconnected supply chain

TECHNOLOGY STRATEGIES

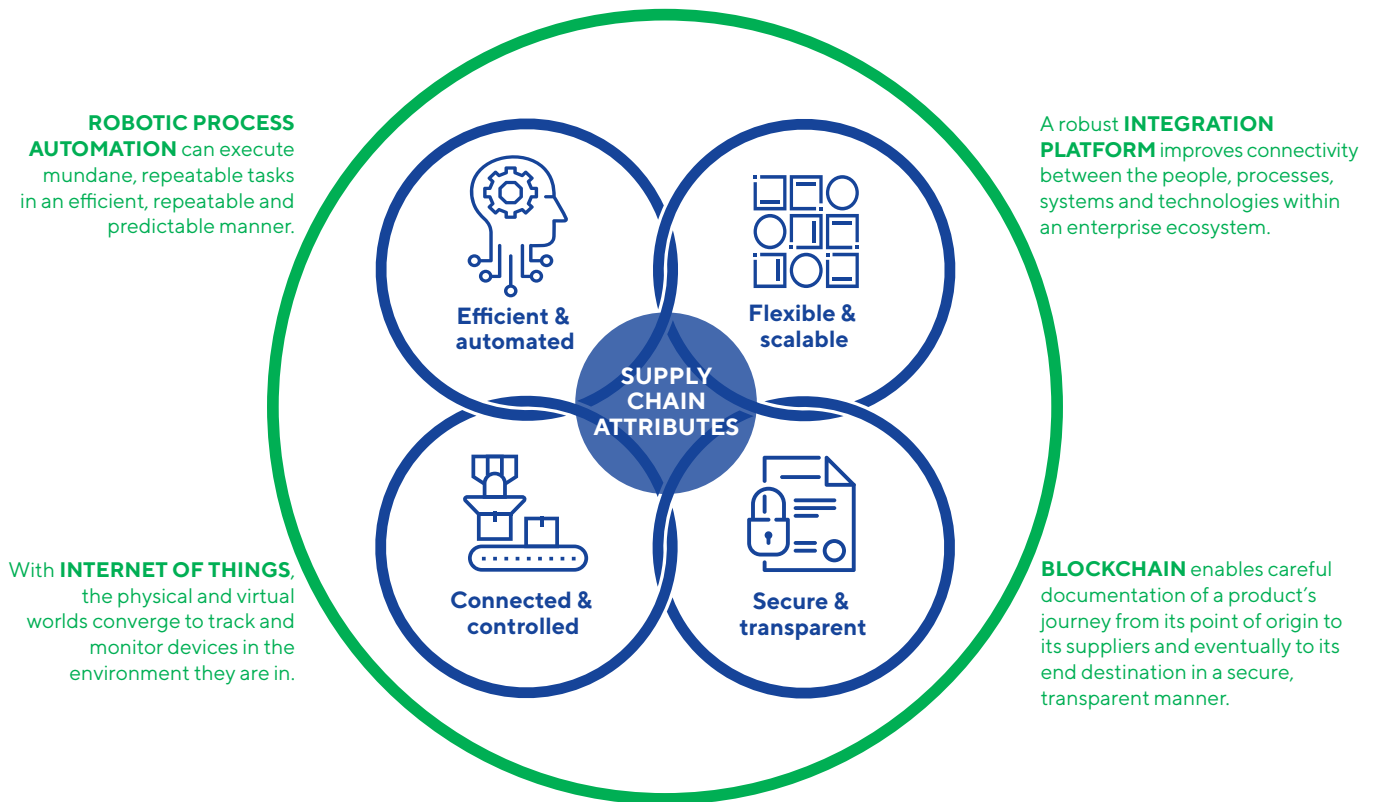


Figure 3

For a business, ensuring that the different moving parts in its supply chain are orchestrated well to reduce the risk of disruption is advantageous. It then is about forming a perfect orchestra that works in harmony to deliver the right notes.



STRATEGY 1

Standing up a robust integration platform for microservices that work well in harmony

As noted, supply chains consist of myriad interconnected processes, partners, products, services and people, reflecting a wide range of stakeholders. As a result, ensuring that a product gets into the hands of an end user represents the cumulative effort of multiple organizations.

These organizations broadly are suppliers, producers, distributors, retailers, customers and service and support providers. They add specific value based on the role that they play in the supply chain. Technology is transforming the way that the new interconnected supply chain interacts among them.

For a business, ensuring that the different moving parts in its supply chain are orchestrated well to reduce the risk of disruption is advantageous. It then is about forming a perfect orchestra that works in harmony to deliver the right notes. As they strive to develop that ideal, superior differentiated offering to their market, supply chain participants will need to experiment with several services and technologies until they reach perfect pitch.

A robust integration platform improves connectivity between supply chain actors — people, processes, systems and technologies — within a cross-enterprise ecosystem. An integration platform plays the role of an orchestrator that pulls in the various components and services of the IT ecosystem. As organizations work to incrementally modernize the systems, each system may possess its own data format and protocols, requiring robust orchestration between the systems. To meet scalable business demands, IT organizations must standardize the integration layer to limit technological complexity and ease maintainability.

With cloud and software as a service (SaaS) in particular, ever-improving software features and functions are more quickly delivered to market. Standardized connectors, integration patterns, and application programming interfaces (APIs) for data, applications and devices make things easier. APIs in particular have eliminated the need for point-to-point integrations and help make the various services in the ecosystem more discoverable and usable. The use of Agile development methodologies drives business velocity. Quickly and nimbly snapping on the business capabilities needed is often critical for retaining customers. The autonomy that microservices architectures offer provides the flexibility of choice for users.

We worked recently with a leading client who chose to develop a foundation platform, comprised of various custom and third-party tools, stitched together to deliver powerful digital-native capabilities that new and existing products and services could utilize (see Quick Take, page 8).

Quick Take

Laying the Foundation to Orchestrate Digital Success

A leading multinational corporation in the food and beverage industry embarked on a large business optimization initiative to strengthen its business interests. The comprehensive program includes consolidating product portfolios, introducing new products, exploiting localized sales opportunities, shoring up and strengthening businesses in specific geographies, speeding up international expansion, and establishing brand loyalty programs among many others. The program required driving robustness into its systems to reduce labor costs and other manufacturing costs while reinvesting potential savings in prioritized higher potential opportunities. In addition, it involved further investment in supply-chain capability, flexibility and next-generation technology.

The client was looking to build a platform, to serve as the foundation for integrating various systems, that establishes the best way for various applications to exchange information and interact with each other. The platform needed flexibility to bolt on the most appropriate service capabilities from external vendors through API contracts. Any business that required launching new features and products would look to utilize such a platform to get to market quickly, while complying with corporate controls.

The Solution

We built a modern cloud-native integration platform to orchestrate transactions between systems such as various e-commerce, sales and CRM platforms, core back-office enterprise resource planning (ERP) platforms and external third-party services. The platform is based on microservices architecture, with Pivotal Cloud Foundry (PCF) and Microsoft Azure as the cloud platforms. APIs are used for data transfer to/from trading partners, customers and vendors. Containerization of services such as the workflow and

decision automation service ensures portability and scalability. The system is designed for high availability with the cloud-based disaster recovery environment in North America. Robust IT controls were implemented across the lifecycle, aligned with the client's security policies. The team adopted scaled Agile practices in building the platform, and trained and coached client team members on adoption. End-to-end continuous integration and delivery (CI/CD) automation was implemented extensively across the platform with Azure IaaS and PCF PaaS – developing microservices, and managing environments, installations, upgrades, and releases, etc.

Results

Through the use of standardized capabilities that this platform offers, new features and applications are now delivered to the market in weeks; this previously took six to eight months. In addition, the platform lets the organization:

- | Control, focus on and differentiate consumer-facing applications.
- | Easily add or swap new capabilities, without impact on other applications.
- | Scale across geographies, brands and channels.
- | Comply with regulatory requirements by implementing a comprehensive set of corporate security controls.



STRATEGY 2

Having robotic process automation handle the mundane

The term robotic process automation (RPA) is about intelligent software undertaking high-volume, repeatable and time-consuming tasks and doing so efficiently.

Supply chain automation offers many opportunities to increase efficiency, reduce costs and improve performance. It involves systematizing part or all of a workflow to improve processes, using technology as the central driving force to making this a reality.

RPA is being increasingly adopted within the supply chain to mimic the actions of human employees: capturing, replicating, and processing data, and communicating with customers, as well as making judgments and learning from past actions.

With RPA, processes can adapt to demand and scale operations faster. Costs are cut due to reduced administrative overheads. Higher quality can be achieved through eliminating human error and duplication in processes and workflows. There is a conscious bias toward shifting human effort away from low-value, repeatable tasks to value-added activities that generate revenue and drive other improvements.

RPA has found extensive use of several processes in the supply chain. It is used to create, update and manage contract and other data for better supplier management. RPA is used by some companies to research the supplier and manufacturer markets using consistent criteria, allowing for easier supplier selection. Payments and invoicing, order fulfillment and inventory updates, onboarding of partners, invoicing, customer service, including tracking generation and email confirmation, selling across multiple channels and applying bulk actions for high-order volumes have all found ways to automate workflows using RPA.

However, organizations need to bring together disparate sub-processes into one cohesive end-to-end journey, especially when the ecosystem consists of disparate enterprise systems. Manual hand-off points between process elements tend to be error prone.

RPA solutions are being applied with success by many organizations across processes in the supply chain and are quickly becoming must-have tools for most digital initiatives.

We utilized the automation platform UiPath to automate parts of goods flow planning (GFP), delivering great results (see Quick Take, page 11).

Quick Take

Letting Software Robots Plan the Flow of Goods in the Supply Chain

A leading footwear, apparel, equipment and accessories manufacturer looked to transform parts of the supply chain planning processes for its European Logistics Center. The centers coordinate all logistics activities between the 200 factories and 30,000 customers in 55 countries.

The company's GFP – with its three sub-processes, advanced shipment notification, mass documentation change and mode changes – handled less than 6,500 requests/month. Over time, they found that the GFP processes had become resource intensive and expensive due to increased order volumes and change orders. Seasonal variations in the company's business added to the complexity and maintenance was a challenge. It needed a way to simplify running these processes.

The Solution

We identified opportunities to simplify and automate GFP processes. We then used RPA to implement the automation, using UiPath as the automation platform. The application ecosystem included SAP, Manhattan WMS, and the Online Dispute Resolution platform among many others. We developed and deployed an accurate, intuitive and fully automated design flow. Automation was applied to areas such as use of Excel spreadsheets, moving data between screens, completing online forms and PDFs, copying and pasting data, closing and rekeying into applications, e-mail notifications and select ERP transactions.

Results

The use of automation:

- I Freed personnel to focus more on high-value activities.
- I Saved an estimated 70% of processing time while executing the same volume of requests in far less time.
- I Helps garner useful insights into the process through additional analytical capabilities of activities completed through RPA.
- I Eliminates human intervention and resulting errors in a complex ecosystem involving multiple applications and system environments.
- I Enables more scalable business processes to handle higher volumes of transactions with robotic automation working 24x7 and executing tasks quickly.



Blockchain adoption is a reality, and around the block

Blockchain offers the promise to fundamentally alter the way business is conducted. A blockchain is a distributed ledger that records transactions in a series of blocks.³ The blocks are bound to each other using cryptographic principles and form a chain of immutable records. The blockchain exists in multiple copies spread over multiple computers, typically known as nodes. Blockchains make it possible for ecosystems of collaborators to share and agree upon important business-related data, without needing intermediaries.

Our research indicates that as blockchain technology matures, decision-makers across industries worldwide see blockchain's lofty promise of operational efficiency using shared infrastructure and business opportunity as reason enough to invest time, money and effort in experimenting with distributed ledger databases, consensus algorithms, and Public Key Infrastructure (PKI) cryptography technology to future-ready their companies.⁴ Smart contracts managed by blockchain ensure that agreements are automatically enforced when predefined rules are met. Contracts are consequently transparent, decentralized and inexpensive, eliminating intermediaries.

The applicability of blockchain to supply chain is reflected in the seeming commonality in their names: a "chain" of dependent activity. Three key capabilities, vital to supply chains, that blockchain delivers are cryptographic security, distributed ledger architecture and a network consensus mechanism.⁵ The cryptographic security underlying blockchain technology enables information immutability and credibility. Transaction records stored on blockchain are thus tamper-proof, reliable and verifiable by all parties at any time. Data confidentiality and privacy are ensured through permissioned access rights for trade participants. The distributed ledger architecture provides transaction transparency and traceability. This increases visibility into data status for tracking, enables automated execution of contractual obligations through smart contracts, and ensures that networks are resilient to downtime and manipulation risks. The network consensus mechanism provides a single source of truth through the network, uniformly available to all parties.

Smart contracts managed by blockchain ensure that agreements are automatically enforced when predefined rules are met. Contracts are consequently transparent, decentralized and inexpensive, eliminating intermediaries.



The use cases for blockchain in the various facets of supply chain are compelling. Cryptocurrency aside, the careful documentation of a product's journey from its point of origin to its suppliers and eventually to its end destination makes for a strong case of transparency and trust.

The use cases for blockchain in the various facets of supply chain are compelling. Cryptocurrency aside, the careful documentation of a product's journey from its point of origin to its suppliers and eventually to its end destination makes for a strong case of transparency and trust. Documentation of product identity, quantities, purchase orders, receipts, product quality standards, stage of progress in the logistical chain, and financial information such as taxation in an immutable, automated manner reduces manual time-consuming activities and makes a strong case for adoption.

Since blockchain acts as a ledger of trusted information, shipment tracking is perhaps an obvious use case to track the movement of goods from the producer to retail within the production cycle. Companies can see where each batch of products comes from, each processing and storage step in the supply chain, and the products' sell-by date. In the event of a product recall, the company can also see which batches are affected and who bought them. Entries in a blockchain database could trigger other tasks downstream such as docking storage area information.

Blockchain solutions to establish a digital identity for suppliers in the procurement value chain are being developed. Smart contracts enabled by blockchain can be used for instant settlement of payments and reduce the time and costs associated with intermediary processing. For example, smart contracts are being used to monitor and redistribute energy in a neighborhood micro-grid. The program automates the buying and selling of green energy to save costs and pollution.

Blockchain enhances supply chain management and can increase the efficiency and transparency of supply chains and positively impact everything from production to warehousing to delivery to payment.

For one client, we are using blockchain to address visibility of products in the supply chain and thereby track quality conformance of products. We used Ethereum, an open-source, public, blockchain-based distributed computing platform and operating system featuring smart contract functionality (see Quick Take, page 14).

Quick Take

Increasing Product Visibility Through the Supply Chain

One of the core priorities of a leading supermarket store chain is to differentiate its food and drink businesses and unlock value in the portfolio. While quality of its products is a given, it was looking at innovative ways to provide more connected, personalized and convenient shopping experiences.

The client has a complex multi-partner supply chain ecosystem. Considering the numerous processes and parties involved in its procurement process, tracking quality conformance of products across the supply chain and measuring efficiency of partners was extremely cumbersome and challenging.

The Solution

To address product visibility during the various stages in the supply chain, we built a blockchain-based solution that opened real-time data visibility/transparency to the entire process, for all parties. Product identifiers were leveraged to track items.

We reviewed the arrangements with the partners in the supply chain: suppliers, freight service providers, third-party logistics distribution centers, retailer distribution centers and stores. The business rules from the relevant partner were extracted. The various data requirements from partner systems were identified and key performance indicators (KPIs) were defined.

Smart contracts enabled differential value-based penalties/incentives. The blockchain system tracks partner compliance based on the contracts and quality conformance of products such as temperature breach, timeliness, etc. across the value chain. A value-based payment system was then implemented with payments dependent on agreed quality, quantity and timelines. Pre-configured business rules and consensus checks execute automatically with little to no human intervention and delays.

Blockchain-enabled supply chain design



We used Ethereum as the blockchain-based distributed computing platform and operating system featuring smart contract functionality. We also used the MEAN stack, a collection of full-stack JavaScript technologies used to rapidly develop web applications, to implement the solution along with Ethereum ledger.

Results

Through this pilot, our client was able to demonstrate the rich value that blockchain could bring to its business. Trading partners felt greater trust and higher satisfaction due to improved transparency across the supply chain. With the ability to track minute product quality parameters and thereby actual performance, partners were held more accountable. Smart contracts drove quality parameter adherence and remuneration. With better tracking and transparency, potential reduction of the non-saleable inventory in the retailer network could drive better working capital efficiency. The client was also able to experiment with differential pricing based on a product's freshness quotient.



Monetizing data with the Internet of Things

The Internet of Things (IoT) blurs the lines between the physical and software worlds. It is a collection of interconnected physical devices that can monitor, report on and send and exchange data. These devices are typically connected to computer systems via mobile data or WiFi networks. With improved network connectivity, smart products and solutions fueled by the IoT touch many aspects of our lives.

In this data-obsessed digital ecosystem, creation of actionable intelligence is what makes IoT so irresistible. It begins with capturing data and identifying actions. Soon, many of these IoT-based products and solutions will think and even do for us. There is significant work under way to allay privacy concerns regarding sensitive customer data,⁶ including:

- Better capabilities at threat modeling.
- Reviewing attack surfaces and attack routes.
- Implementing security throughout the lifecycle with secure boot and hardware-based security controls.
- Device authentication and secure data management.
- Robust governance policy frameworks.
- Securing over-the-air updates.
- Using a layered security design that covers networks, apps and devices.

Network and power, two key requirements to IoT, have been making steady strides along the path to progress.

Data from IoT-driven devices has the potential to become a key input into supply chains. And suppliers, manufacturers and distribution centers are beneficiaries to such intelligence. Figure 4 depicts some of the uses and examples.

The power of IoT is undeniable and it's blazing a path of infinite promise in the digital ecosystem. It is most certainly a "thing" for enterprises to bet on for the future.

Use cases for IoT in the supply chain

WHAT is measured	HOW is it made useful	WHERE is it used
<p>“Awareness” through location, temperature, humidity, light levels, movement, handling, speed of movement, time spent and other environmental factors.</p>	<p>Form factors</p> <p>RFID chips, smart devices and mobile sensors.</p> <p>Processes and practices⁷</p> <ul style="list-style-type: none"> ■ Edge computing/ analytics. ■ Data ingestion and stream processing. ■ Device management. ■ Cold path and advanced analytics. ■ Enterprise integration with business systems. 	<p>Sample use cases</p> <ul style="list-style-type: none"> ■ Produce freshness tracking. ■ Shipment tracking. ■ Inventory tracking through smart vending machines. ■ Managing equipment availability and utilization. ■ Alarm and energy management. ■ Fleet management.

Figure 4

It is important to note that IoT devices originate creation of data bits. It fulfills a key piece in a digital supply chain; it creates a digital endpoint where none existed and makes it easier to generate data. These are then converted to actionable intelligence and monetized, usually downstream. The power of IoT is undeniable and it's blazing a path of infinite promise in the digital ecosystem. It is most certainly a “thing” for enterprises to bet on for the future.

Navigating these challenges requires careful planning, domain knowledge and rigorous implementation.

We are working with a client to utilize an IoT-based solution to bring together data from a disparate set of devices to effectively eliminate wastage and drive automation of tasks (see Quick Take, page 18).

Quick Take

Keeping Food Fresh, and the Data Even Fresher

Every year, a large retail chain attributes nearly \$2 billion in losses to food waste. Of that, refrigeration system failures or issues account for roughly \$300 million. Alarms raised by the controllers of these refrigeration systems reach the operations team after five to six hours, and there is no mechanism to predict failures before they occur. To compound the problem, these legacy controllers are no longer supported by the vendor, making it nearly impossible to change the alarm and logging parameters. The retailer needed new ideas to address these challenges and partnered with us to envision solutions.

The Solution

We are currently iterating on an IoT solution for the retail giant. When completed, the solution will enable the collection of data from meters, energy sources, fleets and other sources and provide an enterprise-level platform for energy, operational and supply chain excellence. Collection of this data will also open the door to algorithm development, which will serve as the foundation for prediction of failure and prevention of food loss.

We endeavored to create an extraction utility that can interact directly with the refrigeration equipment's controllers, and retrieve a set of prioritized sensor information on a periodic basis.

Further, we are designing a platform powered by the IoT that would log, monitor and predict the alarms and failures for all U.S. stores, based on the data retrieved from the various controllers.

Results

- | 40% reduction in food waste costs forecasted by 2019.
- | Automated 87% of work orders, reducing response times from 36 hours to less than four hours.
- | Drastic reduction in false alarm alerts through normalized rules engines.
- | Significant reduction of 100 million alerts per year on average through automation solutions.
- | Production-level deployment in 200 stores, with expected rollout to 5,300 stores.

Looking ahead

Each technology strategy highlighted in this white paper – namely integration platforms, blockchain, robotic process automation and the IoT – requires careful consideration and planning to deliver the value intended across various supply chain processes and components.

Further, in the delivery of these solutions, product development needs to be fast, iterative and continuous. Execution – broad conceptualization, analysis/synthesis, design, build and validate – needs to embrace modern software engineering principles. A strong foundation can ensure that an organization stays the course on executing a sound digital strategy.



Creating a digital foundation

A strong digital foundation equips an organization with the capabilities required to move toward a product-centric and digital-native state, and accelerate time-to-value from its supply chain initiatives. This becomes the launch pad for innovation and to enhance existing products and applications. It captures, standardizes and operationalizes the foundational work necessary to deliver on the promise. Getting there requires the right people, processes, platforms and tools.

- I People.** Planning and executing digital supply chain strategies require reorganizing from a project-centric organization to product-centric organization to ensure better alignment to the capabilities that businesses require.⁸ Organization structures and roles must be aligned to these capabilities. High-performing teams should be aligned to product and feature sets. Cross-skilling for a broader depth of specialization is encouraged, with full stack developers playing key roles in development teams. Integrated teams blur the lines between build and run aspects of products. Blockchain involves more complex collaboration within the ecosystem – users, investors, miners, and developers. All of this requires effective change management to help with the transition.
- I Processes.** The digital foundation focuses on applying the most apt engineering processes to deliver value. Sustainable engineering excellence is realized, adopting Agile and DevOps ways of working, Lean principles, collective code ownership, test-driven development, continuous integration/delivery and release management. DevSecOps models ensure that security strategies are ingrained in every system. A minimum-viable-product approach is preferred over a big-bang rollout. Areas like RPA require careful mapping of business process components that can be automated.
- I Platforms & tools.** Technology platforms and tools are central to delivering advanced capabilities and driving automation in the digital foundation. They include cloud-native platforms delivering microservices architectures, test and release management tools that enable DevOps, automation platforms to implement RPA, adoption of distributed ledger technology (DLT) in physical supply chains or IoT platform services to connect, process, store, and analyze data in connected systems. The digital foundation is constructed with an optimal mix of platforms and tools that align with the targeted capabilities.

With their network of numerous interconnected entities, today's supply chains present many opportunities for technology to influence the way that processes are run and business is conducted. It is clear that businesses need technology to sustain themselves. Efficient supply chains are vital to businesses and have been a subject of much experimentation and innovation as businesses try to differentiate themselves. Technology has paved the path for many an innovation in the supply chain, and will continue to do so.

Endnotes

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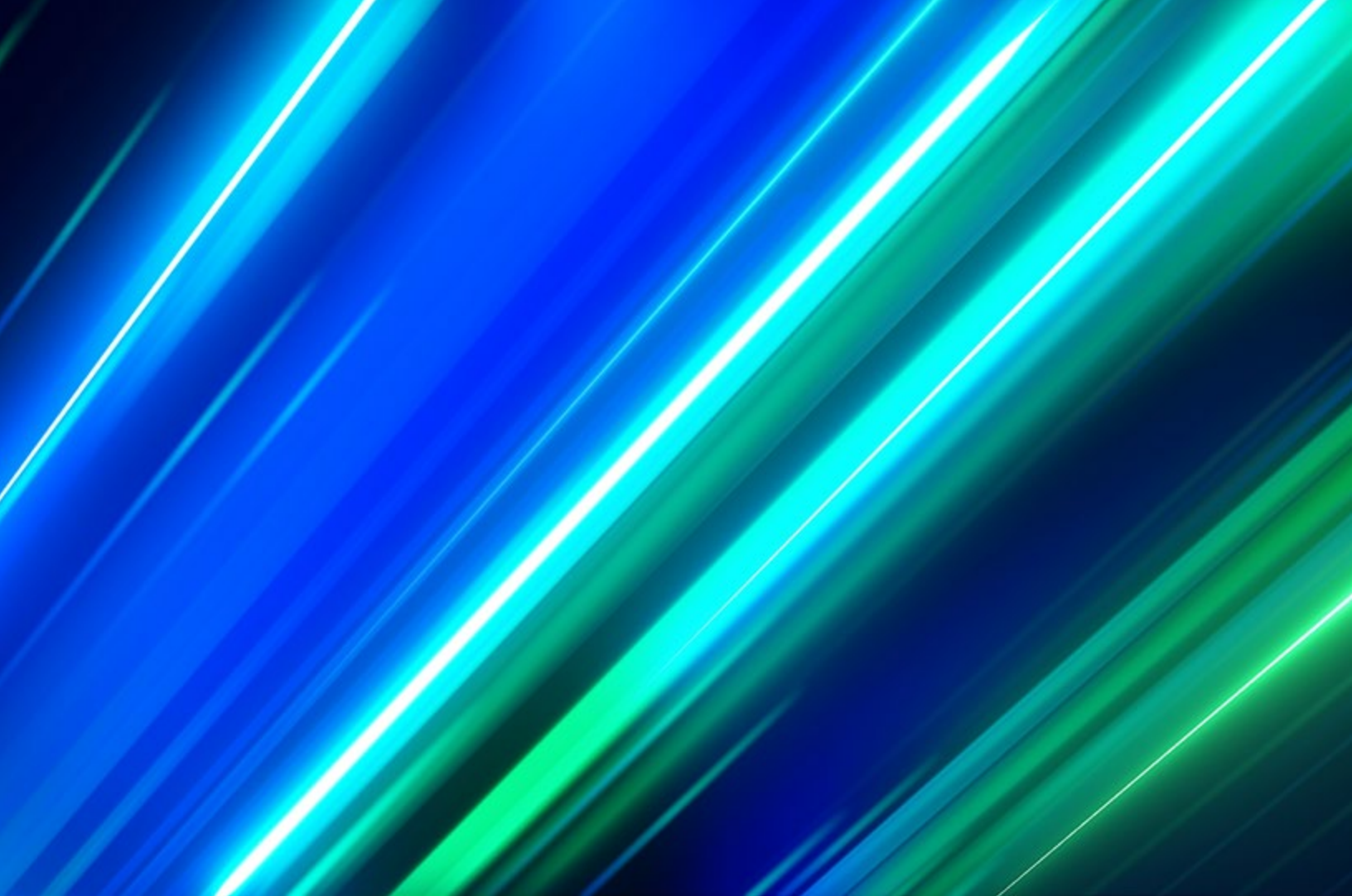


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About Cognizant Digital Business

We help clients build digital businesses and innovate products that create new value – by using sensing, insights, software and experience to deliver on what customers demand in the digital age. Through IoT we connect the digital and physical worlds to make smart, efficient and safe products, operations and enterprises. Leveraging data, analytics and AI we drive intelligent decisions and anticipate where markets and customers are going next. Then we use those insights, combining design and software to deliver the experiences that consumers expect of their brands. Learn more about how we're engineering the modern enterprise at [cognizant.com/digitalbusiness](https://www.cognizant.com/digitalbusiness).

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