Technologies in supply chain management

With the hype surrounding blockchain, IOT, process automation and advanced analytics, it is easy to become lost in understanding each of these areas of advancement, their benefits and future outlook. In this document, we will provide a brief introduction of key information, insight and automation capabilities, as well as their development and applications related to supply chain management.
Visualization

In the world of Big Data, visualization tools enable teams to sift out the noise and bring clarity to their data, empowering better decision making. Leading platforms such as Tableau, Microsoft Power BI, Microstrategy and Qlik provide capabilities to structure and visualize data with cloud-based processing to enable on the move and near real-time analytics. However, ensuring timely analysis and data quality, especially when integrating and aggregating multiple data sources, remains a challenge for many businesses. This is likely a driver in 4PL outsourcing decisions where data aggregation and interpretation remain a key role of the 4PL. It is critical to continue to practice the discipline of evaluating the raw data and the measures themselves in order to ensure that only trusted and up-to-date data are used to drive decision-making.

Powered by Xonar

BDP is pleased to offer customers unparalleled visibility through our Xonar technology. This proprietary technology solution from BridgeNet Solutions, an independent division of BDP, is designed as a dashboard to tackle visibility problems, allowing customers to see what they’re spending and how they’re are spending it within their own architecture.

Xonar’s advanced integrated analytics and visualization capabilities enable customers to manage complex supply chains in a cost efficient manner with optimal execution.

Conclusion

Visualization will continue to be key for all organizations, with a growing democratization of data as more and more teams adopt and utilize BI platforms. As these platforms expand, we will continue to see developments in ‘back-end’ analytics extended to the presentation layers.
Traditionally, businesses use mathematical programming to model outcomes, potential constraints and objectives of real-world problems. Examples include linear and nonlinear programming statistical approaches, which can be utilized for forecast management, order quantity calculation and forecasting. However, developing analytical expressions for real-world problems can be a challenge, due to the inherent complexity and uncertainty of the real world.

Simulation models provide powerful tools for analyzing the dynamics of complex systems. An optimization algorithm then interacts with the simulation model to provide optimal values of decision variables. We can adjust for different business scenarios by simulating the impact of changing different variables.

Many of today’s supply chain planning and management processes are still driven by static lead-time assumptions inherited from parent enterprise resource planning (ERP) platforms. This introduces a significant handicap into real-time optimization and simulation. A key focus in engaging with partners should be the need for flexibility to integrate and manage multiple optimization approaches.
While it may seem that AI is a new discipline, many of the capabilities embedded already within operations utilize components of AI. For example, BDP's document management solution utilizes both OCR and equivalency capabilities to support automated document validation.

From a business perspective, we should view AI through the prism of which business needs it can support, as outlined below:

<table>
<thead>
<tr>
<th>Business Process</th>
<th>Business Process Automation</th>
<th>Analytics &amp; Simulation</th>
<th>Cognitive Engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Robotic process automation (RPA)</td>
<td>• Hybrid learning models</td>
<td>• Intelligent Agents (Chat bots)</td>
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<td></td>
<td>• Image recognition (OCR)</td>
<td>• Deep learning (mimicking human brain cognitive functions / machines train themselves)</td>
<td>• Natural language processing</td>
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<td></td>
<td>• Speech to text</td>
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<td>• Recommendation engines</td>
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Extensive use of RPA in repetitive processes such as invoice auditing, booking management, information updates

Selecting the correct approach to store or flow cargo and mode to use based on simulation can be improved through teaching the optimization engine how to flow cargo and adjust for lead-time variation

Utilization of chat, search and learn capabilities such as Amazon Alexa / Apple Siri to engage with users to search and answer defined topics

At its core, AI is about automating judgments that have previously been the exclusive domains of humans. It is therefore important to define the use cases with a deep understanding of the objective and current approach.

Combining optimization and simulation approaches with machine learning is shortening the gap between traditional heuristics and real-world learnings, leading to self-correcting models which will continue to drive down the inefficiency and inaccuracy of traditional discrete optimization approaches.

Source: Gartner March 2018
Types of Advanced Analytics Used to Make Better Decisions in the Supply Chain Process

**Question:** What types of advanced analytics does your organization use to make better decisions in various supply chain processes?

*Base: Total respondents, excluding DK: n = 260 | Multiple responses allowed*

Source: Gartner March 2018

Today, many companies are already utilizing RPA solutions combined with automation and optimization. We foresee this trend accelerating as more data is available from IOT connected devices and blockchain solutions to fuel greater optimization and automation possibilities.

We recommend engaging with pilots across this technology space in order to assess technology fits and opportunities. An experimental approach is critical as with most technologies to ensure that quality and investment criteria are clearly met.

**Recommendation:** Engage with pilots to assess technology fits and opportunities

**Conclusion**

We have advanced from simplified expressions to the ability to simulate and select multiple outcomes for given scenarios, deriving significant business value. The merging of capabilities between Artificial Intelligence and discrete problem solving is supporting a wider array of simulation options, as the following diagram outlines. These technologies can support various types of business decision making, from predicting future events and trends to daily engagement and prescribing what to do given specific inputs.
Before "blockchain," the term “Big Data” was the long-awaited answer to generating insights and opportunities from untapped mines of information sitting within companies and ecosystems.

Gartner in 2001 defined Big Data as data that contains greater variety arriving in increasing volumes and with ever-higher velocity (known as the “3 V’s”) in principle. The timeliness and depth of insight could provide areas of competitive exploitation where the underlying data is of the right quality, type and structure to generate insights. While the costs of hosting data in large cloud based infrastructure solutions such as Microsoft Azure or Amazon Web Services (AWS) have declined dramatically, organizations do need to be cognizant of the costs associated with processing and analyzing data to prepare it for analysis. Therefore, it is crucial to formulate use cases upfront to define key problems, how data should be structured to best support analysis, and the timeline and frequency of analysis.

As the following diagram outlines, there are significant sources for both structured and unstructured data. The key is to be able to define effective use cases that will lead to timely insights and actions. Veracity still remains a critical component to useful data and insight.
Big Data Challenges

One example of a Big Data problem is the analysis of lead-times for shipping containers. Today, ship position, speed, and identification information is available via AIS (Automatic Identification System) feeds. This information can be correlated against ship metadata (such as cruising speed) weather information, carrier schedule information, port congestion data and historical performance across the same string to predict ETA at a designated port. This process could run for every AIS update which would greatly increase costs to an organization, or, it could be scheduled in a more cost-effective way. This demonstrates the importance of well-defined use cases to assess the type and timeliness of insights to avoid unforeseen costs of analysis.

Conclusion

“Big Data” has been oversold to a degree, in an industry largely governed by structured data that is compartmentalized and constantly crossing different regulatory frameworks. It is difficult to foresee if the mass collection of data will add more value than the capabilities being developed to improve data quality and collaboration. Use cases for areas such as predictive ETA will still add significant value through the utilization of structured data from multiple sources.

Well-defined use cases to assess the type and timeliness of insights are crucial to success.
Blockchain

Blockchain is an information storage system that is decentralized, secure and anonymous and that utilizes a distributed ledger (shared databases across geographies, institutions, partners) as opposed to a centralized database requiring an intermediary to update as a “trusted party”. Blockchain can either be “Permission less” (essentially public) or “Permissioned” meaning ledgers are centralized and governed by a central authority. In simple terms, Blockchain enables the safe and secure sharing of defined data (such as documents) with multiple parties in a manner which can be trusted to such an extent that processes can be automated on the back of simple exchanges. The following diagram outlines a typical flow within a blockchain.

**Blockchain Flow**

1. A new transaction is created
2. A new block is created and broadcast to the network
3. Participants validate the new block
4. After validation the block is added to the ledger
5. Applicable smart contracts are executed

A new product has been produced and shipped

The transaction is validated and added to the blockchain

A smart contract is triggered automatically to pay the supplier

Note that the addition of a self-executing program (known as a smart contract) can automatically execute an action once pre-conditions within the chain are met (in this case, paying the supplier). Given the challenges in today’s supply chains resulting from the number of parties, complexities around integration and lack of standardization, blockchain may be the answer for automating many supply chain flows. However, there are still several challenges facing overall adoption, including:

**Industry Adoption:** Actors within the industry need to adopt the technology and convince their stakeholders to join the chain in order to allow end-to-end processing. Given the various available platforms and pilots, it’s likely that stakeholders will all have their own favored approach.

**Standardization:** Global standards and regulatory alignment need to take place in order to satisfy legal and compliance requirements for documentation and customs activities (critical to global trade) to transition to blockchains with customs authorities likely to enforce further simplification and accreditation of various blockchain based solutions.

**Blockchain Technology:** There are inherent challenges to be addressed in the ability to scale such solutions across large global interconnected networks.

**Model:** Given that many companies may not wish to participate in open networks due to proprietary concerns, it is likely that a truly global blockchain with all actors participating will not exist. This leads to the question of whether actors participating in multiple chains will drive the cost and compliance advantages advocated by blockchain.
“The blockchain cannot be described just as a revolution. It is a tsunami-like phenomenon, slowly advancing and gradually enveloping everything along its way by the force of its progression.”
-William Mougayar

**BDP Compliance Blockchain**
On April 30, 2018, BDP announced a partnership with Chain.io to implement a secure, blockchain-backed digital locker for critical supply chain compliance records.

**Through 2020, 90% of supply chain blockchain initiatives will be proof-of-concept initiatives.**
-Gartner

**BDP & CBP**
BDP is currently partnering with United States Customs and Border Protection (CBP) on various blockchain initiatives. As a member of CBP’s Emerging Technologies Working Group, BDP’s VP Government and Industry Affairs Michael Ford is examining both the current and future state of operations, and how blockchain would alter both.

**BDP Blockchain Partnerships**

- chain.io
- CargoX
Blockchain in Action

Today, BDP utilizes Chain.io’s vault solution for logistics, allowing for the storage and management of highly critical compliance information, including: sourcing records; environmental chain of custody information; tariff classification support; vendor security audits, where shippers, logistics service providers (LSPs), and trade software providers can integrate their existing solutions with vault with very limited effort.

Vault brings the following benefits to our customers’ business:

- **Anonymity:**
  Data is stored fully off chain to ensure nothing is visible on a public blockchain.

- **Active control:**
  Customers are able to define who to share vault records with.

- **Proof of timing:**
  The exact time is stamped when files are captured, ensuring full traceability.

- **Proof of integrity:**
  Any changes at all will invalidate the vault record, allowing customers to prove the integrity of their records.

- **Business friendly:**
  Vault makes it easy to use their system and provide document receipts to auditors, making it both customer and auditor friendly.

Another well documented use case is Tradelens by Maersk-IBM - an open and neutral supply chain platform where events across the shipping life cycle – credit checks, contract signing, arrival at port, and payment – can be recorded publicly. On TradeLens, event data and document information are written on the blockchain where smart contracts can execute in order to support workflow automation. The challenge for Tradelens is to drive adoption and prove value over existing document management capabilities with more maturity, scope and automation capabilities.

Conclusion

Is blockchain worth the hype? At this stage, we can say that a wide number of blockchain initiatives have failed to gain traction or deliver the value they have promised due primarily to adoption issues, cost, scalability and the need for change within highly regulated environments. Yet blockchain technology does offer significant benefits in terms of security, authenticity and control. Given the lack of evidence around true success stories, we continue to follow this technology closely and utilize based on solid use cases. Our recommendation is to continue to prepare API and foundational integration capabilities, as with these capabilities we enable easy and rapid integration with either blockchain or other technologies as the blockchain opportunity matures.
**Internet of Things**

Today, there are 21.3 billion connected devices able to capture and stream data to virtually any point on the globe, with many devices able to capture multiple different data points. With the lowering of technology manufacturing costs, the growth in available data bandwidth (3G 384 KBps – 5G 10 GBps), the lowering of data costs, and the development of mass storage and artificial intelligence capabilities, the Internet of Things (IOT) offers significant opportunities within global industries to sense, analyze, adjust and monitor automatically virtually any installation or activity with an integrated IOT enabled and connected device.

**Benefits of the Internet of Things**

- Improved supply chain transparency in real-time, enabling better forecasting and decision making
- Improved understanding of quality of deliveries through detecting deviances in environmental conditions or theft
- Management of preventative maintenance through detection of variances within processes or output
- Improved customer service, alerting and tracking through geo-fencing and geo-location management
- Improved inventory and merchandise management through better product availability tracking and merging of point of sale (PoS) data

In 2019, the company Loginno launched the Contopia, a term used to describe a world where every shipping container is real-time IoT connected. Contopia is a competition to select a shipping line (Log-In Logistica Intermodal) to install IOT devices across the company fleet as a minimum viable product. Such devices allow real-time schedule compliance monitoring, theft detection, humidity, temperature and movement monitoring, allowing shippers to fully estimate delivery timelines and conditions of goods.

**Conclusion**

The success of IOT enablement is similar to blockchain, in that it will depend heavily on standardization to ensure efficient data exchange, adoption to ensure actors across the supply chain can support asset tracking and information exchange, and infrastructure development to support the rapid collection, collation and distribution of data to cloud based big data solutions. We do see significant automation opportunities linked to IOT data, but note that technology and adoption strategy requires further development.
## In Summary

We have covered a number of trends and technologies at a relatively high-level, hopefully providing new insights to help guide decision-making and empower you to experiment and engage with new technology and continue along with us in the supply chain digitization journey.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Area</th>
<th>Status of Technology</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visualization</td>
<td></td>
<td></td>
<td>Multiple offerings are available with simple deployments, adopt if not already adopted.</td>
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<tr>
<td>Optimization</td>
<td>Algorithms</td>
<td></td>
<td>Define use case and adopt based on business benefits or partner with existing LSP capabilities.</td>
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<tr>
<td></td>
<td>Simulation</td>
<td></td>
<td>Define use case and adopt based on business benefits or partner with existing LSP capabilities.</td>
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<tr>
<td></td>
<td>RPA / OCR Automation</td>
<td></td>
<td>Define use cases and integrate into operations based on ROI in both cost and quality, ensure deep understanding of process before automation.</td>
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<tr>
<td></td>
<td>Analytics</td>
<td></td>
<td>Define use cases and test existing technologies, our recommendation is to allow technologies such as 'deep learning' to mature before further engagement.</td>
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<tr>
<td></td>
<td>Cognitive Services</td>
<td></td>
<td>Having trialed a number of capabilities we still believe there is a requirement for further maturity before engaging in more complex virtual agent solutions.</td>
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<tr>
<td></td>
<td>Big Data</td>
<td></td>
<td>Focus on structured operational data, review use of unstructured data on very defined pilots, focus on veracity and value of data applications.</td>
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<td></td>
<td>Blockchain</td>
<td></td>
<td>Continue to review outcomes of pilots. Review progress on development of standards and prepare API based architectures to support both existing and newer technologies.</td>
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<tr>
<td></td>
<td>Internet of Things</td>
<td></td>
<td>To a large degree, applications for IOT are largely in POC status, continue to review outcomes of relevant POC’s and development of standards.</td>
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</table>

Almost as important as the available technologies to support transformation is the ability to utilize experimental learning and agile development approaches to ensure continued testing of technology opportunities and benefits. Given the number of opportunities we have presented (with many opportunities requiring combinations of multiple technologies) the companies that will succeed in supply chain digitization will be those that learn to experiment, combine and assimilate learnings the quickest as we continue the technological journey.
Headquartered in Philadelphia, BDP International is one of the leading privately held freight logistics/transportation management firms based in the U.S. It operates freight logistics centers in 20 cities throughout North America and a network of wholly owned subsidiaries, joint ventures and strategic partnerships in nearly 140 countries. The company serves more than 4,000 customers worldwide. BDP provides a range of services, including ocean, air and ground transportation; lead logistics process analysis, design and management; export freight forwarding; import customs clearance and regulatory compliance; project logistics; warehousing, consolidation and distribution; and its web-based BDP Smart Suite® of shipping transaction/tracking management and visibility applications.

For more, visit www.bdpinternational.com.

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At BDP, we have a long track record of collaborating with our customers to drive development and support capabilities in order to enhance global execution to deliver the world what matters safely.

If you would like to learn more about these topics, feel free to contact us at www.bdpinternational.com/contact-us.