Rethinking Supply Chain Analytics with Cognitive Technology

Cognitive Technologies are Rgnin ede Businesses

Cognitiv,)IA(ecnegilletnI laic itrA sa hcus seigolonhcet e machine learning, and Natural Language Processing (NLP) are permeating all facets of business, across all domains, with fast growing use cases. Cognitive computing in the context of analytics can refer to the use of analytics to 'learn' about tuoba sthgisni niag ot sa os snoitcnuf ssenisub c iceps customers, competitors, market perceptions, etc. Cognitive analytics can also be used to extrapolate business contexts and run simulation models for predictive insights. The biggest advantages of cognitive analytics technologies stem from their ability to understand queries posed in natural language, processing power to analyze large volumes of data to return real-time insights, and a self-learning loop that enables the algorithms to trace the outcomes of delivered insights, and use the outcomes to improve the accuracy and relevance of results on an ongoing basis.

yllac icepS, compared to traditional analytics solutions, Cognition Driven Analytics (CDA) can:

- Execute tasks through adaptive learning
- Scale analytics capabilities by creating additional instances of the program
- Provide meaningful insights even when data is not complete or structured
- Create and test scenarios to evaluate outcomes on the go
- Automate the generation of interpretations
- Perform monotonous tasks with greater speed and precision
- Enable self-served analytics that can operate round the clock with minimal human intervention

Interestingly, very few companies have been able to leverage the power of analytics even after making significant investments in data management and analytics tools. Most of these analytics tools explain rather than anticipate, need significant intervention of costly human experts and lack speed to generate actionable insights. CDA with its prescriptive and self-served capabilities, can bridge these gaps and can help companies leverage data and analytics to their competitive advantage.

Leading businesses are not only making large investments in CDA solutions but also creating infrastructure and platforms to enable cognition in their business processes. In the following sections we look at the applications of CDA in supply chain management and assess its impact on decision making and optimization efforts in an increasingly dynamic ecosystem.

Applying Cognitive Technologies to Supply Chain Analytics

Supply chain (SC) improvements have been a key opportunity for many companies to enhance their bottom line as well as top line. Cognitive technologies can be leveraged to target improvements of SC metrics at the strategic (e.g., SC design), tactical (e.g., SC collaboration), and operational levels.

Figure 1 shows how cognitive technologies enable end-to-end SC analytics.

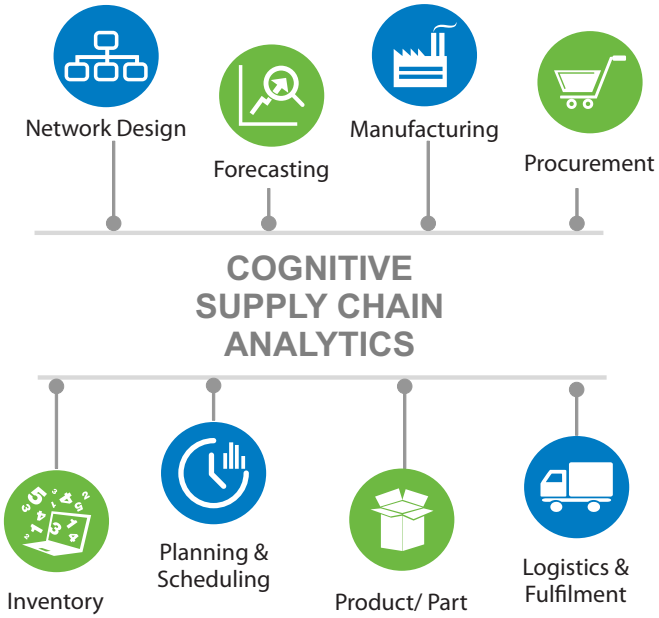

Figure 1: Cognitive Technologies Impact Functions Across the Supply Chain

Let's explore the use cases for CDA in some of the SC functions:

Network Design

Optimization and simulation based approaches have dominated SC network analytics with a focus on building As-Is models, identifying potential To-Be scenarios, shortlisting high impact ones, and running 'what-if' analyses. This works well only in static scenarios with pre-defined parameters. For real world situations where predictions are required on-the-go and without the time for human intervention, enhancing the optimization and simulation based approaches using CDA is preferable. Using reinforcement learning approaches, CDA can auto-select and tune innumerable scenario parameters, prescribe scenarios, simulate scenario outcomes and provide faster and more accurate predictions, thus minimizing business risks.

Forecasting

Cognition-enabled forecast analytics tools can bring significant automation and improvement in the overall forecasting process. CDA models can automate the process to establish relationships between demand and parameters that influence the demand and its magnitude. CDA models use matrix based models that can forecast quickly at individual product levels. CDA models are particularly useful for use-cases such as new product introduction and promotional forecasting, where traditional forecasting tools tend not to be successful. A study was conducted to predict potential sales of vehicles using historical data on the leads and their sales records. The machine learning based model predicted the positive sales and likely vehicle features with accuracy between 70-80%, even for a highly skewed dataset. These predictions helped improve forecasts, shape customer demand, and focus on high potential customers.

Inventory Planning

Companies can reinvent their demand management and fulfillment processes with CDA by accurately predicting customer preferences using a wide range of data sources such as sales history, customer profiles, and product characteristics. Based on the propensity to buy, product availability, and fulfillment options, such personalized predictions are more accurate than traditional algorithms and improve over time. This will close the loop between demand sensing,

personalization, shaping, and fulfillment. Figure 2 depicts the result of aggregating personalized predictions.

Predictions allow customer and product segmentation, inventory planning, and sales enhancement while reducing overall inventory carrying costs. As inventory targets are flexible, CDA leverages reinforcement-based models to provide dynamic decision support, automate the decision quality, and reduce oversight required by inventory planners.

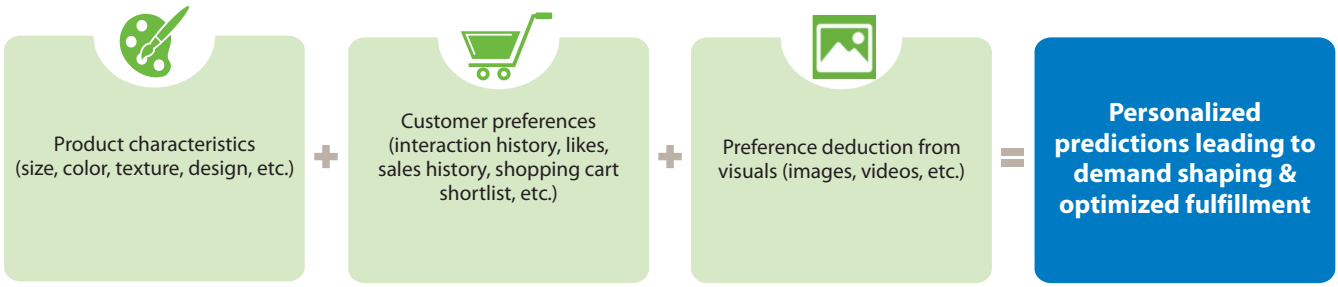

Figure 2: CDA Enables Personalized Predictions for Efficient Demand Management

Product Proliferation

CDA can also be used to control products/ parts proliferation. In many industries such as hi-tech, telecom, metals, and manufacturing, products/parts can be defined using multiple characteristics that take a range of values enabling a high number of product configurations. In many cases, products/parts are also phased-in and phased-out regularly. Growth through mergers and acquisitions, especially when the same part/material is consumed or sold by both companies, can also cause proliferation, which leads to cost leakages across the SC. CDA models can be trained for product/part similarity analysis to provide outputs as good as those provided manually by product experts.

Planning and Scheduling

CDA can enhance decision support to industries' production scheduling that tends to be highly variable due to dependencies on upstream and downstream operations, frequent last minute order changes, and limited optimization and heuristics capabilities. Manual adjustments lead to sub-optimized schedules and low throughput. CDA can use the reinforcement learning approach to predict the expected outcomes of different stages of the schedule. It can also use the reward driven learning approach to provide schedule

alternatives as and when interruptions occur during execution. Figure 3 shows how CDA facilitates decision improvement over time.

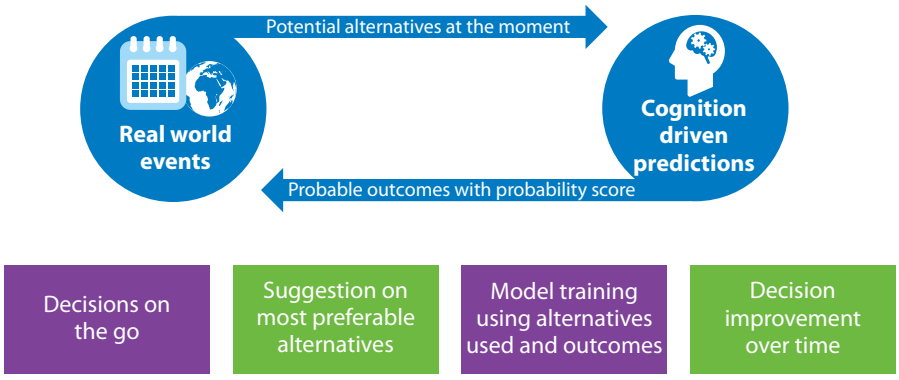

Figure3 : CDA Enhances the Quality of Product Scheduling Decisions

Logistics and Fulfillment

CDA models can support optimization models using unsupervised and reinforcement driven approach to narrow down the potential route options and optimize routes and shipments. They can manage and control logistics and compliance costs; predict transactions where there is a high probability of cost leakage; and improve logistics execution processes, for example through automation of invoice validation process using NLP driven text mining.

Other potential SCA use cases include improving the asset management process for high value assets and predicting breakdowns using diverse parameters and data points received from sensors or IoT devices. Procurement (spend analytics, spend categorization) or after-sales services (spares forecasting, last time buys) can also be explored as SC use cases for CDA.

Enabling CDA

Cognitive technologies are evolving rapidly and many innovative companies have already invested in it. Leading solution vendors are creating infrastructure to enable cognition in business analytics. IDC predicts that by 2020, 50% of all business analytics software will incorporate prescriptive analytics built on cognitive computing functionality.

To explore CDA and its application, a diagnostics-based approach can be used to validate its benefits and support

business cases for further investment. Table 1 elaborates on a three-phase framework that guides businesses towards effective implementation of CDA in high-impact areas.

Phase	Focus Area	Potential SC Use Cases
Establish	Use cases that are critical to business success but haven't been satisfactorily serviced by traditional approaches Test and validate CDA applicability and capability of the new approach	New product and promotional forecasting, demand sensing, product recommendations, flexible or dynamic inventory targets
Build	Use cases that provide the most value, require high manual effort, or dependence on manual validation from highly constrained experts Build CDA capability	Product/part similarity analysis, invoice validation, transport cost analysis, after sales support, predictive maintenance
Execute	Use cases that have future potential as CDA expertise develops in the organization	SC network decision support, production schedule decision support

Table 1: A Framework for Effective CDA Implementation

CDA is an emerging domain that has not been sufficiently proven, but has very high potential. One of the biggest impediments to faster adoption is the unavailability of expertise and the right skills. Companies today can use managed services provided by analytics service vendors for support during the initial stages of building proofs-of-concept and business cases. Once the benefits are sufficiently defined, the future state of CDA within the company can be assessed.

Getting Future Ready with CDA

The arrival of effective cognitive technologies is imminent and they are already disrupting businesses. SC is a key business function that can readily leverage the benefits of CDA. Forward thinking companies have begun to embrace cognition and leverage CDA as a key business driver. CDA is helping these companies transform their SC with the ability and agility to cope with dynamic demand, complex networks and ever-changing fulfillment methods, thus bringing significant competitive advantage.

Supply chain networks are a fertile area for CDA. CDA can help effectively manage multi-tier synchronization and collaboration across the extended SC, reducing costs while also providing personalized attention to customers. In the near future, CDA will no longer be an option but will become an essential capability for business enablement.

References

[1] IDC, IDC: Big Data and Cognitive Systems Conference 2016 Explores the Next Frontier for Innovation, Competition, and Productivity, November 15, 2017, accessed July 19, 2017, https://www.idc.com/getdoc.jsp?containerId=prAP41923416

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