SUPPLY CHAIN INTELLIGENCE: DESCRIPTIVE, PRESCRIPTIVE, AND PREDICTIVE OPTIMIZATION

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Report Highlights

Top performing companies are transforming and harnessing data adopting advanced analytical and dynamic optimization capabilities. Starting with descriptive analytics of the current state, they are moving to predictive analytics to describe the future or alternate states, and prescriptive analytics to optimize outcomes during the supply chain planning and execution phases.

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65% of companies believe that they need to improve their analytics capabilities.

Only 50% believe that they are spending enough on analytics.

Only 30% of companies are developing new strategies to address changing customer requirements.

Top performers are investing in change & technology at twice the rate of their peers.

Big Data and Analytics: Trends and Challenges

Almost two thirds (65%) of companies now believe that they need to improve their analytics. The use of optimization and data analysis to turn big data into intelligence and drive business decisions cannot be ignored any more – not if a business wants to be successful. Today's enterprises are looking to reduce costs and improve operational performance in the context of their increasingly complex and multi-tiered global supply-demand networks. The importance is only amplified for those with global supply chains and partners (Figure 1).

Recent Aberdeen research suggests that contributing factors include 1) the growing availability of business data to analyze, 2) the high velocity and complexity of business decisions and rules, 3) technological improvements in data collection and analysis, and 4) the increased need to determine total cost-to-serve across new logistics, transport channels, and lanes.

All of these factors have driven the need and desire for businesses to base decisions on optimization of the company's supply-demand network, spanning both the current and future state scenarios. Today's optimization challenge goes beyond the current state. Companies need to provide more future-looking answers and recommendations to execution decisions that cannot be addressed by historical analysis. Indeed, this requires a move from current state, descriptive analytics to analytical optimization that applies prescriptive and predictive intelligence during both the planning and execution phases. Yet only 30% of companies state that they are capable of, and operationally ready to, develop new strategies to address the changing customer requirements.

Businesses large and small are embracing the movement and, according to our research, high performing businesses are 3.5

times more likely to embrace analytics than low performers. These trends are transforming business operations from inbound source-to-pay and outbound order-to-fulfill/transport/deliver.

Figure 1: Lack of Supply-Demand Orchestration Equals P&L Impact

Source: Aberdeen Group, February 2015

Global Omni-Channel Demands Require Increased Synchronization and a Control Tower Approach

New logistics formats have emerged to address B2B and B2C eCommerce in a global supply-demand network (Figure 1) and are more fully described in the sidebar on the next page. These new formats are having an impact on physical order, inventory, and fulfillment processes and beg for evolved analytics and the Control Tower Approach.

Control Tower Approach

Defined as a set of integrated processes and technologies that support a seamless flow of product from source to end consumer, regardless of the global complexity or the sales and logistics channel preferences of customers

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New Omni-Channel Shipment Trends across B2B & B2C Companies

- 61% shipping direct-to-consumer
- 60% shipping to or through a traditional distribution center
- 56% shipping through vendor DC bypass, 3PL, or e-fulfillment provider
- 53% shipping through a break-bulk facility (i.e. cross dock, transload, or DC flowthru facility)
- 43% shipping through a free port, free port zone, FTZ for customs
- 38% shipping direct-to-store
- 15% plan to add capabilities in other areas not checked

Source: Aberdeen Group, 137 Companies, Crossborder Transport Survey

Key areas of change under new omni-channel fulfillment trends (sidebar) include:

➔ eCommerce and multi-channel or **cross-channel demand impacts 87% of companies**

➔ **65% bypass their own DCs** and ship direct-to-store via others (vendors, suppliers, 3PLs, break-bulk)

➔ **61% have direct-to-home delivery** models (this is up from only 30% as little as 2 years ago)

➔ **Inbound-to-outbound segmentation and cost-to-serve (CTS)** require higher degrees of big data, collaboration, and analytics then have ever been required before. Even more rigor is required to proactively perform *inventory and item level rebalancing in-transit*, which only 23% of low performers can do

➔ **Managing costs and rates by lane, mode, customer, and product for proper omni-channel fulfillment is limited.** Fragmented collaboration and data sharing restricts visibility into events and rates. Linking these components from inbound to outbound is even severely curtailed at top preforming companies; only about 35% of top performers can segment their logistics/transport rates and costs (for more details on segmentation see *Supply Chain Visibility and Segmentation: Control Tower Approach*)

Such changes are truly transformational and inspire investment in new, streamlined, and collaborative technologies within the industry and across the supply-demand network (Figure 1).

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The Use of Analytics to Optimize Business

A key prerequisite of orchestration and end-to-end optimization is analytics. Analytics facilitate the realization of business objectives through the reporting of data to analyze trends, and predictive models for forecasting and optimizing business processes for enhanced performance.

Aberdeen used four performance criteria, covering key cost and service metrics, to distinguish Leader and Follower organizations (see Maturity Class Definition sidebar). The gaps in performance between Leaders and Followers are significant, particularly in today's global market, where 88% of companies are involved in global supply chains and address new requirements of convergence in B2C and B2B channels.

Our data shows that Leaders are more capable, automated, and advanced. As they strive to become more analytically evolved, they become more organizationally intelligent and have aggressively moved up the analytics hierarchy to optimize their business and operational processes. The research shows that the move from historical descriptive analytics to a culture of organizational intelligence, coupled with the use of prescriptive analytics, is a differentiating factor for top performers, which allows them to optimize and break away from the competition. The typical progression or hierarchy of analysis and optimization is detailed below and further illustrated in Figure 2 on page 7:

- **Descriptive analytics: what HAS happened** – the use of data to figure out what is happening now or what happened in the past. Descriptive analytics prepare and analyze historical data and identify patterns. This type of intelligence looks for trends at the micro-, the macro-, or the aggregated-levels of the business and then drills up, down, or across the data to identify areas of under- and

Maturity Class Definition:

Leaders - Top 30%

- **95.4%** of outbound orders delivered to customers complete and on-time
- **94.6%** of orders received from suppliers complete and on-time
- **0.5% decrease** in total landed per unit costs in the past year
- **7.5% decrease** in the frequency of out-of-stock inventory in the past year

Followers - Bottom 70%

- **86.4%** of outbound orders delivered to customers complete and on-time
- **84.8%** of orders received from suppliers complete and on-time
- **8.5% increase** in total landed per unit costs in the past year
- **0.9% increase** in the frequency of out-of-stock inventory in the past year

Leaders (top 30% of companies) are:

- **63%** more likely than All Others to gain visibility into international *outbound* shipment status within hours
- **52%** more likely than All Others to gain visibility into international *inbound* shipment status within hours

over-performance. Areas may include: geography, time, products, shipments, logistic and transport lanes or channels, customers, stores, partners, campaigns, and other business dimensions such as rates and costs. Techniques such as data modeling, visualization, and regression analysis largely reside in this space. This analysis gives supply chain professionals the context that they need for future actions.

➔ **Predictive analytics: what COULD happen** – the use of data to find out what could happen in the future. Naturally, it is a more refined and sophisticated usage of analytics. Predictive analytics predict future probabilities and trends, and find relationships in data that are not readily apparent with traditional or descriptive analysis. Techniques such as data mining, forecasting, and predictive modeling reside in this space. Predictive analytics provide answers that move beyond using historical data as the principal basis for decision making. Instead, it helps managers anticipate likely scenarios, so that they can plan ahead and address contingencies, rather than reacting to what has already happened.

➔ **Prescriptive analytics: what SHOULD happen** – the use of data to prescribe the best course of action to increase the chances of realizing the optimal outcome. This is a forward-looking future state or alternate path analysis, providing future-looking insights on the business; predicting what is likely to happen and why it's likely to happen. Prescriptive analytics evaluate and determine new ways to operate, target business objectives, and balance all constraints, to better optimize the outcome in terms of cost and service.

Figure 2: Analytics Progression Moving to Predictive/Prescriptive Plans & Execution

Definitions, sample applications and opportunities, and underlying process capabilities

	Descriptive	Predictive	Prescriptive
	What HAS happened?	What COULD happen?	What SHOULD happen?
What the user needs to DO	Increase cross-channel fulfillment and shipments Reduce fulfillment, transport and inventory costs	Predict infrastructure failures, forecast facility space demands Predict costs and profits by customer, product, transport/fulfill and inventory stream, forecast profts and margins Predict capacities by customer, product, transport/fulfill and inventory stream, forecast capacities	Increase asset utilization Optimize resource schedules Remain agile and competitive. Increase asset/inventory utilization. Optimize efficiency and supply-demand in phase with shifts
What the user needs to KNOW	The number and types of asset failures Why transport/logistics costs are high The value of the multi-party inventory	How to anticipate sales/shipments for specific channels and assets/facilities When to consolidate underutilized facilities or to expand them How to determine and segment costs to improve service levels and cost (CTS) How to determine/rank baseline and future scenarios and costs to improve service levels and cost (CTS)	How to increase asset production Where to optimally route service technicians Which strategic facilities and DC network plans provide the highest long-term utilization and flexibility
How analytics gets ANSWERS	Standard reporting - What happened? Query/drill down - Where exactly is the problem? Ad hoc reporting - How many, how often, where?	Predictive modeling - What will happen next? Trends Forecasting - What if these trends continue? Simulation & Segmentation - What could happen? Control tower process, Alerts - What actions are needed?	Optimization - What is the best possible outcome? Random variable optimization - What is the best outcome given the variability in specified areas? Current State and Future State modeling and CTS segmentation - What is the best profit and logistics flow for each product and segment ?
What Leaders do to make this POSSIBLE	Alerts, reports, dashboards, Business intelligence	Predictive models, forecasts, statistical analysis, scoring Trend in mix of transport lanes and modes. Forecasting - What if these trends continue?	Business and process rules, organization models, comparisons, optimization Closing the Loop on Planning and Execution. Supply Chain Agility and Efficiency

The analytics progression in Figure 2 spans, 1) strategy/process development – problem identification and process gap analysis; 2) planning – requirements gathering and data needs/analysis;

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Advanced Analytics to Link Rates & Events

The new logistics format requires the understanding of new B2C and B2B requirements. It involves linking financial and cost-to-serve components with visibility events.

Leaders are 1.54 times as likely to capture actuals and accrue landed cost updates as an order or shipment progresses.

3) execution – data visualization, assessment analysis, predictions and trends, and optimization/simulation; and 4) concludes with what Leaders do to get answers and close the loop across planning and execution stages.

Three Principal Analytics Stages: Provide Answers and Distinguish the Leaders

Maybe the easiest way to understand the progression of analytical capabilities and distinguish between business intelligence and predictive/prescriptive analytics is to look at the answers or value that they can generate. For example, business intelligence (descriptive analytics) allows you to answer questions about the demographics or characteristics of your customers, products, stores, logistics channels, and shipments.

Through each stage of analytics – descriptive, predictive, and prescriptive – the goal is to answer questions (see Figure 2) about the performance of your business across a number of different dimensions:

1. *What the user needs to DO*
2. *What the user needs to KNOW*
3. *How analytics gets ANSWERS*
4. *What Leaders do to make this POSSIBLE*

Following this framework and analytics progression allows businesses to get answers in each of the four dimensions above. This framework also illustrates the specific types of technologies and optimization capabilities that the Leaders utilize to optimize their operations and close the loop on planning and execution throughout each current and future state scenario.

The goal of any analytics solution is to provide the organization with actionable insights for smarter decisions and better business outcomes. Different types of analytics, however, provide different types of insights. It is important for managers to understand what each analytics type delivers and to match analytics functions to the organization's operational capabilities across the inbound and outbound transportation and inventory/fulfillment flows, and the extended partner network in a customer-connected supply chain.

The three types of analytics build on one another, with descriptive analytics being the most common to describe the current state, predictive to describe the future or alternate states, and prescriptive analytics to optimize outcomes during the planning and execution phases. They are different, yet they share goals for optimization of logistics and transportation flows and costs and service, to meet balanced business objectives. These tools and optimization techniques yield capabilities that help to provide an understanding of an event or action, uncover relationships in data, develop what-if scenarios, and simplify business decisions. In most cases, the future state analysis uncovers opportunities for companies to reengineer their supply-demand network (Figure 1) and to transform or optimize their operations.

Three Principal Types of Analytics

- **Descriptive**, which uses business intelligence and data mining to ask: **"**What has happened?"
- **Predictive**, which uses statistical models and forecasts to ask: "What could happen?"
- **Prescriptive**, which uses optimization and embedded decision rules and simulation to ask: "What should we do?"

Key Steps for Strategic Supply Chain Optimization: Moving Beyond Analytics

In this report we examined the growing challenge that companies face in a more complex, high volume logistics/transport, fulfillment, and shipping environment. The Leaders are twice as likely to invest in process and analytical technologies and to follow 5 key process steps. These steps help them harness raw data and allow them to deploy predictive and prescriptive optimization in each stage, and on both current and

➔ Related Research, "The Outside-in Approach to Order Fulfillment"

You Can Invest:

- Leading companies average a 2 year payback. You can now afford to perform analytics and simulation for each and every action taken in business
- Cloud-based transportation and visibility systems allow for intelligent multiparty collaboration and omni-channel fulfillment
- Today's network simulation models and logistics/transport applications have access to data and enough capability to perform analytics and embedded optimization rules
- Thus enabling the use of simulation and dynamic optimization everywhere and every time

future state networks. Here we present the 5 key process steps for moving beyond analytics to embrace segmentation and optimization. If process gaps are uncovered, repeat the 5 step process below at least annually.

➔ **Step 1: Current state baseline optimization**.

For each business unit, product, and process step, look at the current state and build a baseline addressing both the planning and execution phases. The baseline should segment total landed costs and product flows from sourcing through final delivery to the customer. During supply chain planning stages, use descriptive analytics tools, models, and decision rules to plan shipments and optimize cost, service, and capacity across each measured segment. During execution, apply prescriptive analytics modeling and real-time control tower processes to balance cost and capacity, and redirect and re-optimize as conditions change in-flight.

➔ **Step 2: Strategy and future state**.

Determine strategy and future state, uncover process and technology gaps, and perform trade-off studies between stocking/fulfillment and transport options to determine optimal benefit streams. Use predictive analytics and modeling. Discuss the future state of the supply-demand network with senior executives to see what needs to be changed and to determine what elements need to be segmented and reengineered, based on PREDICTED flows and processes. Segment across key business units, products, and logistics flows, inbound to outbound, and build a future state plan to optimize outcomes and cost-to-serve metrics.

➔ **Step 3: Reengineer and streamline B2B and B2C fulfillment and multi-channel shipping processes**.

Explore options to combine and split orders across stock locations, pick broken case items, and ship same-day and next-day if required. Integration of process and technology end-to-end and "outside-in" is mandatory to achieve multi-channel order fulfillment success in this new world of converged B2B/B2C, and of optimized and predictive analytics.

➔ **Step 4: Mobilize the organization to transform and build the future state network and technology**.

Define and document the new re-engineered inventory and logistics/transport flows and changes by segment. Develop descriptive, predictive, and prescriptive tools, models, and strategies. Develop procedures and put new processes and technology in place. Integrate people, process, and technology objectives for best practices across business units and products in the end-to-end supply chain.

➔ **Step 5: Continuously close the loop on planning and execution**.

Establish a baseline of key costs and metrics for each stage of the plan; execute and prescribe processes. Specifically address B2B and B2C convergence; there are several process and technological practices that are identified to support omni-channel integration/ synchronization and overarching operational agility, during both planning and execution. Set thresholds and tolerances and manage cost and service metrics for deviation, using alerts for “by exception management.” Use a control tower approach to PRESCRIBE changes as

Supply and demand synchronization will encompass trade/transport rate and lane analysis, and synchronization from raw materials all the way through to B2B and B2C end consumer delivery

they occur in-flight during each predicted scenario. Rethink and retool processes periodically so that continuous improvement occurs, closing the loop between planning and execution cycles in near real-time.

This report elaborates on the concept of combining an overarching control tower approach and integrated set of platforms and technologies, into a unifying solution that addresses the multi-channel and B2B/B2C convergence challenge, across a complex supply-demand network. This integrated visibility and synchronization solution results in a single version of the truth. It provides a more seamless, connected, and unified customer experience that can address the shifting customer requirements across end-to-end channels, costs, and activities. The Leaders have invested twice as much in analytics and segmentation capabilities. Their high performance analytics capabilities result in smarter, more strategic operational decisions, allowing them to plan for the future, rapidly prescribe actions, and execute accordingly.

For more information on this or other research topics, please visit www.aberdeen.com.

Related Research

Supply Chain Visibility and Segmentation: Control Tower Approach; August 2014
E-commerce Supply Chain: Follow the Leader to Success; September 2013
CSCO 2014: Top Three Supply Chain Execution Priorities; December 2013
CSCO Priorities under Globalization: Cross-Border Transportation Strategies; August 2013
The Outside-in Approach to Order Fulfillment: Providing a Seamless Customer Experience; April 2013

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