From Complexity to Clarity - Part One
Mastering Today's Complex Supply Chains

By Ann Grackin

Introduction

Achieving excellence in business management and performance has always been a challenging task. But over the last decade it has also become more complex. Globalization; the web; mergers and acquisitions; legislation; and businesses' own striving for growth with more products, more markets, and more ways to serve customers have created ever more complex channels. Plus, the increased number of interactions, transactions, and information within each relationship: well, that's complicated!

The sheer scale and size of the data that is used to manage all these moving parts is, of course, the key driver of system implementation. (You can't manage it with an abacus or a spread sheet.) In the last few years, technology has enabled the assimilation of this tremendous volume and complexity of data and process integration to create a relevant user experience, so that organizations can be masters of their complex world.

Supply Chain Complexity at its Roots

Nowhere more does that complexity challenge the business than in Supply Chain Management. The expanding presence of the extended enterprise has created a growing role for Supply Chain Managers.

Supply Chain Managers are chartered with a complex and interlocking set of responsibilities:

- Predicting market behaviors, Demand Planning, and New Product Introductions (NPIs), both at the factory and into the distribution channel;
- Sourcing – creating a differentiating, dependable, low-cost, well-performing supplier network that is competitive and meets administrative and corporate standards as well as customer values;
- Production – managing in-house or outsourced manufacturing consistently and cost effectively, while meeting multiple customers' unique mandates and expectations;
- Logistics – getting the right product to the right place, at the right time, at the right cost;
- Managing risk – assuring that high quality products are being produced from a reliable supply network.

While the supply chain team is managing all these elements, it needs to constantly strive to make the supply chain more resilient. The supply chain has to be very responsive to market conditions to be more competitive, use less working capital, and have the reserve to respond to an upside market opportunity.

And of course, the supply chain team will reduce the cost every year while managing all of that!

Complexity factors from dynamic processes, varying priorities, huge data volumes and interdependencies may not seem too obvious at first pass. Let's look at some of these issues.

The Data

Data is at the core of the challenge, not only by sheer scale (with its hierarchies and attributes), but also because of the sets of relationships and patterns that emerge through the interactions of people and processes.

The Data Explosion

Managing data requires speed and precision —both at a strategic level (setting up the network, including infrastructures (warehouses, and factories) and making process changes) —as well as at the tactical level: the explosion of data streams from sourcing decisions, transportation route management, and managing product demand/supply. Each link in the chain has its own characteristics, though. Each product its own attributes. Each market its own challenges. Each customer their unique requirements, lifestyles, and wallet size. And each partner their own capabilities and limitations.

For example, a product sold in one market has different taxes (and therefore lower or higher cost) than another. In one channel, the packaging and bundling of a product (single use or value packaging, for example) is different than another. Some customers want large safety stocks to buffer uncertainty, some want low. Products have different compliance regulations associated with them. What is packaged in a box changes by country, so kitting and bills-of-material are different.

And all that data is constantly changing, often by the minute.

In a recent talk on Managing Complexity in Your Supply Chain, Jeff Killion of Sigma-Aldrich, pointed out that in their firm, an excellent example of the data challenges in their supply chain is the number of attributes per product, and distribution channels that can be quite different for each product. Furthermore, managing these products can be challenging due to issues such as different product lines, products that do not share the same demand profiles, as well as the many different trade regulations, and the routes that these products flow through (legal requirements on products can determine restriction on specific trade routes).

The various fields in the database systems have to enable staff to manage large arrays of complex product offerings, all with unique attributes. Furthermore, each supply chain has unique requirements such as data for each product based on its attribute; stocking location for each demand stream or customer; each supplier's risk profile for each safety stock location, as well as lead times by product (rather than a standard policy implemented across the company). For Sigma-Aldrich, this means over six million records in the data base! A supply chain manager cannot manage that volume of data without well-crafted designs in systems that reduce the data burden and assist in clarifying that complexity.

Huge savings are netted from getting the correct and specific values in the systems, whether by product or customer. Peanut buttering, as it is often called, (i.e. just spreading allocations, or using averages, average lead times, average safety stock re-order points) instead of becoming very specific per product,

location, or customer, creates significant additional expense. There can be too much safety stock of too many products, in too many locations, and not enough of one specific product. We wind up "chasing parts," expediting, being late, and incurring penalties and charge-backs that we could have avoided.

Managing the data, though often considered tedious, is at the very core of what drives cost.

Patterns - Turning Data into Information

Added to all this data complexity is the *relativism* of it all: What makes something a good price? Or *on time*? What constitutes a lower risk strategy? What is optimal? When are things moving in the right direction? When are they too slow? When are things "the same"?

Some patterns, such as seasonality or event trends (we always sell more snack food on Super Bowl weekend), become obvious with experience. But two things work to make this more challenging—the sheer volume of the products and all their variables, and the ability to glean from this volume of data the relevant patterns to take the best action. For example, if each time customers buy chips they also buy cola, the system will see this pattern and "learn from it." Over time, as the forecast for chips builds, the cola forecast may also build. Or the warehouse will start placing cola and chips in the same location, and so on.

Wading through these oceans of data without good systems, patterns may not emerge, understanding is not garnered and opportunities are lost. And the more complexity, the more data, and the more attributes you have to deal with *simultaneously,* the harder that becomes.

Can Systems Bring Clarity in a Complex World?

Part of the challenge of bringing clarity in complex environments is creating systems and models that people can *understand.* The human brain is excellent at deriving knowledge and understanding from relevant visual representations. So what is the brain doing and how can systems facilitate, rather than encumber that process?

Brain vs. Brawn

*How **do** people think and how can systems facilitate that process?*

Imprinting – Identification and impressing; to see things easily through *visual display*; filtering data to expose highly relevant and prioritized issues and problems. This is also affected by role-based views: what a manager sees is often quite different than what the planner sees.

Reasoning – Enabling human discovery, interpretation and understanding. This is working with data and logic to derive

indicators, so we can diagnose problems. Key indicators in systems are more than just the goal achieved (98% on time and such). *But rather, they facilitate the discovery of trends and serve as early warning indicators*.

For example: We usually consume 10 units per week. We usually have 15 units of safety stock and can replenish weekly. If consumption speeds up, and we are consuming 6 units a day (at that rate, 30 units in five days), we run out before we replenish. The proper indicator can warn us as it sees a change in the pattern *before we run out.*

Act – Ability to act, perform, achieve. What actions/decisions work best? Workflows engage stakeholders; scenario planning and simulations let people "act out" the plan. With a good system, the process of analyzing and making a decision can automatically trigger/execute the action. Once implemented, we can monitor to see if our actions are successful. We can recall them in the system again and again, refining them in action planning exercises and then trusting them to execute, so we can move on to other exceptions.

The computer science field is filled with research and technology methods and tools, learning software, process/ workflow managers, and graphics software. These are used to develop end-user-friendly functions to create an understandable, transparent (clear) environment.

Technology Enablers

There is a partnership, if you will, between people and their systems. Systems have become infused with the expertise and experience of people. We buy packages with pre-built this and that, pre-configured processes, a library of algorithms, a library of alerts and so forth. So let's take a minute to talk about how systems make sense of, and clarify complexity.

The GUI: Visualization – Graphical User Interface is both art and science. You know a great GUI design when you see it! Today's systems not only have an "out-of-the-box" look and feel, but tools that allow users to modify (personalize) their own system to succeed at imprinting and reasoning. (See Appendix for more on design.)

Pattern Recognition, AI and Neural Networks – are used to model how data are related, creating complex structures. Neural networks are used in supply chain systems to discern patterns (pattern recognition and data classification). These systems learn, over time, to make better decisions.

For example: If each female customer whose income is over one hundred thousand dollars purchases a laptop, and at another time also purchases a smart phone, this might be missed. But pattern recognition software will find it. We can create segmentation for this group of customers, the "tech woman." We can then build marketing and up-sells to *tech woman* on a regular basis. Or a manufacturer can build and customize packaging and accessories to support a specific type of channel to support an industry, i.e., industrial firms that need ruggedized products vs. consumer usage.

Work flow or Business Process Management automation – Who needs to know? Whose Key Performance Indicator (KPI) has been impacted? What change in the market has occurred and who is impacted? How can you provide assurance that data, reports and event alerts are arriving at the right

desktops with the right information to take action? There is more to system design than these examples, but suffice to say, great design brings clarity and understanding to otherwise complex environments.

Let's pull this all together now. Nowhere do all the complexities come to together more than in the effort to create and manage advanced business processes.

Making Complex Decisions - Advanced Business Processes

At their core, advanced business processes represent the requirement *of precision in communication across organizations* whether collaborating internally or externally, informally, in meetings or doing interdependent decision making. You gain clarity, if and only if, you have the right data at the right time, and people can *see* what is happening in the business and know *why* you are making a decision; you have the responsive and disciplined business process that coordinates the right set of players, empowered with accountability to make those decisions; and *this technology enabled process* (TEP) is able to propagate those decisions throughout the organization.

The TEP's in your organization, whether you are highly federated and virtual or a firm that manufactures your own goods, can be Sales and Operations Planning, Product Life Cycle Management/New Product Introduction, Pricing, Managing Promotions and Trade Programs, Recalls, Total Cost Sourcing, and so on.

Supply Chain decision making is integrative in nature (Figure 1) requiring data from multiple sources, often in real-time. In a typical organization, hundreds of decisions are made every day, each within their own context, each being locally optimized according to the "rules of each silo." The result is suboptimal global decisions. Integrative technology enables the *global process* to bring together the *global impacts* to enable better decisions for all. To achieve these higher order decisions requires interoperability between systems as well as dynamic *human* communication forums.

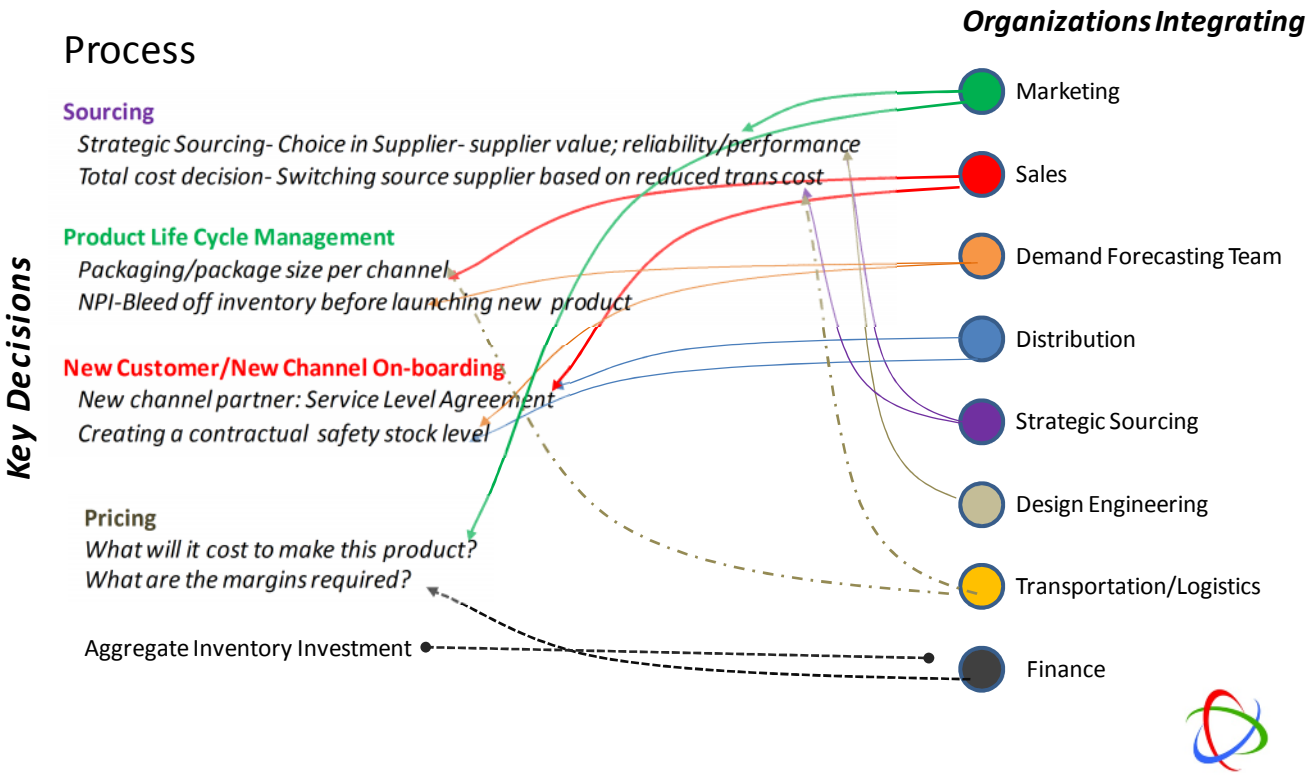

Figure 1: A world of Interdependent Decisions

Supporting and institutionalizing the advanced business processes where critical corporate decisions will invariably be made takes mastery of the functional team's own modules such as transportation, demand or manufacturing schedules, and also sensitizing and collaboration skills to manage the total process. Senior management also needs to be a part of the design process, since the outcomes will benefit the whole corporation or supply chain, rather than be suboptimal.

It sounds complicated, but let's look at a typical example.

New Product Introduction

New Product Introductions (NPI) are a complex set of processes not just across the company; they also engage design partners, suppliers, channel partners, customers, and carriers, to name a few. Within the enterprise, interactions and information flow between teams and departments to support a plethora of decisions: minute as well as the "big ones." (Figure 2) What will we launch? When will we launch it? How much will we sell it for? How much will we earn? The discussions and work activities can last several years or just a few months, depending on the product and its market.

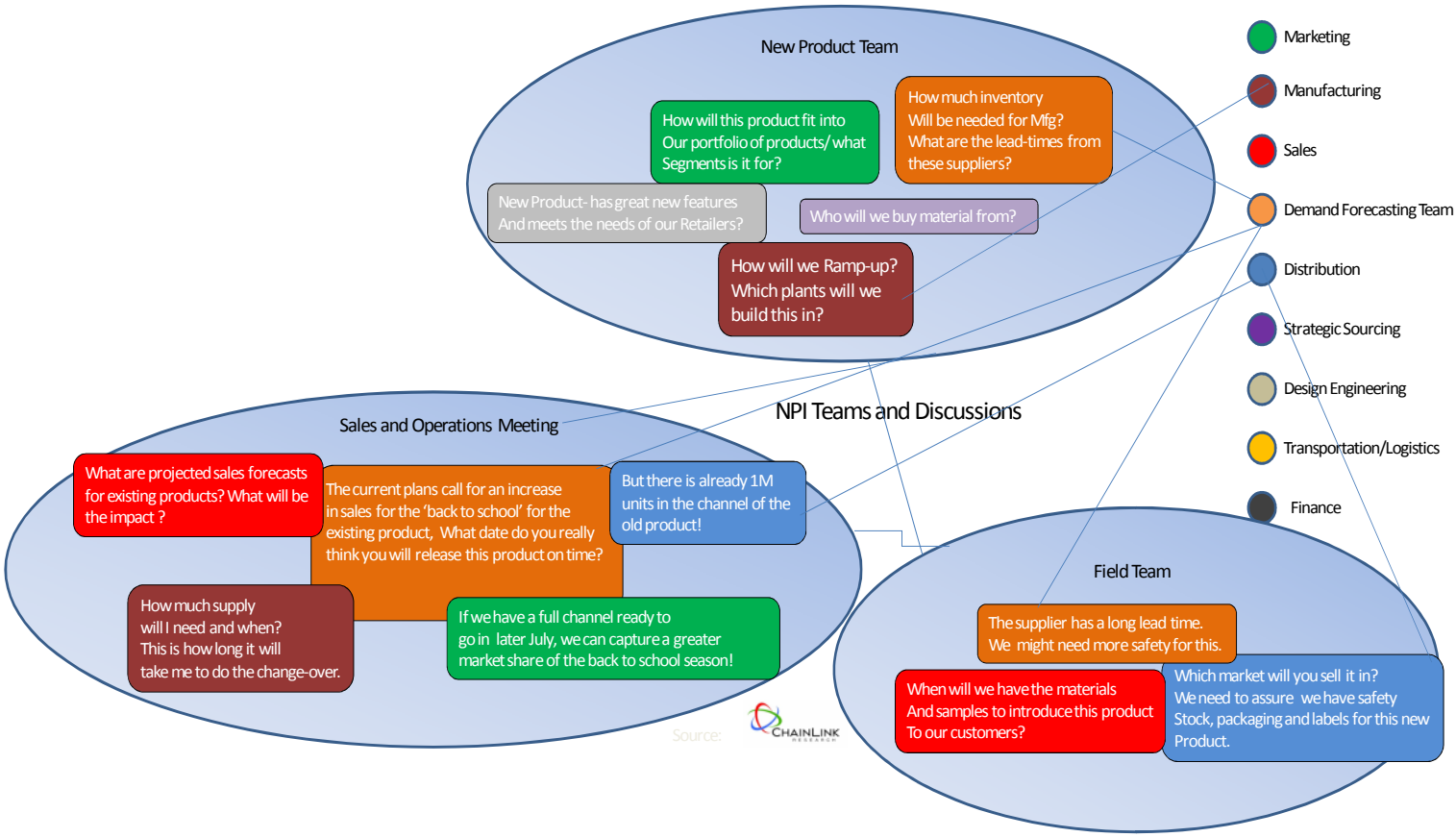

Figure 2: New Product Introduction Discussion

Product Marketing has just announced a new product due out in 6 months!

The decision to go forward has been made by senior management, but still lots of questions remain. NPI challenges tend to be poorly managed and leave cost residue, due to unsynchronized launch plans and excess inventory in manufacturing or in the channel.

For our purposes, we just want to focus on one set of activities in a "moment in time" within this web of interactions of the NPI. Here is a very typical discussion for a Sales and Operations Planning (S&OP) meeting.

What do these members bring to the meeting? (Figure 3) Of late, the challenges of S&OP have been a hot topic. We are focusing on just one element, although this type of discussion happens over a series of planning intervals in each organization. Organizations frequently have 4x4s or 5x5s (meeting with Sales, Marketing, Product/Engineering, Sourcing, Supply Chain, and so on). Each organization has their set of stove pipe information components set in their own data paradigm.

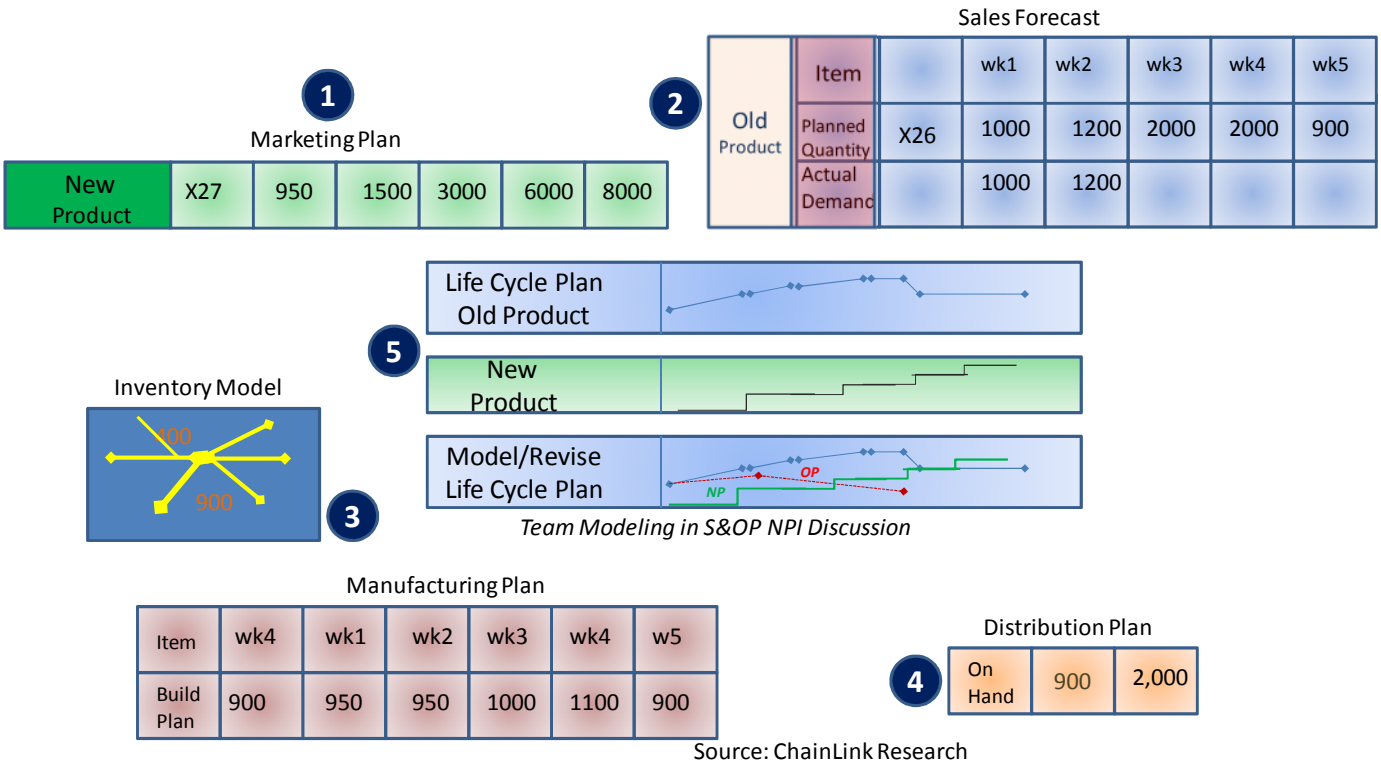

Figure 3: New Product Introduction Discussion

Let's follow the scenario and discussion at this meeting (figure 3).

The agenda for this month's S&OP meeting kicks off with a list of issues. At the top of the list are the new product introductions planned for the next 6 to 9 months. There are ten product announcements: What do we do?

1. Marketing presents their product forecast to the group. As usual, it is wildly optimistic. But it has the approval of management.
    - Marketing discusses the fact that this is a replacement for our old product the x26.
2. The Demand Planning group pulls up the forecast and the Life Cycle Plan for the x26.
3. Manufacturing also is able to look at their plans. We *expected* to build the old product for 1 year.
    - Which means we might have excess inventory, planned orders (and other implications around plant and equipment, but we won't go there in this article)
4. The Distribution side also has on-hand and expected safety stock, packing and labels for the OP line.

As soon as customers hear about the new product, demand for the old one will erode, which may increase excess. But maybe not. We don't know. Flummoxed? We need clarity!

As we are discussing in this article, we can bring clarity to this discussion by focusing the organization with a systems approach. A "real-time scenario management" for making decisions in these types of meetings makes sense, rather than your "spread sheet vs. mine."[1] As well, data shared across the

[1] Based on this author's experience for many years, until modern planning systems were implemented.

enterprise can alert teams to impending changes and prepare them for constructive and *decisive* meetings, rather than wasteful conjectures without data.

A stellar approach is to alert the cross functional teams and consult with them about the impacts of these changes as early as possible. Then they can avoid costly change-overruns and have a well coordinated, and therefore successful launch. Before the meeting, a *common base of plan data* is used rather than mailing reports and spreadsheets. All users, of course, have their own roles and responsibilities to assure that all aspects within their function are addressed.

Realistically speaking, we know that product sourcing/design engineering will have a unique system, but we can integrate the key data, product names, dates, suppliers and so on, into a Life Cycle Planning model.

Users see, ahead of time, *their views* in *their terms* (marketing forecast in units, inventory in the channel, demand scenarios, and so on). This is the critical element of bringing clarity: The data is shared, but with "personalized" graphical views that allow users to see the impact on their environment. This allows them to be prepared to articulate their concerns and provide potential solutions to the challenges.

Now let's return to our S&OP meeting and see how this brings clarity to process.

5. Based on the concerns of the group, we can start to model with a graphical approach (easy for everyone is the room to get the big picture). We can begin to discuss the issues behind the impending launch. Each member can also look at their own views, and answer questions such as:
    - When will inventory run out? We need to look through the distribution channel as well as on-order and existing on-hand inventory.
    - What are the missing components to fulfill this limited demand?
    - For the excess, can excess material be used in the next rev? Where else can the excess be used in a timely way? We need to run our inventory optimization model, reviewing our inventory strategy for the old product, see where we can leverage inventory for the new, or use inventory excess in other products we will continue to sell.
    - If we have lots of excess, should we run a promotion? If we lower the price, can we move all the excess now and avoid cannibalization later?
    - And so on

Ultimately, we can model a plan and get buy-in.

This is not a dream scenario, but "ripped from the headlines," as a famous TV series declares. It is not beyond the reach of even modest size businesses to manage this way. In fact, it's easier, requiring less re-work, fewer meetings, and course, has more clarity. We understand where the gaps are in understanding, how we will resolve issues, and how and why decisions were made.

Conclusions - Get Clear

No doubt, process discipline and meeting management are critical to improving the business process. But what will confront us when we arrive at a meeting? A mass of spread sheets from disparate systems or functional views that can be aligned by insightful information based on a single version of the truth?

Though the world of business is loaded with spread sheets, which are good at calculated and graphed data, they are not at all good, and, in fact, *don't* provide automated data collection and cleansing, analysis, imprinting, work flow, alerting, reasoning or predicting.

The ability to explore and create new insights, to see the whole picture and yet have precision about specific events is what great systems are about today. Complexity can be made clear with great software, timely access to information, and methods that enable collaborative efforts to move from concept to technology-enabled processes.

We can't live comfortably with complexity. It creates stress. It creates poor resolutions of issues, rehashing the same arguments with inconclusive views of reality. Clarity, not complexity, is the way forward if you want to achieve market leadership, be one of the "best companies" or make the "Best Places to Work" list.

Appendix:

For a good article on Neural Networks see Neural Networks by Christos Stergiou and Dimitrios Siganos.

The maestro of graphical design, Edward Tufte: http://www.edwardtufte.com/tufte/.

For interesting insights on Graphical User Interface you can go to Patternry: http://www.patternry.com/.

Workflow management at Wikipedia: http://en.wikipedia.org/wiki/Workflow.

Recent talk by Jeff Killion of Sigma-Aldrich: Manage Complexity in Your Supply Chain webinar.

Demand Management writings: www.clresearch.com/demand.html.

For the ultimate graphical and visual design principles, many people read, take courses from, and generally follow Tufte. To see the famous example, Minard's famous Napoleon's 1812 failed Russian campaign, go to Wikipedia.