



Ultimate Enterprise Value Creation Using Demand-Based Management

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The Next Opportunity is Demand Based Management

The 70's has often been viewed as the decade of quality improvement, during which companies began to invest heavily in quality improvements, and Total Quality Management became a buzzword. In the 80's, with quality a given, the competitive landscape shifted to lean manufacturing, focusing on concepts such as just-in-time, flexible manufacturing, and zero inventory, in order to achieve manufacturing excellence. In the 90's, market globalization, shortening product life cycles, and the disintegration of many industries created the race to improve the supply chain.

In the last decade, industry after industry has embarked on aggressive initiatives to improve the operational efficiencies of their supply chains. Industry-wide efforts began with Efficient Consumer Response for the grocery industry and spread to other sectors such as food service, pharmaceutical, semiconductor, computer and electronics, telecommunications, and automobile. Companies investing in supply chain efforts have found significant improvements in inventory, customer service, response times, and operational costs. To support this, we have seen tremendous growth of supply chain management (SCM) technology solutions.

What will be the next competitive battleground in the 21st century? It will be managing to demand for the total value maximization of the enterprise and the supply chains – Demand-Based Management. Demand-Based Management is critical to an enterprise in managing its supply chain, product development, technology strategy, service support, and organization design. Applying Demand-Based Management to integrate supply and demand management happens to be a big opportunity. Managing to demand involves carefully selecting marketing instruments and working closely with customers so that the overall incoming demand for the enterprise and the supply chain will give rise to

maximum values for all parties concerned. Ideally, all these instruments will eventually lead to higher consumer satisfaction. While supply chain management deals with the buy-side of the enterprise, demand based management addresses the sell-side of the enterprise. Tackling one independently of the other leads to suboptimal solutions.

The Pitfalls of Managing a Supply Chain Without Demand Based Management

Supply chain management has traditionally assumed that the demand pattern is exogenous. Hence, the demand for products or services is viewed as the key input to supply chain management. Demand is either a point forecast, or in more sophisticated settings, a forecast with mean and variance, based on statistical or other scientific methods. Many technology solutions exist to improve the accuracy of such forecasts and to use the characteristics of demand to drive the inventory, replenishment, production, and capacity plans of the enterprise.

But in fact, demand is never truly exogenous. Another side of the enterprise, sales and marketing, also use their own instruments to influence demand. These instruments include pricing, promotions (discounts, rebates, and many other types), product mix or assortment, shelf management, order lead-time, and other special deals (terms and conditions). A common pitfall of supply chain management is that either the people who manage the supply chain fail to recognize that demand was actually influenced by the enterprise's sales and marketing group, or, conversely, the sales and marketing group fails to use the appropriate instruments that truly maximize profits or other objectives of the enterprise. Several enterprises have paid dearly for not addressing this disconnect.

In the mid-90's, Volvo was faced with exactly such a problem when the company found itself with an excessive inventory of green cars in the middle of the year. Eager to get rid of this inventory, the sales and marketing group started aggressively offering special deals, discounts, and rebates on green cars to the distributors. The good news was that the scheme worked, and green cars started to sell. The bad news was that the supply chain planning group, not recognizing that such deals were in place, erroneously thought that customers finally liked green cars. As sales of green cars increased rapidly, they decided to produce even more green cars to meet the seemingly increased demand. The end result was that Volvo was left with a huge inventory of green cars at the end of the year.

A few years ago, when Hewlett-Packard (HP) first introduced its home personal computer, the Pavilion, it also learned a hard lesson from supply chain management that did not capture the impact of demand management. When demand for the Pavilion started to fall due to aggressive price cuts by Compaq and Packard Bell, the HP supply chain planning group decided to curb production of the product, only to discover later that their sales and marketing group had decided to match the competition's price cuts.

The result was a painful Christmas season when HP faced crippling stock-outs of the Pavilion.

On the other hand, setting marketing instruments without regard to the true supply chain cost of the product can also be costly. For a long time, Barilla, a leading pasta manufacturer in Italy, offered special price discounts to customers who ordered full truckload quantities¹. Such marketing deals, however, created customer order patterns that were highly spiky and erratic. The supply chain costs (manufacturing, inventory, and handling) were so high that they outstripped the benefits from full truckload transportation.

Campbell Soup's chicken noodle soup experience is another such example². Campbell promoted the product heavily around the winter season, when demand usually peaked. The result was that an even greater spike of demand occurred in the winter season. In order to meet this spiky demand, Campbell had to prepare the chicken in mass quantities in the spring, using excessive storage for the chicken and other ingredients, and deploy full production capacities during the winter season. In fact, production facilities were used at high gear in overtime during the winter. In order to make room for such production capacities in the winter, Campbell had to manufacture other products in advance, leading to high inventory and more storage needs. The overall result was that the increase in revenue due to the demand stimulated through promotion was overwhelmed by the huge costs incurred to produce the product. The lack of analysis of the true production cost in pricing and promotion decisions led to what Fortune Magazine termed "the Dumbest Marketing Ploy Ever."³

Optimizing the marketing instruments for Demand-Based Management can offer an enterprise great opportunities for value creation. These values can outweigh those obtained through supply chain improvements. Extending the concept from an enterprise to a supply chain, we can see that tremendous values can also be unlocked for the enterprises in a supply chain. But this optimization, a process involving both art and science, must be done right. In particular, the supply chain costs of the product must be adequately captured. If done right, however, the value created can be enormous. I have already seen some companies using new software tools to manage their businesses based on demand, with results ranging between 50% and 100% in net profit increases, which in turn can easily be translated into enormous increases in shareholder and market values. The increased capital released by the optimization can be used by the enterprise to expand their market reach, leading to even higher profits.

¹ Hammond, J.H., "Barilla SpA (A-D)," *Harvard Business School Case* 6-694-046, 1994.

² Clark, T., "Campbell Soup Company: A Leader in Continuous Replenishment Innovations," *Harvard Business School Case* 9-195-124, 1994.

³ Sellers, P., "The Dumbest Marketing Ploy," *Fortune*, Vol. 126, 5 October 1992, 88-93.

Pitfalls of Demand and Supply Management

SCM without Demand Management Input

		<i>No</i>	<i>Yes</i>
<i>Demand Management Integrated with SCM</i>	<i>Yes</i>	Mismatch of supply & demand, wrong demand signals, poor product/capacity plan	Optimal Results
	<i>No</i>	Total Chaos	Costly promotion, inefficient sales deals, overheated supply chain, lost margins

Demand-Based Management Defined

There are two aspects to Demand-Based Management. First, we need to manage the many instruments used in influencing demand. These include pricing, promotions (discounts, rebates, and many others), assortment, shelf management, and deal structure (terms and conditions, price protection, return policies, etc.) In order to make the right decisions regarding these instruments, we must:

1. Understand the impact of changing the levels of these instruments on the demand for the product under consideration, as well as all related products. Note that the effects of these instruments can be interactive.
2. Recognize the management objectives and constraints faced by the enterprise.
3. Incorporate the true supply chain costs corresponding to the demand resulted from the use of these instruments.
4. Link Demand-Based Management decisions with supply chain planning and execution decisions, so that demand can be anticipated and met with the right amount of inventory. Otherwise, either excessive leftover inventory or stock-outs will result.
5. Carefully measure and monitor actual performance.

The second aspect of Demand-Based Management deals with the coordination of the marketing instruments in the supply chain. For example, pricing or promotion efforts at a manufacturer could be wasted if the pricing or promotion efforts at the retailer are not

coordinated. The marketing instruments used at different parts of the supply chain should be coordinated so that the optimal desired results can be obtained.

The Ten Keys to Demand Based Management (DBM) in Retail

Since most companies have thousands to hundreds of thousands of SKUs (stock-keeping-units), it is impossible for the human mind to do the analysis to come up with the optimal marketing instruments. Besides the number of SKUs, Demand-Based Management is also complicated by the fact that many companies have multiple distribution channels – retailers have multiple stores, manufacturers and distributors have multiple distribution outlets, and many companies now also have the added complexity of having to deal with both on-line and off-line customers. Prices, promotion plans, and deals offered at the different outlets could also be different. In short, scientific, computer-based tools are critical.

Advances in information technologies have made massive amounts of data available for such analyses, and some leading solution providers have come up with new tools based on the newest statistical and optimization techniques. Early implementations of such tools have been extremely promising, with fantastic return on investment and net profit improvements observed in a fairly short time frame. But not all these new tools are equally powerful. My research in this area has convinced me that there are some very fundamental requirements for providing comprehensive, easily implementable, scientifically sound, and powerful solutions for Demand-Based Management (DBM) in the retail sector. I termed these the “Ten Keys to Demand Based-Management in Retail.”

The Ten Keys to DBM can be classified into three categories. The first relates to the basis for DBM value creation. The second group relates to the modeling constructs of DBM: the crucial unit of analysis used, and the interactions among four dimensions of modeling – time, physical space (products and sites), marketing instruments, and activity-based costing. The third group relates to the properties of the system as it is implemented and used.

1. The consumer must benefit.

The consumer’s welfare is enhanced through scientific DBM. This is achieved through the system’s ability to make it easier (through proper pricing, promotion, shelf display, merchandising, or other instruments) for consumers to possess products or services that they value more. Specifically, even the prices ultimately recommended by the system should reflect benefits to the consumer, both in terms of actual absolute value and perception. Again, this is achieved through possibly lowering prices on products or services that are of greater value to the consumer (e.g., in which the consumer’s price elasticity of demand is high).

2. The system must deliver strategies that maximize objectives, subject to business constraints.

In using DBM, a clear management objective must be defined. At the same time, DBM should allow for a robust set of management constraints or business rules that are deemed important to management for strategic or operational reasons. For example, there might be an “acceptable range” of prices in which the optimization should satisfy. But once the constraints or business rules have been set, then DBM should find the optimal marketing instruments that truly optimize the objective set by management, instead of simply finding feasible solutions.

3. Results must be immediate, sustainable, and measured by industry-accepted metrics such as net profit and revenue.

The results of applying DBM are immediate, in a time frame that can be measured in weeks, but continue to last in the long run. Moreover, the ultimate results should be measurable in simple terms, such as net profit, unit volume, and revenue units based on standard accounting methods, instead of complicated metrics or soft benefits.

4. Demand models must be created at the level where consumer decisions are made – for each item in each store – so that merchandising strategies match unique local demand.

Individual SKUs and sites all have distinct characteristics and behaviors, and respond to market instruments in very different ways. Hence, DBM should be based on the modeling of the demand impacts at the individual SKU and individual site level. For a retailer, the site is an individual store; for a distributor, the site is a distribution center; and for a manufacturer, the site can either be an individual factory or a distribution center. Such a disaggregate level of demand modeling is necessary to capture the distinct characteristics and behaviors of individual SKUs and markets.

For example, in the chilled juice category in a grocery store, "line pricing" is often used to set price for multiple types of orange juice within a single brand (line pricing is the use of the same price for multiple similar items of the same size). A good example is Tropicana Pure Premium 64oz. orange juice, which is often sold at the same price for the "with calcium" and the "with pulp" SKUs. Depending on the store location, however, it can be a very different customer, with different needs and preferences, buying these different forms of orange juice, meaning that big improvements in profitability available to the retailer who uses DBM to model demand separately for each item in each store. This allows the retailer to bring into alignment the price they charge for an item in a store, and the preferences of the consumer in that specific store who buys that item.

5. To accurately forecast business outcomes in the retail environment, interaction effects between items must be modeled explicitly.

When any marketing instrument is applied to a product, there will be a ripple effect on demand for related products (either substitutes or complements). In some cases, stimulations of demand for one item will result in an increase of demand for a complementary product (such as hot dogs and buns); while in other cases, the effect is opposite for competing products. Hence, it is important that cross-elasticities of products or services be measured and used in DBM. Similarly, the interactive effects at multiple sites, such as competing stores in a market region, should also be captured.

6. In order to enable precise demand forecasts, capturing the peaks and troughs associated with marketing events, merchandising activities should be modeled explicitly across time.

Although in some cases, marketing instruments can result in long-term changes in consumer demand for a product, these stimulations of demand often create a “batching” or “pantry-loading” effect (i.e., customers may purchase a larger than normal batch to take advantage of the marketing instruments offered to them). But such a batching effect could result in customers not having to buy at the same level in the immediate future, until their stocks have run out. Similarly, some marketing instruments may take time before the full effects are realized, creating a time lag before demand changes can be observed. Hence, DBM should capture such temporal effects. In fact, this highlights the importance of modeling demands over a longer time horizon instead of just the immediate future.

7. The combined effects of all marketing decisions (price, promotion, space, and assortment) must be modeled simultaneously, to capture important cross-effects driving profit and volume.

Marketing instruments like merchandising efforts (base and markdown price, all types of promotion including quantity discounts, “magic” prices, competitor prices, rebates and loyalty cards; assortment, and space); and trade deals (price protection policies, return policies, payment terms, etc.) influence demand jointly, and so their effects should be modeled jointly. Moreover, it is not sufficient to model the effects of an enterprise’s marketing instruments in isolation with its competitors. For example, it is the relative price of the product (relative to the prices of competing brands, or relative to the price of the product at competing outlets such as retail stores) that ultimately determines demand for the product. Similarly, for some of these marketing instruments and merchandising efforts, we need to consider their levels relative to competing brands or outlets.

8. To truly link supply to demand, all supply chain costs must be captured using Activity-Based Costing.

As demand volumes for the products or services change, their supply chain costs of delivery also change. Supply chain costs dramatically impact item profitability, and therefore DBM should account for volume-driven supply chain costs. As this type of cost modeling is best done at the activity level, Activity-Based Costing (ABC) models are necessary. Activities related to the complete supply chain processes, such as

inventory, logistics, direct and indirect labor, opportunity cost of capital, and other support costs should be incorporated for all products and services.

For example, a regional grocery chain had been introducing larger and larger sizes in bleach and laundry detergent to compete with the mass merchants and category killers who had traditionally carried the larger sizes. When analyzed on a gross margin basis, the grocery chain's move to larger sizes was positive, and generally led to some pantry loading (moving larger inventories from the store to the household). However, when ABC was used, it became clear that the net profit in the category was severely hurt by this shift, since the larger sizes had many fewer items in each of the manufacturer's cases, and were therefore much more expensive to pull through the supply chain from the point of case picking in the distribution center to the point of shelf stocking in the store. So using ABC to make marketing instrument decisions is very important.

9. To stay accurate over time, the system should be self-learning and evolving, adapting to changes in the environment.

The environment in which businesses are operating is a dynamic and constantly changing one. Hence, it is important that DBM includes a process that would make use of new data and inputs to adapt to new environments. It acts like statistical process control, in which outcomes are observed continuously in order to promptly identify out-of-control conditions. When that happens, the DBM model adjusts and updates itself.

10. The system must integrate with business workflows and deliver actionable answers.

Operationally efficient software tools are ones that are easily used and easily integrated with other business application and systems tools. For any DBM software system to be operationally efficient, its inner workings must be transparent to users who are responsible for setting marketing instruments (e.g., pricing analysts); it must provide intuitive and user-friendly user interfaces (UI); and it must be capable of integration into the enterprise's existing marketing/merchandising and supply chain systems.

Evaluating DBM Software Solutions

Based on the Ten Keys of DBM, we can develop the important technical features and properties from which we can realize the full potential and values of DBM.

The Ten Keys and their associated technical features can be used as criteria for evaluating different DBM software solutions. The above table is an example of using the technical features to evaluate DBM solutions in terms of the Ten Keys.

Category	Keys for DBM	Technical Features of DBM
Valuation Basis	1. The consumer must benefit.	Consumer preferences as expressed in demand elasticities are met.
	2. The system must deliver strategies that maximize objectives, subject to business constraints.	System has large-scale nonlinear optimization capabilities.
	3. Results must be immediate, sustainable, and measured by industry-accepted metrics such as net profit and revenue.	Outputs are measured and expressed in simple accounting terms.
Modeling Constructs	4. Demand models must be created at the level where consumer decisions are made – for each item in each store – so that merchandising strategies match unique local demand.	Demand models are created separately for every item at every store.
	5. To accurately forecast business outcomes in the retail environment, interaction effects between items must be modeled explicitly.	Cross-item, cross-site interactions are measured and modeled.
	6. In order to enable precise demand forecasts, capturing the peaks and troughs associated with marketing events, merchandising activities should be modeled explicitly across time.	Time-lag and batching effects of merchandising are modeled.
	7. The combined effects of all marketing decisions (price, promotion, place, and assortment) must be modeled simultaneously, to capture important cross-effects driving profit and volume.	Interactive relationships of price, promotion, place, and assortment are explicitly incorporated.
	8. To truly link supply to demand, all supply chain costs must be captured using Activity-Based Costing.	Complete supply chain ABC model is explicitly captured.
System Properties	9. To stay accurate over time, the system should be self-learning and evolving, adapting to changes in the environment.	A systematic process to update demand models is in place.
	10. The system must integrate with business workflows and deliver actionable answers.	User-friendly UI integrates easily into the current work environment.

Evaluating DBM Tools

<i>Keys for DBM</i>	<i>Tool 1</i>	<i>Tool 2</i>	<i>Tool 3</i>	• • •	<i>Legend:</i>
<i>Consumer benefits</i>	○	◐	○		<p>● Excellent Coverage</p> <p>◐ Partial Coverage</p> <p>○ No Coverage</p>
<i>Optimization</i>	◐	●	◐		
<i>Results</i>	○	●	◑		
<i>Item-site model</i>	●	◑	◐		
• • •					

Types of Demand Based Management

DBM solutions can be classified in two dimensions. First, DBM can be used to serve products or services. Second, DBM can be used where the availability of the product or service is constrained, or is unconstrained. Constrained availability refers to cases in which the amount of products or services available is given, or fixed, and DBM is used to optimally price or promote the products or services so that the enterprise gets the most values out of them. Unconstrained availability refers to cases in which DBM is used to jointly determine the marketing instruments and the predicted amount of products or services, again to maximize some targeted objective for the enterprise.

DBM solutions for products with constrained availability have been developed to create the optimal markdown prices for fashion apparel products or perishable produce, i.e., products with short shelf lives. They can also be used to create pricing schedules for high technology products (including software products) when the products are entering into the end-of-life phase of their product life cycles. In both cases, these DBM tools assume that the quantities of the products available are given, i.e., they are not decision variables themselves.

DBM solutions have also been used extensively for services with constrained availability. For example, there are now many software tools to help companies determine the pricing schedule for airline seats, rental cars, and hotel rooms. Again, the quantities of services (number of seats in a flight, fleet size, and the number of hotel

rooms) are given, and these DBM tools focus on developing pricing schedules to improve the revenues of the enterprise.

Types of DBM

	<i>Constrained Availabilities</i>	<i>Unconstrained Availabilities</i>
<i>Products</i>	Apparel end of season markdowns End of life product markdowns	Integrative demand planning with complete marketing instruments
<i>Services</i>	Airline seat pricing Rental car pricing Hotel room pricing	Airline flight planning Car fleet planning Logistics business plan

My observation is that a good number of the DBM software tools in the constrained availability cases have focused on pricing as the key marketing instrument instead of on the complete suite of promotion and other instruments; and that the objective has been revenue, instead of profit, maximization. Moreover, these tools treat the products or services in isolation. For example, if you are pricing a batch of computers at the end of the product life cycle, then the DBM software might treat this batch in isolation from the future product generations, and simply determine the pricing schedule of this single batch. In reality, aggressive pricing of a batch of computer products at the end of the product life cycle could cannibalize sales of the incoming new product. Since new products usually command a higher margin, it may not be desirable to aggressively markdown the existing product to get rid of the current inventory. When software tools do not capture the interaction effects of inter-generational products, then suboptimal pricing decisions may result. These, of course, limit the value of these tools.

Unconstrained availability poses a more complex and difficult problem for DBM, since the decisions of marketing instrument setting and product/service volumes are jointly determined, so that the full supply chain costs related to product/service volumes have to be accounted for. The complexity comes in multiple dimensions: scale complexity due to hundreds of thousands of SKUs and hundreds or thousands of site outlets; instrument complexity due to the existence of many different marketing instruments; competition complexity due to the need to capture competitive effects (competitive brands or

competitive sites/outlets); and temporal complexity due to the time lag and batching effects.

DBM software tools for unconstrained product availability must therefore be able to handle the significant challenges presented by the complexities outlined above, and must possess the properties of the Ten Keys mentioned above. Activity-based costing models are crucial.

The Time is Now

Companies who have mastered the art and science of demand management have enjoyed tremendous market value growth and significant competitive advantage.

Seven-Eleven Japan, a legendary convenience store in Japan, has been able to return shareholder values greater than 10 times better than the Nikkei index in Japan. The trick is their extensive use of point of sale data, customer demographics, and market characteristics to drive their merchandising, new product introduction, pricing, shelf display, and replenishment decisions. Their agile logistics system allows them to deliver three times a day to support their decisions. The result is that Seven-Eleven Japan is head and shoulders above its competitors in terms of sales per square foot, profitability, and market share. Indeed, it is the third largest retailer in the world in terms of market capitalization.

Similarly, Zara, an apparel giant in Spain, has been able to achieve a sales growth of 20% in consecutive years since 1990. Its profit margin of 10% is the highest among its competitors. Again, the company makes extensive use of sales and demographics data to create new products on a rolling basis, price their products aggressively, and quickly make products obsolete in response to market signals. Their Demand-Based Management sophistication enables them to introduce new products every week, amounting to 12,000 new products introduced each year. The company also makes use of a very efficient and flexible design and manufacturing supply chain so that the design to sales cycle can be as short as 20-30 days.

Both Seven-Eleven Japan and Zara show that the value of Demand-Based Management is huge. But both companies have employed a combination of extensive data collection and monitoring, coupled with a labor-intensive process to analyze the data to arrive at decisions on their marketing instruments. The exciting news is that advances in DBM have occurred recently, so that the success of companies like Seven-Eleven Japan and Zara can be reproduced with software systems that are in many ways even more powerful and innovative than the ones used by Seven-Eleven Japan and Zara.

The potential value of Demand-Based Management has no limits. The time to act is NOW.