

Real-Time Profit Optimization: Coordinating Demand and Supply Chain Management

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Advances in information technology have generated remarkable opportunities for both marketing and supply chain management. In the marketing area, firms are increasingly able to understand individual customer preferences and therefore to dynamically adjust prices. This greatly improves their ability to optimize revenue generation. In the supply chain area, firms can use technology to improve their visibility to costs and lead times – internally and throughout the supply chain. We believe that the next major opportunity for competitive advantage is for firms to link the innovations in marketing with those in supply chain management, allowing them to refine pricing, capacity, production and inventory decisions. This coordination will give marketing managers visibility to true costs and responsiveness as they make pricing and promotion decisions, and it will provide supply chain managers with a better understanding of pricing structures as they decide when to expand capacity and where to strategically locate inventories. The result: not optimized revenues or costs, but optimized profits across the entire supply chain.

At a recent working summit hosted by the Center for Digital Strategies at the Tuck School and Cisco Systems, executives from many industries debated the opportunities and barriers for wide-scale profit optimization.¹ The group concluded that linking the innovations in supply-chain management with the technology-enabled capability to serve customers in a more targeted manner is key to driving profit optimization. Through our

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ongoing research on this topic coupled with the experiences shared by many different companies at the summit, we have concluded that:

- Given globalization and the increased speed at which the economy functions, the costs to the system of sharing bad information or hoarding useful information have gone up dramatically;
- Digital technology has greatly increased the ability to share information in a timely manner - but organizational cultures are not always keeping pace with the changes technology is enabling;
- Real-time, tailored product differentiation is increasingly possible and important, but it requires a more integrated and visible way of thinking about manufacturing, component standardization, and product design collaboration;
- Tailored or dynamic pricing is viable, but unlike in the Amazon.com experiment, it must be accompanied by clear product differentiation or executed through plausible channel segmentation;
- The value of coordinating marketing and supply chain information has been traditionally focused on making the supply chain more responsive to customer demand, but there are just as many gains to be made from understanding the costs borne by the supply chain of pricing, promotion or product configuration decisions.

In this article, we highlight some of these learnings and explore how digital technologies can be used to better share critical information, enabling profit optimization. We first examine the issues from the vantage point of both marketing and supply chain management. Then we show how the driving forces in both areas lead to exciting new opportunities. Finally, we address key questions executives should ask themselves about the potential of information-sharing breakthroughs.

Marketing Innovations

The Internet has enabled firms to experiment with many new pricing strategies for both goods and services sold over the web. Products that were previously sold in the bricks and mortar channels with weekly or monthly changes in prices can now be sold over the Internet with posted prices changing much more dynamically (daily or even hourly). In fact, the technology has also become available to change prices on the shelves of bricks-and-mortar retailers just as frequently. The term “dynamic pricing,” which includes

markdowns and price promotions such as discounts, rebates, and coupons, encompasses the strategy where prices change over time, and across consumers.

Not surprisingly, the airlines have been leaders in dynamic pricing. For example, American Airlines (and its spin-off Sabre), learned that one key to dynamic pricing is the ability to switch whole distribution channels on and off. That way, the average ticket price for a given flight can be changed without changing the price of the tickets within a given channel. Lowering the average price can be accomplished by making more seats available through the lower priced channels, and raising the price can be accomplished by switching off availability through those channels. Customers with a higher willingness-to-pay have powerful incentives to use the higher priced channels, because the tickets sold through those channels are given particular characteristics that those customers need, such as ability to book only a few days ahead, to get instant confirmation of the reservation, to reschedule without advance notice or fees, and so on. The overall mix of tickets being sold can literally be adjusted from minute to minute.

Other companies have introduced creative pricing systems that enable them to reap considerable rewards. For instance, each selling season, retailers face the perplexing problem of when and how much to mark down leftover inventory. New techniques and software for the markdown problem have been successfully applied at a number of progressive retailers. Likewise, many firms run regular promotions that are designed to increase sales to certain customer segments. Recent research and software advances have provided deeper understanding of the effects of promotions on demand – effects that occur before, during, and after the promotion. Other firms have taken advantage of a careful analysis of customer segments. Dell Computer, for instance, often lists different prices for exactly the same computer depending on whether the customer is ordering for home, government or business.

As firms adjust prices over time, they can gain an understanding of customer segments and their reactions to these changes. In fact, there appears to be growing evidence, at least in consumer packaged goods, that the change in demand for a unit price decrease

(relative to some reference price) is different from that of a unit price increase (relative to the same reference price). In addition, there is an increasing body of research and practical experience that helps firms understand frequency of store visits (both on-line and bricks & mortar) and probability of purchase once the customer is in the store.ⁱⁱ

To charge different prices over an extended period, however, it's usually necessary to do more than clearly delineate customer segments: firms often must also provide different products. Many problems with dynamic pricing and personalized pricing can be solved if companies can differentiate their products at a level that corresponds to the breaks between price points. Airlines can charge different ticket prices because they are differentiating their products through different lead times, different degrees of certainty regarding availability, and different rescheduling and ticket return policies. Dell can customize computer prices because it is also customizing its computers. Cemex, a large Mexican Cement company, can even customize cement prices because it customizes its cement – preventing its products from becoming a simple commodity. Using its website, customers can specify the tensile strength, brittleness, elasticity, texture, color, resistance to molds and fungus, delivery location, delivery time, delivery rate, and a host of other qualities vitally important in using ready-mix cement. Each of these specifications is then taken into account when it comes to pricing.

When companies face problems trying to introduce different prices, it is often because the products in question weren't sufficiently differentiated. Amazon discovered the importance of this principle when its one-day experiment with personalized pricing ended amid a storm of Internet protest and an almost instantaneous customer boycott. The chief reason Amazon *wasn't* able to charge different prices to different customers was that the products it was trying to supply at different prices—books and CDs—were the same. Amazon was actually providing *another* service that *was* customized—its customized recommendations—but it was providing that service for free.

Effects of Marketing Innovations on the Supply Chain

Dynamic pricing and product differentiation unfortunately can create supply chain problems. The well-known bullwhip effect is a direct result of, among other things, varying prices. A simple promotion, for instance, can send a shock wave through the supply chain. Revenue may be maximized, but it is not at all clear that profits are also maximized. Likewise, every time a company adds another unique product, it is gaining in its ability to segment the market and to set more favorable prices. But it is simultaneously increasing the complexity of its operations and adding to its unit costs. Whirlpool, like many companies, experienced the long-term result as a “binge and diet cycle” in which the company first fattened its product lists, to serve more market segments more effectively, then later trimmed its product lists, to get unit costs down—then started the cycle all over again.

Supply Chain Innovations

While impressive marketing innovations have been advancing, supply chain management has undergone a similarly impressive transformation. Managers in many industries now realize that actions taken by one member of the chain can influence the profitability of all others in the chain. Competition has moved beyond firm-to-firm rivalry to supply chain against supply chain. In addition, during the 1970’s and 1980’s global competition forced many manufacturing companies to improve the quality of their products and reduce their manufacturing costs. With 20 years of progress, many of these manufacturers found that the biggest challenges they faced, and the next opportunity for improvement, were outside of their immediate control, and that solutions required better coordination with their upstream and downstream partners.

Such inter-firm integration, long the dream of management theorists, finally began gaining momentum in the late 1990s. Some would argue that managers have always been interested in integration, but the lack of information technology made it impossible to implement a more “systems-oriented” approach. With the recent explosion of

inexpensive information technology, it seems predictable that businesses would become more supply chain focused. However, while information technology is clearly an enabler of integration, it alone cannot explain the radical organizational changes in both individual firms and whole industries. A sea change in management theory was needed as wellⁱⁱⁱ.

Two fundamental catalysts have conspired over the past decade to initiate the required change in management theory. First, power has shifted from manufacturers to retailers. Wal-Mart, for instance, has forced many manufacturers to improve their inventory management, and even to manage inventories of their products in Wal-Mart stores and distribution centers. Following Wal-Mart's lead, most major retailers have been asking suppliers to tighten up their inventory management and improve their order fulfillment capabilities. Second, many eBusiness initiatives over the past five years have led managers to rethink their supply chain strategies. With the rise of outsourcing and virtual supply chains, the importance of integration has grown. Likewise the proliferation of software tools that support eProcurement, vendor managed inventory (VMI), collaborative planning, forecasting and replenishment (CPFR), and product content management (PCM) has put more information into the hands of supply chain managers. In fact, the technology for tracking an entire supply chain often outstrips firms' ability to use it. For example, Deere & Company offers technology that makes it possible to monitor the supply chain all the way back to the component raw materials. These raw materials might include the individual trees from which wood products are made, or in the case of agriculture, the seeds from which the crop is grown. It is possible to track which tree went into which piece of furniture, or which grain went into which loaf of bread. Such awesome supply tracking is possible because Deere has installed sophisticated sensors, wireless communication, and geo-positioning devices in the tractors and other equipment that handle the raw materials.

Do these supply chain innovations solve the issues created by the marketing innovations of dynamic pricing and product differentiation? In some cases they do, at least to some extent. For instance, in a dynamic pricing environment, CPFR and VMI can dramatically

dampen the bullwhip effect. And in a product differentiation environment, it is possible to avoid much of the trade-off between lowering unit costs and increasing product differentiation by increasing modularity in product design. If modularity is done well, a relatively limited list of components can be used to produce a vast number of product variations. Dell Computer is a master of such customization. It is also possible to differentiate products at a relatively low cost if the components and processes that differentiate the product are introduced relatively late in the production process. Colgate-Palmolive has applied this idea to products like liquid detergents, adding fragrances, colors, and different labels at the very end of the manufacturing process.

To employ these techniques wisely, it is important connect pricing and product differentiation initiatives with the implications for every step in the supply chain, from raw materials all the way through to customer needs. Otherwise it is all too easy to design a system that delivers options which *seem* low in cost, but aren't worth their expense in the eyes of the customer.

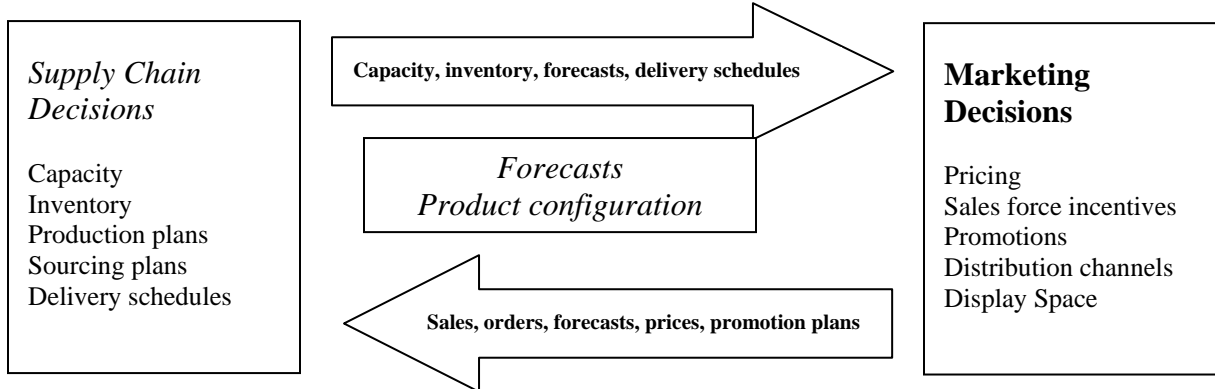
Making the Link

Stepping back to look at the big picture, we see that supply chain managers regularly make decisions about capacity, inventory levels, production plans, sourcing plans and delivery schedules. Marketing managers must decide product configuration, prices, promotion plans and distribution channels, among many other things. Often, managers have good intelligence in each of these areas, and software vendors have captured that intelligence in excellent packages. For instance, Manugistics and i2 offer software tools that can optimize factories, and even supply chains, while ProfitLogic and others can provide support to optimize markdown pricing. Likewise, DemandTec and Manugistics, among others, can help firms optimize pricing of like products or the timing of promotion plans. What is lacking, however, is a strong link among these decisions. Supply chain managers need to know when marketing will be adjusting prices and running promotions; and they need to have input to those decisions based on the load on the supply chain and on availability of products and key components. Marketing managers need to know how

responsive the supply chain can be when they adjust prices. Will a price cut generate so much demand that the supply chain will not be able to deliver on time? Information, in other words, needs to flow both ways (Figure 1).

How does this information flow? Is the Internet and information technology sufficient? The companies at the Tuck-Cisco summit clearly indicated that IT is not enough. Companies as different as Cisco and Colgate-Palmolive have found that more extensive, person-to-person communication, internally and with trading partners, often remains essential. Some supply chain leaders facilitate meetings that span the entire supply chain, from procurement to sales, to reduce waste and prevent missed opportunities. Colgate-Palmolive instituted regular bi-weekly supply chain meetings that typically focus on inventories that have gotten too high or too low, possible sales promotions that need to be started or cancelled, and measures that might be taken to adjust production levels. The outcomes of these meetings are shared with both marketing and production personnel. We submit that there is a huge opportunity for software solutions to facilitate the flow of information and to provide decision support and optimization across both marketing and the supply chain.

The Supply Chain – Marketing Interface



With information flowing in each direction, truly tailored offerings become possible. Tailored offerings involve providing real-time information that enables customers to

make tradeoffs between price, features, and product availability. For example, in a simple way GM does this by telling customers what cars are available in the pipeline, with prices and delivery dates, and then letting the customer choose. Of course, pricing may be handled implicitly for a customer, by understanding elasticities of demand and then changing prices for individuals or market segments based on those elasticities. But there are many other possible features of tailored solutions. Tailoring may also mean using information technology to provide custom bundles of products. For example, Whirlpool has developed a web-based configurator that allows it to create custom appliance bundles for residential builders. Working with Whirlpool, the builder can set up a web site dedicated to a specific housing development. Customers buying a house in that development can then select their kitchen appliances from a group of custom bundled and priced offerings as part of the house buying process.

Profitable tailoring of products and service to individual customers or segments is enabled by freely flowing information from both marketing and supply chain - combining information from ERP, CRM and SCM systems to make decisions (see Figure 2). Information from CRM and pricing systems enables sales people to better understand demand elasticities and individual customer preferences, thus allowing them to make more appropriate sales proposals and increase both sales revenues and customer loyalty. Information from SCM systems allows the firm and its supply chain to optimize the use of resources to support demand. By linking information from these sources, firms can create unique sales opportunities that increase revenue, improve resources utilization, and maximize profits.

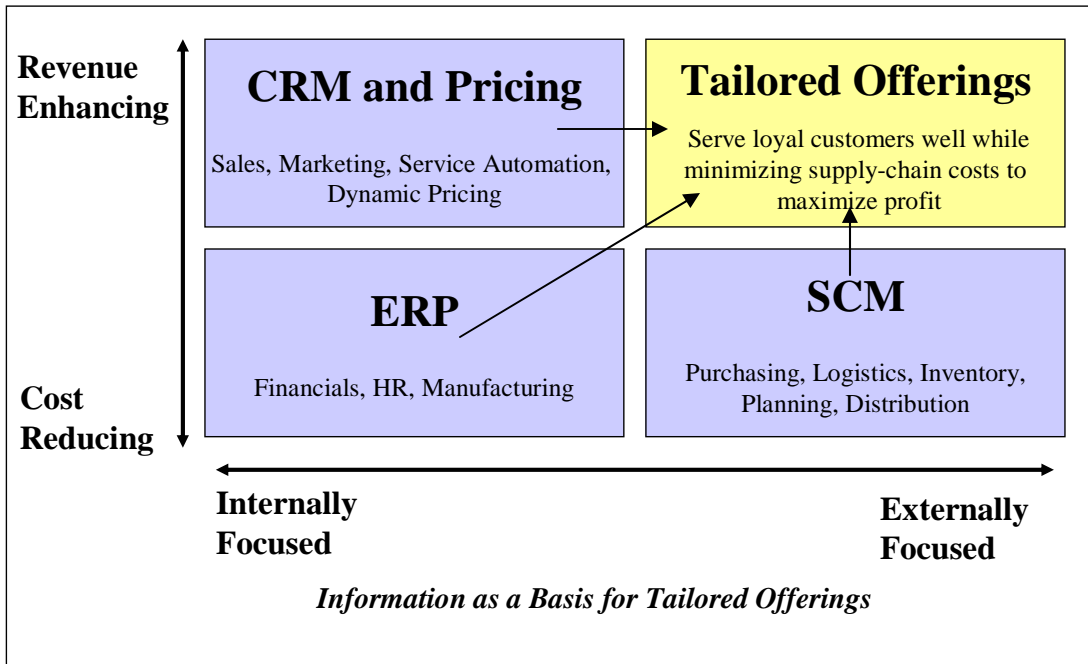


Figure: Providing a tailored customer experience increases customer loyalty and growth. Firms moving toward tailored offerings must integrate their ERP, CRP, and SCM systems^{iv}.

The opportunities are stunning. But to take the first step, firms must overcome hurdles to sharing information. These hurdles are well entrenched and span both system and organizational challenges. To take the first step, managers should ask themselves some important questions:

Seven Questions to Help Determine Where Your Coordination of Supply Chain and Marketing Is State-of-the-Art ¹

- 1) Are you sharing information, not just with your suppliers and customers, but with your suppliers' suppliers, your customers' customers, and other businesses further away on the supply chain?
- 2) Is your information on the changing availability of supplies and the changing quantities of demand arriving as fast as you can adjust for it?
- 3) Do you have an adequate system for making sure all the relevant functions within your business, especially sales & marketing, actually take account of the supply chain information your company is receiving?
- 4) Have you figured out how to receive appropriate value for the supply chain information you are able to collect and provide to your trading partners?
- 5) Are you taking account of the effects on operations and the supply chain when making pricing and product promotion decisions?
- 6) Are you moving simultaneously toward more differentiated products and more differentiated prices?
- 7) Are you controlling the costs of more differentiated products by increasing the modularity of their designs and differentiating them as late as possible in the production process?

Resolving these key questions will open the door to new competitive advantage powered by profit optimization.

References:

ⁱ These summary points along with more details on the summit conclusions can be found in Borg, S., “Real-Time Profit Optimization: Coordinating Demand and Supply Chain Management,” Center for Digital Strategies Report, Tuck School of Business at Dartmouth College, www.tuck.dartmouth.edu/digitalstrategies.

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