PRICING AND REVENUE OPTIMIZATION: A MANUFACTURING PERSPECTIVE
Pricing and revenue optimization is the process of intelligently using a combination of market, customer, product, promotion, and supply-and-demand data to improve business margins by either increasing unit prices or increasing gross revenues.

This pricing and revenue optimization seeks intelligent trade-offs among various competing objectives consistent with an organization’s business strategy. The area of pricing and revenue optimization is fast being recognized as having the capability to leverage optimization technology to help businesses grow margins significantly. Studies by some of the world’s best management-consulting companies have shown that intelligent pricing can add a 15% to 50% incremental margin to the business bottom line and can significantly enhance revenue.

The majority of point solutions available today work in very localized environments and fail to have a wide industry application. SAP, as a provider of world-class, enterprise-level solutions, recognizes that the process of pricing and revenue optimization needs to be managed as an end-to-end, closed-loop process monitored across three time-phased stages: the strategic-pricing stage, the tactical-pricing stage, and the execution-pricing stage. As a result, SAP continues to develop and improve on a series of integrated applications to provide customers with the best solution for profit management by pricing and revenue optimization.
Optimization as a technology has been around for years. However, some significant changes in the past decade have brought optimization to the forefront as a critical business differentiator. In the early 1990s, computing power had an exponential take-off, and it became possible to run complex algorithm routines far faster than before. This computing power was a critical enabler for quickly solving complex optimization algorithms. At the same time, optimization algorithms moved from the academic corridors into the industrial domain, as companies began to realize that optimization could bring substantial benefits when used effectively. Most important, the adoption of the Internet in the late 1990s as a mainstream business-communications vehicle increased information velocity and volume far beyond the capabilities of the “back of envelope” and spreadsheet techniques commonly in use.

Optimization technology today makes it possible to examine thousands of variables and solve complex mathematical problems in ever-shortening time frames and deliver results in minutes and hours, rather than days and weeks. Optimization as a process enables the determination of the best possible utilization of resources (that is, people, time, processes, vehicles, equipment, raw materials, supplies, and capacity) needed to achieve a desired result. The result sought could be either (1) the minimization of cost, process time, or resources, or (2) the maximization of price, profit, throughput, service levels, or revenues. In some cases, the result could be an optimum balance between the two.

Once embedded in software, optimization technology provides the engine that ensures adherence to business rules (or constraints) and quickly and accurately solves complex problems. These problems can range from optimizing tactical operations to help manage operation costs to dynamically optimizing profits and revenue to determine the best price to charge customers.

The term profit has its origins in the Latin word *profectus*, which means advancement or improvement. There are only two ways companies can achieve *profectus*: (1) Raise the top line by managing prices to increase sales, or (2) lower the expense line by reducing costs.

Raising the top line and increasing profits by managing prices is a challenge. Price, without a doubt, is the single most critical driver for managing profits. Yet pricing continues to be one of the least understood profit levers. This is because of the sheer number of variables that need to be factored into the pricing decision, the lack of a single point price ownership within organizations, the inability to have timely visibility into market dynamics, and the lack of an integrated tool that supports complex disaggregated pricing processes.

Lowering the expense line by reducing costs has been more successful than raising the top line by increasing prices. With a back-end internal endeavor relating closely to supply chain and manufacturing efficiencies, the aim is to optimize a set of variables, most of which are under company control. However, despite its success, some significant challenges remain. Although aggregated costs on a company-wide level are typically easy to determine, costs at a single product or customer level continue to be difficult to extract. Tools that help model processes and related cost structures to simulate profitability and the utilization of activity-based costing management (ABCM) methods can assist by accurately allocating realized costs across the supply chain by process, by product, and by customer. Used appropriately, this process can yield significant returns. On the basis of an analysis done by John Bermudez of AMR Research in 2000, planning and scheduling modules that depend on optimization technology have generated 30% to 300% return on investment within many companies that have used these technologies.
Pricing and revenue optimization is the process of intelligently using a combination of market, customer, product, promotion, and business segmentation data to improve business margins by either increasing unit prices or increasing gross revenues. Pricing and revenue optimization seeks the best trade-off among various competing objectives consistent with an organization’s business strategy.

Objectives of this process include maximizing category revenue, identifying promotions that drive business traffic, identifying loss leaders, and increasing the share of wallet in target customer segments.

The process brings structure to an environment in which prices are generally based on heuristics, straightforward target cost, instinct, or other internal business rules that lead to overpricing, undercharging, and inconsistent procedures for managing pricing.

Confronted with the combined complexities of the shrinking times to market and smaller order volumes, the proliferation of SKUs and product configurations, the accelerated commodification of products, and the increasing distribution channel complexity, companies today are realizing that the pricing lever needs to be better managed in order to drive revenue and profits. These complexities create a delicate and challenging balance between underpricing and overpricing. Underpricing is a direct loss of margin that would have flowed straight to the bottom line; overpricing leads to a loss of market share that affects both current and future margins. The demand curve in Figure 1 that identifies revenue captured and revenue lost indicates that companies need to be able to make optimal pricing decisions across product life cycles to continually drive demand toward the most profitable product mix. Without the ability to manage pricing across a product and market life cycle, companies will continue to incur revenue and margin leakage.
Pricing too low initially can cause stock outs across the supply chain and can create margin erosion by losing customers who are less price sensitive and would have paid a higher price than offered. On the other hand, pricing too high, especially as a product matures, can lead to lower revenue and excess inventory buildup that needs to be later discounted or written off as obsolete inventory. These factors make understanding the value equation and the elasticity of products fundamental to effective pricing strategy. (Elasticity is defined as the volume change given a 1% price change.) However, most companies do not have sufficient information about the real demand elasticity of their products and thereby continue to struggle with identifying and isolating segments with differing price elasticity that could allow them to bring intelligence into pricing practices.

In terms of solutions available, most pricing and revenue management applications today are not attached to the demand curve dynamics. Current pricing approaches vary widely and use a mix of inefficient pricing tools that lack any standardization, such as spreadsheets, price books, custom applications, and disparate information systems. Since demand management covers a broad scope, including key item pricing, category price management, promotional pricing, markdowns and discounts, competitive pricing, and multichannel pricing, integrating the pricing solutions into a unified system that provides rapid access to accurate demand-supply transactional data and links into supply chain management solutions is crucial.

Integration is the key because of the complexity of pricing processes and the strong relationship between supply chain efficiency and pricing. Although some vendors today offer stand-alone pricing and revenue optimization solutions, these solutions by themselves have limited usability unless integrated with enterprise supply chain, demand, and cost management solutions.

**Pricing and Revenue Optimization Drivers**

Contribution margins drive profitability. As a result, increasing the total contribution margin is the driving force behind this new focus on pricing and revenue optimization. Pricing and revenue optimization today is at a stage similar to that of supply chain optimization a decade ago. Supply chain optimization produced a significant leap forward in managing expenses and implementing competitive pricing strategies focused on reduced costs. However, the potential to benefit from pricing arbitrage was not addressed. Pricing arbitrage is the concept of buying something at one price and selling it at another, taking advantage of the imbalance between the two prices. Now pricing and revenue optimization can benefit from this arbitrage opportunity to increase overall contribution margins and leverage the elasticity-contribution margin relationship to identify customer segments along the price-elasticity scale.

As shown in Figure 2, this opportunity is identified by the building of a mathematical model that plots the contribution margin against the break-even elasticity, which is defined as the point where any volume change due to price change has no effect on the margin.

If the actual demand elasticity for the product falls below the break-even elasticity curve, raising the price will drive higher profits, even accounting for the related volume reductions. Conversely, if the actual elasticity falls above the curve, lowering the price will drive greater demand, which in turn will drive higher revenues and higher total margins.
Most of the current applications relating to pricing and revenue optimization are in industries that operate more in a business-to-consumer environment. Two of the key industries that have been using some form of this optimization are the airlines (and other service industries such as hotels and car rentals) and retail.

**A. Airline Industry**

For those familiar with pricing and revenue optimization, the first industry that comes to mind is the airline industry. Airlines have been spectacularly successful in leveraging optimization techniques. It is widely known that large airlines earn an additional $1 billion each year by optimizing fare mix, overbooking, upgrading, and balancing capacities. Peter Belobaba, whose optimization strategies most airlines use, estimated that airlines that leverage optimization have a 10% revenue and corresponding profit advantage compared with those airlines that do not.

Although some vendors have been pitching that the airlines’ optimization solution is closely applicable to other industries, it is essential to note that what the airline industry is actually doing is yield management. This means that all the airlines are doing is allocating inventory on the basis of the forecasted expiration to different fixed points (that is, inventory is allocated on the basis of price). This method yields increased revenues by selling the same product at different prices to different customers, but it does not consider costs, optimize profitability, or determine the optimal price points themselves.

Thus far, using this method in other industries has been mostly unsuccessful, especially in those industries with networked supply chains and environments where mass customization, make to order, make to stock, and configure to order are standard practices.
Figure 3: Pricing Optimization Industry Framework

**B. Retail Industry**

The retail industry has also experienced limited success with pricing and revenue optimization. However, the utility of solutions as stand-alone products has been limited. Most of the retail applications available today have been associated with markdown pricing (that is, discounting products). Two different models have emerged to illustrate the differences in the retail industry approach:

* Extended life-cycle products
  
  For products that have alternatives available in the market and can be compared in terms of common attributes, including price, it has been possible to improve sales and pricing by grouping them with products with similar attributes. To maximize the performance of the product categories, customers have been exposed to product groupings, substitutions, and cross-sell promotions.

* Short life-cycle products
  
  For products that have alternatives that are hard to find, the goal is to first optimize the product’s performance in meeting the retailer’s objectives while the item is in the market. Next, the product is priced along its life cycle to retire the item in the market by the target date while zeroing out the inventory.

Given the complexities involved, the extent to which pricing and revenue optimization has been successfully leveraged has varied significantly among different industries. Figure 3 provides a simple framework, along with some examples, for identifying industries that are amenable to pricing optimization.

The greater the similarity of the product offering and the greater the proximity to the end consumer, the easier it is to build holistic optimization models with pricing optimization as the key objective.

This is not to say that pricing and revenue optimization is not applicable to other industries. Instead, the essential point is that either the need for pricing and revenue optimization in these industries is limited or more pragmatic price execution and price visibility options may be available, especially because determination of some type of elasticity models to optimize item prices within a category can be difficult.
The key challenge with pricing and revenue optimization is how to better understand the dynamics of the complex system relations and find feasible solutions that can be constantly tweaked and, when necessary, fed to the back-end supply chain that manages the demand planning, finite planning, manufacturing, and fulfillment process.

As optimization technologies continue to be incorporated into pricing and revenue management, the integration of enterprise data, supply chain data from multiple trading partners, and revenue management analytics is necessary to align with enterprise demand creation and fulfillment activities. Unless fully integrated with the supply chain management solutions, the pricing and revenue management solutions will have limited usage.

In addition, it is essential to keep in mind the challenges that exist while applying pricing optimization within a business-to-consumer (B2C) environment versus a business-to-business (B2B) environment.

A. Application in a B2C Environment
In a B2C environment, price typically is only one of several marketing control variables affecting demand, depending on the industry in which the company competes. And price is not necessarily the most important factor. In addition to price, market share and volume depend on variables such as product availability, fulfillment and replenishment capabilities, promotion and advertisement effectiveness, store and distribution center location, supplier capability, logistics capability, and sales force effectiveness. The combination of these variables leads to an exponential increase in complexity and quickly overloads the intuitive decision-making process.

One example of the scale of pricing complexity is the pricing in a retail store. Figure 4 shows the many factors that need to be considered while organizations are developing a pricing strategy.
Research shows that individual consumers generally remember a maximum of 180 to 200 item prices – mostly consumables. Part of the purpose in creating price-sensitive classifications is to ensure that items that are priced for image are truly priced to be competitive with the market leader. Depending on the number of merchandise categories, most retailers should not define more than 1% to 2% of total SKUs as price sensitive (some retailers define only 50 to 100 items as price sensitive). These SKUs, in turn, rarely generate more than 10% to 15% of revenue or 3% to 7% of gross margin.

However, most retailers have little understanding of the many dynamic factors that impact such intelligent pricing. Therefore, despite the numerous ongoing initiatives to apply price optimizations in a B2C environment, most of these to date have not been highly successful, and margins continue to leak away. The key challenges for pricing and revenue optimization in a B2C environment are:

* Low visibility and integration
  Lack of integration and visibility of item-level pricing decisions with category, fulfillment, purchasing, or financial planning
* Uncertain understanding of elasticity
  Unscientific attempts to understand demand elasticity at levels of granularity that are far too dynamic and complex to be executed
* Lack of analytics
  No systematic analysis of pricing decisions to reflect cross-elasticity within demand groups of like items or to allow proactive identification of trends, which means pricing decisions are driven with inexact information
* Poor dependency understanding
  Inability to decompose sales forecasts supporting markdown timing and markdown depth into product life cycle, seasonality, and price elasticity to net out the impact of price reductions on sales revenue and margin

While some success has been found in specific areas with sophisticated point solutions that optimize prices, the examples are usually too customized and too localized. Bayesian inference techniques are available to predefine pricing structures and leverage information across locations and product attributes to shrink data outliers to average values and then use cross-elasticity to tweak prices among similar products. This helps in a demand shift to higher net profit items. However, these pricing practices, while mathematically sound, depend on the visibility of store-level activity-based costing at the item level, which most retailers are hard pressed to identify.
B. Application in a B2B Environment

The more tiers in a supply chain, the more complex the optimization requirement is. The airline, car rental, and hotel industries are all examples of industries where the distance between the supplier and end customer is minimal. Also facilitating optimization is the fact that each of these industries has relatively few unique product offerings. However, in manufacturing environments that have a multitiered supplier and customer environment, holistic optimization to determine optimal price points is far more complex. The most practical solution, therefore, has been to have local optimaums determined at the most complex business intersections.

For example, if shop-floor scheduling is the most complex operation, the optimization focus should be on maximizing profitable throughput or on minimizing resources on the shop floor. Attempting to add other variables to optimize in addition to the shop-floor operations would provide possibly feasible but unpractical solutions in most cases. Some of the main pricing challenges in a B2B environment are:

* Long-term sales contract
  The majority of the sales in a B2B environment are based on relatively long-term contracts and permanent relationships with well-defined pricing agreements.

* High switching costs
  Switching suppliers and customers in a B2B environment is far more difficult and expensive than in a B2C environment.

* Fragmented price ownership
  Pricing ownership is split among different functional organizations, which means updating policies and consistent practices are not well managed.

* Difficult price reconciliation
  Large differences between the list price and the invoice price because of elements such as terms, freight, rebates, promotions, and chargebacks make visibility into B2B pricing difficult.

Rather than optimization, the key in a B2B environment is to understand price visibility. The current methodology for pricing in a B2B environment is to start with a list price and then track discounts to arrive at the invoice price. However, ignoring details of discounts that were incorporated into the list price prevents a proper understanding of profitability and margins on deals and also hinders good segmentation analysis. Providing visibility into the individual discounts and expenses between the list price and invoice price can help determine the most profitable orders that need to be promised and can provide the foundation to focus on the management of key price elements impacting transactions sliced by region, by product, by age, by elasticity, and by sales representative.
A VIEW OF THE SAP® SOLUTION

Optimizing pricing and revenue is important but is secondary to the objective of a well-aligned demand management process. The optimization of prices based on the elasticity models need not always be the solution. Constructing the pricing and revenue optimization algorithms has never been the issue. The challenge instead is accurately incorporating different variables into the pricing equation and arriving at an optimal price for the market and customer conditions being modeled.

SAP believes that profit management by pricing and revenue optimization is a process that needs to be first streamlined to obtain visibility across the demand management and supply management operations. The solution to address the pricing process may be part of a single solution suite or may reside in different solution suites that could include supply chain management (SCM), customer relationship management (CRM), product life-cycle management (PLM), or existing enterprise resource planning (ERP) applications. Having an end-to-end integrated process that leverages accurate supply-and-demand information and that links the three principal pricing stages – strategic, tactical, and execution – backed by strong analytics, is the key.

As shown in Figure 5, SAP’s position on pricing optimization is based on understanding these key pricing stages that need to be managed to successfully streamline the pricing process. Based on the classification of the pricing strategies, the solutions that form the building blocks for profit management by pricing and revenue optimization are seen in Figure 6.
A. Strategic-Level Pricing

At the strategic level, pricing and revenue optimization is part of a longer-term picture. Strategic pricing is typically done once or twice a year. Necessary decisions include markets to be pursued, products needed to position against competition, appropriate channels (direct, indirect, or electronic) for products and markets, operations alignment to support strategy, and product life-cycle and portfolio profitability analysis. Strategic pricing decisions must address issues within the enterprise and the marketplace. Such decisions are not based solely on quantitative metrics (such as market size, prices, and sales projections) that lend themselves well to automation. These decisions must also address intangible, qualitative considerations such as client goodwill, competitive positioning, brand value, and market awareness.

Strategic pricing offerings from SAP address the areas previously mentioned. Strategic pricing can reference a balanced scorecard methodology to access decision support details and employs value-driver trees to align strategic goals with business operations. By leveraging business planning and simulation, performance measurement, business consolidation, and stakeholder relationship management capabilities, strategic pricing can address the full life cycle of profit management.

B. Tactical-Level Pricing

At the tactical level, developing basic prices (such as list price) and pricing programs that leverage the decisions made in the strategic-planning phase is the objective. Performed quarterly, tactical-level pricing considers expected supply-and-demand balances and production capacity availability to help facilitate setting list and catalog prices by market/customer segment, and it evaluates special promotions strategy and marketing programs (for example, volume discounts, substitutes and bundles, and special offers). Traditional demand-planning tools forecast demand using raw historical volume (such as sales and shipments), and the tactical level tools then leverage the demand patterns to project future sales on the basis of proposed variations in price.

Other significant objectives of profit management at this level include the ability to determine the demand-supply match and cost of manufacturing products, provide services, and plan profitable campaigns. The adaptive pricing and campaign optimization solutions enable this.
C. Execution-Level Pricing

At the execution level, the objective is to develop short-term and very specific prices and pricing programs organized by product, customer, market, and time. This process is generally performed every one to four weeks. The inputs for this process come from tactical-level pricing. Regular and promotional pricing to meet the margin and revenue goals is done at this level, as is promotion management, which is essential to achieve sales goals and objectives. Multiple scenarios are tested and evaluated to identify the optimal cases that meet or exceed targets (such as volume and revenue) while maximizing profitability.

Capabilities and functionalities supporting promotional planning, profitable to promise, and available to promise are all execution-level programs that can be leveraged to identify the most profitable orders to fulfill and to set quantity discounts that are based on inventory available and planned by simulating various price points and the related impact on volumes and margins.

SAP’s promotion and planning solutions can help define campaigns according to higher sales or brand management objectives. Promotions linking the mySAP® Customer Relationship Management (mySAP CRM) and mySAP Supply Chain Management (mySAP SCM) solutions ensure that sufficient demand is generated to exhaust existing product supplies, thereby creating a process by which profitability can be modeled and ultimately predicted. Promotions optimization supports promotional pricing so that the combined value of real additional supply chain costs and the associated benefits are optimized. This optimization enhances the margin visibility in the promotion planning process, which is otherwise mainly driven only by strategic sales and marketing goals.

Also, SAP’s available-to-promise and capable-to-promise capabilities within mySAP SCM ensure availability of product and enable fast and efficient order promising based on customer and product hierarchies. The demand fulfillment capabilities allow customer orders to be committed on the basis of supply chain constraints and constrained capacity that is allocated to the most profitable customers or the most important customers, which are frequently a mix of the two. Ensuring the availability of components and resources that can be delivered on time, on the basis of future production schedules, is also possible.

The profitable-to-promise solution extracts information about customers and margins and analyzes the cost and potential delivery alternatives from an activity-based costing standpoint before promising an order, thus respecting the margin constraints that may have been imposed.

After following through the three stages of pricing, it is essential to get end-to-end visibility to the performance data across the value chain to close the pricing loop. The foundation of all the applications is the SAP® Manufacturing solution that connects the plant floor to the business warehouse solution. The solution provides the business intelligence analytics capability to examine relevant data to support profitability decisions. Support is also available for manipulating commonly sold vendor databases, including data segmenting to identify specific sales goals and objectives.
The key SAP applications that support profitability management across the strategic, tactical, and execution phases include:

- **SAP Manufacturing**
  The SAP Manufacturing solution enables companies to react at the “speed of their business” by providing business context for manufacturing data and exceptions to close the loop between the factory and the enterprise.

- **Profitable to promise**
  The available-to-promise capabilities are extended by considering the initial cost of components required to manufacture products and the cost for substitution locations of components.

- **Campaign optimization**
  Campaign planning solutions define campaigns according to higher sales or brand management objectives. Costs are taken into account in the form of lost or gained revenue and campaign spending cost. Promotion planning across mySAP CRM and mySAP SCM ensures sufficient supply to drive promotions. Campaign optimization supports promotion pricing so that the combined value of additional supply chain cost and gained benefits is optimized.

- **Adaptive pricing engine**
  The adaptive pricing engine supports a price-based demand-supply matching on a tactical level. Using price-elasticity functions derived from historical customer behavior, product prices are adjusted to keep demand optimally adjusted to given supply. Goods with a varying value during their product life cycle, such as computer chips, food, or fashion, especially need regularly adjusted prices so they are not overpriced (lost sales) or underpriced (lost revenue). This is also applicable during product phaseout or phase-in.

- **Strategic pricing**
  Focusing on determining list prices for products, including discount structures for special customer segments, this application takes into account the buying behavior of customers in different segments, as well as value-based pricing approaches.

These applications are built on a number of analytical building blocks that in turn are built on the SAP Business Information Warehouse (SAP BW) component, which includes the following:

- **Measure builder**
  Builds measure catalogs in a businesslike fashion, including business content (delivered set of business measures for financials, CRM, SCM, and human resources)

- **Balanced scorecard**
  Makes strategies operational through translation into strategic objectives, targets for qualitative and quantitative measures, and resource allocation via strategic action program initiatives.

- **Reporting**
  Reports on the basis of the measure or other key performance indicators defined, which allows for analysis of current business performance and influences decision making in the operational, tactical, and strategic pricing applications.

- **Planning and simulation**
  Enables strategic and operative planning in areas such as financials statement planning, sales planning, and profit planning.

- **Activity-based costing and management**
  Models and simulates clearing models for cost and profitability management, visualizes settlements along the entire value chain, and creates cost transparency for the different processes in the enterprise.

- **Customer segmentation capabilities**
  Defines and analyzes customer segments, which are part of the mySAP CRM analytics solution.

- **Price-elasticity determination**
  Determines price-elasticity curves on the basis of the historical data of changing customer behavior due to changes in price and other parameters, which then can be used for simulating the effects of different pricing strategies on the supply chain and on the bottom-line profitability of the business.