CHAPTER 2

The Value of Business Intelligence

According to the PricewaterhouseCoopers Global Data Management Survey of 2001, "Companies that manage their data as a strategic resource and invest in its quality are already pulling ahead in terms of reputation and profitability."[1] This statement implies a quite subtle yet radical notion: Data should be treated as a strategic resource. According to a traditional view, data is the "fuel" driving the automation of a business operation, implying that a company uses computers to help run its business. The forward-looking view of data internalizes the notion that strategic knowledge is embedded in the collection of a company's data and that extracting actionable knowledge will help a company *improve* its business.

This leads to another intriguing idea—that a company may acquire a competitive edge by viewing itself as an information business instead of taking the traditional industry—or vertical—view. Consider this: Is a supermarket chain a business that sells food, or is it a business that exploits knowledge about customer preferences, geographical biases, supply chain logistics, product lifecycle, and competitive sales information to optimize its delivery, inventory, pricing, and product placement as a way to increase margin for each item sold? The answer to that question (and its corresponding versions in any industry) may ultimately determine your company's long-term viability in the Information Age.

So how do you transform data into a strategic resource? A part of that process involves properly applying new technology to your data, but the most important part is being able to understand and subsequently build the business case for the value of information. This is partially an abstract exercise and partially a discrete one, and in this chapter we look at the difference between the traditional use of data in a transactional environment for the

1. Retrieved May 5, 2003 from *www.pwcglobal.com/extweb/ncsurvres.nsf/DocID/E68F3408A463BD2980256A180064B96A.*

purpose of effecting operational side effects and the modern view of data as a valuable resource that can be used for analytical purposes. We introduce the savvy manager to the value of information, discuss what the aspects of information are that make up this value, and indicate what kinds of processing can be performed to add value to data. We also look at some examples of business intelligence (BI) applications to guide your understanding of how to build the business case for a BI program.

The Information Asset and Data Valuation

Is data an asset? Although I have never seen a company's data listed as a line item on its list of assets and liabilities, there are some reasons to consider it both ways. Certainly, if all a company does is accumulate and store data, there is some cost associated with the ongoing management of that data—the cost of storage, maintenance, office space, support staff, etc. This should show up on the balance sheet as a liability.

Alternatively, data can be viewed as an asset, because data can be used to provide benefits to the company, is controlled by the organization, and is the result of previous transactions (either as the result of data creation internally or through a data purchase). But organizations do not treat data as an asset; for example, there is no depreciation schedule for purchased data. Treating data as an asset is important, though, because it allows us to build the business case for investing in BI when we can show how the value of the data asset is improved.

That implies that we must have some way to measure the value of data, and this is where we get stuck. There are relatively few situations where we can accurately assign a discrete price for information, and this pricing structure is more frequently value based than if data were treated as a commodity. As an example, the telephone company charges you, say, $1 for each directory assistance inquiry, although that same telephone number could be acquired free through an online directory. The difference in cost is based on the convenience value of being able to pick up the receiver and get the number right away.

In most cases, though, the value of information depends on a number of contributing factors, and my discussion of these factors is adapted from research by Daniel Moody and Peter Walsh.[1] What is interesting is that as we

1. See "Measuring the Value of Information: An Asset Valuation Approach," Daniel Moody and Peter Walsh, European Conference on Information Systems (ECIS 99).

are made aware of these factors, we can get a lot closer to developing a model for information valuation. This is not to say that we can accurately enumerate data as an asset on the balance sheet, but it does give some parameters to understanding the value of information and, consequently, the value of BI.

The Time Value of Data

There is a timeliness or currency component to the value of information. Here's a simple example: If it is March 1st and some prophet told you today that for a certainty the March 2nd closing price of IBM stock is going to be $10 higher than the March 1st price, you can exploit that piece of information today to buy as much IBM stock as you can and sell it at the $10 profit on March 2nd. Yet if I gave you the same information on March 3rd, you could not exploit it in the same way. In this case, a large portion of the value of that piece of information is bound to its timeliness.

This example may appear to be a bit extreme, yet the concept is clear that a portion of the value of information is related to time and that value may degrade as time elapses. Because stored data represents a snapshot of a real-world state at a particular point in time, then in the absence of continuous maintenance, as the world changes our snapshot grows more out of synch with reality. For example, our direct mail database may be of high value at its initial creation, but because it is estimated that about 20% of the population changes addresses each year, then if that database is not updated with new addresses, its value declines with time. Not only that, bad data actually can be viewed as a liability: There is no reduction in the fixed costs associated with managing that bad data, and using the data as part of an integration or linkage process will yield incorrect answers, and the value of the data set as a whole declines.

Information as a Sharable Resource

As opposed to any other raw resource used in a manufacturing process, data is a raw resource that are not used up. That means that information is sharable, and the value of information increases as more people use it. An example of this is the knowledge of a process for sales professionals to alert them to the best time to contact a prospect. The knowledge of this process can streamline the process for any particular salesperson. But even if that salesperson were to share that knowledge with other members of the sales staff, there is no degradation in the value that can be achieved by any one of the individuals aware of that knowledge. This means that the value of that information is multiplied by the number of people who know it.

In the BI space, this is manifested through the data warehouse, which is used as a central repository for large amounts of shared data. If there is some economic value to be derived from a piece of information, that value can be increased through sharing.

Increasing Value through Increased Use

For most assets, as usage increases, there is some depreciation in asset value. For example, every mile a car is driven decreases the value of the car. On the other hand, the value of data does not decrease with use, because there is no degradation in information based on the number of times it is viewed. When everyone in the organization knows what information is available, how to access that information, and how to exploit that information, the value of that information rapidly increases. If data is stored, managed, and never used, there is no added value, and, as I mentioned in the introduction to this section, it actually becomes a liability.

Increasing Value through Quality

Let's look at the stock price example one more time, but let's change it a bit: This time, the prophet is a false one and tells you that the stock price will fall $10 by the close of business tomorrow, although it really will rise $10. The way you will have exploited what you believe to be true will ultimately result in a significant loss of value instead of an increase. This highlights the value of accuracy of information and the requirement for not only expecting high levels of information quality, but also having a means for defining quality metrics and measuring using those metrics. Having some understanding of the measure or quality of data being used for a decision support process lets the decision maker determine the risks associated with relying on that data.

Increasing Value through Merging

The process of combining bits of knowledge provides significant leverage when increasing the value of information. Having sales channel information is of value; having supply channel information is valuable; combining supply channel information with sales channel information provides knowledge about the movement of products from supplier to customer.

Information increases in value when it can be used to enhance and expand other pieces of information. The BI process revolves around the ability to collect, aggregate, and, most importantly, leverage the integration of different data sets together. As we will discuss many times in this book, there is a

large increase in the value of information if it can be used as leverage in increasing an actionable knowledge base. In other words, if we can take two pieces of information, link them together, and infer something new that could not have been learned independently, we can exploit that inference for competitive advantage.

Value versus Volume

Contrary to the behavior of other assets, we do not necessarily gain greater value by having more information. The sheer amount of information that is produced every year is almost unbelievable; trying to integrate that with what has existed before seems like a gargantuan effort. And in fact, the more data an individual is presented with, the less likely he or she is to absorb *any* of it.

The complexity of data integration grows steeply as the number of data sources is increased. Data from alternate sources infrequently share data models, representations of the same kinds of entities, or even coded reference data. Each data set that is added to the mix must be integrated with all the other sets already extant in the repository, bringing along all the problems associated with that integration.

On the other hand, there is a perception that the more information there is, the better. So there is some fine line between having the right amount of information and having too much. Having the right amount implies that this information supports the defined business requirements and assumes that you are able to integrate that information and provide and present it within the required time.

Not only that, there is a qualitative difference between having lots of data that comes from disparate data sources and having lots of data that derives from the same source. For example, maintaining a large amount of historical transaction data (such as point-of-sale data or call detail records) may prove to be more valuable when it comes to analyzing trends over longer periods of time.

Measuring the Value of Information

One way to assess the value of information is to look at some traditional valuation models for other assets.

- **Historical cost**—In this method, we assess the value based on what had been paid to acquire or create the information or based on how much it would cost to replace the information.

- **Market value**—In this method, we assess the value based on what someone else would be willing to pay for the information. Data aggregators and packagers create products based on this model, especially when it comes to improving the quality of, improving the accessibility of, or enhancing information that is typically hard for individuals to acquire on their own.
- **Utility value**—In this method, we assess the value of information based on the expected value to be derived from the information.

Actionable Knowledge—Return on Investment

It is important to remind you at this point that an asset retains its value only if we do something with it. In the world of BI, some investment is probably required to build the environment where data can be turned into knowledge, but the real benefit occurs when that knowledge is *actionable*. That means that an organization cannot just provide for the information factory; it must also have some methods for extracting value from that knowledge.

This is *not* a technical issue—it is an organizational one. To have identified actionable knowledge is one thing, but to take the proper action requires a nimble organization with individuals empowered to take that action. Although this book is not meant as a replacement for business school, it should be clear that before embarking on building a BI program, every included BI activity should be accompanied by some return on investment (ROI) strategy.

The components of this strategy include analyzing costs, increases in revenues that are related to the activity, and other distinguishable benefits. This strategy should itemize:

- The fixed costs already incorporated into the BI infrastructure (e.g., database or query and reporting tool purchases)
- The variable costs associated with the activity (e.g., are there special software components required?)
- The ongoing costs for maintaining this activity
- The value of the benefits derived by taking actions when expected knowledge is derived from the activity
- The costs and benefits of other BI components that need to contribute to this business activity
- The value model expected from this activity

- The probabilities of successful applications of these actions to be applied to the expected value
- The determination of the time to break even as well as a profitability model

Let's look at a simple example: building a CRM data warehouse for the purpose of increasing the lifetime value of each customer within a company's customer base. The goal is to build a data warehouse that encapsulates all the data related to each individual customer. Building this data warehouse incurs costs associated with physical computational hardware, a database system, additional software tools, and integrating those components into the enterprise. Next there are the additional costs associated with the design and implementation of the warehouse model(s), as well as identifying the data sources, developing the processes for extracting data from its sources and loading it into the data warehouse, and ongoing maintenance of the data warehouse. The expected benefit of the data warehouse is a 30% increase in each customer's lifetime value by the end of the third year following the launch of the data warehouse into production. The ROI model must offset the costs just described with the overall benefit value associated with the increase in lifetime value. If there is no breakeven point, the cost to build the data warehouse is more than the value derived from it; in that case, it is probably worth looking for additional value that can be derived from the project before pitching it to senior management.

Business Intelligence Applications

It is interesting to note the different uses of data and the contexts of each use as it pertains to the exploitation of information. For the most part, we can break those into two areas. The first area is operational data use, and the other is strategic use. The predominant use of information today is operational: how data helps *run* the business, as opposed to strategic information use, which helps *improve* the business.

Clearly these both are valuable, and without the operational use of information a business could not survive. But it is up to the information consumer to determine the extent of the value to be derived from the strategic use of information as well as what strategic uses are of importance. In this section we review some of the strategic uses of information as manifested through BI analytics. Note that although many of these analytic applications may be categorized within a specific business domain, many of them depend on each other within the business context.

Customer Analytics

A common, overused term is *customer relationship management* (CRM), which has become a buzzword implying an all-encompassing magic bullet to turn all contacts into customers and all customers into great customers. The magic of CRM is actually based on a number of customer analytic functions that together help people in a company better understand who their customers are and how to maximize the value of each customer. The results of these analytics can be used to enhance the customer's experience as well.

Following are different aspects of customer analytics that benefit the sales, marketing, and service organizations as they interact with the customers.

- **Customer profiling**—The bulk of marketing traditionally casts a wide net and hopes to capture as many individuals as possible. Companies are realizing that all customers are not clones of some predefined market segment but are thinking individuals. To this end, customer analytics encompass the continuous refinement of individual customer profiles that incorporate demographic, psychographic, and behavioral data about each individual.
- **Targeted marketing**—Knowledge of a set of customer likes and dislikes can augment a marketing campaign to target small clusters of customers that share profiles. In fact, laser-style marketing is focused directly at individuals as a by-product of customer analytics.
- **Personalization**—As more business moves online, the browser acts as a proxy for the company's first interface with the customer. Personalization, which is the process of crafting a presentation to the customer based on that customer's profile, is the modern-day counterpart to the old-fashioned salesperson who remembers everything about his or her individual "accounts." Web site personalization exploits customer profiles to dynamically collect content designed for an individual, and it is meant to enhance that customer's experience.
- **Collaborative filtering**—We have all seen e-commerce Web sites that suggest alternate or additional purchases based on other people's preferences. In other words, the information on a Web page may suggest that "people who have purchased product X also have purchased product Y." These kinds of suggestions are the result of a process called *collaborative filtering*, which evaluates the similarity between the preferences of groups of customers. This kind of recommendation generation creates relatively reliable cross-sell and up-sell opportunities.

- **Customer satisfaction**—Another benefit of the customer profile is the ability to provide customer information to the customer satisfaction representatives. This can improve these representatives' ability to deal with the customer and expedite problem resolution.
- **Customer lifetime value**—How does a company determine who their best customers are? The lifetime value of a customer is a measure of a customer's profitability over the lifetime of the relationship, which incorporates the costs associated with managing that relationship and the revenues expected from that customer. Customer analytics incorporates metrics for measuring customer lifetime value.
- **Customer loyalty**—It is said that a company's best new customers are its current customers. This means that a company's best opportunities for new sales are with those customers that are already happy with that company's products or services. Customer analytics help.

Human Capital Productivity Analytics

One way to attain value internally from BI is to be able to streamline and optimize people within the organization, including:

- **Call center utilization and optimization**—If you have ever dawdled while on hold, waiting for a customer service representative to pick up the telephone, you can understand the value of analyzing call center utilization to look for ways to improve throughput and decrease customer waiting time. When a company's management realizes that inbound calls are likely to be from unsatisfied customers, making them stew on the phone is not going to improve customer satisfaction. In the more advanced cases, quick access to customer profile information may also affect the level of support provided to each customer (e.g., high level to high-value customers, minimal support to low-value customers).
- **Production effectiveness**—This includes evaluating on-time performance, labor costs, production yield, etc., all as factors of how staff members work. This information can also be integrated into an information repository and analyzed for value.

Business Productivity Analytics

Another popular analytic realm involves business productivity metrics and analysis, including:

- **Defect analysis**—While companies struggle to improve quality production, there may be specific factors that affect the number of defective items produced, such as time of day, the source of raw materials used, and even the individuals who staff a production line. These factors can be exposed through one component of business productivity analytics.
- **Capacity planning and optimization**—Understanding resource utilization for all aspects of a physical plant (i.e., all aspects of the machinery, personnel, expected throughput, raw input requirements, warehousing, just-in-time production, etc.) through a BI analytics process can assist management in resource planning and staffing.
- **Financial reporting**—Stricter industry regulatory constraints may force companies to provide documentation about their financials, especially in a time when companies are failing due to misstated or inaccurately stated results. In addition, financial reporting analytics provide the means for high-level executives to take the pulse of the company and drill down on particular areas.
- **Risk management**—Having greater accuracy or precision in tracking business processes and productivity allows a manager to make better decisions about how and when to allocate resources in a way that minimizes risk to the organization. In addition, risk analysis can be factored into business decisions regarding the kind of arrangements that are negotiated with partners and suppliers.
- **Just-in-time**—The concept of just-in-time product development revolves around the mitigation of inventory risk associated with commodity products with high price volatility. For example, the commodity desktop computer business is driven by successive generations of commodity components (disk drives, CPUs, DRAM memory chips, to name a few). Should a vendor purchase these items in large quantity and then come up against a low-sales quarter, that vendor might be stuck with components sitting on the shelf whose commodity value is rapidly declining. To alleviate this, the knowledge of how quickly the production team can assemble a product, along with sales channel information and supplier information (see Sales Channel Analytics and Supply Chain Analytics on page 21) can help in accurately delivering products built to customer order within a predictable amount of time.
- **Asset management and resource planning**—Utilization, productivity, and asset lifecycle information can be integrated through business

analytics to provide insight into short- and long-term resource planning, as well as exposing optimal ways to manage corporate assets to support the resource plan.

Sales Channel Analytics

We might consider sales channel analytics a subset of business productivity analytics, yet there is enough value in segmenting this area of application.

- **Marketing**—Both the ability to fine-tune a marketing program and the ability to determine marketing effectiveness can be derived through sales channel analytics. A typical iterative process would be to identify a marketing strategy based on an analysis of a clustering of customers by profile and then to implement that strategy. The effectiveness of the strategy will ripple through the sales channel data, which can then be used to compare the actual results with expectations. The degree to which those expectations are met (or exceeded) can be fed back into the analytical processing to help determine new strategies.
- **Sales performance and pipeline**—Data associated with the sales staff can be analyzed to identify variables that affect the efficiency of the sales cycle, such as individual sales staff member, region, industry, contact people, contact times, and contact frequency.

Supply Chain Analytics

Supply channel analytics are used to characterize and benchmark a company's supply channels from its various vendors and suppliers, through internal inventory management and ultimately aspects of delivering products to its customers. Aspects of supply chain analytics involve the following:

- **Supplier and vendor management**—Many organizations are unable to identify who their vendors are or how many vendors are supplying products or services. Supply chain analytics allow a company's management to track performance and reliability by supplier, evaluating and rating the quality of the products supplied, as well as help to optimize supplier relationships with respect to spending, procurement, and risk.
- **Shipping**—There are different methods by which a company delivers its products to its customers, each with its own cost schedule. For example, it may be more expensive to ship products by air than by truck, but the products will arrive at the destination faster if shipped by air. A company can minimize its delivery costs by being able to select

the most efficient delivery method for any specific business arrangement, but knowing whether the products can be available within the right time schedule is a difficult problem, especially if your production depends on external suppliers. Therefore, merging supplier and inventory information with productivity data (see Business Productivity Analytics on page 19) lets management accurately determine the best way to move product.

- **Inventory control**—As discussed earlier, maintaining an inventory of commodity products that exhibit volatile pricing *and* limited useful life creates a market risk if those products cannot be used before their obsolescence. Alternatively, we would not want to keep the shelves empty, because parts are needed to build the products that are in the order-and-fulfillment cycle. Between the sales channel information, the productivity data, and the supply chain data, it is possible to make more precise predictions about inventory requirements. It is also possible to determine the best way to quantify and mitigate risk, especially through the development of financial products (such as barrier options) to limit financial losses.
- **Distribution analysis**—Imagine that your company has a large number of retail outlets, a smaller number of regional warehouses, and a very small number of factories. The optimal distribution model would arrange for the delivery of the exact number of products from each factory to its closest warehouses so that each warehouse could deliver the exact number of products to each of the retail stores. Unfortunately for both companies and customers, this optimal distribution is pretty rare. If a company can predict demand for specific products within certain areas, though, the managers cannot only distribute the product to the right locations in the right quantities, but also minimize shipping costs by ramping up product creation at the factories most economically geographically located at a rate that matches the consumer demand.

Behavior Analysis

Most of the analytical applications we have reviewed so far deal with "drillable" data that a manager can use to optimize some kind of process, such as sales, utilization, or distribution. Another area of analytics deals with a more fluid view of activity as a way to predict trends or capitalize on identifying specific kind of behaviors. In general, any behavior pattern that presages significant business events is worth noting and then seeking. This type of

analytical processing makes use of historical data to look for behavior patterns that take place before the significant event (whether or not they are causal) and then try to identify those behavior patterns as they are taking place. This allows for the following kinds of analytics:

- **Purchasing trends**—Although many product lifecycles can easily be predicted and charted, there are apparent nonlinear trends that elude predictability, the most notable cases being toy sales around winter holiday time. Yet not being able to identify a warming (or heating!) product may result in the inability to ramp up production to meet demand or the inability to move products from factory to store shelves, which can effectively dump a glass of cold water on that hot product. Behavior analytics can be used to identify purchasing patterns that indicate a growing trend that can be used to adjust a company's reaction to customer trends.
- **Web activity**—In the world of e-commerce, the ability to draw and maintain customers to a Web site and then encourage them to commit to purchasing products is not only critical to success, but also much more difficult than doing the same in a brick and mortar environment. Different kinds of content presentation may lead different kinds of consumers to behave differently. It is interesting to identify patterns that lead to committed business (e.g., product purchase)—let's call them "success patterns." Then perhaps including some personalization (see Customer Analytics on page 18), the content presentation can be crafted to direct the Web site visitor into these success patterns, which in theory should improve the probability of making a sale.
- **Fraud and abuse detection**—Fraudulent (or abusive) behavior frequently is manifested in patterns. For example, there are many popular health insurance fraud schemes involving making claims with inflated charges or practitioners prescribing expensive medications or procedures that may not be necessary. Behavior analytics can be used to seek out patterns of suspicious behavior by provider, geographical region, agent, etc.
- **Customer attrition**—Another serious problem for many businesses is customer attrition, when a company's customers decide they no longer want to remain affiliated with that company. In competitive industries, it is much easier to convince a customer to stay with the company before the decision has been made to leave rather than afterwards. For example, offering a long-distance telephone customer a better offer than can be gotten from a competitor can recapture that customer, but it is

not to the company's benefit to make this offer to (higher valued) complacent customers. Therefore, it is important to recognize the signs that a customer is ready to cease being a customer. This can be done by evaluating patterns of behavior before previous attritions (such as a history of customer service complaints) and then using those patterns for ongoing customer behavior analysis.

- **Social network analysis**—Sometimes it is important to identify relationships between specific entities within a system and to analyze their behavior as a group. For example, a component of criminal intelligence is finding collections of individuals whose individual behavior may be nondescript yet who act suspiciously as a group. This kind of analytical processing is valuable to law enforcement, regulatory compliance (think of insider trading), marketing (consider *viral marketing*, which is a strategy that encourages individuals to pass your marketing message to all of their contacts), as well as sales optimization (by finding a contact path of people to find the right audience).

The Intelligence Dashboard

A key performance indicator (KPI) is some objective measurement of an aspect of a business that is critical to the success of that business. Such KPIs are a component of the conceptual scorecard for a business and can be associated with a number of different business activities, such as customer satisfaction, productivity, supply channel performance, and profitability. In fact a large number of KPIs can be defined in terms of measuring performance associated with many of the BI analytics functions that we described earlier.

Another conceptual value of BI is the ability to capture the business definitions of the key performance indicators, manage those definitions as part of the corporate knowledge base, and then provide a visualization dashboard that reflects those KPI measurements, presented in a form for management review. This intelligence dashboard displays the results of the analytics required to configure the KPIs in a succinct visual representation that can be understood instantaneously or selected for drill-down. An intelligence dashboard will not only provide real-time presentation of the selected KPIs, but will also hook directly into the BI components that allow for that drill-down.

The following are some example KPIs:

- Regional sales figures by sales location
- Personnel statistics
- Real-time supply chain reports by supplier

- Customer satisfaction measurements
- Factory productivity
- Average customer profitability

Business Intelligence Adds Value

We can confidently say that knowledge derived from a company's data can be used as an asset, as long as senior managers understand that an investment in turning data into actionable knowledge can have a significant payoff. It is important to recognize that this problem cannot be solved solely by the application of technology. In truth, the technology must augment a more serious senior-level management commitment to exploiting discovered knowledge and having a way to measure the value of those activities.

There are a number of BI analytics that provide business value. Selecting and integrating these analytic functions depends on the ability to effectively build the underlying information infrastructure to support the applications as well as the ability to configure reporting and visualization of the discovered knowledge.

For a more in-depth discussion of information valuation, I recommend "Measuring the Value of Information: An Asset Valuation Approach," Daniel Moody and Peter Walsh, ECIS 1999.