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The BI-Based Organization

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ABSTRACT

Business intelligence (BI) is an umbrella term that is commonly used to describe the technologies, applications, and processes for gathering, storing, accessing, and analyzing data to help users make better decisions. For BI-based firms, BI is a prerequisite for competing in the marketplace. Though there are several possible BI targets, it is important to understand how they differ in terms of strategic vision, level of sponsorship, required resources, impact on people and processes, and benefits. Some companies like Harrah's Entertainment, Continental Airlines, Norfolk Southern, and Blue Cross and Blue Shield of North Carolina are exemplars of BI best practices. Despite the progress made with BI, there are still many opportunities for academic research.

Keywords: Analytics, Benefits, Business Intelligence, Case Study, Data Warehousing, Trends

INTRODUCTION

The inaugural issue of the *International Journal of Business Intelligence Research* provides an excellent opportunity to reflect on the history and future of BI, as well as the remarkable and unprecedented transformations it can effect. BI has a rich history with origins that date back fifty years ago. As we journey ahead in BI, we must acknowledge from where we have come and what we currently understand. Only then can we further the field in effective ways.

Organizations first used computers in the 1960s for transaction processing and scientific applications. At the time, organizations did not focus on decision support, although they did create reports that summarized the transaction data that was processed. By the late 1960s, the first decision support applications emerged to help managers better plan and optimize specific business goals and activities, such as production planning and investment portfolio optimization (Power, 2007). The term *decision support systems,* or *DSS,* was used to describe these analytic applications, and later became the name associated with an academic field.

Over the years, a variety of additional decision support applications emerged, including executive information systems, expert systems, and online analytical processing, each with specific differentiating characteristics and unique names. In the early 1990s, Howard Dresner, a Gartner analyst, coined the expression *business intelligence* to describe these applications; since then the term has come to be widely used in industry, and to a slightly lesser extent in academia, as an umbrella term for all decision support applications (Gartner, 2009b). In recent years, *analytics* also has been used to describe

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applications that provide decision support (Davenport, 2006).

Just as the terminology for BI has evolved, so has BI's role and impact on organizations. BI has moved from being a contributor to organizational success to being a prerequisite for it; indeed, for many firms, BI is a prerequisite for even competing in the marketplace. We call these firms *BI-based organizations* because of the critical role that BI plays. BI also has changed from being a tool used by a few specialists to one that is used by many workers. It has changed from focusing solely on the analysis of historical data to including the capture and use of real-time data to impact current, operational decisions. Consequently, it is not surprising that Gartner found in both 2008 and 2009 that BI was at the top of many CIOs' strategic agendas (Gartner 2008, 2009a).

For several decades we have been studying what leading companies have been doing with BI. We have identified best practices by judging The Data Warehousing Institute's Best Practices Awards competitions and by developing case studies about BI and data warehousing vendors' top customers (e.g., Anderson-Lehman, Watson, Wixom, & Hoffer, 2004; Cooper, Watson, Wixom, & Goodhue, 2000). Here we share findings which are not only interesting and significant, but which demonstrate the transformative - and sometimes unanticipated - power of BI. In particular, we describe practices at Harrah's Entertainment, Continental Airlines, Norfolk Southern, and Blue Cross and Blue Shield of North Carolina. Prior to discussing each company, we provide a conceptual foundation for interpreting the work that was done. Later we discuss a BI maturity model that helps explicate how organizations' BI capabilities evolve over time. In closing, we provide suggestions for future academic BI research. We begin, however, with a definition of BI and a description of a generic best practice BI environment.

A BI DEFINITION

There is no universally-accepted definition of BI, but the following is useful for our purposes:

Business intelligence (BI) is a broad category of technologies, applications, and processes for gathering, storing, accessing, and analyzing data to help its users make better decisions.

Several aspects of this definition warrant discussion. While BI sometimes is thought of in terms of applications, such as dashboards/scorecards or predictive analytics, we consider BI to be broader in scope. For us, it includes gathering data from source systems, storing the data, and accessing and analyzing the data using BI technologies and applications. Putting it differently, BI includes both *getting data in* (to a data mart or warehouse[1]) and *getting data out* (through technologies or applications that meet some kind of business purpose).

Much like Sprague's (1980) distinction between DSS applications and DSS generators, BI includes both BI applications and BI technologies, which can be used to develop the applications. For example, a company may have dashboards for call center operators, but these dashboards are built using a specific technology, such as MicroStrategy Report Services. Similarly, a financial analyst may have a financial planning application built using Microsoft Excel that accesses warehouse data.

Processes are also a very important part of BI. For example, there have to be processes for extracting, loading, and storing data; maintaining metadata for IT and users; and prioritizing BI projects. Some of these processes are the responsibility of the BI staff, while others are the joint responsibility of the BI staff and the business units.

A variety of stakeholders play essential BI roles. Extraction, Transformation and Loading (ETL) experts, data modelers and database administrators focus on preparing the data warehouse for use. Over time, data stewards,

project champions, and business owners drive governance and quality processes to ensure that BI remains aligned with the business' strategies and objectives. Data miners, analysts and business users extract value from the data.

A Best Practice BI Environment

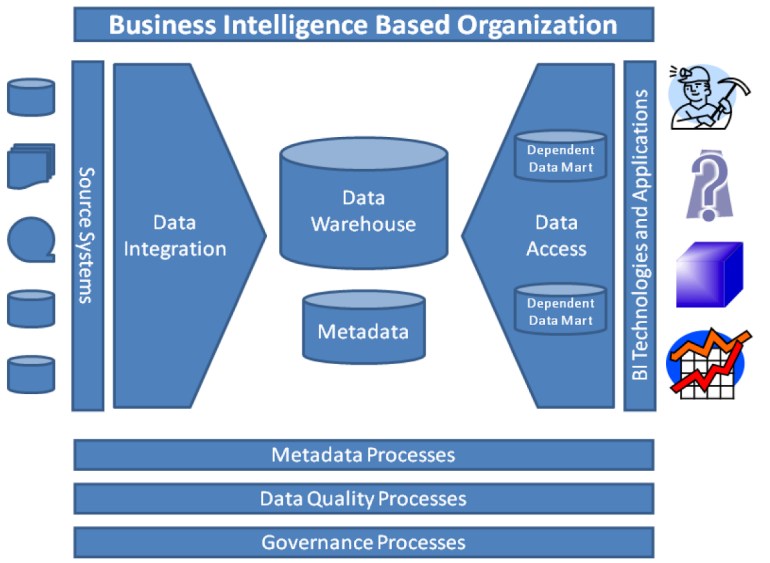
Figure 1 shows a generic, comprehensive BI environment. Not all organizations fully follow this model. Some companies, for example, may have an alternative architecture for their data warehouse, such as having no dependent data marts. Others may have a less comprehensive environment with no data warehouse, but, instead, data marts that support specific applications and business units. All of these variations represent BI, but Figure 1 shows a model that we think exemplifies best practice, and which is typically used by BI-based organizations.

Starting at the left of the diagram, we see that data originates from a variety of source systems, including transactional and ERP systems. Increasingly, sources contain more than just transactional data, such as Web 2.0 collaborations, emails, Word documents, and third party data (e.g., U.S. postal addresses, customer demographics). Companies extract the data from the sources, transform the data (by matching, integrating, and aggregating it), and load the data into the data warehouse. This process often is referred to as ETL, but with the emergence of additional ways of getting data into the warehouse, such as real-time data trickle feeding, the term *data integration* is increasingly used.

There are a variety of architectures for storing data in a warehouse, but we present the hub-and-spoke approach (i.e., a data warehouse *hub* and dependent data marts *spokes*) because it is the most common (Ariyachandra & Watson, 2005), works well, and is used in many of the companies that we later describe.

At the right of the diagram, we see that a variety of users and applications access warehouse data. There are BI information producers (e.g., financial analysts) who analyze data and

Figure 1. A best practice BI environment



create BI information for others, and information consumers (e.g., managers) who use BI information created by others (Eckerson, 2002). A focal point in many organizations is to make the use of BI more pervasive. One way of doing this is to make BI available to more people, including operational personnel, customers, and suppliers. Potential BI applications include SQL queries, drillable reports, OLAP, EIS, dashboards/scorecards, alerts, and data mining/predictive analytics.

It is important to recognize that the BI environment includes metadata, data quality, and governance. While all three involve technology to some degree, they are more about people and processes. It is important to have metadata that supports both the IT people who get data in and users who get data out. And unless the warehouse contains high quality data, it will not be used in the long term. Governance includes the people, committees and processes that ensure that BI meets organizational goals.

THREE TARGETS FOR BI

Organizations make varying levels of commitment to BI. Some have a few data marts with applications that meet very specific, important purposes, such as campaign management, profitability analysis, and Internet behavior analysis. The other extreme includes organizations that have invested in multi-million dollar enterprise data warehouses that support strategic business objectives.

We believe there are three targets that organizations can aim for when implementing BI (Goodhue, Wixom, & Watson, 2002). Some companies have a specific need and put specific applications in place. For example, a department may have a clear business need to run effective marketing campaigns, and may implement a data mart and campaign management software and applications to address this need. Other companies aim to create an infrastructure for BI by cleaning up and defining their data, establishing efficient processes to move data from source systems to a highly extensible data warehouse, implementing a variety of BI tools and applications, and investing in BI user training. A third category of companies is trying to transform itself organizationally, and aims to use BI as an enabler for the firm's new business model. These companies undergo significant process change and use BI to run the company differently. Table 1 highlights the differences among these targets.

None of these targets is inherently better than any of the others; the selection of the target depends on the business needs and BI readiness of the organization (Williams, 2004). For example, to successfully hit the infrastructure target, an organization needs strong IT capabilities, a high-level IT champion, and a highly scalable technical platform. In contrast, hitting the transformation target requires top management's business-level support and a BI-oriented strategic vision.

Organizational Transformation: Harrah's Entertainment Inc.

Harrah's Entertainment Inc. provides a great example of using BI to support organizational transformation. Its CEO, Gary Loveman, a former Harvard marketing professor, saw the opportunity for a new business model when the gaming laws changed. He put together a team of people, including CIO and Director of Strategic Marketing John Boushy, who shared his vision and created the technology infrastructure needed to support that vision. Once the infrastructure was in place, Harrah's hired people and developed applications to support fact-based decision making and become customer-centric. The organization's business model and culture changed. The effectiveness of the new technology-enabled business strategy is evidenced by Harrah's current leadership position in the gaming industry.

In the 1990s, significant changes took place in the gaming industry (Watson & Volonino, 2002). New legislation allowed gambling on river boats and Indian reservations, which opened up new markets. Along the Las Vegas Strip, new properties opened, many with lavish

Table 1. Three BI targets and their characteristics

	Single or a Few Applications	BI Infrastructure	Organizational Transformation
Strategic Vision	Satisfy a business unit need	Provide an organization-wide resource	Fundamentally change how the business is run
Focus	Applications that satisfy particular business units needs	Infrastructure that is used by applications across the organization	Supports and enables a new strategic business model
Level of commitment	Low to medium	High	Very high
Scope	Business unit	Organization wide	Organization wide
Governance	Business unit	All business units that use the infrastructure	Organization wide, with significant senior executive involvement
Sponsorship	Business unit	CIO and business units	All C-level executives
Required resources	Low to medium	High	Very high
Impact on people and Processes	Limited to people who use the applications	Makes jobs and processes more analytical, resulting in fact-based decision making	Fundamentally changes peoples' jobs, work processes, and the organizational culture
Benefits	Low to high at the business unit level	Provides the infrastructure that can generate high returns	Makes the new strategic business model possible

hotels, shopping malls, and attractions, such as a replica of the *Eiffel Tower* at Paris and the Bellagio hotel's *dancing waters*.

Management at Harrah's recognized that there were great opportunities for growth, and started an ambitious program of building new properties and acquiring existing ones (e.g., Rio, and, more recently, Caesar's). The strategy was to operate the hotels and casinos in an integrated way and encourage customers to play at a Harrah's property whenever and wherever they gambled. This was a significant change in Harrah's business strategy. In the past, Harrah's hotel and casino managers operated their properties as independent fiefdoms.

But how could customers be incented to seek out Harrah's casinos? Management ruled out building lavish hotels, shopping malls, and attractions: while taking such actions may draw crowds, they are costly and negatively affect the bottom line. The strategy Harrah's decided upon was to implement BI-based customer relationship management (CRM) and an innovative Total Rewards program that rewarded customers for their stay and play at Harrah's properties.

To implement this strategy, Harrah's created a BI infrastructure and applications. Their starting point was to build a Winners Information Network (WINet). WINet sources data from the casino, hotel and special event systems. Customers who join Total Rewards receive a loyalty card that they enter into slot machines or show to pit bosses when they play table games like blackjack. As a result, the casino system captures data on what games people play, for what amounts of money, and for how long. The hotel system captures personal preferences data, such as whether a customer prefers smoking or non-smoking rooms. Harrah's also collects data about customers who attend special events such as slot machine tournaments and wine-tasting weekends. From this data, Harrah's learns a tremendous amount about its customers.

The data is entered into an operational data store called the patron database. It is used for a variety of purposes, including generating offers to visit a Harrah's casino (e.g., free gaming chips,

meals, and shows) and providing current data to customer-facing applications. For example, front desk personnel can access a wealth of information about customers, including their profitability, room preferences, and recent stays at a Harrah's property. Pit bosses can see that a customer is playing far more than usual and provide a free show ticket.

Some of the data from the patron database is loaded into the marketing workbench, which serves as Harrah's enterprise data warehouse. Analysts use the data in the marketing workbench for their analyses. Many of the applications help analysts better understand Harrah's customers. For example, Harrah's estimates the value it expects to generate from its customers over the course of their lifetimes. It identifies their place in a customer lifetime cycle. It identifies customer segments for marketing campaigns. Here's a typical example: A young male visits a Harrah's casino for the first time and signs up for the Total Rewards program. The data collected from the casino system reveals that he is a high-velocity player, in that he plays quickly and for relatively high amounts. A further analysis of the data classifies him as being in the potential growth stage of the customer life cycle and that he has a high expected lifetime value. As a result of these insights, he is sent an exceptionally attractive offer to visit a Harrah's property soon.

Harrah's is constantly running experiments with control groups to determine what offers are most appealing to different market segments. Harrah's Tunica, Mississippi casino, for instance, draws many customers from Jackson. Which offer is most appealing to these customers: one that involves a free night's stay and a free show, or one that features $60 in free chips? By running an experiment with both offers and tracking the results, Harrah's has learned that the less expensive offer - that of free chips - generates the greatest response. It turns out that people are enticed by the offer of free chips, and prefer to sleep in their own beds. Prior to the use of BI, decisions about offers would have been based on intuition, which may or may not have been correct.

An interesting example of how Harrah's was able to capitalize on its investment in BI is provided by events that occurred shortly after 9/11. Las Vegas is a destination city to which most people travel by plane. Right after 9/11 the Las Vegas casinos suffered a dramatic drop in business as people chose not to fly. Quickly recognizing this, Harrah's used its patron database and marketing workbench to identify customers who were candidates for driving to Las Vegas, and sent them attractive offers. Unlike other casinos, Harrah's business quickly returned to normal.

The potential value of a data warehouse grows as it adds subject areas. Harrah's started with customer data and later added product data (i.e., the games that customers play). With this additional data, Harrah's better understands which games various customer segments and individuals prefer. For example, it makes sense to place slot machines popular with the high rollers close to the high stakes tables. More recently, Harrah's has been using customer data in pricing its hotel rooms as part of a revenue management initiative that strives to optimize the value of its hotel room inventory.

Through its innovative use of BI, Harrah's has become a leader in the gaming industry. This formerly modest, blue collar casino is now the largest and most successful gaming company in the world. Its success has caused other companies to copy its most discernable BI methods.

The Movement to Real-Time BI

While BI applications may vary from being model-based (e.g., revenue management) to data-based (e.g., dashboards), they all depend on a data infrastructure. This infrastructure has evolved over the years, from being application-centric (that is, the data was organized around a single or a few applications), to enabling more traditional data warehousing (that is, the data is organized as an enterprise-wide resource that supports a wide variety of applications), to today's real-time data warehousing (Watson, 2005). The recent movement to real-time or

right-time decision support data represents a true paradigm shift.

Previously, most decision support was conducted off-line by analysts operating with historical data who reported their findings to others. With real-time capabilities, an analysis of real-time (and historical data) can drive operational decisions. For example, decisions about which airline passengers should be given a flight upgrade can be based on both customer value (i.e., profitability) and their recent flight experiences (e.g., a customer who has had flight delays might be given an upgrade). Real-time data blurs the distinction between operational and decision support applications. Continental Airlines is a company that is generating great value for itself and its customers through real-time BI.

REAL-TIME BI: CONTINENTAL AIRLINES

Continental Airlines has done a remarkable job of adapting to accommodate real-time BI, and the company is reaping the benefits (Anderson-Lehman, Watson, Wixom, & Hoffer, 2004). Real-time applications have found their way into operations, marketing, fraud prevention, security, customer service, and other areas. On several occasions, its data warehouse has even served as a backup for Continental's transaction systems. Continental continues to be a leader in its use of real-time BI, a capability that likely contributes to *FORTUNE* magazine's recognition of Continental as the top airline in its annual airline industry list of the World's Most Admired Companies for the past six years.

Continental is the seventh largest commercial airline in the world, employing more than 43,000 people and serving approximately 65 million passengers each year. Continental, along with Continental Express and Continental Connection, offers 2,300 daily departures to more than 265 destinations across five continents. This year, Continental is celebrating its 75th year of business.

Fourteen years ago, senior management implemented a strategy called the Go Forward Plan, which still drives the company today. The four-pronged strategy focuses on reliable operations, a collaborative work culture, savvy financial management, and value-added customer services. The key to this strategy is information, and Continental has invested in an enterprise data warehouse as the platform for delivering key information about customers and the business to employees at all levels of the organization.

Initially, the data warehouse delivered accurate, integrated flight schedule data, customer data, inventory data, and other data relevant to strategic decision-making within revenue management and marketing. Over time, however, Continental realized that revenue and marketing data could be combined with real-time flight data and used to support important operational decisions. For example, airplanes send data in real-time via satellite to a special interface that supports the command center for Continental where the actual flights are coordinated. This data communicates exactly when a plane pushed off from the gate, how fast the plane is flying, its current location, and when it will arrive at its destination given current conditions. Operations managers combined plane data with marketing data about high value customers and began making decisions about things like flight delays and gate changes that optimized customer service interactions.

Continental discovered that the shift to real-time BI is not straightforward; it requires changes to people, process, and technology, as well as a new way of supporting BI. For example, BI end users changed from a small group of highly skilled analytical strategists to literally any employee of Continental, from the CEO to tax accountants to flight attendants. The latter, for example, could pull up a BI application at the boarding gate to look up high-value customers on a given flight to see if they had any special concerns or preferences. Armed with this information, flight attendants could then tailor those customers' flight experiences appropriately.

As the base of end users diversified and expanded, Continental found itself with a growing need for employees who understood BI and had the analytical skills to help increase its use within their areas. We consider IT-savvy business users *hybrid* employees – business users who take on traditional IT roles such as training, report development, and requirements determination. The spread of BI to operational decisions also prompted process changes as BI tools became part of everyday business processes. Tax accountants, for example, use queries to replace manual checks and balances, resulting in faster, more accurate tax management. In the United Kingdom, Continental must pay a departure tax for passengers who leave on Continental flights. Manual processes could not always identify exceptions to the tax rules. Using BI, the tax accountants were able to eliminate overpayment of the departure tax, resulting in annual savings of $300,000 for Continental.

Other significant changes from real-time BI occurred within the IT department. As BI applications became more and more mission critical, and more deeply embedded into everyday processes, the data warehouse and its applications began to require treatment more like that of transaction systems. IT needed to provide 24/7 support, plan for disaster recovery, and ensure fast (i.e., operational) performance. To do this, IT staff needed operations experience combined with knowledge of BI. In addition, the structure of the IT organization (e.g., which group should be in charge of the customer data hub) suddenly became far more complicated.

BENEFITS OF BI

While BI may generate new complexities, it also, of course, generates a wide variety of organizational benefits (Haley, Watson, & Goodhue, 1999). Some BI benefits are tangible and easy to measure. For example, companies may eliminate software and hardware licenses and fees when they consolidate and retire data marts, or companies may reduce headcount when they replace manual reporting processes. These kinds of benefits can be anticipated, tracked, and captured in a spreadsheet. Other benefits, such as the enabling of new ways of doing business, are much more difficult to quantify, but may generate a competitive advantage or open up new markets for the company. When BI generates these kinds of benefits, companies spend less time justifying their annual BI investments, focusing instead on crafting new and creative ways to leverage and evolve their BI capabilities.

Figure 2 illustrates the wide range of possible benefits resulting from BI. Note that the most tangible and easy-to-measure benefits have more of a local impact, typically happening at the departmental level. The more intangible benefits – things like process improvement and strategic enablement – can have impacts across an organization. Throughout our case studies, we have observed that there is an association between the kinds of benefits realized by BI, and an organization's BI target. As Table 2 shows, companies often get what they pay for. Localized benefits are associated with localized initiatives, which are much less costly to put in place than enterprise BI programs that result in significant, transformational impacts. In the following section, we describe the portfolio of benefits being realized at Norfolk Southern.

BI Benefits at Norfolk Southern

Norfolk Southern is one of the four largest freight railroads in the United States. Each day, the company moves about 500 freight trains across 21,000 route miles in 22 eastern states, the District of Columbia, and Ontario, Canada. Norfolk Southern manages more than $26 billion in assets and employs over 30,000 people.

Today, Norfolk Southern is home to a six terabyte Teradata data warehouse, which manages an extensive amount of information about the company's vast network of railroads and shipping services. Norfolk Southern uses the data warehouse to analyze trends, develop forecasts and schedules, archive records, and

Figure 2. Benefits of BI

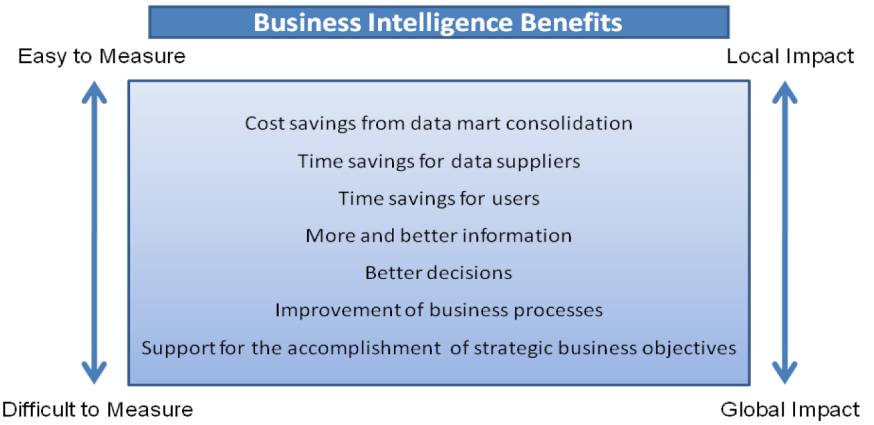


Table 2. Three BI targets and their costs and benefits

	Single or a Few Applications	BI Infrastructure	Organizational Transformation
Costs	Costs are relatively low.	Infrastructure creation is costly, requires a vision to justify. Departments give up control of their data.	An expensive, risky undertaking.
Benefits	Greater efficiencies and effectiveness at the departmental level may result in greater local revenues and profits.	Possible cost savings from infrastructure consolidation. Possible quick-hit returns from follow-on applications.	The potential for great increases in revenues and profits.

facilitate customer self-service. The benefits of the warehouse range from the highly tangible—i.e., cost savings—to the far less tangible—i.e., improvements in decision-making and support for strategic goals. Notably, departments across the enterprise routinely realize these benefits.

But this sort of BI-based efficiency is a relatively new development for Norfolk Southern. For more than a century, the railroad industry was heavily regulated, and Norfolk Southern made money by managing its costs. Managers focused on optimizing the use of railcars to get the most production out of their fixed assets. Then, in 1980, the industry was partially deregulated, which opened up opportunities for mergers and allowed companies to charge rates based on service and enter into contracts with customers. Delivering shipments on time became an important factor in the industry.

Norfolk Southern recognized that a competitive shift was in order, and decided to become a scheduled railroad. This meant that Norfolk Southern would develop a fixed set of train schedules and a fixed set of connections for cars to take as they move among trains and yards. In this way, managers could predict when

they could get a shipment to a customer. The ultimate intent was to compete in the marketplace based on service.

At the time, Norfolk Southern improved its service to customers by providing them with information about their shipments. Prior to 2000, customers would call or fax a Norfolk Southern customer service agent with questions, and then wait for minutes, hours, or days for an answer. Behind the scenes, agents had to place information requests into the IT department, or navigate legacy systems that were hard to use. The customer service processes were costly and time-consuming.

Norfolk Southern implemented a one terabyte data warehouse to store data about railcars, shipments, human resources, and other key transactions. In 2000, the Marketing department began to explore using the Internet to phase out telephone- and fax- based information services, and found that the data warehouse could serve as a platform for serving customers. They built a BI application called accessNS that allowed customers to inquire about their shipments using a Web interface. Customers could determine where their shipments were *right now* – and answer questions about their shipment's history: Where did my shipment come from? How long did it take to arrive? What were the problems along the route? This departmentally focused application had clear, tangible benefits: time savings and improved customer satisfaction resulting from more and better information.

Today, accessNS allows more than 14,500 users from 8,000 customer organizations to log in and access predefined and custom reports about their accounts at any time. The users can access current data, which is updated hourly, or they can look at three years of history. accessNS provides alerting and RSS feed capabilities; in fact, 4,500 reports are delivered to users daily. Norfolk Southern has calculated that it would require 47 people to send out today's volume of reports using the old manual processes.

Norfolk Southern recognized that transparency into operations would improve customer satisfaction, but it turned out that improvements to operations would actually strategically reposition the company. In 2002, Norfolk Southern expanded the use of its data warehouse to support an application for its railroad operators. The Thoroughbred Operating Plan (or TOP) dashboard application pulled data from the data warehouse and then graphically depicted actual performance against the trip plan for both train performance and connection performance. The application used visualization technology so that field managers could more easily interpret the large volumes of data (e.g., there were 160,000 weekly connections across the network). The number of missed connections has fallen sixty percent since this application was implemented. And in the past five years, rail car cycle time has decreased by an entire day, resulting in millions of dollars in annual savings.

Norfolk Southern has an enterprise data warehouse, which means that once data is placed in the warehouse, it is available across the company, not just for a single application. Although train and connection performance data is used for AccessNS and the TOP application, the company has been able to leverage that data for all kinds of other purposes. One interesting internal application was developed by Norfolk Southern's human resources department to help them make better decisions. Recently, the department needed to determine where to locate service offices in the field to best meet the needs of the company's 30,000+ employees. By combining employee demographic data (e.g., zip codes) with geospatial data traditionally used by the engineering group, human resources was able to visually map out the employee population density, making it much easier to optimize service office locations.

BI Governance

Not surprisingly, governance is a critical component of any BI initiative. The more BI-based an organization is, the more comprehensive its BI governance should be. For rich BI environments, the scope of governance should vary from the strategic to the operational. At its highest level, governance ensures that the BI and business

strategies are aligned. It should prioritize projects and make the required resources available. At lower levels, it should ensure that there are consistent data definitions.

There is no single model for BI governance. What works best depends on the organization's BI target, which projects warrant special attention at a given point in time, the organization's overall approach to IT and business governance, and other factors. Let us consider the best practice approach to BI governance used at Blue Cross and Blue Shield of North Carolina.

BI GOVERNANCE AT BLUE CROSS AND BLUE SHIELD OF NORTH CAROLINA

Blue Cross and Blue Shield of North Carolina (BCBSNC) delivers health care products, services, and information to its more than 3.7 million North Carolina members. It provides an excellent example of effective BI governance (Watson, Fuller, & Ariyachandra, 2004). The governance committees are multi-level and cross-functional, and the right people are present to discuss the important issues. The approach to governance is dynamic; it is adjusted to best meet current needs, such as restructuring the mid-level committee to more of a project management focus to support the next-generation warehouse.

BCBSNC has been a BI-based organization for over ten years. The company has stated that its BI mission is to be "the engine that powers a customer-focused, information-driven company." BCBSNC has an enterprise data warehouse that sources data from over a dozen systems and supports applications in Marketing, Financial Services, Corporate Analysis and Risk Assessment, Corporate Audit, and Health Quality Improvement.

A multi-level governance structure has played a key role in ensuring that BI is meeting business needs and adapting to organizational change. To ensure effective communication among the different committees, a member of the BI staff chairs and facilitates the activities of each of the various groups.

The highest-level committee is composed of business leaders from each of the major divisions within the organization. They meet as needed and provide high-level direction for BI initiatives. For instance, they offer strategic guidance, perform high-level resource management, and help resolve project prioritization issues. This group focuses on ensuring the alignment of BI with corporate direction.

Until recently, the mid-level committee was composed of directors and managers who prioritized projects and allocated resources. It also resolved cross-functional area conflicts. This group has changed recently, as BCBSNC is rolling out a next-generation data warehouse. The warehouse will be more comprehensive and easier to use. It will include mechanisms that will allow customers to access data to help them better manage their own healthcare. It will have multidimensional dependent data marts to make it easier for users to understand and access data. There are also initiatives to improve metadata and data quality. Because the warehouse is in building mode with a large number of projects to support the initiative, the mid-level committee has been disbanded and replaced with cross-functional teams that work on specific projects. Once the projects are completed, BCBSNC may reinstate the original mid-level committee.

The lowest-level committee is composed of power users and representatives from the business units that use BI. This group meets bi-weekly to discuss and communicate BI development and use issues with the BI staff and other users. Much of the focus is on the data, including such issues as data quality.

A BI MATURITY MODEL

Maturity models help define and categorize the state of an organizational capability. Maturity models have a long history in the IS field (Watson, Ariyachandra, & Matyska, 2001). The first and most famous maturity model was Gibson

and Nolan's (1974) four stages of EDP growth, which describes the evolution of planning, organizing, and controlling an organization's computer resources. Maturity models also are sometimes called *stage* or *phase* models, and they have been especially popular with practitioners because of their perceived usefulness and face validity.

The fundamental concept underlying maturity models is that things change over time, but in sequential, predictable ways. The various stages are defined and identified by a set of characteristics, which have their own maturity cycles. For example, funding may be a component characteristic of a larger maturity model and have its own stages.

Though companies move through stages in sequential, predictable ways, the movement is not always easy. To move from one stage to another requires changes in all of the characteristics that make up the stages. This typically includes changes in management vision, funding, data management, and more. While all of the stages for the characteristics do not have to be exactly in synch, they should be at approximately the same stage of evolution.

Companies sometimes try to skip stages, but this seldom proves to be wise. There is valuable experience to be gained at each stage, and attempting to move too quickly through the multiple stages of evolution is not only difficult for an organization, but also can have negative repercussions. A notable exception is when an organization is facing a major crisis, or when its survival is at stake. In such situations, management is often willing to do whatever it takes – funding, outside help, reorganizations – to move to an advanced stage of maturity.

There are a number of maturity models for BI. A popular one was developed by Wayne Eckerson (2004), Director of Research for The Data Warehousing Institute, the leading professional organization for BI practitioners. Eckerson's model uses a human evolution metaphor to describe six stages: prenatal, infant, child, teenage, adult, and sage. The stages are characterized and defined by a set of characteristics, including scope, analytic structure, executive perceptions, types of analytics, stewardship, funding, technology platforms, and change management and administration. Eckerson's model provides a useful lens for understanding BI-based organizations.

We have discussed three specific targets for BI – a single or a few applications, BI infrastructure, and organizational transformation. Each of these targets can be mapped onto Eckerson's maturity model. Companies that develop a single or a few applications are at an early stage of BI evolution, typically at the infant or child stage. The characteristics of this stage—the vision for BI, funding, platform and data management, and governance—all tend to be at the departmental or work unit level. There are benefits to be realized, but they tend to be localized.

The BI infrastructure target maps onto the teenager and adult stages. There is sponsorship at the CIO and senior management levels. BI and data are viewed and treated as a strategic resource. One or more data warehouses provide a *single version of the truth*. There is a rich and varied set of analytical applications that help drive the business. Enterprise-wide BI governance is in place. From an ROI perspective, the investment in BI really pays off. Currently, many firms are at this point in their BI evolution. A 2007 study by TDWI found that 64 percent of the respondents were at the teenager stage (Eckerson, 2007).

The organizational transformation target is associated with the adult and sage stages. BI is well-established, organization-wide, and mission critical. As we describe it, however, the decision to make organizational transformation a target involves consideration that goes beyond the characteristics that typically define the stages. Management recognizes that BI is a strategic enabler necessary to take advantage of a once-in-a-lifetime market opportunity, or to respond to an organizational crisis. The former was the case at Harrah's Entertainment. Though not discussed here, the latter is illustrated at First American Corporation, a bank that ensured its survival by implementing a BI-based customer intimacy strategy (Cooper, Watson, Wixom,

& Goodhue, 2000). While BI can help to create significant financial benefits, its creative potential extends far beyond the realm of the financial. BI lies at the core of firms' successful execution of strategy, and how they compete in the marketplace.

CONCLUSION

Although much is known about BI, and conceptual foundations and frameworks (including the ones presented in this article) exist, the BI field offers a wealth of research opportunities for academics to explore. And, new avenues for research regularly arise. We will close by describing a sampling of underexplored and unexplored research topics that exist for BI academics today. We hope that over time, the *International Journal of Business Intelligence Research* will showcase work in these areas.

Global BI

The use of BI is uneven around the world (Watson and Swift, 2002). In North America and Northern Europe (i.e., Norway, Sweden, and Finland), BI is well entrenched, as it is in Hong Kong. This is less true in Central and South America and especially in Africa. These differences may result from dissimilar states of economic development, competitive forces, or cultures, among other reasons. The global diffusion of BI needs to be investigated empirically.

For example, customer relationship management is a popular BI application that requires the collection and use of transaction, demographic, financial, and psychographic data to drive customer interactions. A major event such as the purchase of a home or retirement may trigger a set of offers that are tailored to that person. In some counties, such as China, there are culturally determined hesitancies about collecting and using personal data; some countries are bound by legal constraints (e.g., privacy laws); and some countries find that behavioral norms from other geographies are simply not applicable. At Continental Airlines, for example, North American revenue management models are not used in Japan because Japanese ticket sales through travel agents have unique behavior patterns, and the mainstream analytics are not helpful.

Multi-national companies and vendors that sell BI products and services globally need to understand what practices can and cannot be replicated around the world, and for what reasons. Ultimately, academics need to explore global BI with the objective of discovering how to better diffuse and tailor BI across diverse global settings.

BI for Decision Making

BI is implemented to help decision makers make better decisions, but there is still much to learn about the design of BI for decision making, where BI fits within the decision making process, and, ultimately how and why BI makes a difference.

A critical facet of BI design is the BI interface, which includes the display of data. Edward Tufte (2001) suggests that the display of information significantly can impact the way in which data is interpreted and applied. Although some studies empirically have compared the impact of various interface designs within a context of decision support (e.g., Dos Santos & Bariff, 1988; Todd & Benbasat, 1992), much more work is needed. As new displays of data become popularized in BI, such as heat maps and animation, we need to understand how to leverage them appropriately.

At Norfolk Southern, system developers spend a great deal of time researching and testing out the designs of BI user interfaces. They believe that the BI interface impacts user acceptance and use, as well as decision making outcomes; however, it is still unclear exactly what designs best support various BI needs. As BI becomes more pervasive and companies attempt to deliver BI applications to the masses, including customers and suppliers, there is a greater need to understand how to design BI to be easy to use and to be applied correctly.

Also, practitioners need a better understanding of how metadata should be incorporated into interfaces and the BI infrastructure. Practice recognizes that metadata is critical for BI because system users and designers need to understand the meaning and nuances of data before it can be used in appropriate ways (Foshay, 2007). More academic work addressing metadata can help further our understanding of what metadata strategies to apply for BI and why.

Much is known about the decision making process in general and important concerns that adversely impact the decision making process (e.g., managerial biases, information overload) (Bazerman, 1986; Hammond, Keeney, & Raiffa, 2006). Given this understanding, academics need to help translate existing knowledge about decision making into structures, processes, and designs that improve the effectiveness of BI. And, as BI data moves from being highly quantitative to encompassing documents, video, and other unstructured data formats, research is needed to understand how to use this data to make decisions – and whether emerging technologies like BI search engines, visualization, text mining, mash-ups, and semantic webs help improve decision outcomes.

Organizing for BI

Traditionally, IT organizations contain a group (or groups) of employees dedicated to delivering decision support applications and maintaining data warehouse infrastructures. There are several trends that challenge separating BI into its own organization structure(s). For example, the movement to real-time BI transforms decision support into more of an operational function, which requires operational service levels, skillsets, and structures. IT leaders are struggling with how to organize their IT organizations to address this shift. Research is needed to understand how changing IT roles and capabilities translate into new kinds of organizational designs and processes. Should areas of BI (e.g., the data warehouse group) be folded into operational units within IT? Are designs like BI competency centers (Zeid, 2006) effective ways for building organizational capabilities in BI?

Further, as BI becomes more pervasive within the enterprise, practitioners need to understand how to roll-out BI to larger audiences in cost effective ways. Will investments in training, communication strategies, interface designs, or process change help pervasive BI efforts deliver greater value to the organization? How can BI be embedded within front-line processes as well as emerging social networking communities?

These few areas – global BI, BI for decision making, and organizing for BI – are among many areas that are ripe for exploration by academics interested in furthering our understanding of the field. It is fascinating to consider the progress made on the path from decision support in the 1960's to BI today. But, even more fascinating is the opportunity for academics who seek to further our understanding of the future.

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ENDNOTE

[1] It should be pointed out that some authors use the term BI to refer to getting data out, and the term data warehousing to refer to getting data in. There are also some authors who use the term data warehousing to refer to both getting data in and getting data out, much like we are using the BI term. The good news is that the differing terminology does not normally cause confusion because of the context in which the terms are used.

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