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Business Intelligence Technology



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MPCS Opinion

At a time of great economic volatility, managers and executives of most midsize organizations or corporate departments have experienced a significant decrease in the ability to rely effectively only on experience or intuition to make decisions. They are finding that old cause-and-effect mental models are becoming less relevant, while the demand to respond faster and with greater insight to ongoing internal and external events based on facts is increasing. As a result, more organizations, in both commercial and public sector industries, are turning to business intelligence (BI) and data warehousing collectively referred to as **business analytics solutions**.

As evidence of the value of BI solutions to drive competitive differentiation mounts, leading organizations have recognized the need to take full advantage of all the available relevant information to raise the level of BI of their entire workforce.

However, many organizations are constrained by the current realities of having to do more with less. IT budget and staff cuts in the recent past are exacerbated by an environment of growing data volumes and growing numbers of business end users requesting access to information to improve their own decision-making capabilities. In addition, many midsize organizations simply lack the staff with the necessary expertise in deploying and supporting BI and data warehousing technology. Many are now looking for more prepackaged solutions that enable rapid deployment and optimized system performance, as well as simplified technology acquisition and support options to these increasingly critical decision support and decision management systems own software development project.



Business Intelligence

Business intelligence, or BI for short, is an umbrella term that refers to competencies, processes, technologies, applications and practices used to support evidence-based decision making in organizations. In the widest sense it can be defined as a collection of approaches for gathering, storing, analyzing and providing access to data that helps users to gain insights and make better fact-based business decisions.

What is BI used for?

Organizations use Business Intelligence to gain data-driven insights on anything related to business performance. It is used to understand and improve performance and to cut costs and identify new business opportunities, this can include, among many other things:

- Analyzing customer behaviors, buying patterns and sales trends.
- Measuring, tracking and predicting sales and financial performance
- Budgeting and financial planning and forecasting
- Tracking the performance of marketing campaigns
- Optimizing processes and operational performance
- Improving delivery and supply chain effectiveness
- Web and e-commerce analytics
- Customer relationship management
- Risk analysis

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- Strategic value driver analysis

The Basics of Business Intelligence

The basic components of Business Intelligence are gathering, storing, analyzing and providing access to data (see **Figure 1 below**).



Figure 1: BI Basic Components

Gathering Data

Gathering data is concerned with collecting or accessing data which can then be used to inform decision making. Gathering data can come in many formats and basically refers to the automated measurement and collection of performance data. For example, these can come from transactional systems that keep logs of past transactions, point-of-sale systems, web site software, production systems that measure and track quality, etc. A major challenge of gathering data is making sure that the relevant data is collected in the right way at the right time. If the data quality is not controlled at the data gathering stage then it can jeopardize the entire BI efforts that might follow – always remember the old adage - garbage in garbage out.

BI Architecture

A typical architecture for supporting BI within an enterprise is shown in **Figure 2** (the shaded boxes are technology that we focus on in this article). The data over which BI tasks are performed often comes from different sources—typically from multiple operational databases across departments within the organization, as well as external vendors. Different sources contain data of varying quality, use inconsistent representations, codes, and formats, which have to be reconciled. Thus the problems of integrating, cleansing, and standardizing data in preparation for BI tasks can be rather challenging.

Efficient data loading is imperative for BI. Moreover, BI tasks usually need to be performed incrementally as new data arrives, for example, last month's sales data. This makes efficient and scalable data loading and refresh capabilities imperative for enterprise BI. These back-end technologies for preparing the data for BI are collectively referred to as Extract-Transform-Load (ETL) tools. Increasingly there is a need to support BI tasks in near real time, that is, make business decisions based on the operational data itself. Specialized engines referred to as Complex Event Processing (CEP) engines have emerged to support such scenarios.

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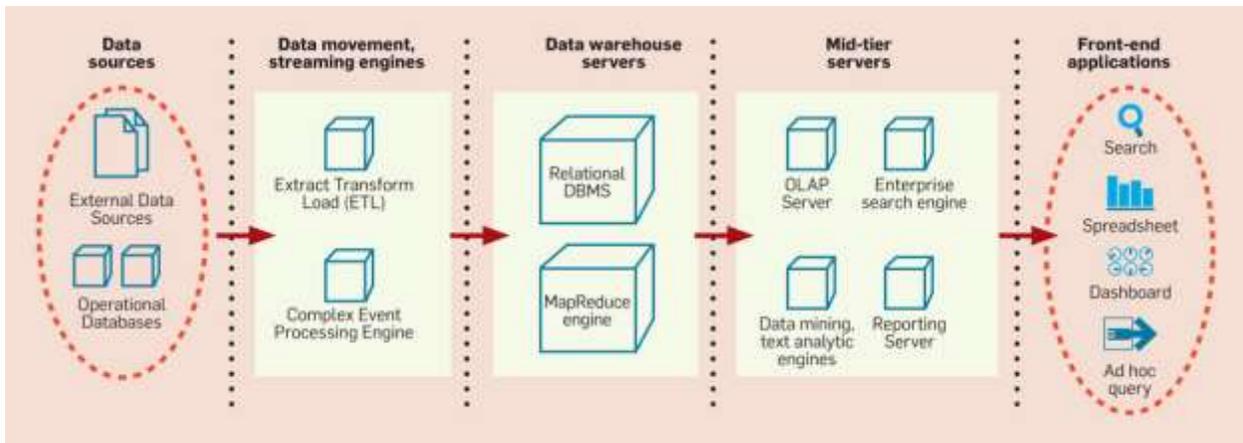


Figure 2: Typical Business Intelligence Architecture

Storing Data

Storing Data is concerned with making sure the data is filed and stored in appropriate ways to ensure it can be found and used for analysis and reporting as shown in **Figure 1**. When storing data the same basic principles apply that you would use to store physical goods – say books in a library – you are trying to find the most logical structure that will allow you to easily find and use the data. The advantages of modern data-bases (often called data warehouses because of the large volumes of data) is that they allow multi-dimensional formats so you can store the same data under different categories – also called data marts or data-warehouse access layers. Like in the physical world, good data storage starts with the needs and requirements of the end users and a clear understanding of what they want to use the data for.

Analyzing Data

The next component of BI is analyzing the data is shown in **Figure3 & 4**. Here we take the data that has been gathered and inspect, transform or model it in order to gain new insights that will support our business decision making. Data analysis comes in many different formats and approaches, both quantitative and qualitative. Analysis techniques includes the use of statistical tools, data mining approaches as well as visual analytics or even analysis of unstructured data such as text or pictures.

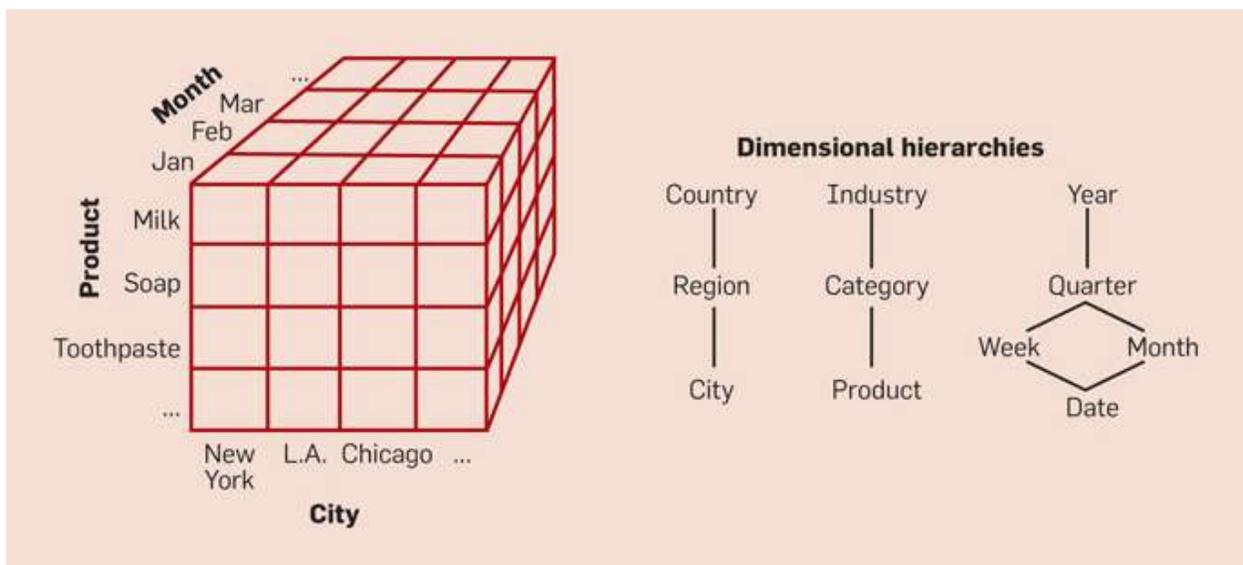


Figure 3: Multidimensional Data

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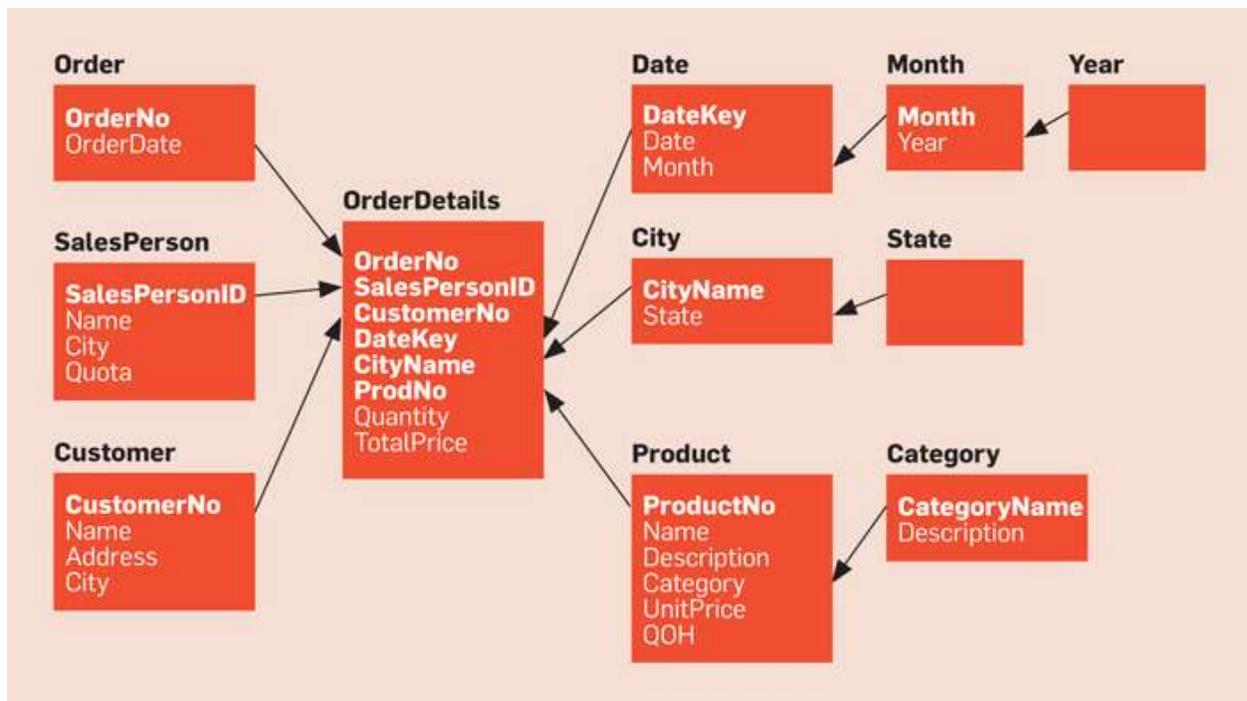


Figure 4: Snowflake Schema

Providing Access

In order to support decision making the decision makers need to have access to the data. Access is needed to perform analysis or to view the results of the analysis. The former is provided by the latest software tools that allow end-users to perform data analysis while the latter is provided through reporting, dashboard and scorecard applications.

Business Intelligence is more than Software Tools and Technology

The term Business Intelligence is often used in a very narrow way to refer to software applications used to analyze an organization's raw data. Terms often associated with BI in an IT sense are data mining, online analytical processing, querying and reporting. In fact, ownership of BI is very often in the IT functions of companies. The reason for this is not that they possess the best analytical capabilities but because they are overseeing the implementation of software tools – so called Business Intelligence (BI) applications.

The problem is that despite huge investments in BI software and solutions in recent years many organizations are still failing to convert data into strategically valuable knowledge. IT infrastructure and software alone cannot make this happen – BI must be owned by business leaders and managers who are supported by IT. Having said this, today's BI applications come with a lot of out-of-the-box functionality that allows managers to start analyzing data even without the help of statisticians and IT professionals. Some key BI vendors are IBM Cognos, Information Builders, Microsoft, Micro Strategy, Oracle, SAP, and SAS. For more information and our opinions on their products see the software section of our Knowledge Hub.

Becoming an 'Intelligent Company'

Business Intelligence should sit within the overall approach to enterprise performance management and help make companies more 'intelligent' (see also our outline "What is Performance Management" for more information or the book "The Intelligent Company").

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Extensive research by the Advanced Performance Institute has identified that there are five essential steps to becoming a more intelligent company (**see Figure 5**):

- Step 1: More intelligent strategies – by identifying strategic priorities and agreeing your real information needs.
- Step 2: More intelligent data – by creating relevant and meaningful performance indicators as well as qualitative management information linked back to your strategic information needs.
- Step 3: More intelligent insights – by using good evidence to test and prove ideas and by analyzing the data to gain robust and reliable insights.
- Step 4: More intelligent communication – by creating informative and engaging management information packs and dashboards that provide the essential information, packaged in a way that is targeted and easy-to-understand.
- Step 5: More intelligent decision making – by fostering an evidence-based culture of turning information into actionable knowledge and real decisions.



Figure 5: Essential BI Steps

These five steps are taken from my book 'The Intelligent Company: Five Steps to Success with Evidence-Based Management' in which I discuss and describe the key tools and best-practice skills that top-performing enterprises apply to become more successful. Here is an overview of each of the steps:

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Step 1: Identify the Strategic Objective and Information Need

In today's turbulent, unpredictable markets it can prove immensely challenging to identify the core strategic objectives of an organization. But it is only by doing so that it becomes possible to ensure that the analytics we generate are relevant to the organization's competitive positioning and support its greatest information needs. Intelligent organizations such as Tesco or Google have created strategic performance management frameworks to guide the collection and analysis of data. Tools such as Balanced Scorecards and in particular **Strategy Map** (see **Figure 6**) can be used to identify high level objectives. A world-leading retailer Tesco has clearly outlined its strategic priorities in a "Balanced Scorecard" called the [corporate steering wheel](#).

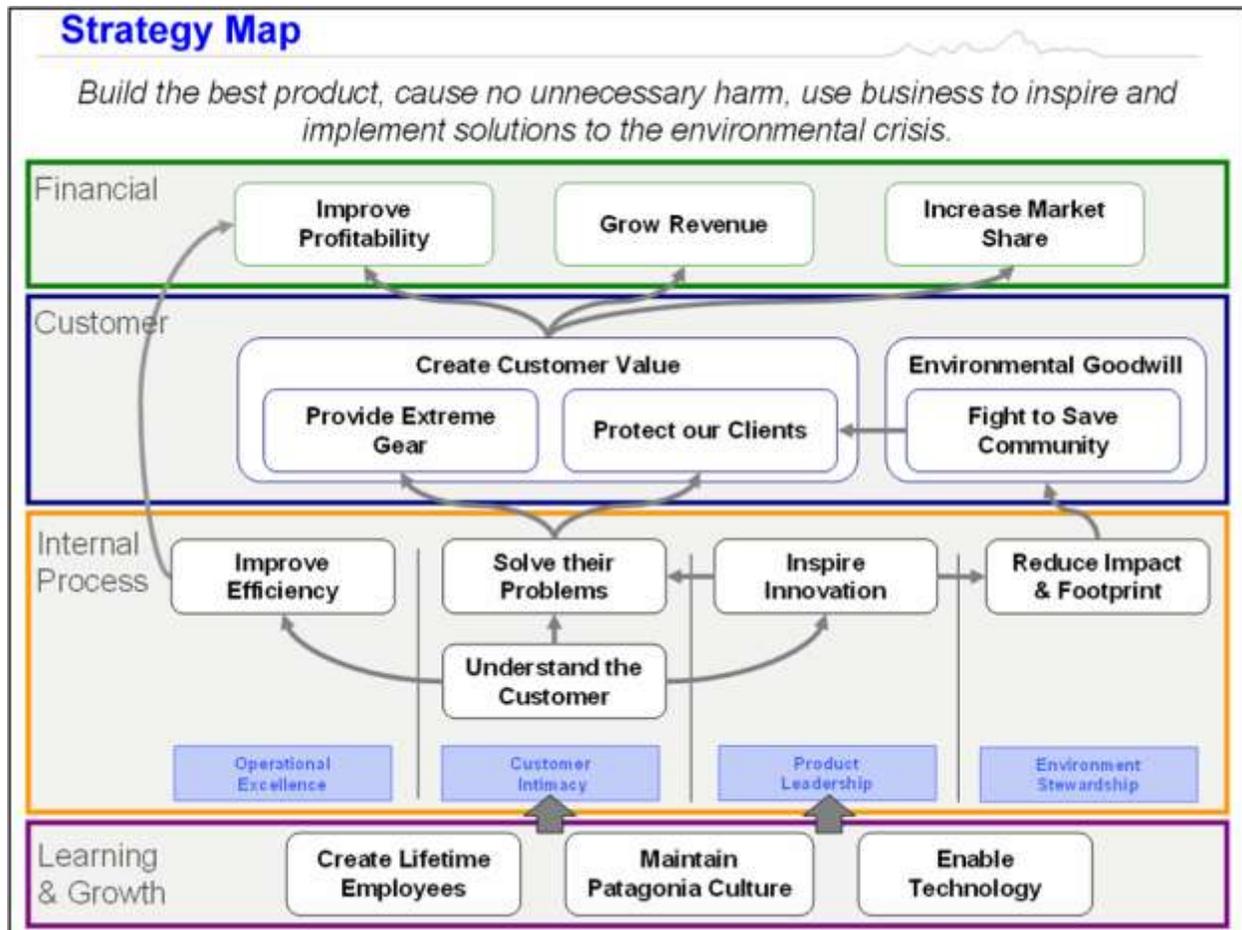


Figure 6: Strategy Map Example

Once a performance framework is in place any efforts to use data can be linked back to the strategy of the organization. That way, organizations don't waste valuable time analyzing something that doesn't really matter in the grander scheme of things. Any efforts in collecting and analyzing data need to be focused on:

1. The strategic objectives of the organization
2. The big un-answered questions in regard to those objectives.

The executive team in Google, for example, has identified the strategic priorities and then formulated a set of questions they as executives really needed to have an answer to. These questions are now used to frame the collection and analysis of data. Google's CEO Eric

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Schmidt makes it very clear that any major efforts to collect or analyze data should be linked to the strategic questions the executive team has formulated.

Step 2: Collecting and Organizing the Right Data

Once the data and information needs are clear we can start to collect the appropriate data and performance metrics that, in turn, will help to answer the strategic questions. In this second step organizations ensure that they gather and organize the right data. The emphasis here is on meaningful and relevant data to meet the information needs identified in step one. Organizations need to assess whether the data needed is already held in the organization or how to devise a best way to collect the data. A typical trap is to think of data as just numbers that come from the operational or transactional systems or those that are collected using over-simplified surveys or questionnaires. If organizations want to gain a robust picture of reality then they must keep in mind that data comes in myriad formats - sounds, text, graphics, and pictures are as much data as are numbers.

Moreover, there are many methodologies for collecting data, which can be quantitative (in that they are concerned with the collection of numerical data) or qualitative (concerned with the collection of non-numerical data). What I have learnt over the years is that the richest insights seem to come from key performance indicators that e.g. are:

1. Unique to the organization
2. Observing actual behavior

Take, for example, the insurance firm Progressive Insurance. The company was among the first to make extensive use of consumer credit scores as input to its automobile insurance underwriting. As competitors caught up with this technique the company has always found new and innovative ways of collecting and using data to gain a competitive edge. Tesco is another great example. With its “**Clubcard**” data it can now observe consumer trends in almost real time and gain insights quicker and in more detail than any of their competitors.

Step 3: Turning Data into Information and Insights

Data has to be analyzed and put into context in order to extract information and insights from it. In the same way as the data collection, analysis must support the core strategic objectives of the organization (as understood through step one). Central to the analytics process is the running of experiments to test assumptions.

- ***A best practice example of organizations that make good use of experiments are Yahoo and eBay.***

These organizations receive many millions of hits to their home pages each hour. To test new assumptions (in this case that making a certain alteration to the home page will change behaviors of visitors) they randomly assign one or two hundred thousand users to an experimental group and have several million other visitors as a control group. In eBay’s case simple A/B experiments (comparing two versions of a website) can be structured within a few days, and they typically last at least a week so that they cover full auction periods for selected items.

Step 4: Communicating Information and Insights

This fourth step focuses on communicating the information and insights extracted in step three. The main focus here is to get the information, in its most appropriate format, to the appropriate decision makers. I always stress the importance of keeping in mind the target audience and their needs when communicating. Even with proper and tailored analysis it is crucial that the visual presentation tools are clear, informative and compelling. We need to package information

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in ways that help recipients to understand they key messages. Different types of graphs and charts can be used as appropriate, such as pictographs, tally charts, bar graphs, and histograms, scatter plots, line graphs and pie charts, as some examples. Moreover, it is important to use more narratives which provide context and meaning to the data. Using graphs and narrative together enable the telling of the story, which neither can fully do in isolation.

Step 5: Turning Information into Actionable knowledge

Amassing knowledge, however insightful or compelling, in and of itself is of little value unless it is turned into action. Decisions have to be made and acted upon. Making this happen often requires a wholesale reworking of the process for turning knowledge into action. This oftentimes needs a cultural transformation that might include, as examples, ensuring that:

- the organization has a passion for learning and Improvement
- there is an unswerving leadership buy-in to the principles of being an intelligent company
- there are widespread analytical capabilities within the organization
- there is a willingness to share information

The five sequential steps of this framework provide a blueprint for Business Intelligence. However, the logic of good evidence-based decision making is not just linear (from step one to step five) but there is a feedback loop between the last and the first step (from step five to step one). Once learning has taken place and decision have been made they in turn inform future information needs.

Which Companies use BI to become more Intelligent?

There are intelligent retailers such as Wal-Mart and Tesco are heavy users of BI. Take the above mentioned Tesco, for example, who has become the second most powerful retailer on the planet. This has not happened by chance but through applying the principles of an intelligent company. Tesco have identified two factors above all: making sure everyone in the company is actively engaged in trying to improve performance - all the time; and having the data and analytical skills to test ideas and turn insights into customer and business relevant actions.

Tesco's Chief Executive Officer puts it in simple terms: **"never stop listening to your customers and giving them what they want"**. This Tesco philosophy is captured in the phrase 'Every Little Helps' and which is more than just a slogan: "Every Little Helps is behind everything we do. It's not just something we say, we really do mean it." To guide their business intelligence activities, Tesco has adopted the Balanced Scorecard. The Tesco Balanced Scorecard, which they call the Corporate Steering Wheel, clearly outlines its strategic priorities. With the performance framework in place, any efforts to collect and analyze data can be linked back to the strategic objectives of the organization. That way, Tesco doesn't waste valuable time analyzing something that doesn't really matter in the grander scheme of things. If you want to read the full case study then you can download it from our case study library.

Restaurant chains such as McDonalds, CKE and T.G.I. Friday's have successfully applied the principles of an intelligent company. They use BI to make strategic decisions, such as what new dishes to add to or remove from their menus and which underperforming stores to close. They also use BI for tactical matters such as renegotiating contracts with suppliers and identifying opportunities to improve inefficient processes.

At the US-headquartered CKE Restaurants, which includes major US brands such as the Hardees and Carl's Jr. quick-service restaurant chains, the process for new product introduction calls for rigorous testing at a certain stage? Testing begins with brainstorming, in which several cross-functional groups develop a variety of new product ideas. Only some of them make it past the next phase, judgmental screening, during which a group of marketing, product development, and operations people will evaluate ideas based on experience and intuition. Those that make

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the cut are actually developed and then tested in stores, with well-defined measures and control groups. At that point, executives decide whether to roll out a product system wide, modify it for retesting, or kill the whole idea. CKE has attained an enviable hit rate in new product introductions—about one in four new products is successful, versus one in 50 or 60 for consumer products—and executives say that their rigorous testing process is part of the reason why.

Yahoo Inc. is another intelligent company that used BI effectively to improve their website. The organization receives many millions of hits to its home page each hour. To test alteration to the home page they randomly assign one or two hundred thousand users to an experimental group and have several million other visitors as a control group.

By doing so, they can quickly see whether or not the alterations to the home page leads to the assumed change in the behavior of the customer. This in turn allows them to optimize their offerings to enhance revenues and profits. The results of these experiments can often be seen within minutes, and Yahoo! typically runs about 20 experiments at any given time. This way, the results of the analysis drive behaviors, cutting out lengthy discussions about website design best practices - which of course can be extremely subjective and biased?

Essential Guidance

One of the top 10 predictions made in 2011 was the emergence and adoption of business analytics appliances that focus on end user facing functionality of query, reporting, and analysis rather than only on data warehousing. In other words, **BI appliances {This term is used to define a technology offering that combines some form of software with some form of either hardware or other platform software (see Wikipedia URL: http://en.wikipedia.org/wiki/Computer_appliance }** are expected to become the next phase in the broader trend toward more prepackaged technology solutions deployed to support information access, analysis, and decision-making processes.

Several decision-making process, organizational behavior, and technology issues need to be considered when evaluating decision support and decision management requirements. For each of these three variables, any opportunity to simplify the effort involved as part of the overall project should be considered. However, only a subset of all decision processes and very few organizational behavior issues lend themselves to prepackaging. Therefore, it is the focus on the technology variable where organizations have the opportunity to derive efficiency from their BI projects.

Thus, we recommend including prepackaged offerings, such as BI appliances, on the short list of technologies to be evaluated to support information access, analysis, and decision support needs. The benefits of leveraging the know-how of technology vendors in optimizing the specific software on a specific hardware platform can be significant in mitigating project risk and controlling initial project costs and ongoing support and maintenance costs.

A BI appliance can also help kick-start a project faster than an equivalent custom-built product by eliminating certain steps in the acquisition and deployment of software and hardware. The speed to deployment is an important variable in any BI project because by their very nature, BI projects are iterative it is difficult to predict all the various decision support requirements.

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BI Selection Requirements

When deciding whether to consider a BI appliance, midsize organizations should reflect on some of the following questions:

- How many users require access to the BI appliance? Not all employees are analysts whose primary role is to slice and dice data. However, every employee makes decisions, whether strategic or tactical, and therefore, organizations should ensure appropriate access to the relevant information at all levels.
- What types and levels of support are provided by the IT vendor or vendors? Does one of the vendors take the lead in the support process to ensure that the communication process is streamlined? Nobody benefits from "finger-pointing" or passing on the blame for a customer complaint to another party. A single point of support is one of the key value propositions of an appliance.
- What is the expected direct technology maintenance cost for the BI appliance compared with a technology solution built from individual components onsite? An appliance not only provides an initial prepackaged technology product but also helps in clarifying the forward path to scale the system, including expected future technology upgrade and maintenance costs.
- What types of internal BI technology skills exist in our organization? Are there appropriate skills to build the BI environment from several individual components? Are there enough experts to deliver desired functionality in a timely manner?
- Does our existing BI technology solution include all the necessary functionality to support both individual information access and analysis and collaborative decision making?

By considering the guidance provided in this document, midsize organizations will be well served in their BI and data warehousing technology selection processes, which should take into account the currently available prepackaged software and hardware solutions.

About the Author

Michael McCormick founder of MPCS, Inc and Management Professional with 35 years of experience managing over \$4 billion in projects for both the Commercial and Federal Government sectors and is a well-known project management (PM) author, consultant, and authority on the subjects of Construction Management (CM), Facility Management (FM), Business Process Management (BPM), Project Management Office (PMO) and Project Portfolio Management (PPM), Risk Management (RM), software development and technology integration.

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