

Improving Organizational Decision-Making Through **Pervasive Business Intelligence**

The Five Key Factors That Lead to Business Intelligence Diffusion



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EXECUTIVE SUMMARY

Evidence of the competitive value of business intelligence (BI) and analytics solutions is growing. BI and data warehouse (DW) tools and analytic applications — a set of technologies and processes that IDC refers to as business analytics — are being deployed to support decision making. An increasing number of organizations are making BI functionality more pervasively available to all decision makers, be they executives, staff employees, managers, or suppliers. But having BI be pervasively available in an organization means much more than distributing reports to all stakeholders.

In some cases, BI solutions are deployed to automate an existing way of making decisions. In other cases, BI solutions are deployed to change the way decisions are made. The change involves moving from decision making in which the variables that go into the decision are unarticulated and estimated to decision making in which the variables are articulated and supported by historical values. This point highlights the importance of defining pervasive BI as more than dissemination of information to all. It is quite possible that using BI with incorrectly specified models or misunderstood data is worse than not using BI in the first place. In this study, IDC set out to:

- ☒ Define pervasive BI and its key indicators
- ☒ Identify the key influencers of pervasive BI
- ☒ Highlight best practices for moving along the path to pervasive BI

IDC's research, which was based on in-depth interviews with 22 leading organizations and a survey of 1,141 additional organizations across 11 countries, resulted in the following definition of pervasive BI:

Pervasive business intelligence results when organizational culture, business processes, and technologies are designed and implemented with the goal of improving the strategic and operational decision-making capabilities of a wide range of internal and external stakeholders.

We identified six indicators of pervasive BI:

- ☒ **Degree of internal use** by employees from different levels and departments of an organization
- ☒ **Degree of external use** by stakeholders such as customers, suppliers, and government agencies
- ☒ **Percentage of power users** or employees who are very familiar with the functionality of the BI software, who use it regularly, and whose primary task is to analyze data and provide decision support to other staff members or management
- ☒ **Number of domains** or subject areas within the primary data warehouse
- ☒ **Data update frequency** or the appropriateness of the DW update frequency to support business decision-making needs
- ☒ **Analytical orientation**, an indicator that consists of responses to several questions dealing with information sharing, importance of and reliance on analytics for decision making, and the influence BI has on an employee's actions

Organizations embarking on or continuing on their path toward pervasive BI need to decide how to allocate their scarce human, capital, and IT resources to tasks and projects that have the biggest impact on increasing the diffusion of BI throughout their organizations and to their external stakeholders. There are large capital and human costs in assembling, cleaning, staging, and analyzing data as well as disseminating and presenting information. There are additional costs in introducing and supporting the business analytics technology.

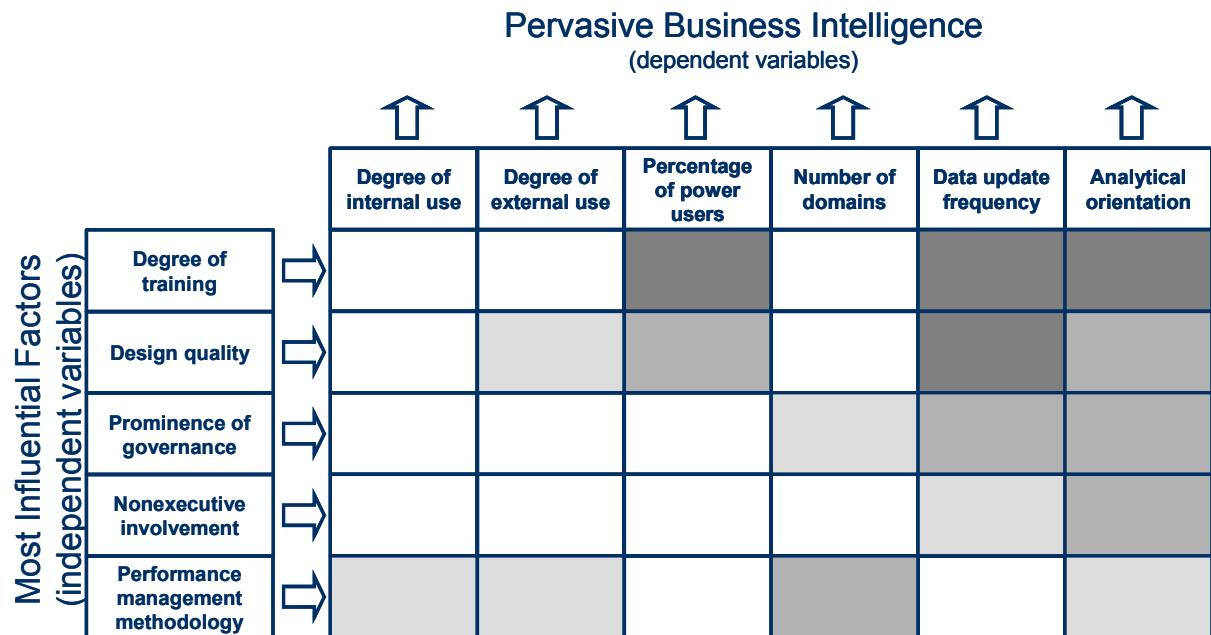
IDC research identified five key factors as having the strongest influence on BI pervasiveness. These factors include technology, business process, and organizational behavior capabilities that have positively influenced BI pervasiveness at some of the leading organizations in the world. These factors, which are shown on the vertical axis of Figure 1, are as follows:

- ☒ **Degree of training** is a factor that consists of responses to questions about the satisfaction level with training on the meaning of data, the use of BI tools, the use of analytics to improve decision making, and other related enabling indicators of training.
- ☒ **Design quality** refers to the extent to which end users' expectations about the speed of adding various BI solution components by the IT group are met.
- ☒ **Prominence of performance management methodology** (referred to in Figure 1 as performance management methodology) is based on the existence of and the level of importance within the organization of a formal performance management methodology.
- ☒ **Nonexecutive involvement** consists of the level of nonexecutive management's involvement in promoting and encouraging the design and use of the BI solution at the organization.
- ☒ **Prominence of governance** refers to the existence of and the importance of a data governance group and associated data governance policies to BI system design or enhancement initiatives.

The model that is shown in Figure 1 depicts the relationship between the six pervasive BI indicators (dependent variables) and the five key factors leading to pervasive BI (independent variables).

FIGURE 1

The Five Factors of Influence



Note: See the Regression Analysis section in Appendix B.

Source: IDC, 2008

The color coding used in Figure 1 identifies which independent variables have a statistically significant impact on the corresponding dependent variable. The three levels of shading represents the level to which a unit change in a given independent variable affects a change in the dependent variable. For example, Figure 1 shows that statistically the degree of internal use of the BI solution can be affected most by focusing on deploying and encouraging the use of a performance management methodology. Percentage of power users can be affected most by focusing on training and design quality. Analytical orientation can be affected by focusing on all five factors — degree of training, design quality, prominence of governance, nonexecutive involvement, and prominence of performance management methodology. However, degree of training will have the biggest impact and design quality the second biggest impact on analytical orientation.

Training and related enabling factors have the strongest relationship with the pervasiveness of BI. The next most important factor seems to be design quality, followed by prominence of governance, nonexecutive management involvement in design and use of the BI solution, and prominence of performance management methodology. We found that while executive involvement serves as an important trigger to many BI projects, when it comes to the diffusion of BI solutions, executive involvement has (statistically) a weak relationship to BI pervasiveness.

We wouldn't anticipate organizations investing in all the factors to achieve pervasive BI unless there was some belief that they would eventually benefit from it. Therefore, as part of our research, we asked respondents to assess their organization's performance relative to that of other organizations in their industry by placing their organization in one of four performance quartiles. Our analysis shows that *analytical orientation* and *data update frequency* are statistically significant predictors of *performance*.

However, we must caution against placing too much trust in the relationship between BI and performance. First, a firm can invest in BI and still fall behind its competitors if the competitors are also investing in BI. Second, even if BI pervasiveness is critical to performance, it doesn't lead directly to performance. The firm must still sell products and service customers. Third, BI pervasiveness is only one of many factors that affect performance.

Nevertheless, the long-term trends suggest that the market is in the early stages of a BI solution adoption cycle that will extend the reach of various decision support and decision automation solutions to a broad set of user groups. These user groups will span all levels of an organization and will be involved in a spectrum of strategic and operational decision making. Some of these BI activities will be based on straightforward information access through reports, dashboards, or alerts to various devices. Other BI activities will include advanced analytic techniques for descriptive and predictive analysis of data.

We hope that the pervasive BI model presented in this study provides guidance and discipline to organizations looking to gain a competitive advantage through pervasive use of BI.

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Mr. Vesset served as the lead analyst for the IDC study on best practices in pervasive business intelligence. His research is currently focused on trends leading to wider and more effective use of business intelligence, data warehousing, and analytic applications — a set of technologies and processes IDC defines as business analytics solutions. Mr. Vesset has authored numerous research publications on business analytics and has been published and quoted in business and trade publications, including *Forbes*, *Investor's Business Daily*, *CFO*, *CIO*, *DM Review*, and *Intelligent Enterprise*. He is a frequent speaker at industry conferences and seminars worldwide and has over 15 years of experience as a user, implementer, and analyst of business intelligence software. Prior to joining IDC in 2000, Mr. Vesset was a consultant in the Enterprise Applications practice of Deloitte Consulting. He also has experience as a systems analyst at State Street Bank & Trust Co. Mr. Vesset earned an M.S. in management information systems and an M.B.A. from Boston University and holds a B.S. in finance from Babson College.

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Dr. Morris started the Analytics and Data Warehousing research service at IDC and coined the term "analytic applications" in 1997. In addition, Dr. Morris led a major study on the financial impact of business analytics, which examined the return on investment (ROI) of analytics projects at 43 sites in North America and Europe. Currently, Dr. Morris is exploring the relationship between business intelligence and business process automation — "intelligent process automation" — and the requirements for unified access to structured and unstructured data. Prior to joining IDC in 1995, Dr. Morris served in a variety of technical and management positions at Digital Equipment Corporation, where he specialized in software for application development. Dr. Morris has been an instructor in technical writing at Northeastern University and Bentley College and an assistant professor of philosophy at Colgate University. He earned a B.A. with distinction from the University of Michigan and a Ph.D. in philosophy from the University of Pennsylvania.

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SPONSORS

The following software, services, and hardware technology vendors, listed in alphabetical order, underwrote the research:

- ☒ Actuate Corporation
- ☒ Business Objects, an SAP company
- ☒ Cognos, an IBM company
- ☒ GoldenGate Software
- ☒ Information Builders
- ☒ Jaspersoft
- ☒ Microsoft
- ☒ Progress Software
- ☒ Spotfire, a division of TIBCO
- ☒ Tableau Software
- ☒ Tata Consultancy Services

PART I. PERVASIVE BUSINESS INTELLIGENCE: DEFINITION, REQUIREMENTS, AND BENEFITS

Introduction

The trend toward evidence-based decision making is taking root in commercial, nonprofit, and public sector organizations. Driven by increased competition due to changing business models, deregulation, or increased regulation in the form of new compliance requirements, organizations in all industries and of all sizes are turning to BI and DW technologies and services to either automate or support decision-making processes. An increasing number of organizations are making BI functionality more pervasively available to all decision makers, be they executives, customer-facing employees, line-of-business managers, or suppliers.

Despite the fact that the term *business intelligence* was first coined in 1958¹ and the first purpose-built BI software tools emerged in the 1970s, BI solutions do not seem to be pervasively used in any organization. However, some organizations are further along than others on the path toward pervasive BI. Organizations that are struggling with changing organizational structure and culture as well as business and IT processes and technologies can learn several lessons by examining the best practices employed by other organizations on their path toward achieving pervasive BI.

Trends in the Business Intelligence Solution Market

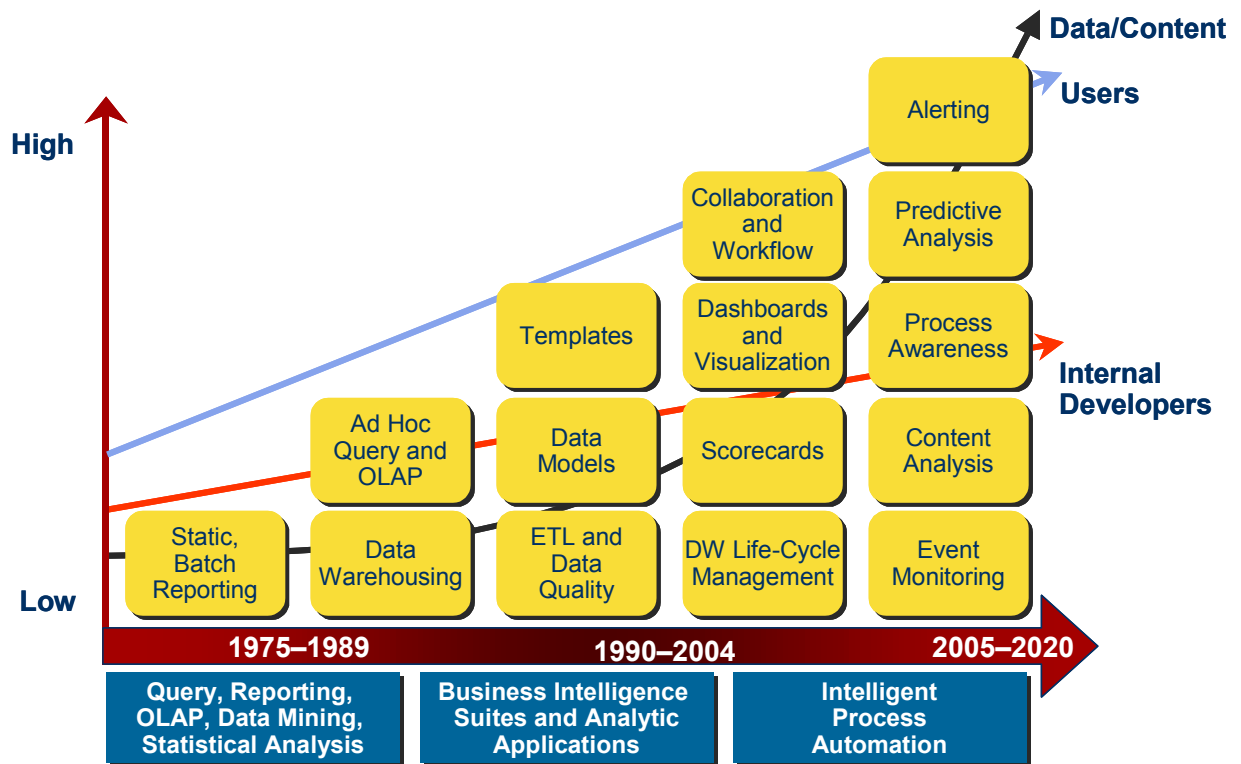
Pervasive BI, ambient BI, BI for the masses, democratization of BI, and operational BI are just a few of the terms used by technology vendors, consultants, and market analysts to describe the new wave of BI technology and process adoption.

The "New Wave" of Business Intelligence

IDC research suggests that the BI market has evolved in 15-year market cycles, as shown in Figure 2. The first market cycle occurred from 1975 to 1989, the second cycle occurred from 1990 to 2004, and we are now in the early years of the third BI market cycle. From the technology supply perspective, the first market cycle was characterized by the availability of basic reporting and statistical tools and the emergence of DWs. The second BI market cycle ushered in the period of client/server-based BI tools with visual interfaces for dedicated analysts. Most markets experience a typical S-curve pattern, with different levels of growth along the S-curve. IDC expects such a pattern to continue in the current (or third) 15-year market cycle.

FIGURE 2

IDC's Business Intelligence Market Evolution



Source: IDC, 2008

By 2005, the business analytics software market reached \$17.5 billion worldwide. There was widespread recognition that to expand the use of BI tools and processes, a new audience, beyond the dedicated analysts, had to be reached. At the same time, Web 2.0 technology began to permeate the corporate technology scene. The availability of new BI technology, a decade or more of operational application deployments, a shift to Web-based business models, and a new global competitive reality converged to signal the beginning of the new BI market cycle.

Although we did not set out to prove a causal link between pervasive BI and organizational performance, one of the research findings did lend further credence to the fact that analytical orientation, one of the indicators of pervasive BI, is a statistically significant predictor of performance. Nevertheless, if we make the assumption that pervasive BI is a desired destination toward which organizations should be moving, then we need to describe the identifiers of such a state and the controllable factors leading to more pervasive use of BI.

Business Intelligence Adoption Triggers

By the mid-2000s, a few of the leading organizations had begun to view BI and analytics as a means of creating competitive advantage. The experiences of these organizations have been captured in articles and books such as *Competing on Analytics*², *Super Crunchers*³, and *Hard Facts, Dangerous Half-Truths and Total Nonsense*⁴. In 2003 IDC released the findings of an ROI research project entitled *The*

Financial Impact of Business Analytics, which was based on interviews with 43 organizations in North America and Europe. As evidence mounted about the potential of BI and analytics to improve organizational performance, BI solution vendors, pushed by their leading customers, began to introduce new products and services to address the needs of a much wider audience of users. The triggers for making BI more pervasively available differ. They often include specific business events and new business process initiatives, which include:

- ☒ **Arrival of new executives.** New, information-hungry top managers who need to better understand past performance and evaluate potential future directions typically place new demands on existing BI solutions. IDC's research shows that the frustration of executives with the lack of timely answers to their questions often acts as a trigger for new BI projects. Several organizations interviewed by IDC launched new BI projects soon after the arrival of a new member of executive management. It is highly likely that executive turnover is a leading indicator for new BI projects, resulting in more pervasive use of BI solutions.
- ☒ **Need to comply with new regulations.** All industries face some level of government regulation, but some industries tend to be highly influenced by a multitude of compliance requirements. This triggers the need for better information access enabled by BI solutions. For example, at one financial services company, the new BI solution was instrumental to the company's ability to respond to government audits within a fixed time frame.
- ☒ **Introduction of a performance management methodology.** There are various performance management methodologies, including Six Sigma, balanced scorecard, and total quality management, as well as numerous methodologies developed by consulting companies and end-user organizations themselves. Introduction of such a performance management methodology tends to increase accountability of all employees because causes and effects of various tasks and processes are highlighted through quantifiable metrics. The need to support a new performance management methodology is fulfilled with various components of a BI solution that is made available to all employees whose performance measurements are affected by the new management methodology.
- ☒ **Corporate reorganization.** Reorganizations, including those due to mergers and acquisitions, often expose misalignment between business and IT organizational structures, creating an imbalance between the decentralized business operations and centralized BI management and support resources or vice versa. The need to eliminate such misalignment by clearly delineating responsibilities among IT, BI, and business groups often acts as a trigger for new BI projects. Disconnected projects, data, and staff resources are thus consolidated or federated, leading to more pervasive use of BI.
- ☒ **Change in the organization's growth phase.** A shift from a start-up mode to a mature growth mode often ushers in a need to begin investing in BI resources. A number of organizations researched by IDC shifted investment priorities from initial customer acquisition and development of supporting operational IT infrastructure to customer retention, more intelligent customer acquisition, and cost control projects that required an investment in BI technology and processes resulting in more pervasive BI.

Besides the aforementioned strategic triggers, there are as many operational BI project triggers as there are processes within the various industries. Some of these operational BI project triggers affect the whole organization, while others are confined to a single business unit or a department. As each BI project is launched, many needs and requirements surface that affect the project plan and direction and the diffusion of BI. A partial categorization of such needs and requirements gathered from IDC interviews of end-user organizations is included in Appendix A of this study.

Benefiting from the "New Wave" of Business Intelligence

In 2008 IDC launched a market research project to evaluate the best practices employed by some of the leading organizations in making BI solutions more pervasively available to all their stakeholders. We set out to answer two primary questions:

- ☒ What are the key indicators of pervasive BI?
 - ☒ What are the factors that management can influence to make BI pervasive?
-

Research Methodology

IDC's research began with the development of a measurement model based on end-user interviews and IDC's expertise in the BI market. Our goal was to identify dependent and independent variables that would help us define pervasive BI and the factors leading to it. The findings highlighted in this study are based on 22 end-user interviews and a survey of 1,141 additional end-user organizations across 11 countries conducted in mid-2008. See Appendix B for a description of the data collection and analysis methodology employed in this study.

Definition of Pervasive Business Intelligence

By synthesizing data from interviews with end users and BI technology and services vendors, with years of IDC experience in the BI market, we arrived at the definition of pervasive BI and identified specific characteristics of pervasive BI as outlined in the next section of this study. The definition states that:

Pervasive business intelligence results when organizational **culture**, **business processes**, and **technologies** are designed and implemented with the goal of improving the strategic and operational decision-making capabilities of a wide range of internal and external stakeholders.

This definition of pervasive BI comprises the following terms:

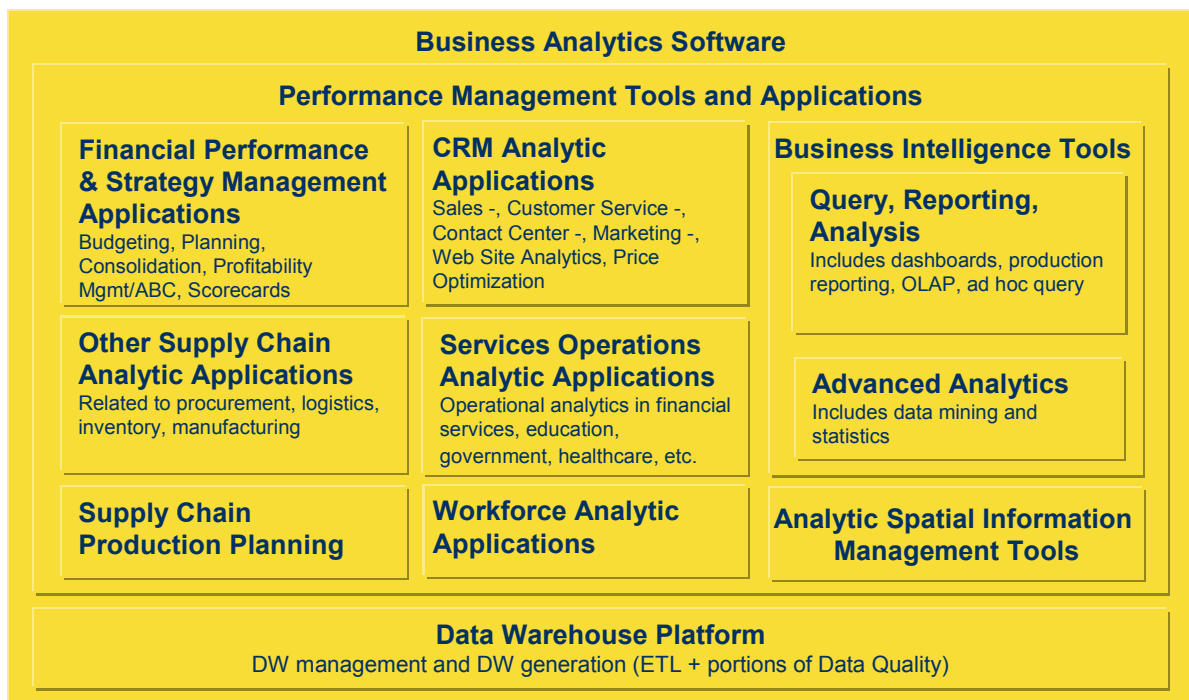
- ☒ **Culture.** To describe organizational culture, we use the definition developed by Edgar Schein, a professor at the MIT Sloan School of Management. According to Schein, "Organizational culture is a pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way you perceive, think, and feel in relation to those problems."⁵
- ☒ **Business processes.** We turned to Babson College professor Thomas Davenport for the definition of business process as "a structured, measured set of activities designed to produce a specified output for a particular customer or market. It implies a strong emphasis on *how* work is done within an organization, in contrast to a product focus's emphasis on *what* is done. A process is thus a specific ordering of work activities across time and space, with a beginning, an end, and clearly defined inputs and outputs: a structure for action. ... Processes are the structure by which an organization does what is necessary to produce value for its customers."⁶
- ☒ **Technology.** In the context of our research, we used IDC's business analytics taxonomy to describe all the related software tools and applications that are commonly deployed to support BI initiatives. Each BI initiative may also include several other applications, application development and deployment, and systems infrastructure software and associated hardware, such as servers,

storage, and data communication equipment. IDC defines the technology to support BI solutions as business analytics software, which includes two broad categories — the data warehouse platform and performance management tools and applications — as shown in Figure 3:

- ❑ The **data warehouse platform** is composed of data integration tools that are used for extraction, transformation, and loading (ETL) of data into a DW and DW management software that is used to store and process queries and execute analytical models.
- ❑ **Performance management tools and applications** are composed of end-user BI tools for reporting, dashboarding, multidimensional analysis, data mining and statistical analysis, and analytic applications. The applications differ from tools because they are prepackaged for specific business processes or industry decision-making tasks and include support for workflow management, prebuilt key performance indicators (KPIs), and templates for reports, dashboards, and scorecards.

FIGURE 3

IDC's Business Analytics Software Taxonomy



Source: IDC, 2008

The Six Key Indicators of Pervasive Business Intelligence

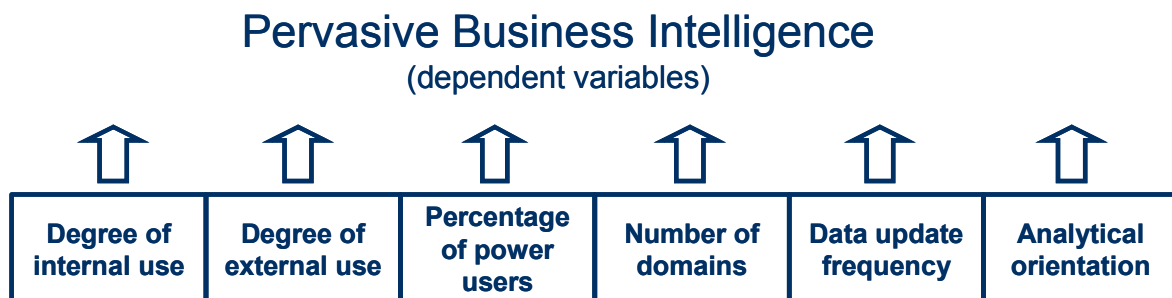
It was clear from our initial interviews that providing all employees with access to the BI software is not the only measure of pervasive BI. Using factor analysis or principal component analysis (PCA), we

found four principal factors and two additional variables that didn't factor with any other variable. As a result, we identified six dependent variables or indicators of pervasive BI, as shown in Figure 4.

While we discuss cause and effect based on our model constructs, we must be clear in stating that organizations that focus on improving an independent variable may improve a dependent variable, but our measurements are done with the assumption of how to best measure a variable, which may or may not be accurate. We are taking license to make claims of cause and effect based on the survey results as well as analyst experience. We further combine cross-tabular observations with more rigorous regression analysis.

FIGURE 4

The Six Key Indicators of Pervasive Business Intelligence



Source: IDC, 2008

1. **Degree of internal use** consists of the use of the BI solution in different departments and by users in various roles. This factor is based on questions about BI penetration across eight departments and five organizational roles. According to the research of Davenport and Harris², the theory behind measuring internal use is that as BI use becomes more pervasive, the number of employees using it will increase. The percentage of employees with access to the BI solution varies across departments and business roles. Based on survey results, the highest median penetration rate of employees with BI solution access is in the IT/IS department, followed by sales, marketing, operations, finance, customer services, human resources, and research and development/engineering. The percentage of employees with access to the BI solution also varies by employee role. Based on median results, the highest penetration of employees with BI solution access exists among managers, followed by analysts, executives, line-of-business operational employees, and customer-facing employees.

In addition to the survey results, our interviews uncovered a broad range of specific employees as users of BI solutions. These employees include sales managers; financial analysts; supply chain management personnel; service and warranty managers; executives; call center managers; regional and local retail office managers; district superintendents; school principals; school administrators and teachers (at the Palm Beach School District, the BI solution is deployed to, among others, 15,000 teachers); scientists; laboratory supervisors; hiring managers; university deans, trustees, and professors; marketing analysts; and fraud analysts and investigators. We found one of the highest levels of BI solution penetration at the Massachusetts Convention Center Authority, where 71% of all 175 employees have access to the BI solution.

2. **Degree of external use** consists of the use of the BI solution by external stakeholders. This factor is based on responses to the question about BI penetration across three external user groups: suppliers, customers, and regulatory agencies. According to the research of Davenport and Harris², the theory behind measuring the degree of external use is that as BI use becomes more pervasive, the number of external users will increase. In addition, information sharing through a BI solution can also strengthen relationships with clients based on codependence on a set of data and metrics that both parties incorporated into their respective decision-making processes. In situations where providing query and reporting functionality to external clients is a core part of an organization's business, there is an opportunity to use the BI solution functionality as a key feature of the service being sold. Citigroup Smith Barney's Global Stock Plan Services business unit effectively utilizes the BI solution available through its corporate client portal in its sales process.

Based on median results, the external group of stakeholders with the highest percentage of access to an organization's BI solution is customers, followed by suppliers and government agencies. These results vary by industry, and the percentage of external users with access to the BI solution tends to increase over time. In our research, we came across several examples of large numbers of external users in the financial services industry and in other business services industries. For example, Matrix Absence Management provides BI access to insurance brokers, benefits administrators from over 400 client companies, tens of thousands of individual employees of Matrix's client companies, and insurance carriers that have electronic interfaces with data coming from Matrix's DW.

3. **Percentage of power users** is based on responses to the question about the percentage of end users who are considered power users. Power users are defined by IDC as users who are very familiar with the functionality of the BI software, who use it regularly, and whose primary task is to analyze data and provide decision support to other staff members or management. As BI becomes more pervasive, the number of power users within an organization grows up to a certain level, which does not seem to be significantly affected by organization size or industry. The median percentage of internal users who are considered power users across all organizations surveyed was 20% and the mean was 28%.

There is a clear difference between the self-assessed level of competitiveness of an organization (our proxy for measuring organizational performance) and the percentage of power users. For example, the median percentage of power users at organizations that ranked themselves as least competitive in their respective industries was only 9.5% (compared with a 20% median for those who ranked themselves as being most competitive).

4. **Number of domains** is based on responses to the question about the number of domains in the DW, where domains were defined by IDC as subject areas. We analyzed both the number of domains and the growth in the number of domains. The theory behind this factor is that as BI becomes more entrenched within an organization, the organization will add additional domains to the DW. An organization may start with just a few domains in one department and then expand the number of domains within and across departments. As the number of domains increases, so does the number of users. The survey results show an increase in the mean number of domains in the DW from 11 in 2003 to 29 in 2008.
5. **Data update frequency** refers to the appropriateness of the DW update frequency to support business decision-making needs. There is a need for the data to be fresh enough to be meaningful to power users and information consumers. Without accurate, timely data, there is no desire to use BI. We also refer to this factor as *operational alignment* because it represents an alignment of the operational procedures regarding BI with business needs. In organizations with more pervasive BI, investments in resources that are necessary to understand and satisfy the data availability

requirements have been made and will be reflected in greater satisfaction with data update frequency in the DW. That is, if the update frequency is correct, it is because the necessary investments in understanding how BI can help and how to support it have been made.

In our survey, 23% of respondents indicated that they completely agree that the frequency with which data is updated in their organization's DW is sufficient to support business needs. This percentage increases to 30% for organizations that rank themselves in the top competitive quartile within their industry. This percentage was lowest among organizations in the aggregated education, government, and healthcare industry group and highest among organizations in the retail and wholesale industry group. For example, an online retailer interviewed by IDC as part of this study is an example of an organization that updates its DW in real time. Internal users at DIRECTV and Revol Wireless receive real time performance information that is derived from the real time data being captured in the DW.

6. **Analytical orientation**, or the degree to which the organization is analytical, consists of responses to questions on four topics: 1) importance of the organization's BI software and processes in helping improve individual decision making, facilitate *intra*-group decision making, and facilitate *inter*-group decision making; 2) degree to which the organization's management-level employees rely on analytics (as opposed to experience) for decision making; 3) level of criticality of the BI solution to the organization's competitiveness; and 4) extent to which the output of the organization's BI solution(s) influences employees' actions. The last point is especially important when evaluating any causal relationship between BI and organizational performance. Even the best designed and broadly deployed BI solutions will have little effect on the organization if users don't take appropriate action based on the information. Although each question is different, they all get at the underlying ability of the organization to use analytics. The theory behind this factor is that BI represents a way of making decisions. As BI becomes more pervasive, it changes how firms make decisions. In analytical firms, individual behavior and group behavior surrounding the use of BI processes and artifacts reflect this analytical paradigm.

In our survey, 21% of respondents indicated that the output of the BI solution is very influential on employee actions, as opposed to 2% who said it is not influential at all. The older the organization, the less influential was the output of BI solutions on employee actions. The longer the company has been using formal BI solutions, the higher the influence of its output on employee actions. There is a substantial difference in the level of influence the output of the BI solution has on employee actions between organizations that have a formal performance management methodology (74% very or somewhat influential) and those that don't (49% very or somewhat influential).

PART II. THE FACTORS THAT LEAD TO PERVASIVE BUSINESS INTELLIGENCE

Organizations embarking on or continuing on their path toward pervasive BI need to decide how to allocate their scarce human, capital, and IT resources to tasks and projects that have the biggest impact on increasing the diffusion of BI throughout their organizations and to their external stakeholders. Our research identified five key factors as having the strongest influence on BI pervasiveness. These factors include technology, business process, and organizational behavior capabilities that have positively influenced BI pervasiveness at some of the leading organizations in the world. These factors, which are shown on the vertical axis of Figure 1, are as follows:

- ☒ **Degree of training** is a factor that is based on responses to questions about the satisfaction level with training on the meaning of data, the use of BI tools, the use of analytics to improve decision making, and other related enabling indicators of training.

- ☒ **Design quality** refers to the extent to which end users' expectations about the speed of adding various BI solution components by the IT group are met.
- ☒ **Prominence of governance** refers to the existence of and the importance of a data governance group and associated data governance policies to BI system design or enhancement initiatives.
- ☒ **Nonexecutive involvement** consists of the level of nonexecutive management's involvement in promoting and encouraging the design and use of the BI solution at the organization.
- ☒ **Prominence of performance management methodology** or predisposition to analytical orientation is based on the existence of and the level of importance within the organization of a formal performance management methodology.

The color coding used in Figure 1 identifies which independent variables have a statistically significant impact on the corresponding dependent variable. The three levels of shading represent the level to which a unit change in a given independent variable affects a change in the dependent variable (see the Regression Analysis section in Appendix B of this study for more information). For example, Figure 1 shows that statistically the degree of internal use of the BI solution can be affected most by focusing on deploying and encouraging the use of a performance management methodology. Percentage of power users can be affected most by focusing on training and design quality. Analytical orientation can be affected by focusing on all five factors — degree of training, design quality, prominence of governance, nonexecutive involvement, and prominence of performance management methodology. However, degree of training will have the biggest impact and design quality the second biggest impact on analytical orientation.

Training and related enabling factors have the strongest relationship with the pervasiveness of BI. The next most important factor seems to be design quality, followed by prominence of governance, nonexecutive management involvement in design and use of the BI solution, and prominence of performance management methodology. As already mentioned, we found that while executive involvement serves as an important trigger to many BI projects, when it comes to the diffusion of BI solutions, executive involvement has (statistically) a weak relationship to BI pervasiveness.

Beyond the obvious relationships highlighted by the regression analysis, we found the data supported the distinction between factors we've talked about in this paper. Design quality, degree of training, prominence of governance, nonexecutive management involvement, and prominence of performance management methodology not only seem correlated with pervasive BI but also are statistically (and practically) distinct from each other. We suggest that management attend to each of these factors as distinct issues to affect BI pervasiveness.

Degree of Training

"The single biggest problem in communication is the illusion that it has taken place." George Bernard Shaw, writer

The *degree of training* has the strongest effect on the following pervasive BI indicators: *percentage of power users*, *data update frequency*, and *analytical orientation*. That is not to say that other indicators, such as the *degree of internal use* and *degree of external use* or the *number of domains*, are not affected by the *degree of training*, but statistically the influence of the *degree of training* is weaker on the latter three indicators. In our model, the *degree of training* does not refer simply to training on the use of BI software tools. Instead, it refers to an interrelated set of variables that organizations should consider as part of their overall BI program. These variables include:

- ☒ Level of satisfaction with training on the meaning of data, metrics, or KPIs; the use of the BI tools; and the use of analytics to improve decision making
- ☒ Level of ease with which end users learn how to use the organization's BI tools
- ☒ Extent to which individuals within a group, who are looking at data produced by their own business processes and systems and individuals from different groups, who are looking at data produced by other groups' business processes and systems, understand data, metrics, and KPIs
- ☒ The level of ease with which data from different organizational domains (e.g., manufacturing, finance, and human resources) can be correlated
- ☒ The level of executive management's involvement in promoting and encouraging the use of the BI solution

Organizations should be aware of the positive impact they can have on pervasiveness of BI when they improve the degree of training across all the elements described above. Results of IDC's analysis indicate that training on the use of data and training on the BI tools are independently important and additively important. Organizations have a choice to train users on the use of tools or the use of data. Although either type of training should increase BI pervasiveness, doing both types of training should have an even greater positive effect on BI pervasiveness.

Organizations are using a number of training methods, ranging from formal classes and computer-based training programs to publication of newsletters and intranet sites with frequently asked questions and other similar content. One of the most effective training methods we observed was the "train-the-trainer" technique. For example, to deliver its new BI solution to all school administrators and 15,000 teachers, the Palm Beach School District's BI team trained representatives from five schools on the new BI solution. These representatives trained their colleagues at the schools.

Using this method of working with a small group of initial business stakeholders, the BI group, regardless of whether it is a separate organizational entity or part of another group, seeks out and trains a few end users from each department or business unit. These "champions" then train their colleagues. This method is effective because it increases the overall number of trainers with expertise in BI tools as well as in business processes, operational data, and KPIs. We found in general that it is faster and less costly to train someone with business knowledge on the use of BI tools than vice versa. In addition, BI competency center (BICC) staff at organizations that achieved high levels of BI pervasiveness usually utilize internal marketing campaigns to promote the BI solution. These marketing efforts most often include emails and road shows. It sometimes falls upon the BI team to show business end users that "they don't know what they don't know."

Another important dimension of training is the ongoing availability of BI content metadata or information about the data, metrics, and KPIs. This metadata can be made available in the context of the BI tools being used or as a standalone reference source. The metadata can include information on the definition of KPIs, data lineage, time stamps, and other relevant descriptors. Assuming that organizationwide definitions of such BI content exist (for a discussion of the value of such definitions see the Prominence of Governance section), exposing the BI content metadata will assist in eliminating misunderstandings about the information made available through a BI solution. As much of BI content metadata as possible should be made available directly in reports or dashboards. This can be accomplished through something as simple as the inclusion of highly descriptive report titles or through features such as "pop-ups" of definitions of each metric and KPI on mouseovers and the inclusion of annotations. However, not all BI content metadata can be made available in the context of the BI tools. In those cases, the metadata should be posted to a centrally available intranet portal as a BI content dictionary or glossary,

to be maintained by a BICC and an internal governance body. Organizations should focus on enabling data correlation by end users rather than solely focus on the technical correlation of data. Technical steps can be taken to create a better environment for user understanding, but ultimately, training on how to use and relate the data must occur.

The fact that the *degree of training* has more influence on the *percentage of power users* than the *overall internal use* may seem counterintuitive. However, we came across several anecdotal proof points to substantiate this outcome. For example, organizations that do provide BI solutions to the majority of their internal employees make the BI software user interface so simple as to not require training. These organizations also make certain that the BI solution exposes enough descriptive metadata to ensure a clear understanding of all the information made available to end users.

It is perhaps obvious why a higher *degree of training* would lead to greater *analytical orientation* of an organization, but the link between the *degree of training* and *data update frequency* may not be as evident. As explained in Part I of this study, we refer to the *data update frequency* indicator also as *operational alignment* because if the update frequency is correct, it is because the necessary investments (including training) in understanding how BI can help and how to support it have been made. Thus, in organizations with more pervasive BI, the investment in a BI solution is reflected in greater end-user satisfaction with *data update frequency* in the DW.

Finally, because so much of the focus on the BI industry has been on power users, we hypothesized whether there is evidence to suggest that training more power users would lead to more pervasive BI. To test our hypothesis, we changed our initial model and looked at using the *percentage of power users* as an independent variable (rather than a dependent variable). Under this assumption, where *percentage of power users* is viewed as something that can be easily modified, we found that this variable is only moderately significant and weakly associated with *analytical orientation*. In other words, while organizations can explicitly train employees to become power users, it would entail a time-consuming and costly process that would yield minor benefits.

Design Quality

**"The art of progress is to preserve order amid change and to preserve change amid order."
Alfred North Whitehead, mathematician**

Design quality has the strongest effect on the following pervasive BI indicators: *degree of external use*, *percentage of power users*, *data update frequency*, and *analytical orientation*. *Design quality* refers to the extent to which end users' expectations about the speed of adding various BI solution components by the IT group are met:

- ☒ New data source
- ☒ New subject area or domain
- ☒ New report
- ☒ New metric, calculation, or performance indicator
- ☒ New dimension or hierarchy

A BI solution must be able to address not only the needs of various end-user groups but also those of the IT group in its effort to support the ongoing BI needs of end users. From a system design

perspective, the user interface is especially important to broader use of the BI solution. While logical understanding of the value of BI exists among most end users, the emotional attachment to a product (or service) leads to pervasiveness. We observed this phenomenon in several organizations.

When a BI solution is well designed, it is easier to add to it new data sources, new domains, new reports, new metrics, and new data hierarchies. The design quality can be viewed as a proxy for system flexibility and organizational agility in responding to ongoing decision support demands. Dissatisfaction with an IT group's ability to rapidly respond to new requests is the primary cause for end users to seek alternate BI solutions to those provided by central IT resources. Thus, insufficient design quality often leads to silos of information that don't follow data governance policies, decentralized purchasing of software by business groups, and the creation of "shadow" IT groups within business groups.

We believe that the statistical significance of design quality on external use can be explained by the fact that organizations that have chosen to provide BI access to their customers, suppliers, or partners become highly sensitive to the demands for information by these external parties (apparently more so than to the demands from internal information consumers). Thus, the codependence on the BI solution can affect relationships with external parties, making the focus on design quality an important strategic goal.

The needs of internal power users are different from those of internal information consumers. The exploratory nature of analytical tasks assigned to power users means that these users are often in need of new data sources or metrics or in need of the ability to view data through new dimensions. The BI solution *design quality*, thus, becomes key to the rapid response by the IT group to power users' requests.

A new report is the easiest of the aforementioned BI solution components to add. 21% of respondents indicated that the speed of adding a new report completely meets their expectations. This figure drops to 16% for adding a new dimension or hierarchy. Interestingly, younger organizations are more likely to meet end-user expectations for speedily adding new BI components. The more rigid processes of older organizations may explain this finding, because design quality is a function of both the technology platform and the systems development and deployment processes.

One of the keys to successfully influencing design quality is proper execution of the end-user requirements gathering process. Much has been written about the need for IT and business groups to collaborate. We not only can confirm this need but also can suggest some collaboration best practices. First, there is no question that the "if we build it, they will come" strategy does not work. When IT groups deploy DWs or reports without direct business end-user input, they find that these technology deployments remain idle or substantially underutilized. As one of the best-known management experts, Peter Drucker, once said, "There is nothing so useless as doing efficiently that which should not be done at all."

Asking end users for their BI system requirements usually results in a question from end users about what data is available, an unprioritized wish list of all possible information, or simply a request for electronic versions of previously available paper reports. We found that leading organizations evaluate end-user decision-making processes, not simply data requirements. In other words, they don't ask "What data do you need?" but rather "What decisions do you make?" They do so through a combination of interviews and systems monitoring, thus capturing information about ongoing decisions to help uncover opportunities for automating certain decision-making steps.

Constant monitoring of transactional data as well as decisions helps organizations develop rules, and monitor and modify them, to increase the amount of automation in operational decision making. Having said that, the iterative nature of BI projects makes the end-user requirements gathering process difficult.

A common characteristic of BI system design among leading organizations was the extensive use of rapid prototyping and the AGILE method of software development. This seems to be the only effective method to match IT development plans with frequently changing end-user requirements.

At Ferrari N.A., the new BI solution created a "sandbox" environment that encouraged a trial-and-error process that helped the BI team to ensure personalized delivery of BI capabilities to all the various decision makers. The ability to make quick, iterative changes using the company's BI toolset ensured a greater degree of BI pervasiveness.

One of the best practices IDC observed was the establishment of a technology architecture, whereby the technology components shown in Figure 2 are segmented into three primary layers: the data integration layer, the data management layer, and the information access and analysis layer. A service-oriented architecture (SOA) is used to enable communication among the layers. Each technology layer could be based on software from different IT vendors, or it could all be provided by a single vendor. Similarly, within any given layer, technology components could be provided by different vendors. IDC observed the highest level of software consolidation at the data integration layer of the technology stack and the most diversity in the end user-facing BI tools for query, reporting, and analysis. We want to emphasize that IDC did not conduct an exhaustive BI solution design evaluation as part of this research project, and therefore, we present the preceding observation as only one example of an effective solution design process.

We did not find evidence to indicate a difference in BI pervasiveness between organizations with single-vendor and multivendor strategies. Recent consolidation in the business analytics software market has moved some organizations toward fewer vendor relationships. However, there remain a large number of data integration, data warehousing, query, reporting, and analysis vendors, and IDC found that the vast majority of midsize and large organizations include software from multiple vendors in the design of their BI solutions. The tendency to rely on fewer BI vendors or a single BI vendor is more evident among smaller organizations.

An effective means to increasing the BI solution design quality is to set up a BICC. This is especially important at midsize and large organizations. Not all the organizations interviewed used the term *BICC*. Some called it a BI group, shared services group, or information management group. Most organizations struggled initially with questions such as the following: Where should we place the BICC? Should the BICC be in charge of data governance? Who should fund the BICC? What should be the responsibilities of the BICC?

We found that to be most effective, a BICC should be tasked with setting the BI strategy, developing and maintaining the logical BI architecture, assisting the data governance group, and interacting with business end users and technology suppliers. The most effective BICCs are relatively small, dedicated groups reporting to the primary operational business unit. For example, at the insurance firm Cardiff Pinnacle, it was the actuarial group; at Air Canada, it was the commercial group. These BICCs are staffed with only a few permanent employees with BI system design expertise and responsibility for internal and external relationship management. At one extreme, Cornell University was able to use less than half of a full-time equivalent staff member to support the KPI project and claims overall deployment time reduction of 75% for any new BI projects.

A BICC is, in effect, an internal consulting group. On the one hand, the BICC interacts with IT and external systems integrators to ensure appropriate technology availability. On the other hand, the BICC interacts with business unit liaisons. The strategy of having assigned individuals from business units

move back and forth between their line-of-business group tasks and tasks within the BICC seems to be the most effective method for ongoing information dissemination (i.e., collaboration).

At Merck, the 2006 introduction of Six Sigma, and the general need for faster and more flexible access to information to support decision making, resulted in the executive-level decision to create a BICC. The BICC, which became operational in 30 days, was tasked with the engineering of BI processes and the selection of automation tools to improve the efficiency of information management. Organizationally, the BICC was created outside the IT group and was composed of business staff, referred to as business integrators, including employees in finance, pharmaceutical product portfolio management, project management, and scientific workforce as well as BI tool specialists. All of the 7 core and 20 business unit members of the BICC are certified Six Sigma professionals who possess both BI tools configuration and business expertise. Historically, 9 months would pass between the time a request was submitted for a new report and when it was deployed. The BICC was able to reduce this time to 3 business days. Removing the operational hurdle of responding to new requests is leading to further adoption and higher satisfaction levels among the 3,500 business users of the BICC at Merck.

Finally, we found that the most effective BICCs are centrally funded for a base level of services, with any special project funding raised by the individual business groups. The funding issues are critical not only to staffing costs but also to software costs. It is important to ensure that the organization's software licensing agreement allows for the addition of a sufficient number of initial users from each of the departments. Once these "beachheads" have been established, it will be easier to ask the department for additional funding, should it request access to the BI solution for more of its employees. Once there is evidence that a tipping point has been reached and requests for access to the BI solution expand throughout the organization, it may make sense to negotiate an enterprisewide, unlimited licensing deal with the primary BI software vendor.

Prominence of Governance

"You are entitled to your own opinion, but you are not entitled to your own facts."

Daniel Patrick Moynihan, politician

If *design quality* is focused on the art of preserving change, then *prominence of governance* is focused on the art of preserving order. The *prominence of governance* factor refers specifically to the existence of and the importance of a data governance group and associated data governance policies to BI system design or enhancement initiatives. This factor has the highest influence on the following pervasive BI indicators: *number of domains*, *data update frequency*, and *analytical orientation*.

About 10% of organizations in our survey sample do not have a data governance group or associated data governance policies. A quarter of the organizations assign very high importance to governance. Large organizations tend to attach more importance to governance, as do organizations in the Asia/Pacific region. Organizations that have more experience with BI assign more importance to governance. Also, those organizations that rank themselves as more competitive within their industry tend to place greater importance on governance.

In 2006, a steering committee was set up at Cornell University to identify and evaluate all organizationwide KPIs used to support strategic and operational decision making. This top-down approach to data governance was a departure from the previous practice of allowing the individual colleges to determine which KPIs to use. This data governance initiative lasted for a semester and was followed by the creation of a technical team staffed with BI experts from the individual colleges and

central IT. By 2007, the KPI initiative became one of the highest-priority business and IT projects at Cornell.

The *prominence of governance*, the development of agreement on the meaning of data elements, and the subsequent need to train end users on what the data represents are key to the diffusion of BI solutions. Without governance, there may not be consensus regarding what the data means, thus guaranteeing BI a noncentral role in decision making. In some sense, when decision making is based on unarticulated, estimated data, decisions are made in an environment of strategic ambiguity — decision makers understand each other less than they think they do. Alternatively, in an environment where the data is much more explicit, ambiguity is stripped away. In data-intensive decision making, coordination is accomplished through consistent interpretation of the data.

In our interviews, data governance was the most frequently mentioned and biggest challenge in the context of BI projects. There are many questions that organizations need to address when thinking about data governance: Who owns the data? How do organizations establish a "single version of the truth"? Is there such a thing as a "single version of the truth"? Is a governance body the same as a BICC?

There are no easy solutions to data governance issues, and it is important not to underestimate the time and effort involved in bringing various internal parties into agreement about the meaning and value of data, metrics, and KPIs. Part of the problem is that in most sizable organizations, the division of labor has resulted not only in data silos but also in process silos, with no single person or group responsible for end-to-end processes and associated data. Another problem is that there are often legitimate internal policy or external regulatory compliance reasons for not being able to share or reconcile information across the entire organization. This is often evident in financial services and healthcare industries. Nevertheless, organizations should seek the proverbial "single version of the truth" as much as possible. This may not be a goal for all data elements because individual or group BI requirements may be highly specialized. Examples of where a single, organizationwide definition is critical are customer data and product data.

At Inchcape plc, data governance policies guide responses to all new end-user information requests. A local request that does not fit into the global data model will not be accepted, while those requests that do conform to established policy and are deemed essential to the whole company are incorporated into the BI solution. The central DW at Inchcape creates "the single version of the truth," which not only ensures data quality but also streamlines the previously time-consuming data collection and reconciliation processes. Following the implementation of data governance policies, Inchcape reported that the supporting technology, the collection and analysis of nonfinancial metrics, and easily consolidated financial metrics have played a pivotal role in improving its fact-based decision-making capabilities and have increased the pervasiveness of BI.

Our research suggests that a best practice is to set up a governance body as a virtual entity that is made up of employees with decision-making authority. Much of the job of the governance body, with the support of the BICC, is to explain, cajole, influence, placate, and otherwise bring different end-user groups into agreement about a common language for managing organizational performance. Thus, a governance body must show leadership in resolving any intergroup conflicts. John Boyd, a military strategist, said, "Leadership is the art of inspiring people to enthusiastically take action toward the achievement of uncommon goals." Organizations taking part in IDC's research can attest to the complexity of such a leadership role.

At the same time, it is not the job of the governance body to automate the data governance process — that should be the task of the BICC. Therefore, the governance body does not need to consist of full-time employees who are dedicated to only this job function. Many organizations effectively utilize external consultants as part of the governance body to help facilitate communication among internal user groups. The role of the BICC in the data governance process is to maintain a data dictionary or glossary; to ensure that reports, dashboards, and other end-user BI interfaces have a sufficient amount of metadata for end users to understand the meaning behind the metrics or KPIs; and to manage the technology governance process.

The combination of the governance body and the BICC results in an internal consulting or shared services group with a matrix structure that combines organizational behavior, business process, BI technology, and analytics skills. BI technology and analytics skills shouldn't be equated. It's one thing to know how to build a report and another to know how to analyze data.

Nonexecutive Involvement

"Most discussions of decision making assume that only senior executives make decisions or that only senior executives' decisions matter. This is a dangerous mistake."

Peter Drucker, business management expert

Nonexecutive involvement is a factor that consists of the level of nonexecutive management's involvement in promoting and encouraging the *design* and *use* (separately) of the BI solution at the organization. This factor has the highest influence on the following pervasive BI indicators: *data update frequency* and *analytical orientation*.

Based on our survey data, nonexecutive management is very involved in promoting, encouraging, and coordinating the *design* of BI solutions at 20% of organizations and is very involved in promoting and encouraging the *use* of BI solutions at 17% of organizations. Organizations that assess themselves as being more competitive have a higher level of *nonexecutive involvement*. This is also the case for large organizations compared with midsize organizations. Older organizations tend to have less *nonexecutive involvement*, yet organizations that have had more years of experience with BI solutions have higher levels of *nonexecutive involvement*.

Statistically, nonexecutive management's involvement in BI has more influence on the pervasiveness of BI than the involvement of executive management. The existing literature regarding BI and analytics suggests that executives must be involved in BI initiatives in order for them to lead to analytic organizations². Our research confirms that executives must be involved, but their involvement should be different from that of nonexecutive management. The biggest impact of executives is that they often act as triggers for new BI projects, while nonexecutive management can be more influential in driving these projects once they have been launched.

One of the key lessons from our research is the recognition of the importance of a "champion" to expanding the use of the BI solution throughout the organization. The "champion" could be a single person, or a small team of employees, with the vision and expertise to convince key business stakeholders about the potential positive impact that a BI solution could have on the performance of an organization. These BI project "champions," who persist in using a BI solution and encourage colleagues to do the same, most often come from the ranks of nonexecutive managers. The association of nonexecutive managers in meetings facilitates information sharing⁷ and, subsequently, BI solution diffusion.

At Air Canada, two years after the concept of a new BI solution emerged in the commercial branch, the custom portal remained a "side project" for one of the group's managers and her small team while she tried to show its value and highlight the problems with the old reporting system. Some of the initial new reporting results were very useful in convincing key stakeholders, such as the vice president of the commercial branch, that suboptimal decisions were being made due to a lack of the right information. Over the next five years, following the deployment of a new BI solution to support the information needs of newly available Six Sigma–certified staff, the number of business end users with direct access to the BI solution at Air Canada's commercial branch increased from a few power users to 700 internal employees of the commercial branch and to the company's corporate customers.

One of the common techniques for expanding the use of BI functionality is for the BICC to seek out a partner in one business group and provide that individual with information and BI tools that can give that person an advantage over his or her peers during meetings. There are many examples where the resulting "BI envy" leads those without the latest information and BI tools to request it from the BICC. However, it is important to note that the spread of BI tools and processes in an organization is not "viral," as some pundits would say. Unlike biological viruses, BI use does not spread simply by association. It requires the "unaffected" party to consciously agree to start using BI, which is likely to happen only if that party understands the data, understands the BI tool, and sees value in using both.

Prominence of Performance Management Methodology

"The real difficulty in changing any enterprise lies not in developing new ideas, but in escaping from the old ones."

John Maynard Keynes, economist

The *prominence of performance management methodology* factor is based on the existence of and the level of importance within the organization of a formal performance management methodology. This factor has the highest influence on the following pervasive BI indicators: *degree of internal use*, *degree of external use*, *number of domains*, and *analytical orientation*. We hypothesize that such formal methodologies predispose an organization to adopt BI processes as a way of achieving formal management goals.

Based on our survey sample, 70% of organizations use a formal performance management methodology. The percentage is highest for the largest of organizations. The percentage is also higher for organizations that rate themselves as most competitive in their industry (75%) than those that rate themselves as least competitive in their industry (43%). A similar trend is observed when the *importance* of the performance management methodology is considered. Manufacturing companies have the highest rate of use of a formal performance management methodology, and the manufacturing industry also finds the existence of such a methodology most important.

In 2003, faced with the inability to make operational decisions based on a consistent set of corporatewide metrics, Steak 'n Shake, the 75-year-old, \$650 million restaurant chain, adopted a formal performance management methodology. Following the adoption of the new performance management methodology, the company established a BICC. Within 18 months, 3,000 business end users, including restaurant operators, managers, general managers, and executives — representing the vast majority of potential users — were actively using the newly deployed BI software.

This is just one of several similar examples observed by IDC that demonstrate the effectiveness of introducing a formal performance management methodology on increasing the pervasiveness of BI by increasing the number of internal and external users of the BI solution.

Several industry-standard performance management methodologies exist, such as balanced scorecard, Six Sigma, and total quality management. However, organizations can and also do develop their own methodologies. The success of such efforts depends in large part on expanding accountability within the organization through the availability of metrics for all employees and through tying a portion of compensation to performance metrics. For example, at a United States-based online retailer interviewed by IDC, new BI information affects not only business processes but also employee performance measures. Merchandise buyers are partially measured on metrics that track allocation of physical warehouse space and capital tied up in inventory, while marketers are partially measured on the amount of revenue generated through a given channel.

The use of a performance management methodology such as balanced scorecard demonstrates how this factor can affect the pervasive BI indicator *number of domains*. The cross-domain nature of this methodology, by definition, will force any organization looking to automate some aspects of balanced scorecard to ensure that all organizations' domains or subject areas are represented in the BI solution.

CONCLUSION

We wouldn't anticipate organizations investing in all the factors to achieve pervasive BI unless there was some belief that they would eventually benefit from it. Therefore, as part of our research, we asked respondents to assess their organization's performance relative to that of other organizations in their industry by placing their organization in one of four performance quartiles, ranging from most competitive to least competitive. Our analysis shows that *analytical orientation* and *data update frequency* (or *operational alignment*) are statistically significant predictors of *performance*.

However, we must caution against placing too much trust in the relationship between BI and performance. As Albert Einstein said, "Not everything that can be counted counts, and not everything that counts can be counted." First, a firm can invest in BI and still fall behind its competitors if the competitors are also investing in BI. Second, even if BI pervasiveness is critical to performance, it doesn't lead directly to performance. The firm must still sell products and service customers. Third, BI pervasiveness is only one of many factors that affect performance. Nevertheless, pervasive BI seems to be one of the increasingly important enablers of performance.

The long-term trends suggest that the market is in the early stages of a BI solution adoption cycle that will extend the reach of various decision support and decision automation solutions to a broad set of new user groups. These user groups will span all levels of an organization and will be involved in a spectrum of strategic and operational decision making. Some of these BI activities will be based on straightforward information access through reports, dashboards, or alerts to various devices or they may be enabled through search functionality within BI solutions. Other BI activities will include advanced analytic techniques for descriptive and predictive analysis of data.

Organizations embarking on or continuing on their path toward pervasive BI need to decide how to allocate their scarce human, capital, and IT resources to tasks and projects that have the biggest impact on increasing the diffusion of BI throughout their organizations and to their external stakeholders. In this study, IDC defines six indicators of pervasive BI and five key factors that lead to pervasive BI, which organizations can effectively influence. These factors include technology, business process, and organizational behavior capabilities that have positively influenced BI pervasiveness at some of the leading organizations in the world.

Finally, we found some statistical evidence to suggest a diminishing return on BI experience. Just having tools in place will increase the pervasiveness of BI for a limited time. However, the indicator

analytical orientation does not continue to increase at a constant rate. We originally theorized that longevity of experience with BI should lead to increased depth and breadth of BI use. However, after a time, training or new technology deployment must occur to spur further adoption. We hope that the pervasive BI model presented in this study provides guidance and discipline to organizations looking to gain a competitive advantage through pervasive use of BI.

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Appendix A: Business Intelligence Needs and Requirements

During our interviews with came across many needs and requirements that influenced organizations to invest in BI solutions. Some of these needs and requirements are categorized in the following paragraphs.

General Improvement in Decision-Making Capabilities

- ☒ A need to expand or modify KPIs, including business process–specific and cross-functional KPIs to ensure that the information made available to end users through any given BI solution is actionable
- ☒ A need to ensure appropriate level of data granularity to enable analysis of and reporting on detailed data, including the exploration of causes behind KPI threshold breaches
- ☒ A need to improve the timeliness of data availability to ensure that decisions can be made on a timely basis
- ☒ A need to ensure agreement among all organizational groups about the meaning of KPIs, metrics, and data elements and the need to document definitions of this BI content
- ☒ A need to improve information accuracy and transparency to overcome end users' lack of confidence in the data
- ☒ A need to eliminate dependence on the few employees who act as unintentional bottlenecks to more pervasive BI by controlling access to information

Business Analytics Technology Functionality Enhancement

- ☒ A need for real-time, in addition to batch, data integration
- ☒ A need for data consolidation and aggregation in a central enterprise DW
- ☒ A need for deployment of specialized data marts that support analysis of large and increasing volumes of data
- ☒ A need for intuitive and interactive user interfaces for data manipulation to support exploratory analysis
- ☒ A need for flexible data modeling functionality to support changes to data hierarchies
- ☒ A need for expanding the business analytics software portfolio to include tools for static reporting, parameterized reporting, dashboards, scorecards, multidimensional analysis, statistical analysis,

data mining, data integration, data quality, and data warehousing as well as various prepackaged analytic applications

- ☒ A need for reporting from both analytic data sources, such as DWs, and operational applications

Technology Cost Reduction

- ☒ Through consolidation of redundant BI technology deployments within and across business units
- ☒ Through introduction of self-service query, reporting, and analysis functionality to decrease the reliance of end users on IT for information access and analysis
- ☒ Through consolidation of BI technology procurement to fewer vendors or mitigating technology procurement risk by changing from a single-vendor to a multivendor sourcing strategy
- ☒ Through deployment of a flexible architecture that eliminates or decreases the constant need to build and rebuild data aggregates
- ☒ Through decreasing reliance on the error-prone and time-consuming manual data integration, reconciliation, and report development processes, usually using standalone spreadsheets

Appendix B: Expanded Methodology

Interviews

IDC requested that each vendor that sponsored this study identify two customers that represented the leading edge of organizations on their path toward pervasive BI. IDC analysts interviewed end-user organizations independently, without the presence of the vendor sponsors. Each interview, which lasted from 1 to 2 hours and was in some cases followed by additional phone or email discussions, resulted in a case study highlighting drivers, solutions, benefits, and lessons learned for each end-user organization. These case studies are available from the vendors who sponsored this study and IDC. The following list depicts the organizations interviewed by IDC. Some organizations preferred to remain anonymous.

- ☒ Air Canada
- ☒ Avantium
- ☒ Cardif Pinnacle
- ☒ Citigroup Smith Barney Global Stock Plan Services
- ☒ Cornell University
- ☒ DIRECTV
- ☒ Europe-based Financial Services Company
- ☒ Ferrari N.A.
- ☒ Inchcape plc

- ☒ India-based Telecommunication Services Company
- ☒ International Financial Services and Consulting Organization
- ☒ Massachusetts Convention Center Authority
- ☒ Matrix Absence Management
- ☒ Merck & Co. Inc.
- ☒ Palm Beach School District
- ☒ Revol Wireless
- ☒ State of Louisiana
- ☒ Steak n Shake
- ☒ United States–based Life Sciences Company
- ☒ United States–based Online Retailer
- ☒ United States–based Pharmaceutical Company
- ☒ U.S. Subsidiary of Europe-Based Insurance Company

The Survey

The IDC survey was launched in May 2008 and was fielded for 3 weeks in 5 languages in 11 countries. The survey resulted in responses from 1,141 organizations. The organizations and survey respondent characteristics include:

- ☒ Region: Americas (51%), EMEA (27%), and Asia/Pacific (22%)
- ☒ Economic development status: Industrialized economies (80%) and emerging economies (20%)
- ☒ Organization size based on the number of employees: 250–999 (12%), 1,000–9,999 (43%), 10,000 or more (45%)
- ☒ Industry groups: Government/education/healthcare (19%), process and discrete manufacturing (17%), communications/utilities/consumer services (15%), financial services (14%), professional services (14%), retail/wholesale (7%)
- ☒ Respondent title: Corporate/business management (62%) and information technology professionals (38%)

Comments on Dependent Variables

Based on our model, we identified dependent variables as measures of pervasive BI. As in the development of any model, we made certain assumptions about potential dependent variables (indicators of pervasive BI) based on years of IDC's experience in the BI market and conversations with dozens of BI vendors and end users. The dependent variables are those measures that we hoped to predict in subsequent regression analyses. In our survey, we asked many specific questions about the use of BI solutions. We anticipated that each question would get at something slightly different in the end-user environment. As it turns out, many of the answers to the survey questions were correlated. We

used the patterns of correlation to distill a few underlying factors. The logic is that some underlying factor common to a group of questions will explain why the answers to those questions are correlated. In other words, each dependent (and independent) variable is based on responses to one or more survey questions.

Natural logs were used for the variables *percentage of power users* and *number of domains* to transform the data so that we could use a linear regression model. Such a transformation is often used when the dependent variable is skewed, as it is in our data set. The *percentage of power users* consists of the natural log of the percentage of end users who are power users. The *number of domains* consists of the natural log of the results to the question about the number of domains in the DW, where domains were defined by IDC as subject areas.

Comments on Independent Variables

Conceptually, *prominence of governance*, *nonexecutive involvement*, and *executive involvement* (the latter turned out to have a statistically weaker effect on BI pervasiveness and is therefore not included as one of the five key factors), might appear to overlap. However, these independent variables factored into separate components and had differing relationships with dependent variables.

Nonexecutive involvement in the design and nonexecutive involvement in the use of the BI solution loaded onto the same factor, but *executive management involvement* factored quite differently than *nonexecutive involvement*.

Evaluating the Relationship Between Pervasive BI and Organizational Performance

To evaluate the relationship between the indicators of pervasive BI and organizational performance, we used a two-stage estimation model in which the pervasiveness measures used are those predicted by the factors, and not the value directly from the survey.

Regression Analysis

After using factor analysis to identify defining indicators of pervasive BI (dependent variables) and the factors that we believe management can manipulate (independent variables) to positively influence pervasiveness of BI in their organizations, we used regression analysis to identify factors that were statistically most influential in affecting pervasive BI (see Figure 5 for coefficient and t-stat values). The purpose of using regression analysis was to better understand the relationship between a set of variables that organizations can manipulate and variables that they want to affect. We found that the survey data is broadly supportive of the constructs we had laid out in our model and relationships among them. The fact that the different dependent and independent variables factored out supports the argument that the data reflects much more than the respondents' biases.

FIGURE 5

Summary Results of the Regression Analysis

		Dependent variables					
	Degree of internal use	Degree of external use	Percentage of power users	Number of domains	Data update frequency	Analytical orientation	
Independent variables	Degree of training		.2825/6.77		.3538/10.10	.4118/14.06	
	Design quality		.0880/3.19	.1671/4.47		.2180/6.76	.1609/6.47
	Prominence of governance				.0861/3.41	.1082/5.20	.1153/7.79
	Nonexecutive involvement					.0639/2.70	.1382/6.99
	Performance management methodology	.1000/2.72	.0467/2.14		.1892/5.36		.0562/2.96
coefficient/t-stat							

Source: IDC, 2008

Controls

The analysis of the relationships among the independent and dependent variables is performed with the stipulation that all else remains equal. We are trying to understand what explains the differences in the levels of the dependent variables after controlling for factors that are beyond the control of the decision makers interested in this analysis. For example, BI may be more pervasive in some countries than in others. If there are country differences, we want to control for these. Properly controlling for variables that can influence the level of the dependent variable will minimize the error term and will result in more meaningful coefficients for the variables we assume can be controlled. In this study, we controlled for country, title, involvement with BI, industry, and organization size and age.

Appendix C: References

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