International Good Practice Guidance

Predictive Business Analytics: Improving Business Performance with Forward-Looking Measures

IFAC International Federation of Accountants

IFAC's mission is to serve the public interest by:

- contributing to the development, adoption, and implementation of high-quality international standards and guidance;

- contributing to the development of strong professional accountancy organizations and accounting firms, and to high-quality practices by professional accountants;

- promoting the value of professional accountants worldwide; and

- speaking out on public interest issues where the accountancy profession's expertise is most relevant.

The Professional Accountants in Business (PAIB) Committee serves IFAC member bodies and professional accountants worldwide who work in commerce, industry, financial services, education, and the public and not-for-profit sectors. Its aim is to promote and contribute to the value of professional accountants in business. To achieve this objective, its activities focus on:

- increasing awareness of the important roles professional accountants play in creating, enabling, preserving, and reporting value for organizations and their stakeholders; and

- supporting member bodies in enhancing the competence of their members to fulfill those roles. This is achieved by facilitating the communication and sharing of good practices and ideas.

Other recent publications by the PAIB Committee include *Competent and Versatile: How Professional Accountants in Business Drive Sustainable Organizational Success* (August 2011), which outlines the diverse roles of professional accountants in business and the many ways they serve their employers and the public interest. Copies of *Competent and Versatile* and this International Good Practice Guidance may be downloaded free of charge at www.ifac.org/paib.

The *Preface to IFAC's International Good Practice Guidance* sets out the scope, purpose, and due process of the PAIB Committee's International Good Practice Guidance series.

The PAIB Committee extends its appreciation and thanks to Lawrence S. Maisel, Managing Partner of DecisionVu, LLP for preparing and assisting the PAIB Committee in developing this International Good Practice Guidance.

INTERNATIONAL GOOD PRACTICE GUIDANCE
PREDICTIVE BUSINESS ANALYTICS

CONTENTS

1. Overview

1.1 Professional accountants in business should be capable of assisting their organizations in implementing and utilizing predictive business analytics to improve managerial decision making across many core performance areas. For years, organizations have sought to develop and deploy an effective process to capture and filter forward-looking measures that enable it to understand significant patterns, relationships, and trends in order to facilitate better and more insightful decisions about the future. Several terms are in current use for this process: Predictive Analytics, Business Analysis, Driver-based Forecasting, etc. To ensure that this guidance relates the application of predictive analytics to all organizational functions, we have elected to use the term *predictive business analytics (PBA)*.

1.2 As the term implies, PBA is forward looking in nature, oriented to the organization at an enterprise level, and based on analysis of relevant business data and drivers that have a strong and traceable linkage to financial results and operational performance. PBA should enable management to identify new opportunities for growth and improvement, as well as to highlight areas for corrective actions and, possibly, strategy adaptations.

1.3 Increasing volatility and economic uncertainty in the business environment reinforce the importance and benefits to be realized by organizations that (a) develop a workable PBA process, and (b) use it to anticipate and guide its operations to productive outcomes. For example, knowing that its business was closely tied to shifts in gross domestic product (GDP), executives at Caterpillar, a global manufacturer of construction and mining equipment, diesel and natural gas engines, industrial, gas turbines and diesel-electric locomotives, asked its economists to find a leading indicator of performance. They established that Caterpillar's sales to users predicted shifts in the economic and business cycle (with a lead time of six to nine months in relation to U.S. GDP). Using this metric, Caterpillar anticipated the U.S. recession coming in the third quarter of 2007. Although the company underestimated the depth of the recession, it used the information to trim operations and come out of the recession in a much better position than its rivals.[1] This shows how predictive insights can draw on the linkage between economic indicators and internal key performance indicators.[2]

1.4 A well-structured and properly executed program of PBA can achieve tangible and measurable benefits across the eight drivers of sustainable organizational success identified in *Competent and Versatile, How Professional Accountants in Business Drive Sustainable Organizational Success*. These drivers define what organizations need to do to achieve and sustain success and, therefore, provide a basis for determining the expected key areas of competency for professional accountants in business. Important managerial questions related to PBA in each of the eight drivers are considered below in *Drivers of Sustainable Organizational Success*.

---

[1] *Fortune Magazine,* May 23, 2011, 141

[2] Russ Banham, "Strategic Inquisitions," *CFO Magazine* (December 2010), 44, www.cfo.com/article.cfm/14540197/c_14540453

Drivers of Sustainable Organizational Success

- **A customer and stakeholder focus**

  ○ Are we delivering the results and sustainable value expected by our key stakeholders (e.g., shareholders, creditors, customers, employees)?

- **Effective leadership and strategy**

  ○ Are we positioned for future changes to our functional and industry practices, opportunities, and competitors?

  ○ Can we recognize and respond rapidly to fundamental changes in our business model, customer markets, competitive positions, regulatory requirements, and external developments?

  ○ Have the long-term consequences of decisions been taken into account, including how they impact operations, customers, employees, and the reputation of the organization?

  ○ Do we recognize our societal obligations for the environment, and the sustainability of our owned and used natural resources?

- **Integrated governance, risk and control**

  ○ Are our governance, risk management, and control practices and policies meaningfully related to how we operate and perform?

  ○ Do they ensure the protection of a sustainable value creation strategy against strategic, operational, and financial risks, and ensure compliance with regulations, standards, and good practices?

  ○ Do we comply with defined laws and regulations and our internally stated values and code of conduct or ethics?

- **Innovative and adaptive capability**

  ○ Is the organization adapting to meet changing market demands by innovating their products and services and adapting their structure, processes, and systems to changed circumstances?

- **Financial management**

  ○ Are we optimizing revenues and reducing costs by anticipating future events and market trends?

  ○ Are we optimizing productive capacity, resources, and capabilities for a range of anticipated economic conditions?

- **People and talent management**

  ○ Are people and talent management being managed as a strategic function and key value driver to achieving sustainable success?

  ○ Do we have the right set of skills, competences, and resource capabilities?

  ○ Are rewards and recognition systems effective in incentivizing desired behaviors and performance cultures?

- **Operational excellence**
  - Are we using and managing the proper operating business model for our customers, suppliers, employees, stakeholders, and regulators?
  - Are we achieving the proper balance of effectiveness and efficiency?
  - Are resource allocation decisions aligned with strategic direction, goals, and objectives?
- **Effective and transparent communication**
  - Is PBA being used to improve internal and external business reporting in terms of readability, usefulness, and relevance?

1.5 The primary purpose of PBA is to identify how the future might look and what subsequent actions need to be taken. It is a continuous process to cultivate managerial and operational decision making that affects future financial and operating results, and facilitates strategy execution. Several uses of this process include:

- updating estimates of projected results given the current state;
- evaluating changes to current strategies and operating plans (deviations) and adopting corrective actions (gap closing);
- planning investments in critical resources and productive capacity;
- sharing expectations among interdependent groups or entities;
- looking "around the curve" with an eye toward actions and changes; and
- approximating results based on changes in business drivers to provide a broad palette of alternative actions for discussion and decision among responsible managers.

1.6 PBA supports an organization's need for the capability to (a) anticipate future events, (b) forecast their possible outcomes, and (c) select actions and decisions that improve its performance, operational capabilities, response to changing market and industry dynamics, and recruitment and retention of critical people, skills, and competencies. An example of the use of predictive analytics is found below at *PBA in Practice*.

PBA in Practice

A consumer finance company monitors its outstanding credit card balances across several key internal and external elements. Internal elements include the aging of balances, level of repayments relative to minimums due, and geographies and demographics, to name a few. In addition, external elements include employment rates, unemployment insurance claims, credit scores, etc. These elements, or "drivers," form the foundation of an organization's ability to apply PBA to its business model, and to convert its insight into a series of decisions and actions. Several critical elements are necessary to make this process relevant, namely:

- information quality (e.g., is the data trustworthy, are the relationships causal and consistent);

- tools and access to the information (e.g., are formats graphic and intuitive, is information easily and rapidly accessible);

- operating processes to capture, validate, distribute, and analyze relevant data for establishing performance insights and facilitating decisions at the designated levels of accountability;

- skilled individuals who are knowledgeable and informed about the strategic or operational results and their implications (e.g., asking what happened instead of why is it happening, is this an anomaly or is it a trend, and will the trend continue); and

- credible management processes to raise awareness and determine actions and decisions, and a process to monitor and measure the effectiveness of these actions.

1.7 PBA is a process that uses existing tools and techniques to continuously analyze past business performance and forward-looking data to drive business decisions and actions. These existing tools include the balanced scorecard, forecasting, target setting, and managerial costing. PBA requires knowledge and understanding of the activities across the organization to determine measures across all functions of the organization and how they interrelate, in order to begin to predict patterns and behaviors that ultimately have a financial impact.

1.8 PBA can involve implementing business intelligence (BI) technologies to facilitate data insights and accessibility. However, PBA is different than BI in two respects. First, PBA incorporates both internal and external data and insights, whereas BI projects typically focus on internally generated data. Second, BI is generally a term synonymous with implementing information technology to facilitate data mining and extraction, and presentation of information using, for example, dashboards.

Rising Expectations of Professional Accountants in Business

1.9 The quality of management information expected by internal business users is expanding both in terms of the range of data to be considered and the level of required analysis. From strategic issues to routine tasks, all executives, managers, and operational staff expect higher-quality information to support their decision making. Management information also should (a) relate financial to non-financial performance measures, (b) report past performance and monitor current operations, and (c) assist operating managers to anticipate future events and, if needed, take

appropriate corrective actions. This requires professional accountants in business to have strong analytical skills to interpret large sets of interrelated data.

1.10 The perception of chief financial officers (CFOs) and finance directors, and the finance function, will be related strongly to the analytical support provided to decision makers and others. Finance professionals are increasingly expected to have the capacity to provide decision support as business partners, or "navigators." As navigators, professional accountants support organizational leaders and managers with information and analysis about the organization's position and course. They contribute to strategic and operational decision making, and are prepared, when necessary, to challenge constructively to ensure that the organization is managed in the long-term interests of stakeholders. In essence, the financial professional needs to base their contribution on hard analytics and facts that relate to the key drivers of organizational performance. Such capabilities will require a blend of operational experience and strong financial acumen.

1.11 PBA requires a structured decision-making process such as the one shown in the figure below. As creators, enablers, preservers, and reporters of sustainable value in leadership, management, analyst, and controller roles, professional accountant in business can be involved at various stages of a decision process depending on their role and position in an organization.[3] In all roles, decisions should be properly framed and considered against strategic and operational objectives on the basis of the available data and evidence. Supporting information needs to be relevant, actionable, and able to drive desired behaviors. Ultimately, to be beneficial, the decision-making process needs to lead to influence over decision makers, and deliver an impact. The comfort zone in Figure 1 below refers both to some professional accountants in business and also the expectations of managers. Professional accountants can provide managers with greater understanding and insights where they are involved in the PBA process and have organizational awareness and understanding.

---

[3]   *Competent and Versatile: How Professional Accountants in Business Drive Sustainable Organizational Success* (International Federation of Accountants, 2011), www.ifac.org/publications-resources/competent-and-versatile-how-professional-accountants-business-drive-sustainab

Figure 1: The Opportunity to Reinvent Finance Business Partners

Source: Chartered Institute of Management Accountants[4]

Structure of the Guidance

1.12 Section 2 of this International Good Practice Guidance (IGPG) highlights a set of guiding principles to help frame how best to design and implement PBA, and section 3 provides high-level practical guidance on implementing these principles. Section 4 defines a continuous framework within which to implement and sustain an effective PBA process. Using the framework's structural components, a staged competency model can be used to (a) gauge how an organization currently employs this process, and (b) determine what additional resources and practices are necessary to achieve increased degrees of analytical effectiveness and, more importantly, achieve improved operating business performance and results. Finally, section 5 summarizes several implementation strategies, approaches, and challenges facing each organization and its determination on how best to pursue PBA.

2. Key Principles Supporting Predictive Business Analytics

2.1 An organization's PBA capability enables it to (a) improve its decision making and enhance management actions based on a range of expected outcomes, and (b) test the impact of planned actions before implementing actions and changes. Accordingly, an organization's PBA needs to incorporate guiding principles that can be used to guide the direction of the organization in executing its strategies and facilitating decision making by managers to improve operations throughout the organization. The guiding

---

[4] *Improving Decision-Making in Organisations: The Opportunity to Reinvent Finance Business Partners* (Chartered Institute of Management Accountants, July 2009), 11, www.cimaglobal.com/en-gb/Thought-leadership/Research-topics/Development/Improving-decision-making-in-organisations/

principles below are generally applicable to performance management and measurement but contain a specific focus on PBA.

2.2 The guiding principles underpinning PBA are:

A. **Demonstrate a strong *cause-and-effect* relationship**. To be able to predict outcomes, it is important to measure and monitor what most likely causes an outcome to occur.

B. **Incorporate a *balanced* set of financial and non-financial, internal, and external measures.** Too often, management reporting is concentrated on internally focused financial results, such as net income, and less on the (a) externally driven metrics that show how the marketplace views the organization or (b) non-financial activity or drivers of performance that have a financial impact.

C. **Be *relevant*, *reliable*, and *timely* for decision makers.** Analytics should be provided to users when, where, and how they need it. It should also be relevant to the business, industry, or function, and have the right level of timeliness and reliability for the critical issues being addressed.

D. **Ensure *data integrity*.** Data integrity is of key importance in fostering trust in analytics and recommendations for action. Ensuring data integrity depends on the establishment of data standards and data quality practices.

E. **Be *accessible* and well *organized*.** For analytics to contribute to managerial decisions and actions, it needs to be easily accessible, using tools and technologies that are "user-friendly" and organized in a way that reflects the business model.[5] All levels of an organization should use consistent data, analytical practices, and tools.

F. **Integrated into the *management* process**. PBA and forward-looking performance measures are an integral part of the management process and can therefore be tied to accountability.

G. **Drive *behaviors* and *results*.** Analytics should highlight those measures that foster desired behaviors of the organization, such as innovation, teamwork, collaboration, and risk taking, and facilitate the achievement of desired results.

---

[5] Business model is defined in the *International Good Practice Guidance on Evaluating and Improving Costing in Organizations*

3.   Practical Guidance on Implementing the Principles

PRINCIPLE A

Demonstrate a Strong *Cause-and-Effect* Relationship

A.1   Causality is the relationship between an event (the cause or driver) and a second event (the effect or outcome), where the second event is a consequence of the first. To successfully predict outcomes, it is important to understand the cause-and-effect relationship between events (their drivers). The key question is "If X happens, what will happen as a result?" Simple cause-and-effect examples include: if headcount goes up so will costs, or if shipping errors increase, customer loyalty, and ultimately revenue, will decrease. In the development of medicines, the number of clinical data errors will slow down the clinical trial process and hence lengthen research cycle time, and ultimately delay launch and anticipated revenues. Effective portrayal of cause-and-effect performance measures enhances the ability to predict outcomes. In a predictive model, the technique of "back testing" the cause-and-effect relationships used in a predictive model can also help provide insight into the effectiveness of the measures being used.

A.2   PBA should be able to reasonably predict future outcomes, and be based on provable causal linkages rather than "best guesses." Every measure selected should be part of a chain of cause-and-effect relationships that represents and aligns the strategy, measures, targets, and initiatives of the organization. It can be common for process improvement efforts that focus on the inputs and outputs of a process to be able to quickly highlight the cause-and-effect relationship between inputs and outputs and often referred to as leading (process) and lagging (results) measures (usually called Process and Results Measures). A process measure is one that can typically influence and change such things as cycle time or data errors. A results measure is often too late to enable changes to be made, such as in net income or earnings per share. The appropriate balance of process and results measures that show a cause-and-effect relationship will allow PBA to better predict outcomes.

A.3   The ability to make decisions based on PBA requires insight into the internal economics of an organization, which in turns requires information and analysis from the organization's costing system. An organization's capability to understand the cause-and-effect cycle from external drivers of change therefore needs to be linked to its internal processes and resources, which will ultimately drive costs and investments necessary to respond. The IGPG on *Evaluating and Improving Costing in Organizations* provides guidance on using costing effectively for decision making, which, like PBA, also requires understanding clear and timely cause-and-effect relationships, particularly between an output and the inputs required to produce it. An organization's PBA and costing system should be able to effectively analyze the impact of predictive scenarios so that potential operational impacts and responses are understood. The PBA process can directly address uncertainties and assumptions derived from a scenario planning process (see paragraph 4.9).

PRINCIPLE B

Incorporate a *Balanced* Set of Financial and Non-Financial, Internal, and External Measures

B.1 Although organizations may have a significant amount of data, often only one or a few measurements are focused on, which causes an unbalanced view of organizational performance. For product development, a core measure could be the number of innovations moved to a new stage of development. A sales person may close a deal on an unprofitable sale, while product development may push a bad potential product forward. This clearly shows the need for balance and an ability to make choices. For example, "if I sign this deal, my profit margins will suffer," or "if I move this bad product forward for more development, we will spend more money on a product that will not result in revenue." A balanced set of measures helps in making decisions, particularly about trade-offs.

B.2 A balanced set of measures will reflect internal and external factors and drivers and incorporate financial and non-financial performance. The number of customer product returns is a non-financial process measure that can indicate to managers a negative impact on revenue. Some non-financial measures can be sustainability related, such as greenhouse gas emissions.[6] External measures indicate the projected economic climate, marketplace environment, and potential impact of competitors and suppliers. Business drivers can be financial or operational; they can also be external or internal. There are many examples of such drivers: (a) some reflect changes over time, such as new home sales, new product sales, mortgage delinquencies and foreclosures; (b) some reflect changes in a given period, such as new births, new car sales, and new hirings; and (c) some reflect changes at a point in time, such as in interest rates, fuel prices, tax rates, and sales commissions. Drivers will typically be related to external uncertainties and factors that impact the competitive environment and the organization, such as changes in the competition, technology, consumer preferences, and demand, as well as market changes. An organization's risk management can also feed into the PBA process as risk management explicitly takes account of uncertainty, the nature of that uncertainty, and how it can be addressed.[7]

PRINCIPLE C

Be *Relevant*, *Reliable,* and *Timely* for Decision Makers

C.1 For PBA to be of value, it should (a) reflect the need of business users (see paragraph C.2, Relevance), (b) be the result of a consistent and trusted process (see paragraph C.3, Reliability), and (c) reflect the appropriate timeframe (see paragraph C.4, Timeliness) for the decisions being made. Users need meaningful data at the right time and in a form they can rely on. For PBA information to be meaningful, it should be tailored to the designated consumers of that information in a form and context that describes the outcomes, causes, and consequences of decisions and actions associated

---

6   Sustainability Framework 2.0 (International Federation of Accountants, 2011), www.ifac.org/publications-resources/ifac-sustainability-framework-20

7   *ISO 31000:2009 Risk Management – Principles and Guidelines* (International Organization for Standardization, 2009), www.iso.org/iso/catalogue_detail?csnumber=43170

with alternative future drivers (amounts or quantities) and business conditions. Information should be presented in a manner that conveys the key messages and portrays the alternative actions in an unambiguous and straightforward manner, using formats that are graphic and intuitively understood. For example, when driving a car, one sees a series of data points on an automobile dashboard (e.g., gauges for speed, engine temperature, oil pressure). These may be complete, but unless they inform the user of the range of acceptable tolerances and the implication related to the situation (e.g., a smooth highway versus a bumpy country road), they will usually not be sufficient for meaningful decision making and alternative actions regarding safety and timely arrival. Building on this example, PBA can be expanded to provide alerts and suggested alternative decisions and actions that might be considered.

C.2 *Relevance*: PBA should reflect an organization's business model and develop forward-looking information in a manner that facilitates focused decision making regarding relevant business issues and decisions. For example, a health care organization analyzing its staffing needs will likely gather data about its (a) service area population (e.g., age, ethnicity, gender) and (b) present and future health care reimbursement contracts and conditions. These attributes, and others, enable the organization to better select the range of options regarding its longer-term staffing levels, competencies and skills requirements, and specialties, as well as service level capacities (e.g., number of beds) in each of these specialty areas. The data from the analysis should be useful to the user or it will not be used. The tolerance of the ranges needs to be "fit for purpose." For example, predicting required production volumes by location for next week's operating plans and scheduling is different than predicting revenues six months forward. Asking a user what decisions they want to make based on the data is key in ensuring the usefulness of the analysis.

C.3 *Reliability*: PBA should provide fit-for-purpose data to users when, where, and how they need it. Reliability often refers to predictability. If a process consistently produces the same outcome, it is said to be predictable. If a process never produces the same outcome, it cannot be relied on. For example, if a machine with the same settings never produces a unit of same shape and length, it lacks reliability. The same holds for PBA. Although the analysis will vary, the output must be relied upon to be useful to the users. The process by which the analysis is created should be standard and consistent. If users do not trust the performance measurement system, they will not use it.

C.4 *Timeliness*: Timely data is critical to the ability to predict outcomes. However, while information that is six months old may not be useful to the end user, having daily or real-time information delivery may not be necessary.

PRINCIPLE D

Ensure Data *Integrity*

D.1 Integrity with respect to data is a concept of consistency of actions, values, methods, measures, principles, expectations, and outcomes. The source of the data for PBA should have integrity. Data integrity underlies an organization's efforts to establish data standards and data quality practices. Data integrity refers to the ability to trust

the underlying data. Without trusted data, even the most consistent process will produce bad results.

D.2   All users of information derived from the PBA process should be made aware of data integrity and quality issues, or where best estimates of data input have been used. Underlying assumptions used in collecting and analyzing the data should be transparent. Data integrity and validity can also be tested in retrospect and results communicated openly.

PRINCIPLE E

Be *Accessible, Understandable,* and *Well Organized*

E.1   In PBA, all levels of the organization should use consistent data, analytical practices, and tools. This creates transparency by sharing one version of the "truth" with various management teams and users. Instead of discussing individually generated reports and forecasted analysis with different versions of the "truth," managers need access to the same set of performance measures upon which they can exercise their judgments. Different levels of users need different lenses to view management information and predictive measures.

E.2   There are "user-friendly" tools and technologies that are easy for the user to interact with and conducive to examining outcomes based on alternate driver values and possible business scenarios. These tools and technologies, when implemented correctly, greatly aid in establishing reliable and timely data while enhancing the level of confidence in the forward-looking outcomes that become the basis for decisions and actions. However, most predictions, no matter how carefully prepared, are to some extent uncertain. The way a prediction, as well as its limitations, is presented needs to be disclosed to users.

PRINCIPLE F

Integrated into the *Management Process*

F.1   To be an integrated part of the management process, PBA and forward-looking performance measures can be tied to accountabilities and related to rewards and other incentives. This involves developing roles and responsibilities (see paragraph F.2), accountabilities (see paragraph F.3), and governance structures and practices (see paragraph F.4).

F.2   Roles and responsibilities should be clear, and incentives should be in place to (a) influence behaviors, (b) reinforce organizational alignments and management authorities, and (c) ensure coherent decision making. Accuracy of outcomes should be weighed against several factors in determining the effectiveness of management decision making, such as risk, resource requirements, and short- versus long-term trade-offs.

F.3   PBA should establish a clear set of accountabilities and responsibilities for "owning" each step of a process. Responsibilities extend from capturing and validating financial and operational data to defining the decision-making authorities and accountabilities for actions within defined governance practices.

F.4 Governance practices related to PBA should be defined and disseminated. This should include defining roles and responsibilities, ownership for updating and reviewing data, and approval processes for making changes. To help implement such processes, charts can be used to specify and map the decisions and/or actions and, related to each decision or action, assign organizational positions and individuals who (a) initiate the action or decision, (b) approve the action or decision, (c) are informed about the action or decision, and (d) are consulted about the action or decision. Generally, the more detailed and specific roles and authorities are aligned to decisions and actions, the better the governance process.

PRINCIPLE G

Drive *Behaviors* and *Results*

G.1 The adage, "you get what you measure," holds true with PBA. Therefore, PBA should drive desired behaviors and results. If shortened cycle time is a desired outcome, then by measuring it, understanding and eliminating or reducing its drivers/causes, predicting it, and holding people accountable to cycle times, will result in shortened cycle times. Benchmarking (see paragraph G.2) and rewards (see paragraph G.3) can also be effectively used to ensure that desired behaviors and results are achieved.

G.2 *Benchmarking*: Wherever possible, predictive performance measures should be compared to those of other internal groups or external competitors. Benchmarking information should be evaluated for its comparability and relevance to its prospective use. Benchmarking often highlights areas of needed improvement in cost, cycle times, and quality. Benchmarks in these areas can be used to rally organizations around needed improvements and efficiency gains.

G.3 *Rewards*: PBA should highlight those measures that foster desired behaviors to support the delivery of organizational objectives and intended results. Rewards and recognition might be used to foster desired behaviors of the organization, such as innovation, teamwork, collaboration, and long-termism. Sometimes, it should reward and recognize risk-taking actions that have been approved, even if they fail, so as to promote an entrepreneurial culture. Performance-related remuneration should encourage the right behavioral triggers.

4. Implementing a Predictive Business Analytics Continuous Framework

4.1 An effective approach to implementing and sustaining an integrated and continuous PBA process is best accomplished by deploying a framework that is continual (i.e., ongoing), coherent, and collaborative throughout the organization. Figure 2 illustrates a continuous framework that has been demonstrated to work effectively in numerous organizations. Although adaptations are always necessary, this framework can serve as navigation or a starting point to enable and encourage an organization to begin to build its capabilities and competences. It is important to recognize that in setting up the analytical process, it should be organized to manage the whole value stream (i.e., all processes required to create value for the customer), rather than manage and optimize each process step in isolation.

Figure 2: PBA Continuous Framework
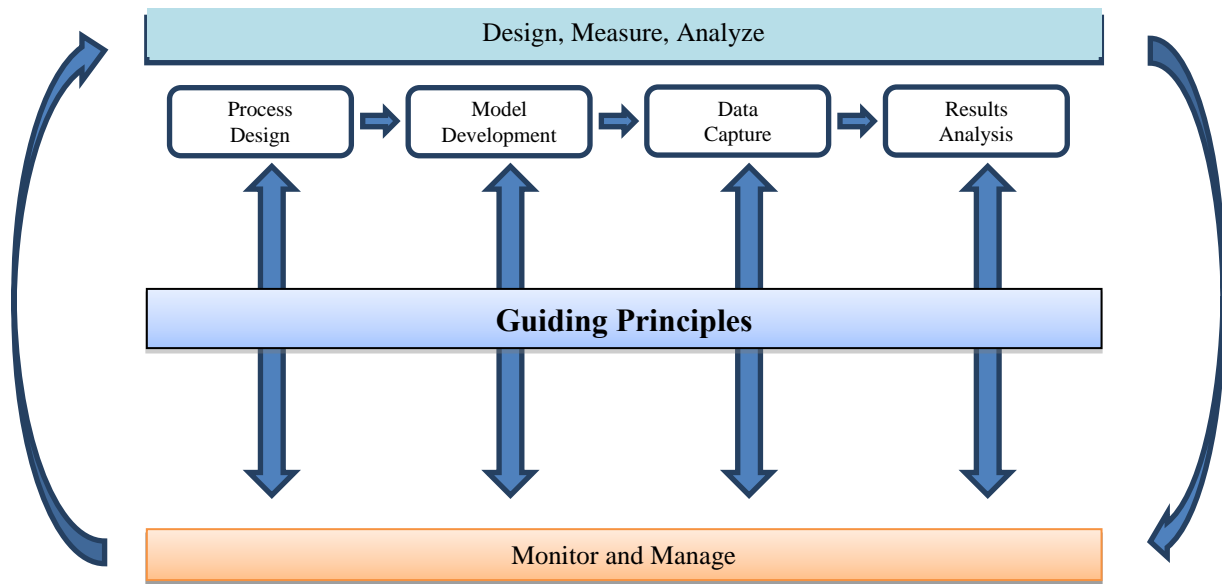
Developing a Continuous Framework

4.2 For PBA to be effectively deployed by an organization, a continuous framework is essential to an effective understanding of the events, their relevant drivers, and PBA's impact on decision making. The framework has two major components: (a) a structural element that focuses on design, measure, and analyze, and (b) a managerial element that focuses on monitor and manage.

4.3 This guidance addresses the structural element, which is developed in four key steps:

1. Process Design

2. Model Development

3. Data Capture

4. Results Analysis

Process Design

4.4 The objective is to develop a process that enables the organization to predict a future outcome based on expected cause-and-effect relationships. The ability to leverage and/or refine historical relationships based on changes in current business conditions, competitive landscape, economic trends, etc., is an inherent aspect of the process. However, there needs to be caution about fundamental changes regarding the future that are not currently apparent. In essence, the ability to distinguish an anomaly from a fundamental change in a cause-and-effect relationship is critical to implementing an effective process. It is important during process design to continually keep the principles in mind, and to test if the new process highlights (a) a cause-and-effect relationship; (b) a balance of financial and non-financial, internal, and external

measures; (c) relevance, reliability, and timeliness; (d) integrity; (e) accessibility; and (f) the potential to drive desired behaviors.

4.5 The process design can be accomplished using a range of techniques, from highly quantitative mathematical models often used by investment banking organizations to drive their trading operations and trading decisions, to anecdotal approaches sometimes referred to as trial and error or experiential models (see Delphi Method). Many organizations adopt a hybrid approach, and use regression analysis to form the baseline model. They then refine outcomes based on experience among senior managers and employees who provide subject matter expertise based on their broad and deep experiences in the subject area. Although regression is more definable, less subjective, and encourages collaborative involvement, managerial experience can help to foster ownership of the process among users within the organization.

4.6 In addition to determining the appropriate techniques, other factors that influence the process design are the resource requirements and organizational context. Resource considerations typically include defining the requisite analytical skills, functional knowledge and capabilities, and the scope of decision authority that need to operate to sustain the PBA approach. In terms of organizational context, the culture, roles, and responsibilities play a critical part in determining how best to deploy the process, and sets the necessary boundaries around analysis and decision making. Understanding the cultural boundaries is critical to ensure that the PBA process assists in driving the right cultural incentives.

For example, a new product launch requires close coordination among several organizational functions, including marketing, sales, distribution, and manufacturing. The PBA process must (a) integrate the key drivers for each function, (b) reliably link cause-and-effect across the process, and (c) display alternatives for several key decisions and actions associated with the new product launch. Any one flaw in this chain of events could undermine the overall success of the product launch. In addition, the PBA process must demonstrate balance between internal (e.g., new product cycle time) to external (e.g., first-year sales) measures. Small- to mid-sized organizations have an inherent advantage in that their size can facilitate more direct communications and interactions, and promote coordination of decisions and actions, than is easily achieved in a large organization where there can be a wide scope of responsibilities for decision making.

4.7 The decision as to which process design is better may be determined by a variety of considerations, including:

- **Industry dynamics** that affect an organization's business model and cycle (e.g., long cycle versus short cycle), competitive position, regulatory landscape, and environmental boundaries.

- **Degree of impact** influences the process design in terms of response time, cost impacts, order cycle, inventory levels, staffing levels, and capital investment.

- **Materiality and volatility** can also be key factors to consider in designing a workable process, especially by viewing the balance between these two factors. Figure 3 illustrates a set of managerial actions, based on these factors and

appropriate actions arising from balancing these relationships in a way that would support the selected process design.

Figure 3: Suggested Actions in Relation to Materiality and Volatility of Data
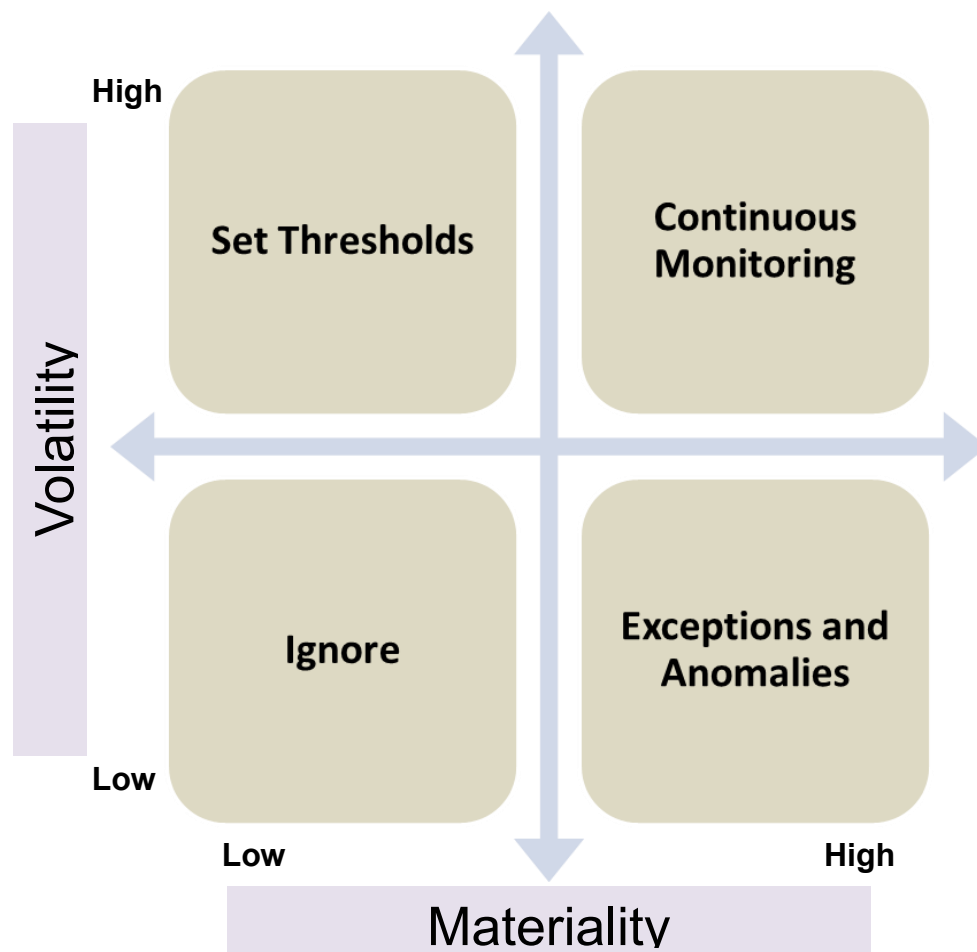
Model Development

4.8   The initial step in model development is to determine the relevant relationship(s) between an input and its outcome. Inputs can be discrete events (e.g., change in interest rate, new product launch), aggregated events (e.g., unemployment rates, consumer delinquencies) or structural events (e.g., new plant, regulatory approval). Often these inputs are referred to as "drivers," and can be viewed as leading indicators of future outcomes. Outcomes are the result of events, can be measured over a period of time, and can be viewed as lagging indicators. This is the basis of Principle A covering cause-and-effect. For example, an airline makes reservations for a scheduled flight (input/aggregated event) and can immediately measure its change in passenger revenue (output/result). What is essential is to determine the likelihood that this relationship between events and outcomes has been consistent over time, and that there is a reasonable expectation that these relationships will continue into future

periods. There are numerous refinements to the airline example, such as pricing of reservations, cancellation policies, and historical trends. After an organization understands and determines its driver and results relationships, it can begin to develop, refine, and apply these relationships to its PBA process. A critical few driver relationships can account for a significant portion of the predictive results.

4.9 Several techniques can be used to define and refine an organization's approach to model development or, more specifically, to driver identification and its related results. These techniques vary from quantitative methods to empirical methods. Several recognized methods or techniques are described below:

- **Regression Analysis** includes any techniques for modeling and analyzing several variables, when the focus is on the relationship between a dependent variable (e.g., outcome or result) and one or more independent variables (e.g., drivers). More specifically, regression analysis helps to understand how the typical value of the dependent variable changes when any one of the independent variables is modified, while the other independent variables are held fixed. In all cases, the estimated value is a function of the independent variables, and the variation of the dependent variable can be described by a probability distribution. For example, in the banking industry, the mortgage interest income (dependent variable) can be estimated based on the change in several independent variables, such as interest and employment rates. Regression analysis is not useful in all situations. For example, many cause-and-effect relationships are non-linear, having two, three, or more related effects that are not captured by the analysis. A *Monte Carlo simulation* can help interpret the results of regression analysis. Such a simulation is based on artificially recreating a chance process over many occasions, and observing the results.

  Additionally, the impact of each independent variable can be measured by and based on levels of confidence in the data. A series of scenarios can be developed and, based on managerial judgment and the data itself, used to effect operating decisions. For example, a consumer finance organization might seek to predict mortgage application fees and interest income, and establish a historic and statistically valid relationship with changes in interest and employment rates and growth in national gross domestic product. The results of the analysis would have been driven by the changes in interest and unemployment rates and growth in gross domestic product. Thus, when interest rates are lowered, employment rates increase, and there is growth in gross domestic product, it is reasonable to expect increases in mortgage fee and interest income over time.

- **Resource Capacity and Activity-Based Analysis** allows an organization to model how varying levels of resources (e.g., staff, working capital, and capacity) are being consumed through business processes to create end objectives such as a product or service. An organization needs to measure the effect its resource capacity and processes have on each other and how they contribute to overall profitability or service effectiveness. For example, a food distribution organization might consider an expansion of its business with a well-known food restaurant chain. This expansion of business would represent a

significant increase in business volume of approximately 20 percent. The organization needs to understand the incremental impact the increased volume would have on the capacity of delivery, packaging, and other warehousing resources and the expenses associated with the new business. They can determine the investments and operational changes necessary to meet the new level of demand. By analyzing the predictive nature of these processes and activity relationships and their impact on consumed resources, the organization can negotiate higher prices and achieve higher margins that contribute to an over 20 percent improvement in profitability.

- **The Delphi Method** is a systematic, interactive, non-quantitative technique for forecasting that relies on a panel of experts. The experts answer questionnaires in two or more rounds. After each round, a facilitator provides an anonymous summary of the experts' forecasts from the previous round, as well as the reasons provided for their judgments. Experts are then encouraged to revise their earlier answers in light of the replies of other members of their panel. It is believed that during this process the range of the answers will decrease and that the group will converge toward the "correct" answer. The process is stopped after a predefined stop criterion (e.g., number of rounds, achievement of consensus, stability of results) and the mean or median scores of the final rounds determine the results. Digital communication has greatly facilitated the procedure.

  One of the most important factors in Delphi forecasting is the selection of experts. The people invited to participate should be knowledgeable about the issue, and represent a variety of backgrounds. The number must not be too small to make the assessment too narrowly based, nor too large to be difficult to coordinate.

- **Experiential Insight** is a less structured form of the Delphi Method. As a quick way to begin, operating managers are often able to select drivers based on operating experiences—but these need to be reliably correlated with results. Consequently, results should be tested against multiple variables using regression or statistical analysis. It is common to "back test" these relationships, especially where these methods are based on experience and intuition. This is accomplished by applying actual historical data to these relationships, then measuring whether the cause-and-effect basis is within an acceptable margin of error given these known outcomes. After review, it is appropriate to adjust on an ongoing basis by looking for new drivers and/or adjusting the weighting associated with each driver.

- **Scenario Analysis and Planning Scenarios** are powerful tools in the strategist's armory. CMA Canada's 2020 Vision paper, *Forecasting the Future Role of the Management Accountant*, identifies scenario planning as the defining organizational capability and a primary management accountant skill for the coming decade. Scenarios are particularly useful in developing strategies to navigate the kinds of extreme events we have recently seen in the world economy. Scenarios enable the strategist to steer a course between the false certainty of a single forecast and the confused paralysis that often strike in

troubled times. Scenarios have various features that make them a particularly powerful tool for understanding uncertainty and developing strategy accordingly, including (a) expanding your thinking, (b) uncovering inevitable or near-inevitable futures, (c) protecting against "groupthink," and (d) allowing people to challenge conventional wisdom.[8] Scenarios typically cover various future states, one of which can cover challenging events and conditions for the organization.

Data Capture

4.10 Data capture for PBA differs in many ways from financial accounting. In financial accounting, recorded financial information is based mainly upon historical transactions and judgments whereas, in predictive analytics, information is often a blend of historical as well as forward-looking financial and non-financial data. Consequently, organizations can develop a series of estimates for their drivers and compile a set of possible scenarios. These scenarios can be weighted as to their likelihood of outcome by applying regression analysis and assigning a probability to each of the possible outcomes or actions.

4.11 In determining the better option for data capture, it is important to consider the context and relevance of how PBA will be used, and the impact of actions being considered by management. Figure 4, an example from Southwest Airlines, illustrates forecasting frequency. Revenues have high economic relevance and high variability, and thus would be updated daily; the predictive time horizon might be updated monthly. On the other hand, fuel prices, which also have high economic relevance and high variability, would be updated semi-monthly, and the predictive time horizon might be three to six months. These are in contrast to those categories that have medium to low economic relevance and variability, and thus would not need to be tracked nor updated as frequently.

---

[8] Charles Roxburgh, "The Use and Abuse of Scenarios," *McKinsey Quarterly* (November 2009), www.mckinseyquarterly.com/Strategy/Strategy_in_Practice/The_use_and_abuse_of_scenarios_2463

Figure 4: Southwest Airlines Forecasting Frequency

	Economic Relevance	Variability	Operating Plan Response Speed	Update Frequency	Forecast Horizon
Revenues	High	High	High	Daily	Month
Labor Costs	High	Low	Medium	Semi-Monthly	6 Months
Fuel Prices	High	High	Medium	Weekly	Quarter
Maintenance Spending	High	Medium	High	Semi-Monthly	6 Months
Advertising Spending	Medium	Medium	High	Monthly	Year
Aircraft Rental Prices	Medium	Low	Low	Quarterly	Year
Landing Fees	Low	Low	Low	Annually	Year
Agency Commissions	Low	Low	High	Semi-Annual	Year

Source: Southwest Airlines[9]

4.12 For many organizations, data capture is complex. Often, the requisite data for a defined driver may not be readily available or easily accessible. Organizations can discover that, in the early stages of implementing predictive analytics, the delivery of information is inefficient, cumbersome, or costly to capture. Such problems are especially evident when (a) systems are highly fragmented, (b) data definitions are inconsistent, (c) data capture is redundant and manually intensive, and (d) access is limited. A workable alternative is to identify surrogate drivers. These are drivers that, as the name implies, are used as substitutes for the more preferred but less available drivers. An organization will often begin to collect the preferred driver data for future availability.

As organizations mature, they may use more automated technology tools, to not only capture data but also to store and access large volumes of financial, non-financial, and operational data that can be effectively integrated in performing its analysis.

---

[9]   Steve Morlidge and Steve Player, *Future Ready: How to Master Business Forecasting* (Chichester, UK: John Wiley & Sons, 2010), 71.

Results Analysis

4.13 The analysis of results performed by organizations is the most crucial element of developing a meaningful PBA process. In essence, predictive analytics' primary purpose is to identify "what we think the future will look like" and cultivate managerial decision making about operations and forward-looking actions that affect future operating results and promote strategy execution.

4.14 Organizations may progress along a path of analytical maturity that reflects their capacity and capability to use predictive analytics. The major stages are (a) reactive, (b) systemic, (c) dynamic, and (d) collaborative. These stages can serve as a compass for organizations embarking on implementing a PBA process. An organization that understands its current state is better positioned to progress to a desired future state by planning its series of activities; developing its model and drivers; allocating sufficient resources and people to the initiative; capturing relevant data; instituting necessary management review processes; and making key decisions needed to achieve its vision and improve operating performance and results.

4.15 A summary of these stages below can help an organization to gauge its position and help to determine the extent of effort and resources to achieve its desired level of analytical capability.

- **Reactive**: At this stage, organizations' efforts are primarily focused on reacting to business events that often (a) are centered on departmental scope of responsibilities, functional activities, or performance measures, and (b) depend on a limited set of tools and techniques to pinpoint cause-and-effect relationships. This does not imply a lack of capacity to operate effectively, but more a sense of limited scope and narrowly defined set of corrective action alternatives.

- **Systemic**: At this stage, organizations' efforts are more broadly centered on a cross-departmental focus on business events and some structural changes in product or markets. There are tools and techniques that are more "battle tested" and deliver a fair degree of insight into future operations or expected market results. Additionally, during this stage there are clear signs of a systemic process, defined governance and risk management practices, and managerial discussions to guide decision making and corrective actions.

- **Dynamic**: At this stage, organizations' efforts are more robust, with refined sets of driver and result/outcome relationships. Often, a dedicated group of business performance analysts/management accountants (a) routinely perform the periodic (monthly or quarterly) PBA program tasks; (b) routinely capture key driver data; and (c) have a well-developed set of tools and management practices to discuss, decide, act upon, and monitor decisions and corrective actions. Discussions are about current activities, threats and opportunities, and the need to develop sustainable improvements rather than solve a problem or situation at a single point in time. Additionally, the level of confidence in credible forward-looking information used for decision making is fairly high, and more time is devoted to discussing "what should we do?" and less about "are the numbers right?"

- **Collaborative**: At this stage, organizations' efforts are enterprise-wide and well developed. The ability to access key information is typically real-time (if needed) and is proactive in that trends and patterns are continuously captured and analyzed by business models and based on defined tolerances. Alerts and notifications can then be distributed to designated management and staff. There are clear accountabilities, and the interdependences of various departments or divisions are correlated to the business events and their anticipated consequences, thus rendering a more cohesive understanding of the organizational impacts. Managerial actions and intended results are continuously shared, and the organization's ability to learn and disseminate critical knowledge to other areas is advanced and trusted. There is clear buy-in of the process, and a strong sense of leadership and executive support for actions and improvements.

Monitor and Manage

4.16 Many organizations develop reporting tools to monitor the outcomes identified in their PBA process. Several of the more widely used reporting techniques include balanced scorecards, key performance indicators (KPI), and tailored business reporting templates. Regardless of reporting tools and techniques, it is critical that a robust and structured management review process be sustained that reviews business results, assesses actions and key decisions, and links operational and strategic performance to their management process. For example, a global pharmaceuticals research and development organization developed a KPI system that reflected its strategic objectives of improving time, cost, and quality, and linked the system to their management leadership team monthly review meetings. This integration of outcomes and operating management controls contributes to the effective deployment of PBA.

5. Implementation Strategies, Approaches, and Challenges

5.1 Each organization faces numerous implementation strategies and operational considerations, approaches, and challenges in implementing a meaningful and workable process of PBA. These are summarized as follows:

- **Executive sponsorship and culture**: Having an appropriate level of executive sponsorship and buy-in is critical. In effect, management sets the tone for the organization, from "why didn't we anticipate that event" or "who messed up" to a more collegial and effective tone of "okay, clearly things have changed, what are the major drivers of the change? What are the implications for our organization going forward? What actions should we be taking as a result?" Assigning organizational responsibilities and focus to this senior level ensures that the proper resources will be available and behavioral actions and accountabilities will be recognized. For example, a major global financial services organization operates its driver-based forecasting models within the CFO's authority.

- **Change management**: A clear program for effecting change will help with the implementation of predictive analytics. There are many sources of information on effective change and project management. Professional accountants need to

ensure that they have the required technical and business competences to support and, where necessary, lead change management initiatives or arrange for the involvement of such capabilities. Whether within the context of the finance function and accounting innovations or, more broadly, by implementing a PBA approach within other parts of an organization, professional accountants should be able to adapt to changing circumstances, and to help manage others to apply and benefit from new tools and techniques. A change management role will require an understanding of the broader social and behavioral issues involved in implementing innovations and new ways of working.

- **Communications**: Providing frequent and informative communications is essential to effectively introduce a PBA process capability to the organization. Generally, a communications plan can support a series of communication messages regarding PBA activities. These can be conveyed using already established internal communications vehicles, such as organization newsletters, email announcements, and success stories. What is important is that the organization is informed about how the process contributes to operating results and tangible benefits.

- **People**: The right mix of skills and competences will be needed among people assigned to properly analyze and communicate the insights and actions from the analysis. Such individuals should possess industry experiences and functional expertise, and be able to exercise a level of judgment that comes from past actions with an acquired sense of practicality.

- **Tools**: Automated tools can facilitate the analytical process in sustaining the model structure, capturing and validating data, and performing analytical routines and reporting results.

- **Data standards**: Maintaining a rigorous set of data standards that address the quality, integrity, and consistency of the captured data is necessary. It is appropriate for the organization to apply standards to this that are similar to those applied to financial accounting data and transactions. However, the data collection effort and cost of collection should not be burdensome and exceed the value of the data.

- **Project management**: As with any new initiative, it is important to provide project oversight in terms of effective project management. This can be best accomplished when an implementation plan has been developed, and regular updates and status reports for the plan are provided to key stakeholders.

- **Process and workflow**: The organization should implement an end-to-end process that includes supporting workflow tools in order to efficiently perform the analysis and to communicate its insights and selected actions and decisions.

- **Use of consulting services**: Organizations can turn to outside consulting services to design and implement this process, and/or supplement internal resources that may be lacking specific skills or expertise in critical areas. Regardless of how consultants are used, it is important that the organization ensures that the proper level of knowledge transfer is achieved, and that

eventually the internal team assumes responsibility for performing and sustaining the process.

5.2 Several alternative implementation approaches that might be considered are:

- **Pilot:** Often, organizations decide to implement these process changes by first selecting a pilot department or function. The benefit to this approach is that the investment and resources are small and manageable, the focus is narrow, implementation will be deployed within a reasonable timeframe, and its effectiveness and long-term benefits can be gauged. Several considerations include (a) the receptiveness of senior managers to the pilot, (b) sufficient support from the leadership team, and (c) a clear recognition that this is a pilot and that its expectations of success are subordinate to its purpose—learning and refining the process, as well as highlighting ways to improve the process and future use and extent of resources.

- **Scaled phase-in:** Scaled phase-in approaches are appropriate where an organization both wants to implement the process and to do so in a deliberate and steady manner without an inordinate commitment of resources to the process. This approach is similar to the pilot approach, but may involve several concurrent pilot departments or functions that offer the opportunity to (a) use broader sets of analytical focus and more extensive drivers, and (b) utilize the wider scope of management responsibilities and decision making.

- **Enterprise-wide:** An organization will follow a pilot or scaled phase-in approach with an enterprise-wide implementation. The focus could be on a division (e.g., consumer lending, retail banking, personal lines insurance) or a major department (e.g., education, public safety, graduate business school within a university). This approach has the additional benefit of truly understanding the scale and complexity involved in deploying the PBA process.

5.3 The choice of alternative implementation approaches is a matter of circumstances and priorities for an organization, and would be determined based on a realistic assessment of the alternatives, organizational resources, risks and consequences, as well as other key criteria that will influence a successful implementation.

This list of resources is not intended to be exhaustive. Use the IFACnet at www.ifac.org to search IFAC and many of its member body websites for additional information (click on the search function and select IFACnet).

Accenture, "Using Analytics to Achieve High Performance," *The Harvard Business Review,* June 2010, www.accenture.com/us-en/research/hbr/Pages/insight-business-analytics-competitive-advantage-summary.aspx.

Custom Solutions Group, *CFO Magazine,* and Oracle, *Thriving in the Recovery: How CFOs and CIOs Can Work Together to Improve Their Use of Technology for Forecasting and Planning* (March 2011), www.cfo.com/research/index.cfm/displayresearch/14544688?topic_id=10240273.

Thomas H. Davenport, Jeanne G. Harris, and Robert Morison, *Analytics at Work: Smarter Decisions, Better Result* (Boston, MA: Harvard Business Press, 2010).

Deloitte, *Achieving Analytics Excellence, Part One: Organizing the Analytics Center of Expertise* (Atlanta, GA: Deloitte Development LLC, 2011), www.deloitte.com/view/en_US/us/Services/additional-services/deloitte-analytics-service/7a525d130f782310VgnVCM1000001a56f00aRCRD.htm?id=us_email_imo_092611.

"Finance Transformation," Chartered Institute of Management Accountants, www.cimaglobal.com/Thought-leadership/Research-topics/Finance-transformation/.

Kaiser Fung, *Numbers Rule Your World: The Hidden Influence of Probabilities and Statistics on Everything You Do* (US: McGraw-Hill, 2010).

IBM Institute for Business Value, *Analytics: The New Path to Value* (New York, NY: October 2010), www-935.ibm.com/services/us/gbs/thoughtleadership/ibv-embedding-analytics.html.

Eric Krell, *Forecasting the Future Role of the Management Accountant* (Ontario, Canada: Certified Management Accountants of Canada, 2011), www.cma-canada.org/index.cfm/ci_id/20539/la_id/1/document/1/re_id/0.

Gert H.N. Laursen and Jesper Thorlund, *Business Analytics for Managers: Taking Business Intelligence Beyond Reporting* (Hoboken, NJ: John Wiley & Sons, Inc., 2010).

Steve Morlidge and Steve Player, *Future Ready: How to Master Business Forecasting* (Chichester, UK: John Wiley & Sons, 2010).

SAS, *The State of Business Analytics for SMBs: Trends in Business Analytics: Predicting the Future of Business* (2010), www.sas.com/reg/wp/corp/20332.

Robert Simons, *Levers of Control: How Managers Use Innovative Control Systems to Drive Strategic Renewal* (Boston, MA: Harvard Business School, 1995).