INTRODUCTION

This book examines many issues that concern the field of business intelligence (BI). BI remains an emerging field, but it is one is rapidly maturing. The field has multiple facets as it is comprised of several disciplines. BI is the application of data, technology, and analytics in the pursuit of insights and knowledge that enables decisions and actions that yield value for a firm. BI creates value by providing evidence that organizations can use to make informed decisions about people, processes, products, and services.

Figure 1 presents a vision of BI as an integrative application of technologies, models, techniques, and practices. In Miori and Klimberg’s (2010) framework, each of the three circles of the Venn diagram represent applications that have previously been considered quite distinct: (1) information systems and technology, (2) statistics, and (3) operation research/management science. This structure serves to encapsulate a broad definition of BI, where BI is characterized from each of three viewpoints, which consist of (1) business information intelligence (BII), (2) business statistical intelligence (BSI) and (3) business modeling intelligence (BMI). Each of these three viewpoints has particular business aspects.
that are independent of the other viewpoints. Conversely, each viewpoint can work together or utilize
techniques/skills from one or possibly two of the other disciplines. For example, data mining, which
requires a high level of statistical knowledge as well as the availability of necessary data, may require
significant IT skills and/or knowledge. Further, if data mining analysis demands a systematic process
of analysis, modeling skills may be required. Within the context of this framework, data is secured by
technology and then is subjected to statistics and modeling analytics to derive understanding of the data
to facilitate evidence-based decision-making.

This book acknowledges the complexity of business intelligence and its papers explore the diversity
of topics and issues that BI faces. For example, papers in this volume explore such concerns as the ap-
plication of BI in college admissions, long range planning in the aerospace industry, organizational
talent acquisition, the importance of BI in examining Web-based information, and BI application devel-
opment techniques.

To facilitate the exploration of the various BI topics presented in this book, I have organized the
papers presented in this volume into three groups: organizational issues, analytic issues, and technology
issues. In doing so, the volume is consistent with the themes I routinely see as Editor of the International
Journal of Business Intelligence Research. I think you will find the papers included in this collection
informing while also helping to advance this important field.

ORGANIZATIONAL ISSUES

In their paper, Using Business Intelligence in College Admissions: A Strategic Approach, Dale Amburgey
and John Yu note that higher education often lags behind industry in the adoption of new or emerging
technologies. They state that competition increases among colleges and universities for a diminishing
supply of prospective students, the need to adopt the principles of business intelligence becomes increas-
ingly more important. They analyzed data from first-year enrolling students for the 2006-2008 fall terms
at a private, master’s-level institution in the northeastern United States for the purpose of developing
predictive models. A decision tree analysis, a neural network analysis, and a multiple regression analy-
ysis were conducted to predict each student’s grade point average (GPA) at the end of the first year of
academic study. Numerous geodemographic variables were analyzed to develop the models to predict
the target variable and the overall performance of the models developed in the analysis was evaluated
by using the average square error (ASE). The authors find that three models had similar ASE values that
indicated that any of the models could be used for the intended purpose. Amburgey and Yi make sug-
gestions for future analysis include expansion of the scope of the study to include more student-centric
variables and to evaluate GPA at other student levels.

Anticipatory Standards Development and Competitive Intelligence is a paper by Françoise Bousquet,
Vladislav V. Fomin, and Dominique Drillon who state that more and more companies operate today in a
worldwide market under conditions of globalization, increased complexity, and competition. In such an
environment, they assert that business decisions need to be made quickly yet intelligent, substantiated
by the most salient and relevant information available. Under the global competition, with a diligent
and measured manner, many companies are increasingly treating business like an economic war. The
authors report that enterprises are methodically monitoring and investigating their competitors, while
deploying all the resources they have at their disposal in order to beat their current or future rivals.
Hence, Competitive Intelligence (CI) has become the ‘latest weapon in the world war of economics’. This paper contributes to the growing body of literature on competitive intelligence by synthesizing knowledge stemming from many years of experience in the standardization arena. The authors aim to show how, in the economic war, engaging in committee-based standards development may be used for winning the competition battle.

In Champion for Business Intelligence: SMART Goals For Business Focused and Financially Backed Results, Irina Dymarsky notes that although Gartner’s EXP 2006 CIO Survey ranked Business Intelligence (BI) as the top technology priority, BI projects face tough competition from other projects in IT portfolios promising more tangible financial returns (Wu & Weitzman, 2006) Irina states that two major hurdles that prevent BI projects from shining in portfolios are vague requirements and weak benefits calculations. However, she asserts that these hurdles can be addressed. This is accomplished by examining and learning from a number of case studies that prove tangible ROI on BI solutions that have been scoped and designed with a focus on specific, measurable, achievable, results-oriented, and time bound SMART business goals. In order for BI projects to compete in IT portfolios based on financial measures, like ROI, Dymarsky declares that BI champions need to approach BI requirements gathering with the goal of addressing a specific business problem as well as employ standard ways of calculating BI benefits post project go live. She says that by examining common failures with BI requirements and case studies which demonstrate how successful BI implementations translate into tangible benefits for the organization, BI champions develop a toolkit of tips, tricks, and lessons learned for successful requirements gathering, design, implementation, and measure of business results on BI initiatives.

Joseph Morabito, Edward A. Stohr, and Yegin Genc examine the key issues associated with current and future implementations of business intelligence (BI) in their paper Enterprise Intelligence: A Case Study and the Future of Business Intelligence. The authors review the literature and discover both the growing importance and emerging issues associated with BI. The issues are further examined with an exploratory, but detailed, case study of organizations from a variety of industries, yielding a series of lessons learned. The authors find that organizations are rapidly moving to an enterprise perspective on BI, but in an unsystematic way. Morabito, Stohr, and Genc then present a prescription for the future of BI called “enterprise intelligence” (EI). EI is described in a framework that combines elements of hierarchy theory, organization modeling, and intellectual capital. The authors note that organizations are emphasizing tools and technology sub-systems to detriment of the other, necessary, interacting structural sub-systems. In fact, they assert, each sub-system must be designed and managed to realize the full potential of EI.

In Business Intelligence Competency Centers: Centralizing an Enterprise Business Intelligence Strategy, Daniel O’Neill states that enterprises today continue to invest in business intelligence (BI) initiatives with the hope of providing a strategic advantage to their organizations. He asserts that many of these initiatives are supporting the tactical goals of individual business units and not the strategic goals of the enterprise. Although this decentralized approach provides short term gains, it he says creates an environment where information silos develop and the enterprise as a whole struggles to develop a single version of the truth when it comes to providing strategic information. Hence, he notes that enterprises are turning toward a centralized approach to BI that aligns with their overall strategic goals. At the core of this centralized approach is the business intelligence competency center (BICC). This paper details why the centralized BICC approach should be considered an essential component of all enterprise BI initiatives. He demonstrates that examining case studies of BICC implementations details the benefits
realized by real world companies who have taken this approach. O’Neill states that it is also important to provide analysis of the two BI approaches in the areas of BI process and BI technology/data and people relations. O’Neill’s findings indicate the benefits of the centralized BICC outweigh the deficiencies of the decentralized approach.

Robert Sawyer’s paper, BI’s Impact on Analyses and Decision Making Depends on the Development of Less Complex Applications, examines why BI developers have failed to create applications suited for the common end-user and it provides a conceptual roadmap to address these shortfalls. He argues that BI’s impact on analyses and decision-making depends on the development of less complex applications. Research conducted for his paper finds that BI lacks a common definition and standard, that BI tools are too complex for the common user, and that a shortage of analytical literacy relevant to BI among business professionals is a barrier to BI adoption. Sawyer suggests that until BI analysis tools become more “human-centric, design-oriented” and less from a “technology-centric, engineering-oriented perspective,” BI will continue to fail in its objective to routinely improve business decision-making.

In Discovering Business Intelligence from the Subjective Web Data, Ranjit Bose states that the online word-of-mouth behavior that exists today in the Web represents new and measurable sources of information. He declares that automated discovery or mining of consumer opinions from these sources is of great importance for marketing intelligence and product benchmarking. This is because techniques are now being developed to effectively and easily mine the consumer opinions from the Web data and to timely deliver them to companies and individual consumers. His study investigates this emerging field named ‘opinion mining’ in terms of what it is, what it can do, and how it could be used effectively for business intelligence (BI). He provides a rigorous review of the research literature on opinion mining to explore its current state, issues and challenges for its use in developing business applications for competitive advantage. This study aims to assist business managers to better understand the current opportunities and challenges in using opinion mining for deriving BI. Future research directions for further development of the field are also identified. Bose believes that the key to the future success of opinion mining is integrating the strengths of two worlds – creating technology that combines a human’s linguistic capabilities with the speed and accuracy of a computer. He posits that advances in natural language processing research are beginning to close the gap between the human and computer language processing capabilities and he asserts that the research community has come to a conclusion that machine learning based approaches with the help of natural language processing is the most promising way to go for future developments. However, he is optimistic that there will be novel automated techniques coming out in the next few years to make opinion-mining technology practical for large-scale applications.

David Ellis examines Business Intelligence Enhances Strategic, Long-Range Planning in the Commercial Aerospace Industry. David notes that the world’s largest aircraft manufacturers like Boeing and Airbus have traditionally been dominant in the commercial aerospace industry, but due to the rise of several smaller commercial aircraft companies and in spite of air travel increasing each year, he argues that it will be paramount for Boeing and Airbus to thoroughly understand past and current market conditions and be able to combine their understanding with the proper analytical tools to anticipate the market demands of the future if they are to remain the world leaders in their industry. His paper presents a discussion of industry factors such as airline routes, past passenger demands in different regions of the world and the sizes and types of aircraft that were required to support those demands, and more importantly, how analysis of that information is integral to the projection of future demands within the commercial aerospace market which will facilitate Boeing and Airbus positioning themselves to provide
their airline customers with the right product at the right time. He finds that due to the complexity of the required data analysis for forecasting, the utilization of business intelligence methodologies such as regression and correlation analysis greatly enhance long-range, strategic planning in the commercial aerospace industry.

In *Performance Management through Societal Performance Indicators*, Joe White states that performance management is tied to external forces and stakeholders whose assessment of performance is more focused on societal outcomes than purely financial outcomes. He declares that government, corporate, and even personal performance measurement should take into account societal indicators that link these disparate yet intertwined spheres of influence. White says that new initiatives in both government and commercial sectors are bringing greater understanding of how societal indicators can measure performance. His paper highlights how societal indicators are used to measure performance in corporate and government sectors. Corporate societal indicators are explored primarily through literary research. Government societal indicators are then further explored through an examination of both the EPA and Superfund program. White’s research demonstrates that there is synergy between corporate, government, and personal government performance measures and he shows how business intelligence tools are making these relationships more transparent.

In his paper, *Business Intelligence Should Be Centralized*, Brian Johnson argues just that. His paper also reviews how the concept of centralization is defined, how it relates to the implementation of BI, and how it can effectively overcome the common implementation hurdles. Johnson maintains that the implementation of BI into the business strategy and culture is laden with many potential points that could result in failure of the initiative, leaving BI to be underdeveloped and a source of wasted resources for the company. Due to the unique nature of BI in the business space, he believes that properly setting up BI within the organizational structure from the onset of integration minimizes the impact of the most common hurdles to BI implementation. His analysis finds that many companies choose to mitigate these problems by using a centralized approach by building a Center of Excellence. However, Johnson argues that when doing this their place in the company’s organizational structure needs to be well defined and properly empowered to be effective. He states that Core BI functions must be centralized, but consumerist functions like analytical processing can be farmed out to business units, or be housed in a central analytical unit as works best with the company’s culture.

In a paper entitled, *The Future Talent Shortage Will Force Global Companies to Use HR Analytics to Help Manage and Predict Future Human Capital Needs*, Carey Worth examines exactly that issue. Her paper focuses on why companies should use analytics (a subset of Business Intelligence (BI)) to transform and maximize the potential of their human capital. During the recent recession the number of jobs lost has been widely publicized. However, Carey states that lurking among this obvious and simple metric of how human capital is involved in the workforce, there is also a need to analyze and predict future talent. She emphasizes that, as economic conditions are slow to improve, decisions to simply cut the traditional costs, benefits, compensation and headcount are no longer enough. She notes that companies have already started using business intelligence (BI) to transform and maximize the potential of their human capital and that the use of human capital based business intelligence (BI) has increasingly become one of the vital strategic components for world-class companies. By using HR analytics, Carey asserts that organizations become more effective in managing and improving the performance of human capital and in the process become more competitive and profitable. HR analytics helps an organization improve its profitability through more effective workforce cost control, balancing the lowest effective
headcount while ensuring satisfactory service delivery. Managers can analyze top and bottom-performing employees to better develop and retain key talent pools addressing any retention trouble spots or looming gaps in needed competencies. Both executives and managers alike can better understand, she says, the causal effect of workforce investment on operational results.

**ANALYTIC ISSUES**

Lakshmi Iyer and Rajeshwari Raman present a paper entitled, *Intelligent Analytics: Integrating Business Intelligence and Web Analytics*. They state that web analytics is an evolving area that presents companies with myriad opportunities to enhance their online presence. In this paper, they make a case for organizations to find ways to integrate web analytics with traditional BI to be proactive in the competitive market place by exploring new growth strategies. Iyer and Raman first identify growing trends in web analytics that pave the way for integration and they then discuss the capabilities that organization must consider in looking at possible solutions to adopt. The authors suggest that if organizations find possible ways to accomplish the integration, the ability to track and market to existing or new consumer needs can give firms a sizable competitive advantage. The challenge, they note, though is the constant innovation of online technologies to track user behavior. They assert therefore that it is therefore important that as the BI field grows, structure and standards be implemented to balance stakeholders’ concerns such as data rights management, accuracy, and privacy. They urge more research into developing standards for data representation, development of methods to analyze complex data such as audio or video, identifying appropriate metrics for measurement, examining organizations and governance issues, and assessing the impact of text analysis of social media data.

In *Strategies for Improving the Efficacy of Fusion Question Answering Systems*, José Antonio Robles-Flores, Gregory Schymik, Julie Smith-David, and Robert St. Louis state that web search engines typically retrieve a large number of web pages and overload business analysts with irrelevant information. One approach that has been proposed for overcoming some of these problems is automated Question Answering (QA). This paper describes a case study that was designed to determine the efficacy of QA systems for generating answers to original, fusion, list questions (questions that have not previously been asked and answered, questions for which the answer cannot be found on a single web site, and questions for which the answer is a list of items). Results indicate that QA algorithms are not very good at producing complete answer lists and that searchers are not very good at constructing answer lists from snippets. These findings indicate a need for QA research to focus on crowd sourcing answer lists and improving output format. The authors also assert that precise, timely, and factual answers are especially important when communication channels are limited. The point out that a growing number of Internet users rely on mobile devices such as internet-enabled cell phones, which do not have the luxury of a large screen space. Moreover, military personnel, first-responders, and security specialists frequently are under such tight time constraints that every additional second spent browsing through search results put human lives at risk. A high priority for BI researchers should be additional research to determine the extent to which QA algorithms can get the right information to the right person at the right time and in the right format to make the right decision.
TECHNOLOGY ISSUES

Sam Schutte, Thilini Ariyachandra, and Mark Frolick present a paper entitled Test-Driven Development of Data Warehouses. They introduce their topic by stating that over the course of the last decade, the business of software development has gone through rapid changes due to the introduction of new lightweight methodologies. These methodologies - such as Extreme Programming, Agile Development, and SCRUM - emphasize a focus on frequent inspection and adaptation of business requirements and technical architectural structure, and introduce new programming methods such as peer programming and stand-up meetings that help reduce re-work and improve quality. One of the newer methods used by Agile development teams, they note, is test-driven development, which is a software development technique that uses short development iterations based on pre-written test cases that define desired improvements or new functions. The authors state that the overall result of the introduction of these new methodologies has been a measurable improvement in the quality, time-to-market, and productivity of software development teams. The authors note that at the completion of a test-driven data warehouse project, the end result would be a provably correct system. Additionally, any future changes to this system that “break” the rules of the requirements would quickly be visible because a test case would begin to fail. The authors conclude by asserting that with the vast amount of data that resides in data warehouses, the only way to have such a provably correct system is through the use of automated tests. By using test-driven development they believe that data warehouse implementation project teams can better strive towards implementing a provably correct warehousing solution.

Uncovering Actionable Knowledge in Corporate Data with Qualified Association Rules is a paper by Nenad Jukic, Svetlozar Nestorov, Miguel Velasco, and Jami Eddington. The authors first note that Association rules mining is one of the most successfully applied data mining methods in today’s business settings (e.g. Amazon or Netflix recommendations to customers). They then note that qualified association rules mining is an extension of the association rules data mining method, that uncovers previously unknown correlations that only manifest themselves under certain circumstances (e.g. on a particular day of the week), with the goal of improving action results, e.g. turning an underperforming campaign (spread too thin over the entire audience) into a highly targeted campaign that delivers results. They add that such correlations have not been easily reachable using standard data mining tools so far. Their paper describes the method for straightforward discovery of qualified association rules and demonstrates the use of qualified association rules mining on an actual corporate data set. The data set used by the authors is a subset of a corporate data warehouse for Sam’s Club, a division of Wal-Mart Stores, INC. The experiments described in this paper illustrate how qualified association rules supplement standard association rules data mining methods and provide additional information that can be used to better target corporate actions. They conclude by stating that by utilizing qualified association rules, organizations can add an inexpensive, and yet very practical and fruitful method of analyzing data that can quickly discover a layer of knowledge that was previously unknown. Moreover, they say, once this additional knowledge is discovered, its potential to affect and improve corporate performance is immediately apparent.

Adam Hill, Thilini Ariyachandra, and Mark Frolick present a paper entitled, 10 Principles to Ensure Your Data Warehouse Implementation is a Failure. The authors begin by acknowledging that the demand for business intelligence solutions continues to grow in the industry at record rates to combat competitive pressures and to attain business agility. Despite this fact, the authors find that many organizations continue to struggle on how to implement successful business intelligence solutions. Despite BI’s growing popularity and maturity as a field, the authors believe that it appears that organizations follow key
guidelines that ensure the failure of their business intelligence implementation. Their paper highlights ten major principles that organizations follow to ensure the failure of their BI solution and in so doing they describe how to avoid BI failure in terms of strategy and design, implementation management and communication, and technology and resource investment for BI solutions. They conclude by asserting that if a company is clear on what it intends to achieve with the project, allocates sufficient thought to design, ETL processes, and resource and technology investments, and benchmarks its progress, providing regular communication to all key stakeholders, it will have a much greater chance at achieving success in their data warehouse implementation.

**Business Intelligence Conceptual Model** is a paper by Fletcher Glancy and Surya Yadav. In this paper, a business intelligence conceptual model (BISCOM) is proposed as a process-focused design theory for developing, understanding, and evaluating business intelligence (BI) systems. The authors allege that previous research has concentrated on subsets of the BI systems, use of BI tools, and specific business functional area requirements. BISCOM, however, provides a unified and comprehensive design theory that integrates and synthesizes existing research. The authors say that BISCOM extends existing research by proposing functionality that does not currently exist in BI systems. The authors validate BISCOM through descriptive methods that they claim demonstrates the model utility. Moreover, through prototype creation, they avow they can demonstrate the need for BISCOM.

Kenneth Lozito notes that business intelligence has often been described as the tools and systems that play an essential role in the strategic planning process of a corporation. In his paper, *Mitigating Risk: Analysis of Security Information and Event Management*, he notes that the application of BI is most commonly associated with the analysis of sales and stock trends, pricing and customer behavior to inform business decision-making. However, Lozito proclaims that there is a growing trend in utilizing the tools and processes used in the analysis of data and applying them to security event management. He states that Security Information and Event Management (SIEM) has emerged within the last 10 years and it provides a centralized source for enabling both real-time and deep level analyses of historical event data to drive security standards and align IT resources in a more efficient manner. Lozito states that SIEM is a solution that requires cooperation and planning from within an organization. The benefits of compliance and gaining a centralized view of a security infrastructure as a whole gives distinct advantages over other organizations that do not implement this type of solution. Another key benefit of SIEM is the ability to perform deep threat analysis to drive security policy initiatives that will reduce the risk of exposure overall.

In *IT and Business Can Succeed in BI by Embracing Agile Methodologies*, Alex Gann contends that while the potential benefits from BI are potentially substantial, organizations have struggled to successfully deploy it. He notes that BI applies myriad advanced techniques, performed by the firm’s Information Technology (IT) group, to fulfill the reporting, analysis, and decision-support needs of the Lines of Business. Gann suggests that two of the greatest challenges in BI are accurately and continuously communicating requirements from the business to IT and quickly yet affordably delivering the requested functionality from IT to the business. He argues that companies can overcome these challenges by embracing a prescribed set of Agile development methodologies for BI. This paper examines the history of selected systems development approaches, weighs the advantages and disadvantages of prevailing practices, and ultimately recommends a path forward to succeeding in BI through the application of Agile methodologies.
The final paper entitled *Agile Development in Data Warehousing* is also focused on Agile development. Here Nayem Rahman, Dale Rutz, and Shameem Akhter state that traditional data warehouse projects follow a waterfall development model in which the project goes through distinct phases. Each phase must complete before the next one can commence. These phases include requirements gathering, design, development, testing, deployment and stabilization. The issue is that both business requirements and technology are complex in nature. The waterfall development model can easily take six to nine months or longer to fully implement a solution, and by then business as well as technology has often changed considerably. The result is usually disappointed stakeholders and frustrated development teams. The authors detail the agile development approach that implements projects in an iterative fashion. Also known as the sixty percent solution, the agile approach seeks to deliver more than half of the user requirements in the initial release, with refinements coming in a series of subsequent releases that are scheduled at regular intervals. The authors assert that the agile data warehousing approach greatly increases the likelihood of successful implementation on time and within budget. This article discusses agile development methodologies in data warehousing and business intelligence, implications of the agile methodology, managing changes in data warehouses given frequent change in business intelligence (BI) requirements, and demonstrates the impact of agility on the business.

**REFERENCES**