ARTICLES

Data-driven decision making for the enterprise: an overview of business intelligence applications

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Abstract
Purpose – The purpose of this paper is to inform the knowledge worker about Business Intelligence (BI) – its origins, value in decision-making processes, and currently available BI applications.
Design/methodology/approach – The paper discusses the evolution of decision support systems (DSS) and their close relationship with the business intelligence arena. Open source and commercial BI products are also identified.
Findings – The data that are accessed by BI applications must be accurate if managers of knowledge enterprises are to make informed decisions. Effective partnerships for business and information entities should be observed when BI tools are introduced to an enterprise. Buy-in from top management is absolutely necessary for the successful implementation of BI tools.
Originality/value – The use of BI applications aids a knowledge enterprise by promoting efficiency within an organization, particularly by using analytical methods to provide valuable decision-making knowledge to minimize operating costs and to accurately forecast market trends.
Keywords Intelligence, Decision support systems

Introduction
In today’s competitive, knowledge-based economy, organizations require the assistance of business intelligence (BI) tools to collect, analyze, and disseminate information so that knowledge workers are able to make informed decisions. The sheer speed at which a global economy operates makes critical the ability for managers to access “actionable data”, information that can be used to display performance metrics, understand customer behavior, and forecast market trends in a “real-time” manner. Business Intelligence applications support activities such as decision support, data mining, data warehousing, scorecarding, dashboarding, and financial analysis.

The birth of business intelligence: decision support systems
Dr Dan Power, founder of the Association for Information Systems Special Interest Group on Decision Support, Knowledge and Data Management Systems (SIG DSS) and editor of Decision Support Systems Resources newsletter (dssresources.com), defines a decision support system (DSS) as “an interactive computer-based system or subsystem intended to help decision makers use communications technologies, data, documents, knowledge and/or models to identify and solve problems, complete decision process tasks, and make decisions” (Power, 2007a).
The emergence of minicomputer and mainframe systems in the 1960s spurred the creation of decision support systems. It soon became apparent that the computer technology of the time was becoming powerful enough to conduct automated quantitative modeling tasks. DSS pioneers include Michael Scott-Morton, a Harvard PhD student who in 1967 submitted the first DSS-related dissertation that tested a model-based management decision system. In 1969, R.L. Ferguson and C.H. Jones conducted the first documented research study of a computer-based decision system.

In the 1970s, business journals began publishing DSS-related articles, such as a 1971 *Sloan Management Review* article authored by A. Gorry and Michael Scott-Morton that coined the term “decision support system.” DSS applications appeared in the 1980s, and the mid 1990s ushered in a generation of internet-based DSS tools for the world wide web. Current DSS applications feature artificial intelligence (AI) and expert systems in DSS capabilities. Table I lists the six broad categories of DSS (Power, 2007a).

**Business intelligence: definition and organizational integration tasks**

Noted KM consultant Tom Davenport (2005) defines business intelligence as “IT applications that help organizations make decisions [by] using technology for...”

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<th>Type of DSS</th>
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<td>Model-driven</td>
<td>Access and modification of financial, optimization, and/or simulation models&lt;br&gt;The most basic functional level is provided by quantitative models&lt;br&gt;Gerald Wagner develops the interactive financial planning system (IFPS), the first commercially-available app for generating model-driven DSS in the late 1970s&lt;br&gt;VisiCalc (visible calculator), a microcomputer-based analysis/DSS application, is developed by Dan Bricklin and Bob Frankston in 1978</td>
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<tr>
<td>Data-driven</td>
<td>Access and modification of real-time internal and external data&lt;br&gt;The most basic functional level involves search tools that access simple file systems&lt;br&gt;Executive information systems (EIS) are data-driven; the first EIS was created by Northwest Industries and Lockheed in the 1970s&lt;br&gt;Data warehousing and on-line analytical processing (OLAP) are derived from EIS&lt;br&gt;Ex.) Oracle and DB2</td>
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<td>Communications-driven</td>
<td>Communications and network technologies drive decision-based collaboration activities&lt;br&gt;Communications technologies are a major architectural component&lt;br&gt;Ex.) Video conferencing, groupware, and computer bulletin board systems (BBS)</td>
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<td>Document-driven</td>
<td>Document retrieval is accomplished via computer storage and processing&lt;br&gt;Search engines access legacy documents, policies, etc.&lt;br&gt;Ex.) Images, hypertext documents, sound, scanned documents</td>
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<td>Knowledge-driven</td>
<td>Systems that are devoted to problem solving via expertise (domain knowledge) and skill&lt;br&gt;Ex.) AI and expert systems</td>
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<td>Web-based</td>
<td>DSS info is presented via a web browser and TC/IP protocol&lt;br&gt;Ex.) Enterprise knowledge portals, web-centric databases</td>
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Table I. DSS categories
reporting and data access, as well as analytical applications” (Power, 2007b). Typically, BI applications retrieve and manipulate information stored in databases to help knowledge workers formulate decisions by analyzing available data. It is crucial that this data be as accurate as possible so that statistical inferences are made correctly to indicate forecasting trends and other important knowledge.

A thorough formulation of business objectives and information technology must be established for an enterprise to obtain value from a BI implementation (Williams and Williams, 2007).

Figure 1 highlights the human, financial, and organizational components necessary for successful BI integration. The illustration also suggests that, as with any KM-related activity, support from top management is necessary for a successful BI implementation to take place.

**Knowledge model for BI applications**

Business intelligence applications use a structured sub-grouping of data and an accompanying object model to create mapped relationships known as ontologies (Daconta et al., 2003). Relationships, policies, and data sources are used contextually to forecast likely outcomes for future events based on analysis of known data (historical information) (Figure 2).

**Business intelligence applications**

*Business Objects SA*

Business Objects SA (2007) is a leading commercial BI provider. The company’s Business Objects Enterprise XI product provides decision support capabilities for users via a BI portal interface that queries trusted data. The application supports Windows, UNIX, and Linux environments. For software programmers, Java,.NET, and web service development kits are available for software integration activities (Figure 3).

*IDV Solutions*

IDV Solutions (www.idvsolutions.com) specializes in dashboard interfaces for enterprise BI applications. Its Thetus Publisher provides information connectivity and has the ability to derive solutions from available data sources. One of IDV
Solutions’ products is a geographic information system (GIS) dashboard for offshore drilling monitoring in the Gulf of Mexico (Figure 4).

Pentaho Open Source Business Intelligence
Pentaho (2007) serves as a lead development facilitator for the Pentaho BI Project, an open source activity whose comprehensive capabilities include data mining, reporting, dashboards, workflow, and framework products. As Figure 5 illustrates, the Pentaho Open BI Suite supports a presentation (client) layer, analytical functionality (reporting, analysis, dashboards, and process management), security, business logic management, and integration with other third party applications.
Dundas Data Visualization, Inc. (2007), a leading distributor of digital maps, charts, and gauges for Microsoft.NET applications, offers a dashboard solution for airline executive management personnel that projects operational costs for maintenance, aircraft fuel, payroll, amortization, airport fees, and advertising. Features include break-even financial analysis and transaction itemizations (Figure 6).

**Conclusion**

The need for making complex decisions, combined with the emergence of powerful information systems, gave birth to the field of business intelligence. BI’s beginnings trace back to the creation of decision support systems in the 1960s. Since that time, five types of DSS have emerged: model-driven, data-driven, communications-driven, document-driven, and knowledge-driven. The internet prompted the creation of a sixth type, the web-based DSS, which powers today’s web-centric databases and knowledge portals. Effective BI partnerships for business and information integration are:

- business is responsible for capturing BI value;
- IT is responsible for delivering BI applications in an effective manner;
- BI projects should be funded based on a projected Return-on-Investment (ROI);
Figure 5. Pentaho Open BI Suite Architecture (Pentaho Open Source Business Intelligence)

Figure 6. Airline executive management dashboard (Dundas Data Visualization, Inc.)
BI expertise should be developed using a pool of knowledgeable business personnel;

business expertise should be developed using a pool of knowledgeable IT personnel; and
an organizational emphasis should be placed for BI in order for it to be successfully implemented.

Lastly, knowledge-based organizations should avail themselves of current BI offerings such as business object SA’s Enterprise XI suite, Pentaho’s open source business intelligence products, and Dundas Data Visualization, Inc.’s dashboard applications.

References

About the author
Darius Hedgebeth is a Senior Software Engineer with the Technatomy Corporation in Fairfax, Virginia. His professional experience includes over 20 years of software development and systems engineering expertise. Mr. Hedgebeth is a member of the IEEE and Web 3D Consortium, a standards-based organization devoted to the promotion of open standards for web-based 3D communication and visualization. He holds an MS Degree in Engineering Management with a concentration in Knowledge and Information Management from George Washington University, a BS Degree in Mathematics from North Carolina Central University, and is currently pursuing his PhD at George Mason University. Darius Hedgebeth can be contacted at darius.hedgebeth@gmail.com