



An Introduction to Business Intelligence for Higher Education

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This article is the first of a three part series on business intelligence (BI) for higher education institutions. This article includes an introduction to business intelligence and the purpose of BI, BI terminology, BI trends, and BI solution categories. The second article in the series will explore assessing an institution's readiness to implement a business intelligence program. The third article will tackle implementing a business intelligence program.

What is Business Intelligence?

In general, business intelligence refers to the skills, processes, technologies, applications, and practices used to leverage an institution's internal and external information assets to support and improve decision making.

The momentum to adopt a formal business intelligence program has been growing during the past few years in higher education. Some of the reasons include a greater demand for accountability, the requirement to "do more with less," more accessible technologies, and the quiet adoption of business intelligence through its ubiquitous use in commonly-used applications.

Purpose of Business Intelligence

The purpose of business intelligence is to support the mission and goals of the institution by enabling fact-based decision making.

From a data/information perspective, business intelligence solutions integrate data across information silos to provide a holistic perspective of the data, provide both data transparency and security, deliver consistent and reliable information, and give people access to the information they need in a way that allows them to more effectively meet their goals and objectives.



An effective business intelligence solution can be used to:

- Provide insight and measurement regarding strategic and tactical efforts
- Provide the ability to see the big picture and to find the needle in the haystack
- Support fact-based decision making
- Provide rapid feedback regarding actions
- Validate or discredit assumptions
- Discover non-intuitive relationships



While many institutions perceive and address business intelligence as a technology issue, the true purpose of business intelligence is to support the mission and goals of the institution. Achieving that purpose requires work in a number of areas besides technology as we will discuss in the next two articles in this series.

Business Intelligence Terminology

Ask five people from different organizations what business intelligence is and you'll likely get five different answers. The beauty and dilemma of that fact is that they are probably all correct.

Business intelligence covers a broad spectrum of practices, concepts, and technologies. The following list of terminology is not all inclusive, but will give you an overview of the typical business intelligence terminology.

Analytics refers to the study of data using statistical analysis in order to discover and understand historical patterns with an effort to predict and improve business performance in the future.

Benchmarking is the process of comparing processes and performance metrics to industry bests and/or best practices from other industries. Dimensions typically measured are quality, time, and cost. An example is benchmarking the time required to make Financial Aid Award decisions.

The **Business Intelligence Road Map** is an evolving plan that starts with an assessment of the institution's current state and the definition of the desired state in regard to business intelligence. The road map consists of the high level and detailed plans required to move from the current to the desired state.

Business Performance Management is a set of management and analytic processes that enable the performance of an organization to be managed to achieve pre-selected goals.

Collaborative Decision Making is emerging as a distinct software product category. Collaboration is an iterative process where two or more people or organizations work together to accomplish a task. Collaborative Decision Making products support collaboration by providing a framework for decision making and a platform for sharing, storing, and organizing ideas and work products in various formats.

Complex Event Processing (CEP) consists of processing many events happening across all the layers of an organization, identifying the most meaningful events within the complex event, analyzing their impact, and taking subsequent action. A student withdrawing from school is a complex event made up of a combination of many events. Data mining or an online analytical processing OLAP application may help identify the factors or events to monitor in order to be able to intervene prior to the student withdrawal.

Data Governance is a set of processes that ensures that important data assets are formally managed throughout the enterprise so that they may be used effectively and consistently by the entire organization. Data governance implements processes to ensure that data is accurate and consistent. Often a data governance council or board consisting of representatives from across an institution is formed to develop the policies and practices and to serve as the subject matter experts for their area.

A **Data Mart** is a separately stored subset of the enterprise data focused on one particular business function or application designed to serve a specific department or a particular community of knowledge workers. Often, the data mart is sourced from a subset of data in a data warehouse and sometimes stored in a multi-dimensional database for faster analysis. The Finance department may use a data mart for budget development and analysis. The Admissions department may create a data mart for data mining to help them identify the characteristics of an “ideal” prospect for the Engineering program.

Data Mining is a type of database analysis used to discover useful patterns or relationships in a group of data. The analysis uses advanced statistical methods, such as cluster analysis, and sometimes employs artificial intelligence or neural network techniques. A major goal of data mining is to discover previously unknown relationships among the data, especially when the data come from different databases. Colleges and universities can use data mining to discover relationships that were not previously realized between alumni and giving levels, applicants and student retention, and the timing of financial aid disbursement and retention, as well as countless other relationships.

A **Data Store** is a permanent storehouse of data. The term is often used to lump the storage of all types of data structures (files, databases, text documents, etc.) into one generic category.

A **Data Warehouse** is a repository of an organization's electronically stored data. Data warehouses are designed to facilitate reporting and analysis across the enterprise. Most organizations have a goal of a single, enterprise-wide data warehouse. However, often different areas of the school will implement data warehouses independently of one another. This often leads to a consolidation effort and can actually be beneficial since it allows an opportunity to revisit the design and adopt best practices and lessons learned. In higher education, it is not uncommon to find both a student data warehouse and a finance data warehouse, especially if the two areas use administrative software from different vendors.

A **Digital Dashboard** is an executive information system user interface that is designed to be easy to read. Often a dashboard contains information drawn from multiple applications presented in a consolidated display. This interface is also referred to as a mash up. Digital dashboards allow managers to monitor the key performance indicators for their area in a way that quickly draws attention to the area(s) needing attention by providing a snapshot of performance in a visual manner.

Benefits of using digital dashboards include visual presentation of performance measures, ability to identify and correct negative trends, measure efficiencies/inefficiencies, ability to generate detailed reports showing new trends, ability to make more informed decisions based on collected business intelligence, align strategies and organizational goals, save time when running multiple reports, and gain total visibility of all systems instantly.

For example, a Dean may have a dashboard that tracks actual vs. budget for the department, displays a list of the department's students with a mid-term GPA below 2.0, and a graph of projected enrollment vs. target enrollment for the next semester.

Extract, Transform, and Load (ETL) is a process in database usage and especially in data warehousing that involves:

- Extracting data from outside sources
- Transforming it to fit operational needs
- Loading it into the end target (database or data warehouse)

A **Key Performance Indicator (KPI)** is a measure of performance. Such measures are commonly used to help a school define and evaluate how successful it is, typically in terms of making progress towards its long-term organizational goals. KPIs can be specified by answering the question, "What is really important to an institution's stakeholders?" KPIs are typically tied to the strategic goals of the institution and help to evaluate the progress of an organization towards its vision and long-term goals, especially toward difficult to quantify knowledge-based goals.

A KPI is a key part of a measurable objective, which is made up of a direction, KPI, benchmark, target, and time frame. For example: "Increase Full Time Undergraduate Enrollment from 15,000 students to 16,750 students by the Fall Semester of 2011." In this case, 'Full Time Undergraduate Enrollment' is the KPI.

Longitudinal Analysis is the detailed examination of data to reveal trends over time. Longitudinal analysis in education can be used to reveal patterns in student achievement over a number of years.

Metadata is defined as data about data. Metadata is used to describe the definition, structure, and administration of data to ease the use of the data and to ensure consistency of use. For example, a data warehouse may include a calculated field called GPA. The metadata would define the fields that were used in the calculation and their source, as well as the calculation itself. It would also define the use of the field.

Online Analytical Processing (OLAP) is a methodology to provide end users with access to large amounts of data in an intuitive and rapid manner to assist with deductions based on investigative reasoning. OLAP systems support the complex analysis requirements of decision-makers, analyze the data from a number of different perspectives and support complex analyses against large data sets. The two prominent architectures for OLAP systems are multidimensional OLAP (MOLAP) and relational OLAP (ROLAP). MOLAP architectures utilize a multidimensional database to provide analyses while ROLAP architectures access data directly from relational databases.

An **OLAP Cube** is a multidimensional database that holds data more like a 3D spreadsheet rather than a relational database. The cube allows different views of the data to be quickly displayed. A student cube could allow rapid analysis based on high school attended, veteran status, age group, program, club participation, and several other factors.

A Vice President of Enrollment Management may want to look at student retention for a specific student cohort from various perspectives. These factors could include GPA, gender, program of study, residency,

veteran status, SAT or ACT scores, and financial need to determine contributing factors to a decrease in retention for that cohort over the last two semesters.

Operational Reporting is the most basic and widely used business intelligence application on campuses. Operational reports are those day-to-day, or monthly, reports that institutions use to better understand their operations. They can be delivered as hard copy reports, electronic reports, drillable reports, ad hoc reports, and even as spreadsheets. They may be regularly scheduled or on demand. Often they are not included in business intelligence discussions, but they are always a requirement for the complete solution.

Predictive Analysis focuses on the application of statistical or structural models for predictive forecasting or classification. Examples would include predicting next semester's enrollment and graduation rates over the next four years.

Text Mining refers to the process of deriving high-quality information from text. High-quality information is typically derived through means such as statistical pattern learning. Typical text mining tasks include text categorization, text clustering, concept/entity extraction, production of granular taxonomies, sentiment analysis, document summarization, and entity relation modeling. Text mining can be used in the initial review of employment and student applications.

Trends in Business Intelligence

Looking at the present and near future states of business intelligence, a few trends seem quite evident.

The adoption of business intelligence practices and tools is moving to the enterprise level. Business units are becoming more involved with business intelligence initiatives and control more of the business intelligence budget than they have in the past when it was considered primarily an IT initiative. Typically the program sponsor or one of the co-sponsors will now come from one of the business units. Enterprise adoption will increase the focus and demand on business intelligence program governance and data governance and will result in a broader use of semantic technologies to support enterprise wide data integration.

As business intelligence practices become more institutionalized, institutions will expand their use of advanced analytics and complex event processing to address more complex problems and provide a greater return on investment. The adoption of business intelligence will drive the narrowing of the gap between operational systems and the data warehouse, and it will be important for analytic systems to be much more integrated into the organization's operations and information infrastructure. Addressing broader and more complex problems at an institutional level will also increase the importance of integrating and analyzing unstructured and semi-structured data.

As business intelligence matures and becomes more adopted, new product categories and options will emerge for implementing business intelligence. Some industry-specific analytic applications will be delivered via software as a service as a standard component of the business intelligence portfolio. Collaborative decision making will continue to develop as a new product category that combines social software with business

intelligence and social computing will be a growing area for business intelligence. As with enterprise

transactional systems, institutions will increase their interest in both cloud computing and Open Source solutions for business intelligence.

Categories of Business Intelligence Solutions for Higher Education

Implementing business intelligence can be done through a variety of approaches. Following are some of the solution categories and examples of providers in each category. In some cases a provider may fit multiple solution categories. These provider examples are not intended to be complete lists.

Non-Industry Specific Analytic Reporting Tools: This category consists of traditional business intelligence vendors, such as Business Objects, Hyperion, Cognos, Information Builders, MicroStrategy, SAS, and SPSS. Considerable market consolidation of reporting tool solutions through acquisitions has taken place with vendors such as Oracle, Microsoft, IBM, and SAP. Often these tools are integrated into end-to-end business intelligence suites.

Analytic and Data Visualization Tools: This category is represented by vendors including Rapid Insights, Tableau, and Salient. Typically these solutions have a powerful desktop development and deployment environment and can publish web interfaces and dashboards. They have data visualization and exploration capabilities and tout ease of use. Some may include predictive analysis capabilities.

ERP Vendor BI Solutions: This category consists of leading providers of administrative systems for higher education such as SunGard Higher Education, Campus Management, Datatel, and Oracle/PeopleSoft. The solutions are often based on a partnership with a toolset provider or an analytical application provider and include a data warehouse. The solutions are developed for and integrated with the administrative systems.

Custom-Developed BI/Analytics Solutions: This category consists of consulting and systems integration firms, such as Accenture and Sapient, which work with your team to build a custom solution.

Industry Specific Packaged Analytic Applications: This category consists of vendors such as eThORITY and iStrategy Solutions who have developed solutions that include interfaces to many of the leading higher education administrative systems. The solutions are targeted to accelerate business intelligence implementations and adoption.

Process-Oriented Consultants: This category consists of consultants who specialize in one or more of the following processes: strategic planning, change management, process management, project management, RFP development, and vendor selection.

Summary

Business intelligence refers to the skills, processes, technologies, applications and practices used to leverage an organization's internal and external information assets to support and improve decision making.

The purpose of business intelligence is to support the mission and goals of the institution through the enablement of fact based decision making. Its popularity is growing within higher education as institutions address an increased demand for accountability and complex enterprise wide requirements.

The next article in this series will explore assessing an institution's "readiness" to implement a business intelligence program.

About the Author

Dave Sharman, Owner and President of [Owl's Perch](#), has spent most of his career developing and delivering solutions for Higher Education with an emphasis on business intelligence. He is a senior leader with extensive experience in managing the definition, development and delivery of higher education solutions. Dave brings over 20 years of project, program, and product management experience, as well as the perspective gained from successfully managing business unit performance and working with vendors, partners, and customers. Dave founded Owl's Perch with the goal of helping colleges and universities better serve their constituents through the effective and strategic use of information. Dave partners with Collegiate Project Services to provide various BI readiness and planning services.

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