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Business Intelligence and Big Data Analytics: An Overview

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ABSTRACT

This research investigates the current status of big data business analytics and critical skills necessary to create business value. Business analytics refers to the skills, technologies, applications and practices for continuous iterative exploration and investigation of past business performance to provide actionable insights. Business analytics focuses on developing new insights and understanding of business performance based on data and statistical methods. Big data is used to characterize data sets that are large, diverse and rapidly-changing, as seen by ever-increasing numbers of organizations. Big data require database management systems with capabilities beyond those seen in standard SQL-based systems. According to Manyika et al. (2011), the projected demand for deep business analytical positions could exceed the supply produced with the current trend by 140,000 to 190,000 positions, in addition to the projected need of 1.5 million managers and analysts in dealing with big data business analytics in the United States. Specifically, the emphasis of this research is on how organizations are using big data business analytics and how business school in the United States and across the globe are designing their programs to fill in the talent gap, which leads to a more in-depth analysis on the graduate degree programs in the Greater New York Metropolitan area and potential applications in various industries.

Keywords: business intelligence, business analytics, big data analytics

INTRODUCTION

*Business analytics refers to the skills, technologies, applications and practices for continuous iterative exploration and investigation of past business performance to provide actionable insights. Business analytics focuses on developing new insights and understanding of business performance based on data and statistical methods. The term *big data* is used to characterize data sets that are large, diverse and rapidly-changing, as seen by ever-increasing numbers of organizations. *Big data* require database management systems with capabilities beyond those seen in standard SQL-based systems. According to Manyika et al. (2011), the projected demand for deep business analytical positions could exceed the supply produced with the current trend by 140,000 to 190,000 positions, in addition to the projected need of 1.5 million managers and analysts in dealing with big data business analytics in the United States. “Increasingly, top thinkers in academia and business believe that analytics, especially analytics connected with big data, is going to be a driving force in our economy and society in the next 10 to 20 years” (Kiron, Ferguson, & Prentice, 2013, p. 3). To ensure continuing relevance for organizations in the future, this research reviews the current status of big data business analytics and critical skills required to create business value in real*

business operations. Specifically, the emphasis of this research is on how organizations are using big data business analytics and how business school in the United States and across the globe are designing their programs to fill in the talent gap. Potential applications in various areas are also discussed.

The rest of the paper is organized as follows: Section 2 reviews the literature. Section 3 provides a detailed case analysis on graduate degree programs with respect to big data business analytics. Section 4 discusses potential applications in business analytics. Finally, Section 5 summarizes the research.

LITERATURE REVIEW

Big data refers to huge datasets that are beyond the ability of traditional database software tools to capture, store, manage and analyze, with extreme volume, velocity, and variety (Chan, 2013). According to Das and Kumar (2013), the volume of the digital data will grow to 8 Zettabytes by 2015, which is equivalent to 18 million Libraries of Congresses, 90 percent of which will be unstructured data in the next decade, including text, document, image, video, and other forms of social media data.

Business analytics makes extensive use of data, statistical and quantitative analysis, and explanatory and predictive modeling to help make actionable decisions and to improve business operations. There are many kinds of business analytics, real-time vs. non-real-time, strategic vs. tactic, planned vs. unplanned, and structured vs. unstructured (Chan, 2012). Managers have used business analytics to inform their decision making for years. Now, they are using business analytics not only in analyzing past performance but also in identifying opportunities to improve future performance (LaValle, Lesser, Shockley, Hopkins, & Kruschitz, 2011). According to Chen, Chiang, and Storey (2012), business analytics consists of big data analytics, test analytics, web analytics, network analytics, and mobile analytics, many of which are unstructured and cannot be analyzed by relational database management tools. Fitzgerald (2014) points out that there are three types of career categories for graduates majoring in big data business analytics: top tier management consulting, financial and risk analysts, and data scientists. Wills (2014) suggests that applications of big data analytics in healthcare industry may begin with small data analytics since it is much more appropriate for healthcare managers and organizations to translate data and to have actionable intelligence based on current infrastructure in the healthcare systems.

Critical skills for business analytics include optimization analytics, descriptive analytics, and predictive analytics. For example, Watson, Wixom, and Ariyachandra (2013) suggest the following:

- Communication skills
- SQL and query skills
- Data mining and data warehousing
- Statistics skills
- Data visualization
- Text mining
- NoSQL skills

- Emerging topics

GRADUATE PROGRAMS IN GREATER NEW YORK METROPOLITAN AREA

We list six graduate business analytics degree programs in the Greater New York Metropolitan area, in addition to a newly launched Master of Science in Business Analytics (MSBAPM) at Fairfield University's Dolan School of Business in Fairfield, Connecticut.

University of Connecticut—MS in Business Analytics and Project Management

About the Program. The mission of the Master of Science in Business Analytics and Project Management (MSBAPM) is to deliver a program of excellence in the study of advanced business analytics and project management. The program delivers a core set of advanced courses in both business analytics and project management. MSBAPM provides an integrated curriculum and a global perspective using evolving technology platforms to facilitate and support the learning process. MSBAPM is structured to provide businesses a pipeline of talented and energized professionals who will create immediate value for their organization and the communities they serve.

The program requires 33 credit hours, including four 3-credit courses in business analytics, four 3-credit courses in project management, and 9 credit hours in elective courses.

Course Descriptions. Detailed course descriptions can be found at: <http://msbapm.business.uconn.edu/academics/course>

Business analytics (12 credits required)

1. Business process and modeling and data management
2. Predictive modeling
3. Business decision modeling
4. Data mining and business intelligence

Project management (12 credits required)

5. Introduction to Project Management
6. Project Leadership and Communications
7. Project Risk and Cost Management
8. Advanced Management

Fordham University—MS in Business Analytics

About the Program. Fordham's Master of Science in Business Analytics (MSBA) program integrates analytic techniques, data management, IT, modeling, and statistics to train students to become effective analysts and informed users of business data. MSBA students develop the skills required to succeed in data-driven industries such as banking, consumer products, energy, government, health care, insurance, manufacturing and pharmaceuticals.

This program consists of 30 credits over three semesters and can be completed in one year of full-time study or in flexible part-time study. The program starts in August and runs 12 months, full-time, until the following August. The program is completed over three trimesters: fall, spring, and summer.

Course Descriptions. Detailed program description can be found at: http://www.bnet.fordham.edu/academics/ms_programs/ms_business_analytics/index.asp

Fall term (12 credits)

1. Database management
2. Data warehousing
3. Data mining for business
4. One elective

Spring term (12 credits)

5. Business analytics for managers
6. Text analytics
7. Web analytics
8. One elective

Summer term (6 credits)

9. Business performance and risk management and analytics
10. One elective

Stevens Institute of Technology–MS in Business Intelligence and Analytics

About the Program. The market has an increasing need for professionals with data management knowledge, analytical capability and problem-solving skills. Stevens is one of a select few universities worldwide to offer a master's degree in this emerging field. Currently, Stevens is the only university in the New York City area to offer a business intelligence and analytics (BI&A) master's degree intended to train students to fill the growing demand for big data analysts.

This BI&A degree is a 36-credit graduate program for students who have already completed an undergraduate degree in science, mathematics, computer science, engineering or a related field. Stevens offers flexible study options for both full- and part-time students interested in advancing their careers within industry-specific analytical fields such as finance, information technology, telecommunications and engineering.

Course Descriptions. Detailed course descriptions can be found at: <https://www.stevens.edu/howe/academics/graduate/business-intelligence-analytics-bi-ms/msbi-overview>

1. Organizational context
 - Financial decision making
2. Data management
 - Strategic data management

- Data warehousing and business intelligence
- 3. Optimization and risk analysis
 - Process analytics and optimization
 - Financial enterprise risk engineering
- 4. Statistics
 - Multivariate data analytics
 - Experimental design
- 5. Data mining and machine learning
 - Knowledge discovery in databases
 - Statistical learning and analytics
- 6. Social network analytics
 - Social network analytics
 - Web analytics
- 7. Industry practicum (Select 1)
 - Applied analytics in the life sciences
 - Algorithmic trading strategies
- 8. Electives—Electives in additional departments are available for students who waive one or more of the required courses (financial decision making or strategic data management). To waive courses, students must have approval from a faculty advisor.
 - A. Finance
 - a. Investment and capital markets
 - b. Many financial engineering electives are available
 - B. Information systems
 - a. IT strategy
 - b. Integrating IT architecture
 - c. Marketing online

New York University—MS in Business Analytics

About the Program. The Master of Science in Business Analytics Program is designed with busy working professionals in mind. Participants live and work in their home countries and attend five concentrated, rigorous modules in New York and Shanghai. There is an optimization of classroom time, with usage of distance learning between modules. The modules are time intensive so that all teaching is done in-person only. Experienced managers who can benefit from unlocking the potential of big data. Participants come from a broad range of sectors: financial services, communications, consulting, health and pharmaceuticals, manufacturing, energy, nonprofit/NGO, education, IT, etc.

This program is one year in length and starts in May of each year.

Course Descriptions. Detailed module descriptions can be found at: <http://www.stern.nyu.edu/programs-admissions/global-degrees/business-analytics/academics/course-index/index.htm>

The modules in the MS in Business Analytics are spread over 12 months. Between modules, students complete approximately 20 hours of work per week on pre- and post-module tasks.

Module One: New York

1. Digital analytics and strategy: An introduction
2. Dealing with big data
3. Data mining for business analytics
4. Decision models
5. Probabilistic models for finance
6. Prediction

Module Two: New York

1. Data driven decision making
2. Social media and digital marketing analytics
3. Managing for quality

Module Three: Shanghai

1. Operations analytics
2. Advanced decision models
3. Data visualization

Module Four: Shanghai

4. Special topics in analytics: Revenue management and pricing
5. Strategy, change and analytics
6. Market modeling

Module Five: Closing—New York City

1. Strategic capstone

St. John's University – MBA in Business Analytics

About the Program. The Master of Business Administration with a concentration in business analytics develops professionals with training in the emerging field of integrated statistical analysis, data mining, predictive modeling, business intelligence and optimization methodologies with state-of-the-art information technology tools to automate or support decision-making activities in the ever-changing economy.

This program option provides students with a combination of technical and managerial coursework needed for dealing with future challenges in the technology and data-driven global environment.

Potential career options for graduates from this program include data scientist, health care analyst, statistician, predictive modeler, quantitative analyst, project manager, market research analyst, computer systems analyst and technical team leader.

Course Descriptions. Detailed module descriptions can be found at: <http://www.stjohns.edu/academics/graduate/tobin/academics/departments/cis/mbacis/mbabusinessanalytics.stj>

Quinnipiac University—MS in Business Analytics (Online)

About the Program. The Master of Science in Business Analytics is 33 credits in length and provides a strong quantitative foundation that is inclusive of advanced statistics, data mining, text mining, tools for analysis and presentation and other relevant courses. The mission of the program is to develop in working professionals the skill sets needed to address the massive amount of data that has become universally available in order to leverage this toward successful business and decision-making applications. Numerous business functions and industries have noted the enormous need for individuals who possess the quantitative, analytical and presentation skills required to apply data to the solution of business problems, to create new business opportunities and to support innovative practices. These skills are also critical to decision-making in the nonprofit, governmental and educational industries as well as to entrepreneurship and small business management. All courses are offered online.

Course Descriptions. Detailed module descriptions can be found at: <http://www.quinnipiac.edu/academics/qu-online/online-programs/online-graduate-programs/master-of-science-in-business-analytics>

Core courses

1. BA 610 Statistics and probability
2. BA 615 Predictive modeling
3. CIS 620 Data management
4. CIS 627 Data warehousing and data mining
5. CIS 628 Business intelligence and data mining
6. BA 620 Text mining
7. BA 690 Business analytics capstone

Four electives from the list below

1. CIS 625 ERP design and implementation
2. MG 603 Project management
3. CIS 690 Managing information technology projects
4. BA 680 Statistical quality control
5. BA 660 Optimization
6. BA 650 Data visualization

Fairfield University—Master of Science in Business Analytics

About the Program. The Master of Science in Business Analytics at Fairfield University's Dolan School of Business seeks to fill the talent gap in the area and to prepare graduates for this fast growing field by developing students' critical skills in data and model driven management decision making along with a strategic vision. The MS in business analytics is a thirty-credit program over three semesters, and can be completed in one year of full-time study or in flexible part-time study.

This program is designed for:

- Graduates from analytics disciplines who want to develop advanced skills to solve complex business problems in light of the big data challenges
- Graduates with degrees in quantitative areas such business, economics, computer science, engineering and statistics

- Experienced professionals seeking career advancement via specialized training.

Course Descriptions. The curriculum includes 30 credits of coursework, consisting of 10 three-credit courses: nine required courses and one elective. Detailed course descriptions can be found at: <http://www.fairfield.edu/academics/schoolscollegescenters/charlesfdolanschoolofbusiness/graduateprograms/businessanalytics/courses/>

Required courses:

1. QA 400 Applied business statistics
2. OM 400 Operations and supply chain management
3. IS 500 Information systems and database management
4. IS 520 Project management
5. OM 525 Process improvement and quality management
6. QA 500 Business forecasting and predictive analytics
7. OM 500 Introduction to business analytics
8. IS 540 Data mining and business intelligence
9. IS 550 Business analytics and big data management

One graduate elective:

1. MK 520 Marketing research
2. OM 535 Global logistics and supply chain management
3. IS 585 Contemporary topics in information systems and operations management

POTENTIAL APPLICATIONS OF BUSINESS ANALYTICS

Healthcare Industry

The Healthcare industry is one of the largest pieces of the economic make-up of the United States with 17.9 percent of the GDP or \$8,500 per capita in 2010, as shown in Figure 1.

With the amount of data set to increase within the industry as a result of ObamaCare, there will be great potential for hospitals, insurers, and doctors and researchers to use business analytics tools more affordably and effectively to deal with the information influx and at the same time to provide quality cares for the patients.

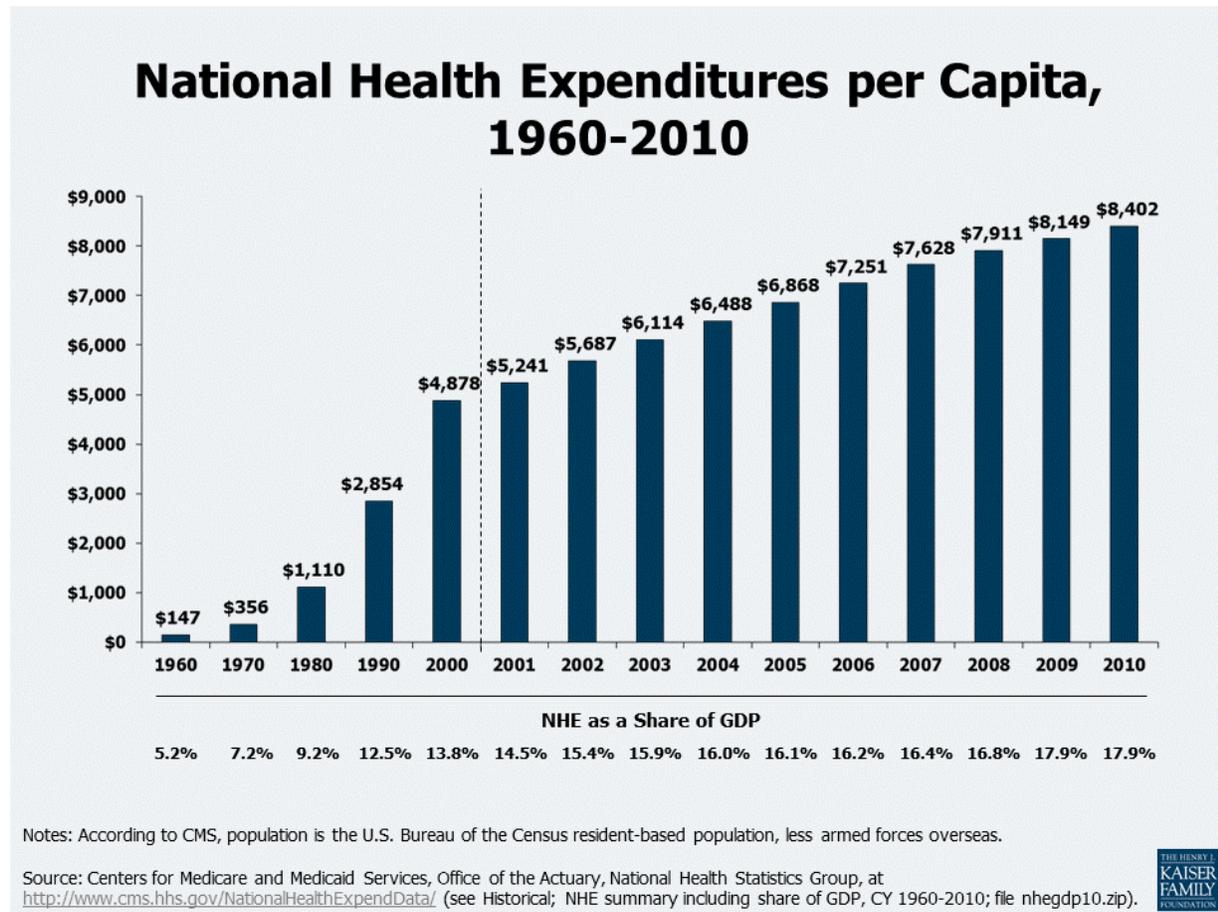


Figure 1: United States Healthcare Expenditures per Capita and GDP.

Supply Chain Management

Effective use of business analytics tools would help such companies as Boeing to make right decisions as to how much to outsource for its Boeing 787 Dreamliner, which is designed to use 20 percent less fuel and expected to be 10 percent lower in cost-per-seat mile. This brand-new product is not only a revolutionary aircraft, but also it serves as a role model with an unconventional supply chain strategy in order to drastically reduce new development cost from \$10 billion to \$6 billion. In fact, Boeing 787 has outsourced a full 30 percent of its parts and components that are managed by its tie-one suppliers, contrary to its Boeing 747 with only 5 percent. However, a series of supply chain delays had cost Boeing over \$5 billion late delivery penalty charges, in addition to the battery overheating incidents in January 2013. Since outsourcing and offshoring will continue as long as competitive advantages exist, the real challenge is: what, how, and how much outsourcing for a specific product to tradeoff between cost and quality (He, 2013).

Risk Management in Financial Industry

Big data business analytics has the potential to help financial institutions and insurance companies not only describe what has already happened such as Bernie Madoff Ponzi scheme that defrauded thousands of investors of billions of dollars and global financial crisis in late 2008, but also predict

how such catastrophic disasters might be prevented from happening in the future. To that end, companies need to understand fully the impact of operational risks and how to identify such risks by means of both descriptive and predictive analytics.

SUMMARY

This research provides an overview of the current status of big data business analytics, looks into critical skills necessary to create business value, reviews graduate degree programs that offer big data business analytics in the Greater New York area, and discusses potential applications in various industries. Specifically, the emphasis of this research is on how organizations are using big data business analytics and how business school in the United States and across the globe are designing their programs to fill in the talent gap.

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