WPU Webinar Series in Business Analytics

Myles D. Garvey, Ph.D

WILLIAM PATERSON UNIVERSITY

WPU Webinar and Workshop Series - 4-21-2020

Who is Myles D. Garvey?

- Assistant Professor of Management Analytics @ WPU
  - Research primarily lies in the areas of Supply Chain Risk Management, Social Media Textual Analytics, Marketing Analytics, and Optimization.
  - Currently tasked with designing and lecturing courses, as well as advising students within the Applied Business Analytics program.
- Educational Background
  - B.S in Math and a separate B.S. in Computer Science from University of Hartford, CT
  - Ph.D in Supply Chain Management and Marketing Science from Rutgers Business School
- Previously worked for Redhat as a Middleware Consultant
- Years of experience in analytics and software consulting.

Overview of Agenda

- Overview of Study
- Defining Business Analytics
- 3-min QA Break
- Responsibilities of a BA
- 3-min QA Break
- Current Market Trends
- Common Applications of Business Analytics
- 5-min QA Session
- Introduction to R Workshop
- Closing Remarks and Final Questions
- For those who can stick around until 2pm, I will be more than willing to stay to answer any additional questions!

Rules and Recommendations

- We ask everyone to ask questions in the "QA Box", even as we are presenting. This allows us to build up a queue of questions to answer during the QA Times.
- If you wish to verbally ask your question, please raise your hand.
- We recommend during the workshop portion of today to view the webinar on one screen and work in the R Studio Browser in a different screen. This will allow you to more easily follow along with us.
- Please keep voiced questions to a maximum of 15 seconds. We will need to cut off questions short which are longer than this.
- Please ask questions that can be answered within a 15 second time frame.

Data Sources for BA Industry Study

- Our study on the field of Business Analytics is based on a rigorous academic study we conducted over the prior few weeks.
- Sources of information:
  - Job postings on Linked In with search parameters of:
    - "Business Analyst"
    - "New York Metropolitan Area"
  - Survey of manager with samples sizes of 100 international and 100 domestic.
  - Each set of data contains information regarding common job titles, roles, responsibilities, skills required, salaries, and degrees.
  - United States Bureau of Labor Statistics
  - Other Academic Research

Some Commonplace Definitions

- Many definitions, from many sources! Here are a few:
  - "The method of logical analysis" - *Merriam-Webster*
  - "Management analysts, often called management consultants, propose ways to improve an organization's efficiency. They advise managers on how to make organizations more profitable through reduced costs and increased revenues." -*U.S. Bureau of Labor Statistics*
  - "Business data analytics is a practice by which a specific set of techniques, competencies and procedures are applied to perform the continuous exploration, iteration, and investigation of past and current business data, for the purposes of obtaining insights about a business that can lead to improved decision-making." - *International Institute of Business Analytics (IIBA)*
  - "INFORMS defines analytics as the scientific process of transforming data into insights for the purpose of making better decisions." - *The Institute for Operations Research and Management Sciences (INFORMs)*

Some Commonplace Definitions

- So what some themes we can see here?
  - Scientific Discovery
  - Mathematics and Statistics
  - Management, Decision Making, and Business Application
  - Data Manipulation and Data Analysis
  - Logic and Theory
- No wonder there is so much confusion about the differences between Data Analysis, Data Science, Business Intelligence, Artificial Intelligence, and Business Analytics!
- In order to arrive at a definition, let's dig deeper into common job descriptions and managerial perceptions of "Business Analytics".

Industry's Perception - Survey of Managers

- "Identifying key performance indicators and utilizing that information to gauge how the business is doing overall."
- "Using data-driven, scientific statistical methods to evaluate various aspects of business."
- "Using data that is generated in the course of business to identify useful patterns or trends that inform decision making".

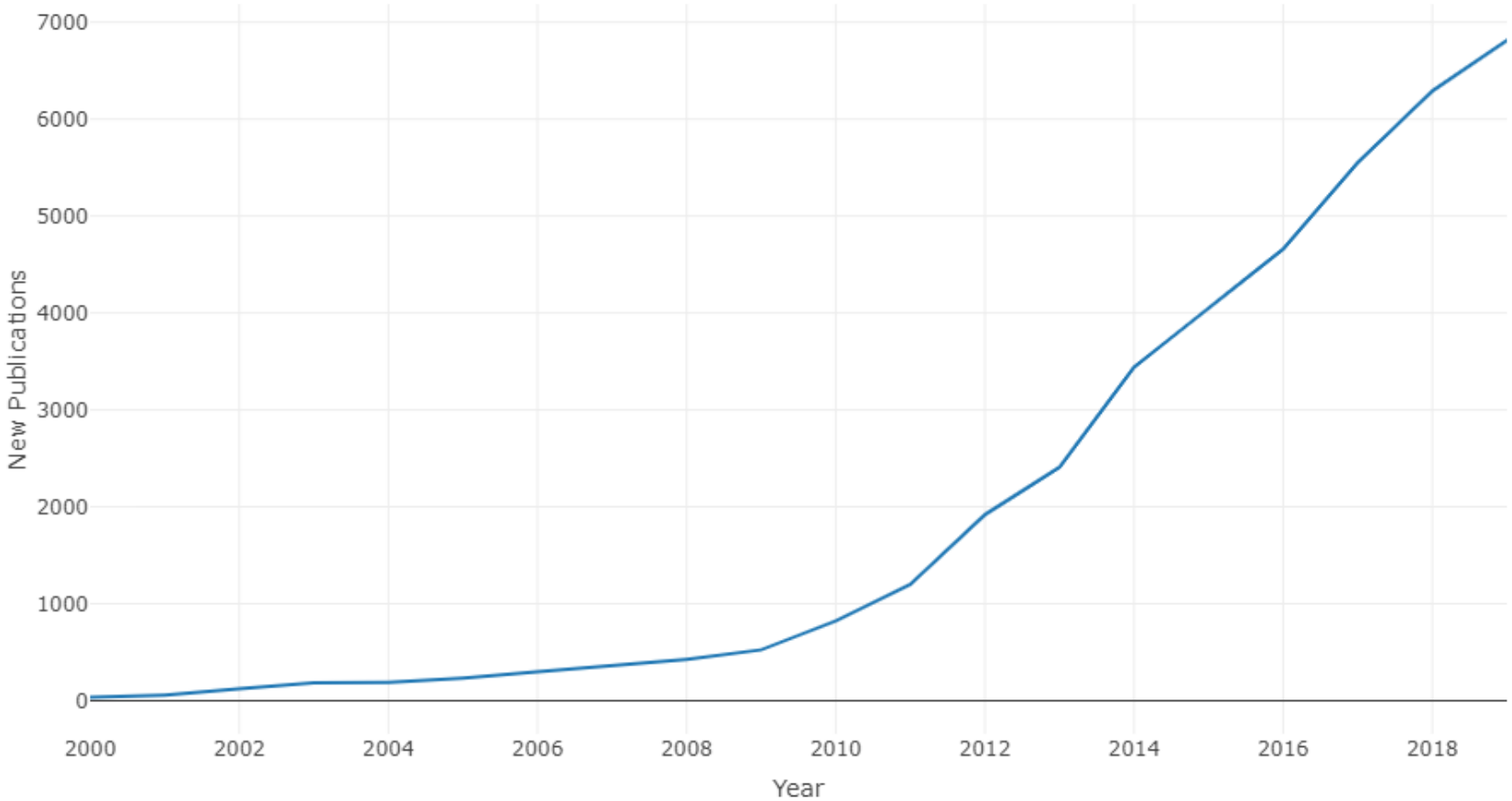
Industry's Perception - Survey of Managers

Industry's Perception - Linked In Descriptions

- "...seeking a Business Analyst with excellent analytical, financial and communication skills to support the financial and business management function within Deployment Runtime and Architecture."
- "... seeking an analytical, process, detail-oriented Business Planning Operations Analyst who can partner effectively with leadership across our Global Marketing Solutions organization."
- "...The Business Analyst will be asked to transform data into insights that drive business value. Through use of data analytics, data visualization and data modeling techniques and technologies, the BI analyst will develop dashboard solutions that can help other departments, managers and executives make strategic and tactical business decisions."

Industry's Perception - Linked In Descriptions

Academia's Perception - New Publications per Year



Academia's Perception - Proposed Definitions

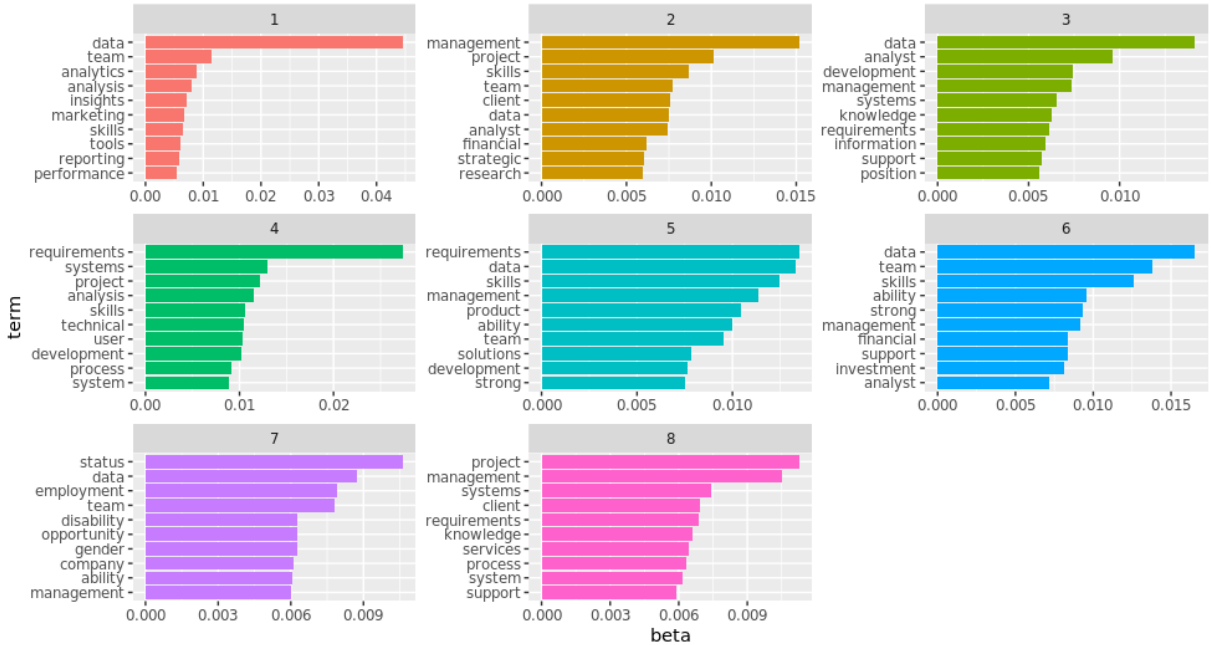
- "analytics is more than just analytical methodologies or techniques used in logical analysis. It is a process of transforming data into actions through analysis and insights in the context of organizational decision making and problem solving. Such a process can be initiated by the desire to address specific problems or the need to explore and learn from existing data" (Liberatore & Luo, 2010).
- "the use of data, information technology, statistical analysis, quantitative methods, and mathematical or computer-based models to help managers gain improved insight about their business operations and make better, fact-based decisions" (Evans & Lindner, 2012).
- "Business analytics can also be viewed as sitting at the intersection of OR, artificial intelligence (machine learning) and information systems" (Hindle & Vidgen, 2018).
- "Business analytics, for our purposes, is the application of processes and techniques that transform raw data into meaningful information to improve decision making" (Wilder & Ozgur, 2015).

Triangulating the Definition

- With our observations above, we can see that Business Analytics involves and is centered on a few themes.
- In order to objectively identify these themes, we decided to group the Linked-In data together with our Manager Survey data.
- We subsequently ran a Latent Dirichlet Allocation (LDA) model on our text data.
  - The goal of LDA is to:
    - Identify the number of "topics" within which we can categorize the text.
    - Assign to each text a collection of probabilities for each topic. This gives us a "topic distribution" of each text.
    - Categorize each description under a single topic by using the previous information and picking the topic with the highest percentage.
    - In our case, each "topic" represents a "theme" for the description.

Triangulating the Definition

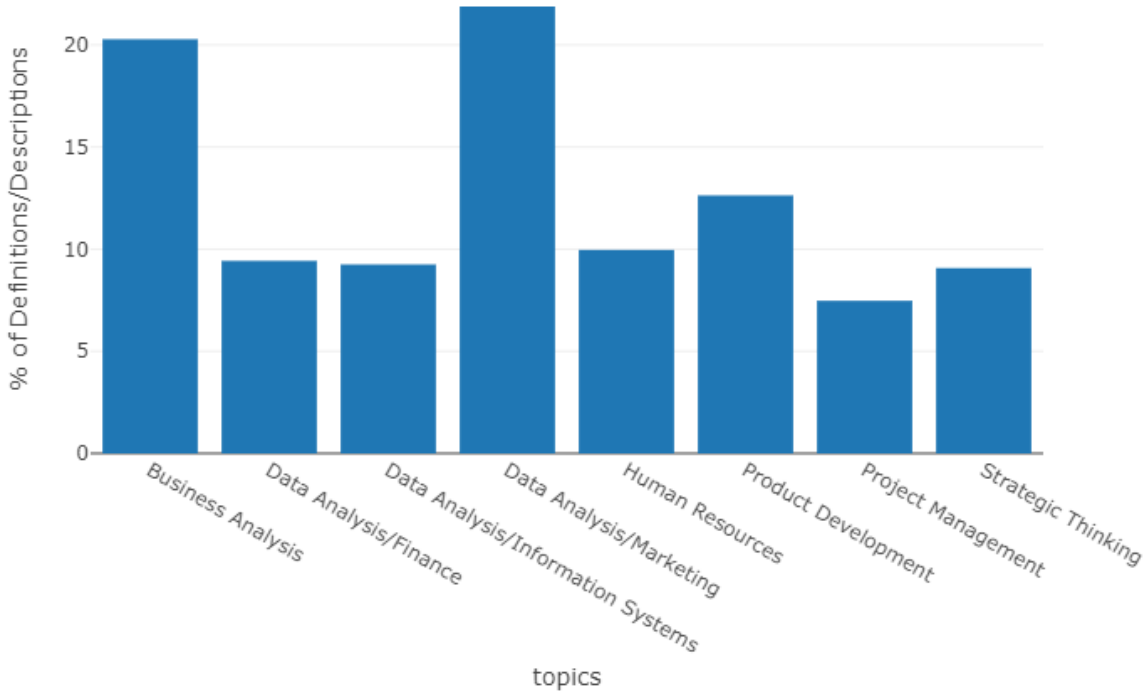
- We have the following words which "best describe" each topic:



- 1 = Data Analysis/Marketing", 2="Strategic Thinking", 3="Data Analysis/Information Systems",4="Business Analysis", 5="Product/Solution Development",6="Data Analysis/Finance",7="Human Resources",8="Project Management"

Triangulating the Definition

- We took this model and auto-assigned each text description to the "best topic". Our results lead us to a "profile" of what industry considers a "business analyst" skill wise:



Triangulating the Definition

- Taking the profile into account, along with academic definitions, we can therefore define Business Analytics as:
  - *Business Analytics* is the process of applying the scientific process and principles of management, as well as technology, computer programming, mathematics, advanced statistical approaches, and business domain knowledge, leveraging past business data, theories, or assumptions, to problems that arise in any functional area within an organization, with the specific intent to make a decision, solve a business problem, or understand the consequences of potential actions under consideration. Put differently, Business Analytics is science, math, and technology-driven management.

Responsibilities of a BA According to Academia

- Business Analysts are responsible for carrying out the standard process of Descriptive, Diagnostic/Predictive, and Prescriptive analytics (Evans & Lindner, 2012).
  - Descriptive - What **is** happening. The process of aggregating and summarizing data into tables, graphs, plots, and other visualizations. The purpose is usually to understand the "present". This is essentially a form of *Business Intelligence*. Yet, we could describe information about the furture, so while there is intersection, these two are not exactly the same.
  - Predictive - What **could** happen. The process of using statistical models, simulations, machine learning and data mining, among other approaches, using assumptions and data about the firm's environment, to predict outcomes based on current and future decisions.
  - Diagnostic - **Why** did it happen? The process of using information to understand the causes of outcomes.
  - Prescriptive - **How** can we make it happen? The process of taking information from our descriptive, predictive, diagnostic, along with other sources of information, to determine what is the "best" decision. Mostly, this involves the use of *mathematical optimization*.

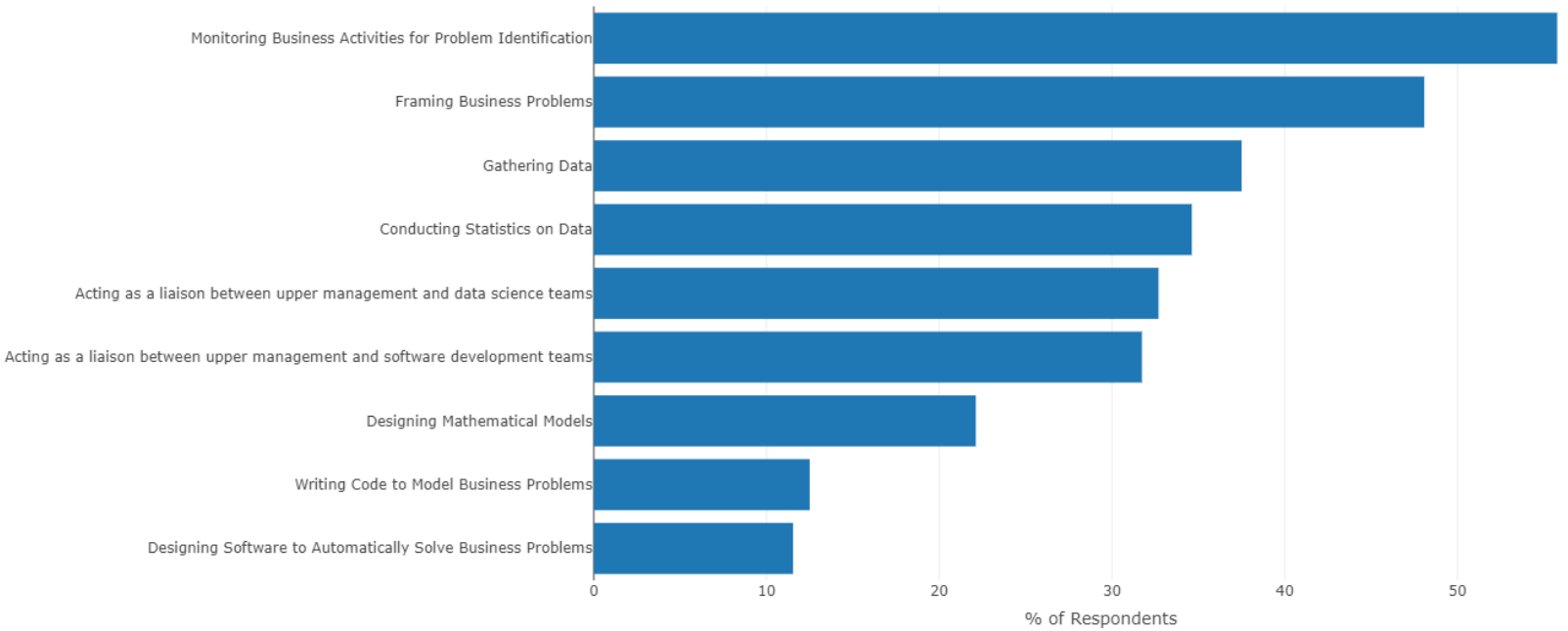
Responsibilities of a BA According to Academia

- Other responsibilities of the business analyst include but are not limited to (Wilder & Ozgur, 2015):
  - Monitoring current KPIs by way of BI Tools
  - Identifying and formalizing business problems in functional areas of the firm
  - Acting as an advocate for various business analytics projects
  - Designing models to drive their decision making
  - Managing business analytics projects
  - Managing cross-functional teams of data scientists, data specialists, and software developers/engineers.

Responsibilities of a BA According to Academia

- A nice simple model has been suggested for the life-cycle of business analytics projects (Dutta & Bose, 2015) :
  - **Phase 1: Strategic Groundwork** - This is the phase where the business analyst identifies a problem, and finds the justification for further investigation and the formation of a new BA project.
    - Formulate the Business Problem
    - Conduct research on prior projects, literature, data sources, and the current organizational environment.
    - Form a cross-functional team involving data specialists, analysts, data scientists, software developers, and functional area experts.
    - Put forth the project roadmap and advocate for the project.
  - **Phase 2: Data Analytics** - The is the phase where the "hard skills" are essential. The BA works with a variety of members in their cross-functional team to explore and design new models, analyze the data, and ultimately determine which model or models will be recommended for full-scale deployment.
    - Gather data and information. Judge its source, determine if it is primary/secondary, judge its quality, determine its fit to the project, etc.
    - Data analysis and modeling (Descriptive/Predictive/Diagnostic/Prescriptive) using Econometrics,Statistics, Bayesian Statistics, Probability, Simulation, Machine Learning, etc.
    - Create data visualizations to emphasize and "tell the story".
    - Extract and summarize insights, offer recommendations for decision making, potential consequences, etc.
  - **Phase 3: Implementation** - This is the phase where the business analyst's project is brought into the full production deployment into the rest of the organization, or, where final results are delivered.
    - Integrate solution with current IT systems.
    - Train individuals to use new additions to dashboards, other systems.
    - Use new system module to monitor and identify business problems (return back to phase 1!)

Industry's Perception of BA Responsibilities



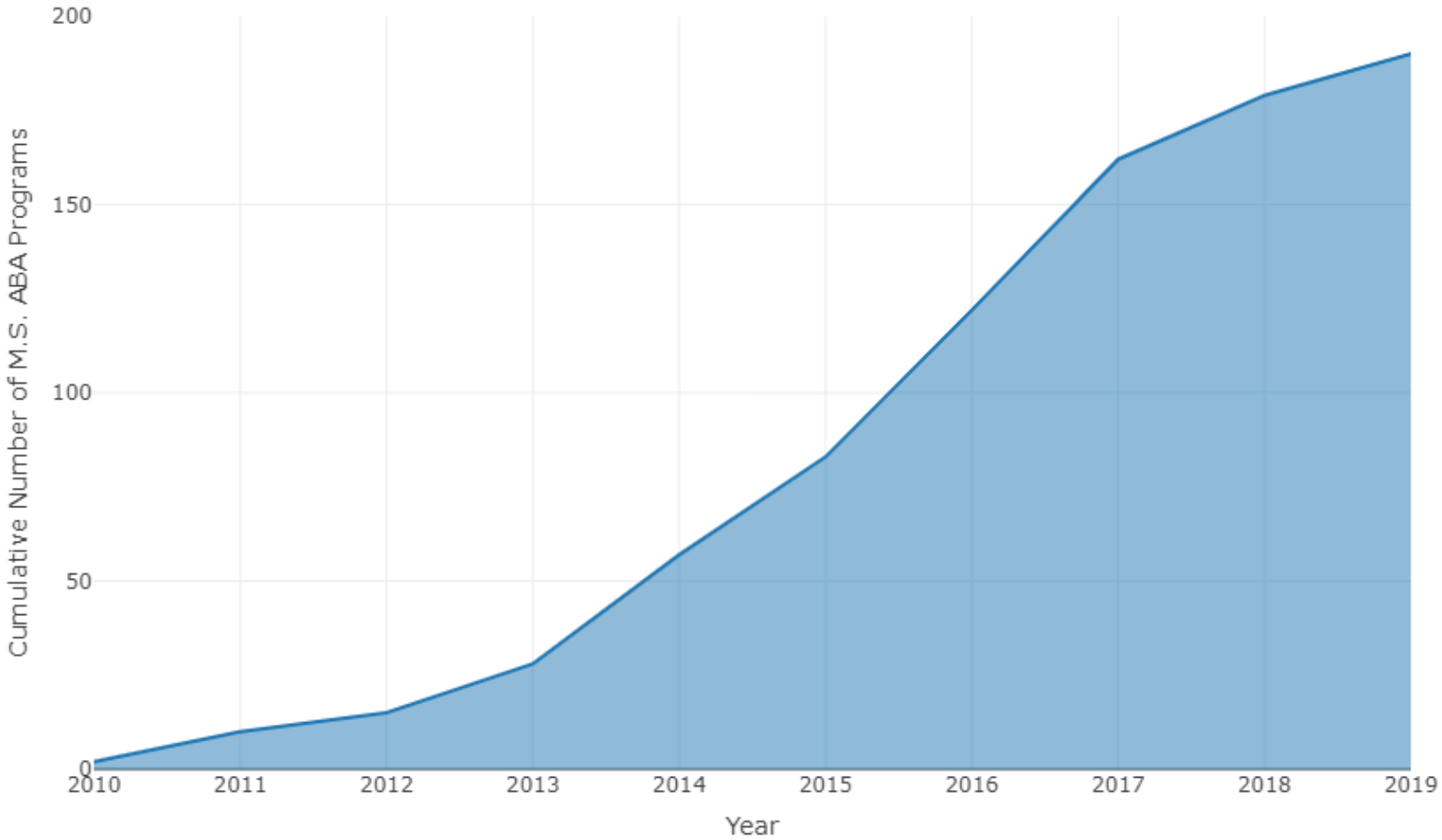
Sample of Other BA Responsibilities

- "Analyzing business data; reporting business metrics; formulating plans for improving those metrics."
- "Finance analysis, Team performance, Supply Chain Analysis"
- "Predicting market trends and using that knowledge to drive business, gathering opinion data, preference data, and satisfaction data. "
- "Discover lags in production; suggest ways to improve efficiency"
- "Predicting market trends and using that knowledge to drive business, gathering opinion data, preference data, and satisfaction data."
- "The most popular and well-known tools in both data analytics and business analytics are open source programming languages that provide statistical tools. The two most popular options are R and Python (with the pandas library). Though they require programming and understanding of the underlying statistical techniques, they are flexible and powerful. Any data processing or analysis task can be automated using these languages. R and Python both have large communities that provide support and many packages and libraries which provide added functionality and statistical methods. These include data visualization tools, advanced statistical algorithms, data scraping tools and much more."

Industry Outlook and Demand

- Currently, the Bureau of Labor Statistics estimates that demand for Management Analysts will grow by 14% between 2018 - 2028.
- The current average rate of growth for all other occupations: 5%
- As for our surveys:

Market Response



WPU M.S. in Applied Business Analytics

- Our Masters of Science in Applied Business Analytics is uniquely designed and delivered to give students a solid quantitative background, while also delivering the "soft business skills".
- Courses include into 2 Lower Core, 6 Upper Core, and 2 Electives
  - **Lower Core**
    - Calculus for Business Analytics
    - Statistics
  - **Upper Core**
    - Business Analytics for Decision Making
    - Data Warehousing and Data Mining
    - Multivariate Statistics
    - Machine Learning
    - Economic Models
    - Capstone Course
  - **Electives**
    - Offerings can vary, including but not limited to Financial Analytics, Marketing Analytics, Game Theory, Simulation Modeling, and others!
- Most classes are offered at night, and in hybrid format (meeting in-person every other week).
- Flexibility with part-time/full-time.
- If interested, you can apply now at https://wpunjgrad.org/apply/

Examples of Applications

- Marketing
  - Optimizing social media posting so that total engagement is maximized.
  - Market segmentation.
  - Co-Placement of products on retail shelves to maximize profit.
  - Product feature recommendation and new product recommendation.
- Finance
  - Scanning and analyzing financial assets on daily basis to predict movement in value.
  - Selecting the optimal group of assets, and the proportion of each in which to invest, so as to maximize expected profit.
  - Using news articles and social media to predict stock market valuation.
- Logistics
  - Predicting when a truck will break down, and optimizing truck maintenance schedules based on prior data.
  - Determining optimal truck delivery routes.
  - Determining the optimal mix of modes of transportation (truck, air, water, rail, etc).
- Supply Chain Management
  - Determining the optimal selection of suppliers and back up suppliers to minimize the risk of a supply chain disruption.
  - Using social media data and past sales to predict above average periods of demand.
  - Optimizing inventory levels based on prior data.

Questions?

Questions?

Dutta, D., & Bose, I. (2015). Managing a big data project: the case of ramco cements limited. *International Journal of Production Economics*, *165*, 293–306.

Evans, J. R., & Lindner, C. H. (2012). Business analytics: the next frontier for decision sciences. *Decision Line*, *43*(2), 4–6.

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