KENT STATE UNIVERSITY
CERTIFICATION OF CURRICULUM PROPOSAL

Preparation Date **18-Mar-15** Curriculum Bulletin _____

Effective Date Fall 2016 Approved by EPC _____

Department	**Management & Information Systems**
College	**BU - Business Administration**
Degree	**MS - Master of Science**
Program Name	~~**Master of Science in**~~ **Business Analytics** Program Banner Code ~~**MSBA**~~
Concentration(s)	Concentration(s) Banner Code(s)
Proposal	**Establish program**

Description of proposal:

The MSBA is designed to provide students with the knowledge that will enable them to glean meaningful information they need to provide business solutions from natural and often imperfect data. The need for business analytics experts has become more acute in recent years due to proliferation of technologies, both for capturing and analyzing the data. Consequently, as sophistication in technology grows, the need for data analytics experts will continue. At the present, there are much fewer experts in the field of data analytics than there are opportunities for them.

Does proposed revision change program's total credit hours? ☒ Yes ☐ No

Current total credit hours: Proposed total credit hours **30**

Describe impact on other programs, policies or procedures (e.g., duplication issues; enrollment and staffing considerations; need; audience; prerequisites; teacher education licensure):

The MSBA may improve enrollment in the School of Digital Sciences (SDSC), Computer Science (CS), and Information Architecture & Knowledge Management (IAKM). Otherwise, the program will have no appreciable impact on any other programs.

Units consulted (other departments, programs or campuses affected by this proposal):

SDSC, CS, IAKM, and the College of Business Graduate Council

REQUIRED ENDORSEMENTS

Department Chair / School Director	3/18/15
Campus Dean (for Regional Campuses proposals)	___/___/___
College Dean (or designee)	3/19/15
Dean of Graduate Studies (for graduate proposals)	3/26/15
Provost and Senior Vice President for Academic Affairs (or designee)	___/___/___

KENT STATE
UNIVERSITY

Interdepartmental Correspondence

Department of Management & Information Systems

TO: Dr. Deborah Spake, *Dean*, College of Business

FROM: O. Felix Offodile, *Chair*, M&IS Department

DATE: March 18, 2015

SUBJECT: Full Proposal to establish a Master of Science in Business Analytics (MSBA)

Attached is the full proposal to establish a Master of Science in Business Analytics (MSBA) in the College. The development of the full proposal was informed by our industry survey that shows strong support for the program curriculum, and comments from our peer Ohio institutions that reviewed the PDP. The proposed program aims to educate students to become cross-functional decision-makers at multiple levels of an organization's complex data-driven decision-making process for competitive advantage. Several publications show that there is ever-growing demand for graduates with expertise in business analytics. The goal of the proposed program is to graduate students who could take advantage of these opportunities.

The program has been approved by the M&IS Faculty Advisory Committee (FAC) and the College's Graduate Council.

Ohio | Board of Regents

John R. Kasich, Governor
Jim Petro, Chancellor

University System of Ohio

Request for Approval

Submitted by
Kent State University

Establishment of a Master of Science in Business Analytics (MSBA)

Date: _____

KENT STATE UNIVERSITY

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Master of Science in Business Analytics (MSBA)

Summary and Rationale

The College of Business Administration, Kent State University, proposes to establish a Master of Science in Business Analytics (MSBA). Analytics is the science of turning data into meaningful information a business could use for its competitive advantage. Demand for business analytics expertise transcends all areas of business including banking, healthcare, retail markets, manufacturing, finance and the public sector. As a diverse field that caters to the needs of equally diverse industries, business analytics programs are an amalgamation of curricula from business, engineering, mathematics, information systems, statistics, and other cognate disciplines. Designating the degree program at a master's level will enable the college to attract more mature students with work experiences and/or strong science, technology, engineering and mathematics (STEM) or business requisite baccalaureate proficiencies.

The College of Business Administration offers undergraduate majors in Accounting, Business Management, Computer Information Systems, Economics, Entrepreneurship, Finance, Managerial Marketing, and Marketing while graduate degrees are offered in MBA, EMBA, Masters in Accounting, and Masters in Economics, and Ph.D. in several concentrations. The proposed MSBA will draw from the college's diverse expertise in some of these disciplines to provide an interdisciplinary curriculum in business analytics. Graduates from the program will gain the knowledge that will enable them to glean meaningful information they need to provide business solutions from natural and often imperfect data.

The disciplinary purpose of the program is to produce graduates that understand and are ready to implement business analytical methods in realistic business contexts. By being 'ready to implement' business analytical methods, we mean that the graduate is not only aware of the general analytical methodologies in play but also has an understanding of the challenges involved in choosing the right problems or opportunities to address, selecting the best method(s) for analysis, interpreting the results into actionable solutions, and communicating and promoting the solution to stakeholders. Additionally, graduates of this program should be prepared to provide leadership throughout the entire process. The MSBA program, described in detail below, will provide opportunities for baccalaureate graduates from Business, Computer Science, Digital Sciences, Mathematics, Technology, etc. to advance and diversify their educational backgrounds in an emerging field with excellent potential for continued growth and employment.

1. Academic Quality

1.1 Program Structure

The core tenet of the philosophy behind the design of the program is that Business Analytics is more than a collection of quantitative tools. The business analytics professional first must be a member of the business team. They must understand underlying technologies such as databases and ERP systems. They must be expert communicators and decision-makers in order to be able to identify the right problem and communicate solutions. They must be leaders who are able to guide projects from inception to completion. They must be problem solvers – not simply data processors.

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The courses in the curriculum have been designed to achieve a balance between the technologies, analytical methods, and the business and personal acumen needed in order to effectively implement analytical methods and interpret, communicate, and act on the results. The correct balance (note that an equal balance is not the goal) should provide a graduate from the program with both a firm grasp of the most important analytical techniques along with the knowledge of how they should be implemented, interpreted, and communicated in a variety of business contexts. To help guide and evaluate the curriculum the following "Three-Foci Model" (Figure 1) was developed to help ensure adequate coverage of these areas. The overall philosophy of the program is reflected in an observation made by Dave Clark, Vice President of Amazon.com: "People who can do high level math are practically a commodity. People who can figure out which problem is the right one to solve and then apply high level math are both expensive and elusive. Those who can communicate effectively the answer in such a way managers can understand, priceless."[1] Our goal for the MSBA program is to produce these "priceless" individuals.

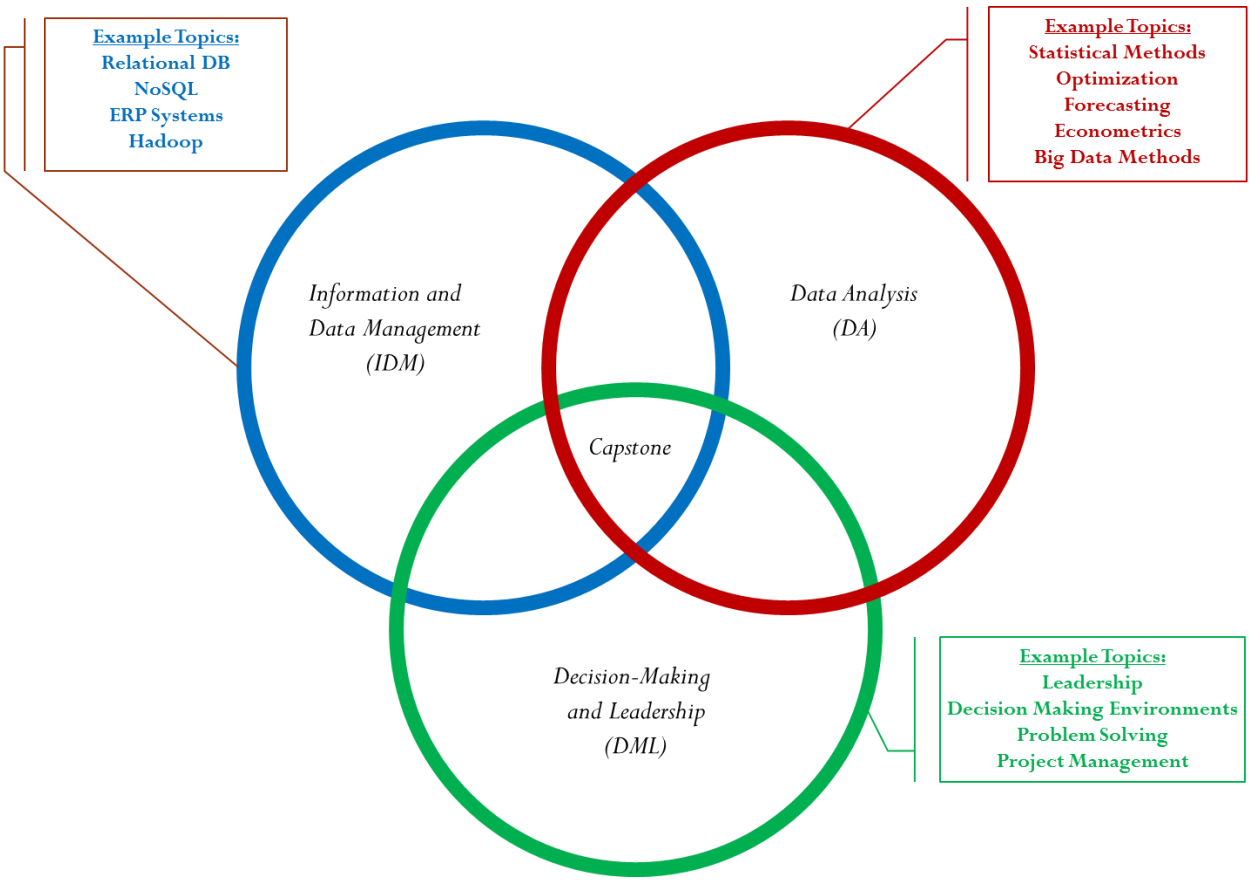

Figure 1 – Three-Foci Model

[1] Minter,S. "New Business Analytics Degree Aims to Produce Problem Solvers." *IndustryWeek*. Sep 23, 2011. http://www.industryweek.com/articles/new_business_analytics_degree_aims_to_produce_problem_solvers_25653.aspx. Retrieved January 4, 2015.

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The balance the program strives for would be towards a mixture of 50% Data Analysis [2](DA) with the other 50% split evenly between both Information and Data Management (IDM) and Decision-Making and Leadership (DML). As the data analysis portion contains the primary computational skills associated with analytics it is appropriate that the mix would emphasize this portion while still adequately addressing the important skills represented in the other two facets. Although this is conceptually appealing, we wanted to ensure that potential employers viewed the necessary mix in a similar fashion. In our survey of potential employers we described these three program facets and asked them to enter what percentage of a graduate's knowledge should be aligned with each facet. Respondents could enter any percentage they wished as long as they totaled 100%. The results were: 40.83% of knowledge should be aligned with Data Analysis (DA), while 29.58% should be aligned with both Information and Data Management (IDM) and Decision-Making and Leadership (DML). While the percentages are marginally different this lends support to the overall philosophy and emphases of the program. Full survey results can be found in Sections 1.4, 2.2, and Appendix A.

Information and Data Management includes technologies and methods used to collect, manipulate, and extract data from the extremely large, "messy", and unstructured data commonly referred to as "Big Data", as well as from traditional data sources. Data Analysis includes methods and software technologies for implementing those methods. Decision-Making and Leadership includes decision-making at all stages of analysis: from identifying and defining the problem, to identifying correct technologies and methods to employ, to interpreting the mathematical results and making sound business decisions based on those results. Finally, the leadership component of this facet is a term that is used here in its broadest sense and encapsulates all the business acumen, communication, human, and other soft skills necessary to be an effective leader within an organization, thus facilitating the ability to achieve maximum benefits associated with the organization's analytics efforts. These communication and leadership skills are covered explicitly in the "Analytics in Practice" and "Business Analytics" required courses and will be 'practiced' in each of the methods-oriented courses as is described below. Additionally, electives such as "Leadership and Organizational Change" allow a student to go into even more depth. Finally, ethics is appropriately becoming a major topic in analytics circles.[3] The INFORMS Certified Analytics Professional (discussed in detail in Section 1.2.3) program has created a code of ethical principles that should inform this discussion well.[4] These and other social responsibility topics will have formal coverage in these two classes and should be included in the context discussions concerning problem examples as well.

The goal in the design of each of the courses listed below is that all three facets will be integrated into every course. The courses that are predominantly focused on methods should expend at least 10 to 20% of course time on business contextual elements that elevate "mathematical problems" to the level of "business cases". Starting with artificial and polished datasets and stopping with the mathematical conclusions should be strictly avoided. These courses should spend significant time exploring data

[2] The focus named 'Data Analysis' is intentionally not named 'Data Analytics' in this model. It is our view that the profession of business analytics encompasses all three foci and, therefore, no one of them would be properly termed 'analytics'. 'Data analysis' was chosen to convey that this is the computational component of analytics but is not analytics by itself.

[3] Robb, D. "Big Data Analytics Needs a Code of Ethics." *enterprise APPS today*. October 8, 2014. http://www.enterpriseappstoday.com/business-intelligence/big-data-analytics-needs-a-code-of-ethics.html. Retrieved December 19, 2014.

[4] INFORMS, "Code of Ethics for Certified Analytics Professionals Prepared by the INFORMS Certification Task Force." https://www.informs.org/content/download/268914/2540648/file/CAP_CodeofEthics.pdf. Retrieved January 7, 2015.

sources, as well as extracting, modifying, and cleaning data that would be required when encountering problems in the real world. Additionally, they should explore the business motivation behind and value of such analyses and, finally, they should explore how the mathematical conclusions inform the business problem and how the results of the analysis can best be communicated. Leadership, as was discussed earlier, is emphasized throughout the process. Leadership is not only reflected in the final conclusions, decisions, and solution implementation but throughout the process from problem identification through implementation and evaluation. Again, the need to incorporate full business cases and contexts in the methods-based courses is a requirement to achieve this goal. Focusing on only the mathematical portion of the process would exclude this critical component.

Simulating the organizational context of business analytics cannot really be accomplished without utilizing the same technologies that are likely to be encountered in real-world organizations. Hence, our memberships in the SAP University Alliance program and Oracle Academy give our students access to some of the premier enterprise-level analytical software available today. Instead of using *predominantly* MS Excel and statistical packages for demonstration and practice of analytical concepts, our students will interact with fully functional enterprise versions of the various software packages these vendors provide. This is not to say that MS Excel will not be used at all; Excel is currently an important component within the set of available analytical tools - as both a standalone analysis tool as well as a tool for viewing and manipulating the output of other analytical tools.

Although one will not see SAP or Oracle names in any of our course descriptions or course names (the SAP Alliance actually prohibits that), they will be used pervasively as example environments within the coursework. Students will use SAP (*as well as other technologies*) for tasks such as data visualization, big data analytics (using the huge Sam's Club data warehouse provided through SAP among other sources), predictive analytics and data mining, OLAP analysis, and reporting (Crystal Reports). In addition to these more exclusive technologies, the program will also utilize open source and other proprietary software such as Hadoop, Map Reduce, SAS, JMP, R (through SAP integration and standalone), and others.

As new technologies are constantly being developed, the program will actively seek out and incorporate these new technologies where appropriate and available. It is important to note that the program will not be built on, and will not over-emphasize any specific technological environment (such as SAP). We adhere to a technology-agnostic view in our instruction of methods. Technologies will be used to gain hands-on experience with prevalent industry software as an example of the implementation of the underlying general method. Our instructional focus will be on applying the general method and then specific implementations of the method in industry-software will be explored.

The value of the program described above and detailed below is again supported by our survey of NE Ohio potential employers. When asked how they felt about the program overall on a scale from very negative to very positive, 96% were positive or very positive, 4% were neutral, while 0% were negative or very negative. Additionally, they were asked, "If you were responsible for hiring an entry-level employee for an analytics position in your organization, how interested would you be in interviewing graduates of this proposed program?" To this question their responses were, 70% were very interested, 22% were somewhat interested, and only 9% were not interested. Complete survey results are introduced in Sections 1.4 and 2.2 and discussed in Appendix A.

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1.2 Courses (30 total credit hours) and Course Descriptions

1.2.1 Required Courses (24 credit hours)

The proposed program has eight required courses, all of which are designed as three-credit hour courses yielding 24 total credit hours. Four of these have been taught previously (with minor modifications) and four of these are new courses. The program is designed to provide coverage of the three foci as follows: Information and Data Management (IDM) – 25%, Data Analysis (DA) – 50%, Decision-Making and Leadership (DML) – 25%. The degree of coverage of the three foci in each course is given at the end of each course description using the acronyms listed here.

Required Course Descriptions

Business Analytics (MIS 64036)
This course provides an overview of business analytics and its appropriate applications in various industries and functional areas. Critical thinking, problem definition, problem solving, effective communication, and leadership are emphasized. Methods such as data visualization and descriptive, predictive, and prescriptive analytics are covered from a broad perspective. This course is applied, hands-on, and case-based. Cases emphasize the communication of quantitative solutions to laypeople and required leadership during decision-making and implementation stages. Must be taken during the first semester of enrollment after acceptance into the program (20% IDM, 40% DA, 40% DML).

Database Management and Database Analytics (revision of MIS 64082)
The design, implementation and management of database management systems within organizations are studied from an applied perspective. Additional emphases include data warehousing, structured query language for analytics, and introductions to NoSQL databases and Big Data analytics. Must be taken during the first semester of enrollment after acceptance into the program (70% IDM, 20% DA, 10% DML).

Data Mining Techniques (CS 63015)
The course presents the concepts and techniques of data mining. Data mining is a process of discovering information from a large set of databases. This course takes a database perspective on data mining. (10% IDM, 80% DA, 10% DML).

Advanced Data Mining and Predictive Analytics (MIS 64037)
This course extends the coverage of data mining and predictive analytics. Topics will focus on the applied use of these techniques in realistic settings. Statistical and machine learning techniques will be covered. (10% IDM, 80% DA, 10% DML).

Quantitative Management Modeling (MIS 64018)
A variety of optimization and heuristic modeling techniques are explored. Decision-making environments, model selection, and interpretation are emphasized. Various linear and non-linear mathematical programming techniques are the primary topic but are supplemented with other optimization and heuristic techniques (10% IDM, 80% DA, 10% DML).

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Big Data Analytics (CS 63016)
This course focuses on techniques commonly applied to the vast stores of mostly unstructured data being generated in business today. Focal techniques and technologies include: Hadoop, map reduce technology, unstructured data concepts, and NoSQL databases (40% IDM, 50% DA, 10% DML).

Analytics in Practice (MIS 64038)
This course focuses on supporting techniques and managerial and professional skills necessary to being an effective business analyst. Other topics include project management, requirements analysis, change management, team dynamics, leadership, and effective communication between all stakeholders (10% IDM, 10% DA, 80% DML).

Capstone Project in Business Analytics (MIS 64098)
In this culminating project, students draw on the breadth and depth of the curriculum to address an industry supplied problem in small teams. Teams will explore prescriptive analytics as is appropriate to their design project (30% IDM, 40% DA, 30% DML).

Table 1 below shows the responses from our industry survey on the importance of the courses proposed for the program. It is notable that 100% of respondents find that every one of the proposed courses is at least 'somewhat important'. Full details and additional discussion can be found in Appendix A (question A2.5).

Table 1. Employers View of the Importance of Each Course.
Survey Question to Potential Employers:
"Please provide your opinion as to the importance of each course in the curriculum as a whole"

Course Title	Not Important	Somewhat Important to Important	Critical
Business Analytics	0%	26.1%	73.9%
Database Management & Database Analytics	0%	60.9%	39.1%
Data Mining Techniques	0%	65.2%	34.8%
Advanced Data Mining and Predictive Analytics	0%	73.9%	26.1%
Quantitative Management Modeling	0%	82.6%	17.4%
Analytics for Big Data	0%	73.9%	26.1%
Analytics in Practice	0%	52.2%	47.8%
Capstone Project in Business Analytics	0%	47.8%	52.2%

1.2.2 Elective Courses (6 credit hours)

The program also requires students to complete two three-credit hour elective courses. As much of the program is required, students can use these courses to customize their program to their specific interests without compromising the general business analytics components that reside in the eight required courses.

These electives are intended to extend knowledge on methods and/or business functions and processes. Additionally, an industry internship course is also available as an elective. Students will select two total from any or all categories (forcing a selection from specific categories was considered but individual students may need additional knowledge from one category more than the others).

Elective Course Descriptions - Methods Electives:

Systems Simulation (MIS 64011)
Techniques and applications of computer simulation of existing or proposed real-world systems. Use of simulation language, simulations studies, analysis and interpretation of results.

Econometrics I (ECON 62054)
Introduction to problems and methods of the empirical estimation of economic relationships.

Semantic Analysis Methods (IAKM 60370)
Introduces students to the practical contexts, methods and tools associated with semantic analysis. Focuses on early life cycle aspects of semantics, including identification and modeling of semantic problems, design of semantic solutions, and the identification and implementation of appropriate semantic technologies. Covers natural language processing, rule-based and grammar based concept extraction, rule-based and dynamic classification and automated summarization. Students work with a variety of semantic technologies.

Clinical Analytics (IAKM 60411)
The use of well-defined and well-integrated clinical analytics throughout the healthcare value chain can be transformative. Through careful implementation of health analytics, hospitals can transform unwieldy amalgamations of data into information that can: improve patient outcomes, increase safety, enhance operational efficiency and support public health. Given the immense size of the data challenge, the distinctness and geographic spread of many healthcare-related activities, and the fact that so many healthcare activities are conducted by different entities which must interact with each other, there is really no other way to provide operations management tools necessary to deliver personalized medicine and to control spiraling costs. Since clinical analytics is an immature discipline, we carefully examine the practices of those institutions who are standard setters in the industry.

Data Science (DSCI 64210)
Introduction to the concept of big data and data analytics, including the business challenges of working with big data. Students are introduced to the concepts of both structured and unstructured data. Fundamental concepts include data design and management, database design and management, data driven programming and discovery, and data presentation and use. Data analytics in industry verticals are discussed, including science, intelligence and law enforcement, health, retail and financial services.

Elective Course Descriptions - Business Functions and Processes Electives:

Global Supply Chain Business Models (MIS 64028)
Focus on modeling techniques for supporting decision making in supply chain management. Introduces students to the problems facing a global supply chain manager and the implementation of spreadsheet-based models for solving problems that arise in the operation of a supply chain. Emphasis is placed on model formulation and interpretation in support of decisions to coordinate and improve supply chain operations.

Leadership and Organizational Change (MIS 64160)
Course provides students in-depth knowledge of leading organization change. Covers analysis of existing conditions, drivers of change and readiness for change along with methods of change and change implementation.

Marketing Research (MKTG 65057)
Examination of the research process as applied to decision making. Course focuses on steps in problem formulation, the research process, application of techniques and basic data analysis using SPSS-PC.

Enterprise Architecture (DSCI 61010)
Facilitates the alignment of IT and IS investment decisions with business goals. Enterprise architecture is increasingly used in industry as a result of the continued emergence of new technologies and ongoing pressures to reengineer business processes to achieve improved efficiency and greater customer focus. Enterprise architecture identifies the main components of an organization and the ways in which these components work together. The components include performance and strategy, people, business capabilities, applications, technology, knowledge and information, as well as financial and other resources.

Elective Course Descriptions – Experiential Learning Elective:

Internship in Business Analytics (MIS 64092)
A supervised field experience at a cooperating organization. Requires regular contact with instructor and preparation of an internship report connecting academic coursework to on-the-job experiences.

1.2.3 Program Congruence with Industry Standards – The Certified Analytics Professional

"The Institute for Operations Research and the Management Sciences (INFORMS) is the largest society in the world for professionals in the field of operations research (O.R.), management science, and analytics."[5] Recently, INFORMS began a certification program for analytics professionals (Certified Analytics Professional or CAP). During the design of the program this and other analytics job task analyses were reviewed to help frame the coverage of the program. It is notable that to qualify to take the CAP exam a person would need to complete a BA/BS or a MA/MS and have three years of analytics-related work experience or seven years of unrelated work experience. As such, a new graduate from our program would not be expected to be ready to take and pass this exam (unless they had prior work experience sufficient to qualify). Therefore, we would not expect our program to fully prepare the student on every element in the CAP listed job tasks. However, this is a current, well-researched, and validated list of analytical job tasks constructed by multiple subject matter experts so it is, in our opinion, valid to view this list as a proxy for the current state of the art of the analytics profession. Therefore, while our program does not seek to fully cover every element of the certification tasks it should be congruent with that list and offer a solid academic foundation for the student to build on with their ensuing job experience in the field. Therefore, the balance of this section will discuss the job tasks associated with INFORMS CAP certification and how our program fits into that framework.

[5] INFORMS. "About INFORMS." https://www.informs.org/About-INFORMS. Retrieved January 24, 2015.

Table 2 lists the job task breakdown and categorization into seven related domains[6] and maps our proposed program's foci and courses to those job tasks. As can be seen in the breakdown each of the tasks listed has some coverage within the program. It should be noted that we do not consider any of our courses to be 100% in one focus so we use the phrase 'all DA courses' in the table for brevity but intend the meaning to be, 'those courses that have a goal of 80% coverage within the DA focus'. We also have not put the capstone course in the table since it would be expected to touch on all the domains. We do not claim that each topic is covered in the depth required to pass that portion of the certification exam as the certification designers do not feel academic preparation is sufficient in itself and we are not attempting to 'teach to the test'. However, we do believe that this table does validate that our program will provide a solid academic base for the student to augment with experience and prepare for, take, and successfully pass the INFORMS Certified Analytics Professional exam. This further lends credence to our proposed program being congruent with established industry standards.

1.2.4 Course Delivery & Schedule Options

The courses in the proposed program are all currently designed as face-to-face rather than online or hybrid. In light of the ever-increasing demand for online and blended learning education, the program could be modified to any of these delivery modes in the future; however, this is not part of the current proposal. The program is not cohort-based and the courses could be taken in any order if their prerequisites are met. The normal time to completion for the 30-hour, 10-course program is one academic year, plus summer, with a course load of 4 for each academic semester and 2 for the summer term. However, the curriculum is designed to be flexible enough to offer exceptional students with requisite experiences the opportunity to complete the program within one academic year. Similar 15-credit hours per semester programs are available at the Carlson School of Management (University of Minnesota), Lindner College of Business (University of Cincinnati), and the Carey School of Business (Arizona State University), to name a few. At Kent State University, the Master of Science in Chemical Physics is also designed with this flexibility.

[6] INFORMS, "Analytics Job Task Analysis." https://www.informs.org/Certification-Continuing-Ed/Analytics-Certification/Analytics-Job-Task-Analysis. Retrieved January 24, 2015.

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Table 2. Program Foci and Courses Mapped to CAP Tasks.

Certified Analytics Professional: Domains and Tasks	Primary Foci	Primary Courses
(12-18%) Domain I: Business Problem Framing	**DML: All Tasks DA (problem definition portion): All Tasks.**	**Business Analytics, Analytics in Practice, All DA courses.**
T-1 Obtain or receive problem statement and usability requirements		
T-2 Identify stakeholders		
T-3 Determine if the problem is amenable to an analytics solution		
T-4 Refine the problem statement and delineate constraints		
T-5 Define an initial set of business benefits		
T-6 Obtain stakeholder agreement on the problem statement		
(14-20%) Domain II: Analytics Problem Framing	**DA: All Tasks**	**All DA courses**
T-1 Reformulate the problem statement as an analytics problem		
T-2 Develop a proposed set of drivers and relationships to outputs		
T-3 State the set of assumptions related to the problem		
T-4 Define key metrics of success		
T-5 Obtain stakeholder agreement		
(18-26%) Domain III: Data	**IDM: T1, T2, T3, T4 DA: T4, T5, T6 DML: T5, T6**	**Database Management and Database Analytics, All DA courses, Business Analytics, Analytics in Practice**
T-1 Identify and prioritize data needs and sources		
T-2 Acquire data		
T-3 Harmonize, rescale, clean and share data		
T-4 Identify relationships in the data		
T-5 Document and report findings (e.g., insights, results, business performance)		
T-6 Refine the business and analytics problem statements		
(12-18%) Domain IV: Methodology Selection	**DA: All Tasks DML: T1, T2**	**All DA courses, Business Analytics**
T-1 Identify available problem solving approaches (methods)		
T-2 Select software tools		
T-3 Test approaches (methods)1		
T-4 Select approaches (methods) 1		
(13-19%) Domain V: Model Building	**DA: All Tasks IDM: T3 DML: T5**	**All DA courses, Database Management and Database Analytics, Business Analytics, Analytics in Practice**
T-1 Identify model structures1		
T-2 Run and evaluate the models		
T-3 Calibrate models and data1		
T-4 Integrate the models1		
T-5 Document and communicate findings (including assumptions, limitations and constraints)		
(7-11%) Domain VI: Deployment	**DML: T1, T2, T5 DA: T1, T2, T3, T4**	**Business Analytics, Analytics in Practice, All DA courses**
T-1 Perform business validation of the model		
T-2 Deliver report with findings; or		
T-3 Create model, usability and system requirements for production		
T-4 Deliver production model/system1		
T-5 Support deployment		
(4-8%) Domain VII: Model Lifecycle Management	**DML: All Tasks**	**Business Analytics, Analytics in Practice**
T-1 Document initial structure		
T-2 Track model quality		
T-3 Re-calibrate and maintain the model1		
T-4 Support training activities		
T-5 Evaluate the business benefit of the model over time		

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1.2.5 Example Schedules for Degree Completion

Full-Time Schedules:

❖ **One-year, 12 Months, example:**

Fall – 12 credit hours
Business Analytics*
Database Management and Database Analytics*
Data Mining Techniques*
Analytics in Practice or Elective

Spring – 12 credit hours
Advanced Data Mining and Predictive Analytics
Quantitative Management Modeling
Analytics for Big Data
Analytics in Practice or Elective

Summer – 6 credit hours
Capstone Project
Analytics in Practice or Elective

❖ **One-year, 9 Months, example (only suggested for exceptionally prepared students):**

Fall – 15 credit hours
Business Analytics*
Database Management and Database Analytics*
Data Mining Techniques*
Analytics in Practice or Elective
Elective

Spring – 15 credit hours
Advanced Data Mining and Predictive Analytics
Quantitative Management Modeling
Analytics for Big Data
Analytics in Practice or Elective
Capstone Project**

* Must be taken first semester
** Take in final term

❖ **Part-Time Schedules:**

Part-time students should be carefully advised so their schedules are kept in tune with projected course offerings. There is substantially more flexibility in a part-time schedule so this is just one of many possible schedules:

Fall 1 – 6 credit hours
Business Analytics*
Database Management and Database Analytics*

Spring 1 – 6 credit hours
Data Mining Techniques*
Quantitative Management Modeling

Summer 1 – 3 credit hours
Analytics in Practice

Fall 2 – 6 credit hours
Advanced Data Mining and Predictive Analytics
Elective

Spring 2 – 6 credit hours
Analytics for Big Data
Elective
Summer 2 – 3 credit hours
Capstone Project**

* Take as early in the program as possible
** Take in final term

1.2.6 Bridge Courses

The program will require students to have completed a baccalaureate degree in STEM disciplines such as engineering, computer science, mathematics, the sciences, or in business where they would have gained the requisite background for the program. As it is expected that students will be coming from different feeder undergraduate programs, bridge courses, undergraduate or graduate level courses, may be assigned by a program advisor. For instance, on entry to the program students should have general knowledge of inferential statistics, adequate general business knowledge, basic knowledge of business information systems and technologies, and a solid understanding of algebra and general mathematics with some exposure to calculus. Students who have not passed at least an undergraduate course (B minimum grade) that has substantial coverage of inferential statistics must take MIS 64005 - Statistics for Management. Students who have at least three years of experience working in industry may have the academic business requirement waved. Students entering without any business coursework or experience will generally be required to take MIS 24163 - Principles of Management and/or MIS 64158—Leadership and Managerial Assessment. Deficiencies in math would be met with appropriate undergraduate courses and business information systems and technologies as well as partial fulfillment of the business knowledge requirement can be obtained by taking MIS 64042 – Globalization and Technology Strategy. Students will usually be required to complete these bridge courses before they start on the related program requirements. Concurrent enrollment may be considered according to the background of the student and the courses proposed to take concurrently with the bridge courses.

1.2.7 Program and Course Technologies

As some of the technologies used in the program are currently evolving, our plans for exposing our students to these technologies must evolve along with them. However, we already have two of the

primary environments, Oracle and SAP, installed and being used in several courses in our information systems, supply chain, MBA, and MS Accounting programs. Additionally, our Oracle server (and our database courses) are used by the School of Digital Sciences in both their undergraduate and graduate programs (even with all this usage the server is operating at a small fraction of its capacity). As such, we already have solid experience in delivering many of the required technological environments to our students.

The department has been successfully delivering hands-on education in the area of databases for some time. As mentioned, we have a departmentally-managed server with Oracle 12C Enterprise Edition (the most current version) installed on Windows 2012 Datacenter Server OS. Students work on Oracle with client software (such as Oracle SQL Developer – available free from Oracle) on their own computers or our lab computers. SAP is hosted by the SAP University Alliance at the University of Wisconsin – Milwaukee. We need not host or manage any of the SAP server software since as a member of the alliance, full access is granted to our instructors and students through SAP's client software. SAP software does have big data capabilities[7] and Sam's Club database, as well as other big data sources, is available through SAP. As we have discussed earlier we will avoid learning concepts exclusively (or even primarily) in SAP or other proprietary environments. Direct non-SAP Hadoop access and training will be delivered either through a hosted solution such as Cloudera[8] or our own Hadoop cluster installation. Currently a single-node cluster Hadoop instance has been installed and tested. Expanding this into a multi-node cluster may be required if a hosted solution is not chosen. A hosted solution is preferred so that local resources do not have to be used to manage the cluster. The college and university have more than adequate computer labs and network infrastructure to allow students to interact with these technologies from any on-campus computer and from anywhere with Internet access using a VPN (virtual private network) connection.

1.3 Curriculum Development Process

The proposed curriculum was developed through a combination of activities. The primary sources of information utilized during curriculum development included:

- Bench-marking of leading programs (e.g. InformationWeek: 20 Top Analytics Programs[9])
- Workshops at international conferences (e.g. Decision Sciences Institute: Panel discussion on *Business Analytics Programs and Curricula)*[10]
- Weekly reading of practitioner newsletters (e.g. *Data Science Central*[11])

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[7] Nerney, C. "SAP Updates University Alliances Program to Include Big Data Analytics." *Data Informed*. January 29, 2013. http://data-informed.com/saps-updates-university-alliances-program-to-include-big-data-analytics/. Retrieved January 15, 2015.
[8] Cloudera. "Cloudera Academic Partnership." http://www.cloudera.com/content/cloudera/en/developers/home/academic-partnership.html. Retrieved December 28, 2014.
[9] Henschen, D. "Big Data Analytics Master's Degrees: 20 Top Programs." *InformationWeek*. January 7, 2013. http://www.informationweek.com/big-data/big-data-analytics/big-data-analytics-masters-degrees-20-top-programs/d/d-id/1108042. Retrieved July 22, 2014.
[10] Decision Sciences Institute, "44th Decision Sciences Institute Annual Meeting 2013." http://convention2.allacademic.com/one/dsi/dsi13/. Retrieved November 27, 2013.
[11] Granville, V. "DSC Digest and Membership - Big Data, Analytics, Visualization and Data Science." June 20, 2013. http://www.datasciencecentral.com/profiles/blogs/check-out-our-dsc-newsletter. Retrieved September 7, 2014.

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- Vendor informational meetings (e.g. TDWI & IBM[12])
- Vendor workshops (e.g. SAP Analytics[13])
- The Guide to the Business Analysis Body of Knowledge[14]
- Invited talks in our *Center for Information Systems* meetings on analytics from area practitioners[15]
- Personal discussions with many interested parties in both the academic and practitioner circles
- Analyzing the content of leading analytics textbooks

The process of building the curriculum began with a review of InformationWeek's list of the top 20 analytics programs. The first differentiating characteristic noted was the difference between *business* analytics programs and *non*-business programs. As one would expect, the business analytics programs tend to include more managerial and business-oriented courses than the non-business analytics programs that are generally offered by schools of mathematics, statistics, and engineering. York University[16] in Toronto has a very good example of a business analytics program. In addition to a selection of data analysis and data management courses, they have courses titled: *Skills for Leadership*, *Analytics Consulting*, and *Case Analysis and Presentation Skills.* These courses clearly fall into our focal category of *Leadership and Decision-Making* and would not likely be present in a non-business analytics program. In our proposed curriculum, similar content can be found in the *Analytics in Practice*, *Business Analytics*, and *Capstone Project* courses. On the other-side, a non-business program that provides a good example of the alternative form is the Master of Science in Analytics (MSA) program offered by the Institute for Advanced Analytics at NC State.[17] It is unlikely that one would find a course specifically dealing with leadership and management in these more technically-oriented programs offered outside of business schools.

After initial benchmarking that provided the three focal categories of the program, other sources were used to support this framework and additionally revalidate the model. An "analytical body of knowledge" (BOK) was constructed through reviewing another BOK from a professional society (The International Institute of Business Analysis or IIBA) and cross-referencing this with other MSBA programs, skill lists from the program at Villanova as well as from professional websites (e.g. INFORMS) and textbooks. This produced a list of technical, managerial, and software skills that were relevant to the program. The final result balances these skill sets in the curriculum within our three-foci model. No program can hope

[12] TDWI. "Join Us in Cleveland for a Free Event on Big Data Analytics!" http://events.tdwi.org/events/solution-spotlight-ibm-2014/information/cleveland.aspx. Retrieved May 2014.
[13] McLeod, A. "SAP University Alliances Americas Faculty Summer Workshops 2014." *SAP Community Network*. http://scn.sap.com/community/uac/blog/2014/04/01/sap-university-alliances-americas-faculty-summer-workshops-2014. Retrieved September 22, 2014.
[14] IIBA International Institute of Business Analysis. (2009) *A Guide to the Business Analysis Body of Knowledge.* IIBA press.
[15] KSU Center for Information Systems. "Big Data." Joe Turk, Director for Technology Business Development, The Cleveland Clinic; Doug Meil, Chief Software Architect, Explorys; Gary Weber, IT Group Manager, Progressive. Nov 1, 2013.
[16] York University, Schulich School of Business. "Schulich Master of Business Analytics." http://www.schulich.yorku.ca/client/schulich/Schulich_LP4W_LND_WebStation.nsf/resources/File+Downloads/$file/MSBAViewbook.pdf. Retrieved February 2, 2015.
[17] NC State, Institute for Advanced Analytics. "MSA Curriculum." http://analytics.ncsu.edu/?page_id=123. Retrieved February 2, 2015.

to include a comprehensive treatment of all possible analytical skills so prioritization was also part of the final selection of skills and the course designs to impart them. The degree plan is a one-year 30 credit-hour full-time program with part-time options. Courses will be delivered traditionally (face-to-face) and the program is not cohort-based. Twenty-four (24) of the hours will be required and six (6) will be electives. The curriculum will be balanced with respect to the coverage of problem types within functional business areas. Irrespective of their area of specialization, instructors of required courses will be expected to pull examples from all of the various business functional areas. There are substantial numbers of public datasets available within each functional area, where instructors could select appropriate examples and project scenarios in consultation with appropriate departmental units. Finally, the balance of the functional area coverage may be customized by selecting appropriate electives. As the program grows, it is expected that additional functional-area offerings will be developed, though initially, electives will be selected from predominantly existing method-based courses as well as a set of the most relevant business courses. Optimally, some or all of the function-specific elective courses should be designed and staffed by faculty in those areas.

Table 3. Summary of Questions and Conclusions from Industry Survey: Curriculum Design and Academic Quality

Question (click on question to go to discussion)	Assesses	Conclusions
How important do you view each of these areas to be in the MSBA (M.S. in Business Analytics) curriculum?	Curriculum Design, Academic Quality	The respondents view each of the three foci to be from 'important' to 'critical' for the program.
Assuming the proposed model will be implemented, what percentage of a graduate's knowledge should be associated with each area?	Curriculum Design, Academic Quality, Validity of Program's Three-Foci Model.	Respondents largely agree with the foci weights proposed. The aggregate percentages would suggest *slightly* more time to be spent on business/management topics than the design.
What about the program philosophy is good and should not be changed?	Curriculum Design, Academic Quality	Those who chose to respond to this question seem to like the general philosophy of the program mix and identify several specific individual elements such as data analysis and big data methods that should not be changed.
What is the program philosophy missing? What should be changed?	Curriculum Design, Academic Quality	These responses are very insightful and reflect the respondents' real-world perspectives on the topic. Each comment is addressed individually in the discussion.
Please provide your opinion as to the importance of each course in the curriculum as a whole:	Curriculum Design, Academic Quality	The results show that all of the courses are generally considered important by respondents.
Please use this space to provide any feedback that you have, positive or negative, concerning any aspect of the curriculum, philosophy, or any other aspects of the proposal.	Curriculum Design, Academic Quality	Each of these comments is addressed individually in the discussion.
Given the brief description of the proposed program that you have read as part of this survey, how positive/negative are you concerning the program?	Curriculum Design, Academic Quality, Overall Program Quality	96% of respondents describe their opinion of the program as positive to very positive.
If you were responsible for hiring an entry-level employee for an analytics position in your organization, how interested would you be in interviewing graduates of this proposed program?	Curriculum Design, Academic Quality, Overall Program Quality, Employment Opportunities	70% report they would be *very* interested and 92% report they would be at least somewhat interested in interviewing graduates of the program.

1.4 Industry Survey of Curriculum Design and Academic Quality

One part of the local industry survey focuses on the curriculum design and the respondent's perceptions of the quality of the proposed program. The survey methodology and metrics are further discussed in Section 2.2; and Table 3 in the previous page displays each question, the issue(s) being assessed, and brief conclusions. Full information on the responses and a full discussion is included in Appendix A. Clicking on the question text in the table will take the reader to the question's discussion in the appendix.

1.5 Faculty Resources

Kent State University College of Business Administration is accredited by the Association to Advance Collegiate Schools of Business (AACSB), International and abides by that organization's strict standards for faculty qualifications and curricula rigor. With a Doctor of Philosophy (Ph.D.) degree in several disciplines the M&IS department faculty have the requisite expertise to offer the MSBA program. Table 4 shows qualifications of the M&IS faculty who will be involved in the proposed MSBA program.

1.6 Program Accreditation

The proposed MSBA program aligns with the standards of the college's accreditor, AACSB, International. All AACSB standards (faculty qualifications, admission requirements, technology resources, curricular expectations, etc.) will be followed. The College of Business Administration was originally accredited in 1915. This accreditation has been continuously reaffirmed, with the last reaffirmation occurring in 2013. The next review is scheduled for 2018 at which point the prosed program, if approved, will be part of the review. No separate accreditation is planned for the proposed program at this time.

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Table 4: Faculty Resources

Name	Rank	Status	Highest Degree	Degree Date	Field	Expertise
Arikan, Ilgaz	Assistant Professor	Tenure Track	Ph.D.	2004	Business Administration, Economics	Competitive Strategy, International Business, Strategy
Brandyberry, Alan	Associate Professor	Tenured	DBA	1995	Decision Sciences, Information Systems	IS, Operations Research, Management Science
Datta, Pratim	Associate Professor	Tenured	Ph.D.	2003	Information Systems, Decision Science	IT, Systems Security, Analytics, Infrastructure/ Process Redesign and Engineering
Dragan, Natalia	Assistant Professor	Non-Tenure Track	Ph.D.	2010	Computer Science, Data Mining	Software Engineering, Applied Mathematics
Guiffrida, Alfred	Associate Professor	Tenured	Ph.D.	2005	Industrial Engineering, Statistics	SCM, Statistics, Operations, Management Science
Kwak, Dong-Heon (Austin)	Assistant Professor	Tenure Track	Ph.D.	2014	Management Information Systems, Management, Science	Online Donations, Web Design, ERP, Data Mining, Business Intelligence
Patuwo, Eddy	Professor	Tenured	Ph.D.	1989	Industrial Engineering, OR	OR, Neural NWs, Operations Management
Offodile, O. Felix	Professor	Tenured	Ph.D.	1984	Industrial Engineering, Operations Research	Operations Management, SCM, Manufacturing Mgt, Statistics, Stochastic Models, Decision Sciences
Polites, Greta	Assistant Professor	Tenure Track	Ph.D.	2009	Management Information Systems	Habits/Resistance to Change, Human-Computer Inter., Cross-Cultural Differences in IS, Analytics, Stats.
Shanker, Murali	Professor	Tenured	Ph.D.	1990	Operations Mgt., Management Science, Statistics	Parallel Simulation, Neural NWs, Optimization, Statistics

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2. Need for Proposed Program

There has always been need for data analysts. But, this need has become more acute in recent years due to proliferation of technologies, both for capturing and analyzing the data. Consequently, as sophistication in technology grows, the need for data analytics experts will continue to grow. At the present, and more importantly, for the foreseeable future, there are substantially fewer experts in the field of data analytics than there are opportunities for them. The projected shortfall of analytics professionals in the coming years is virtually universally accepted and supported by substantial research in both the private and public sectors. For instance, the McKinsey Global Institute projects a 50-60% shortfall in deep analytic talent by 2018 (see Figure 2).[18]

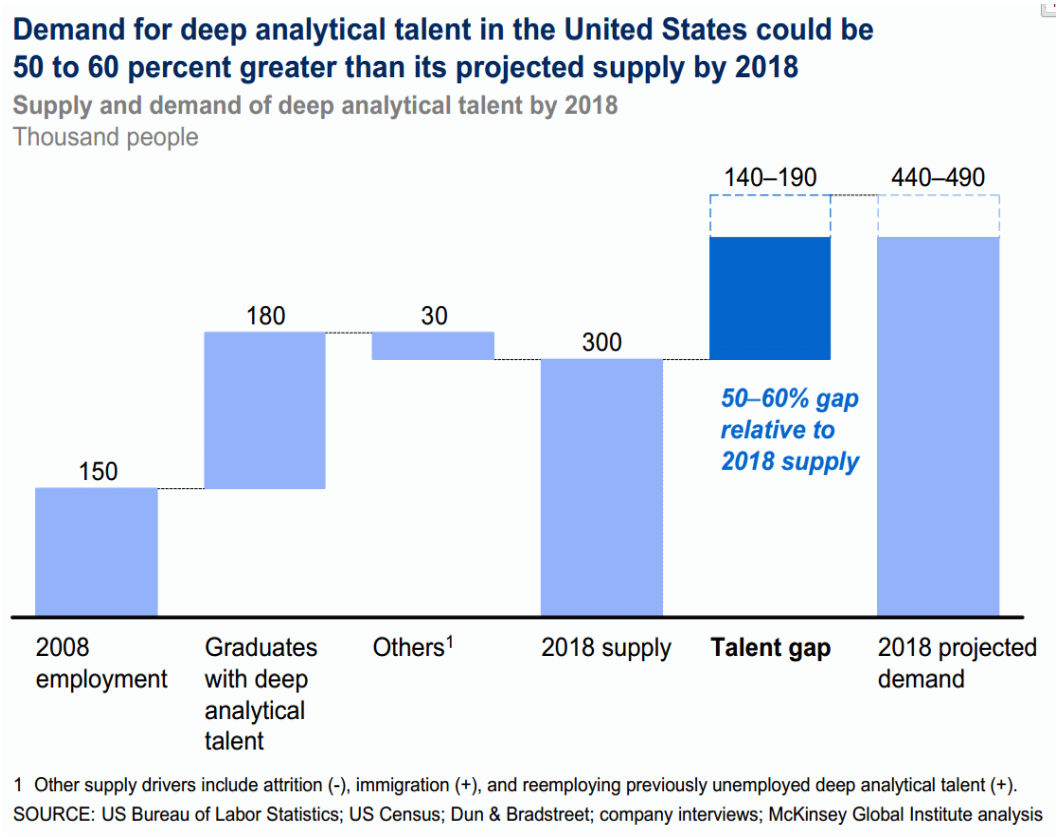

Figure 2. Demand for Analytics

[18] Manyika, J., Chui, M., Brown, B., Bughin, J., Dobbs, R., Roxburgh, C., & Byers, A. H. (2011). "Big data: The next frontier for innovation, competition, and productivity." McKinsey Global Institute.

Likewise, the Accenture Institute for High Performance projects analytics labor shortfalls worldwide in the current period of 2010-2015[19] (see Figure 3). As can be seen from the graphic below, of studied countries, the shortfall is by far the greatest within the United States with a projected shortfall of more than 20,000 analytics professionals.

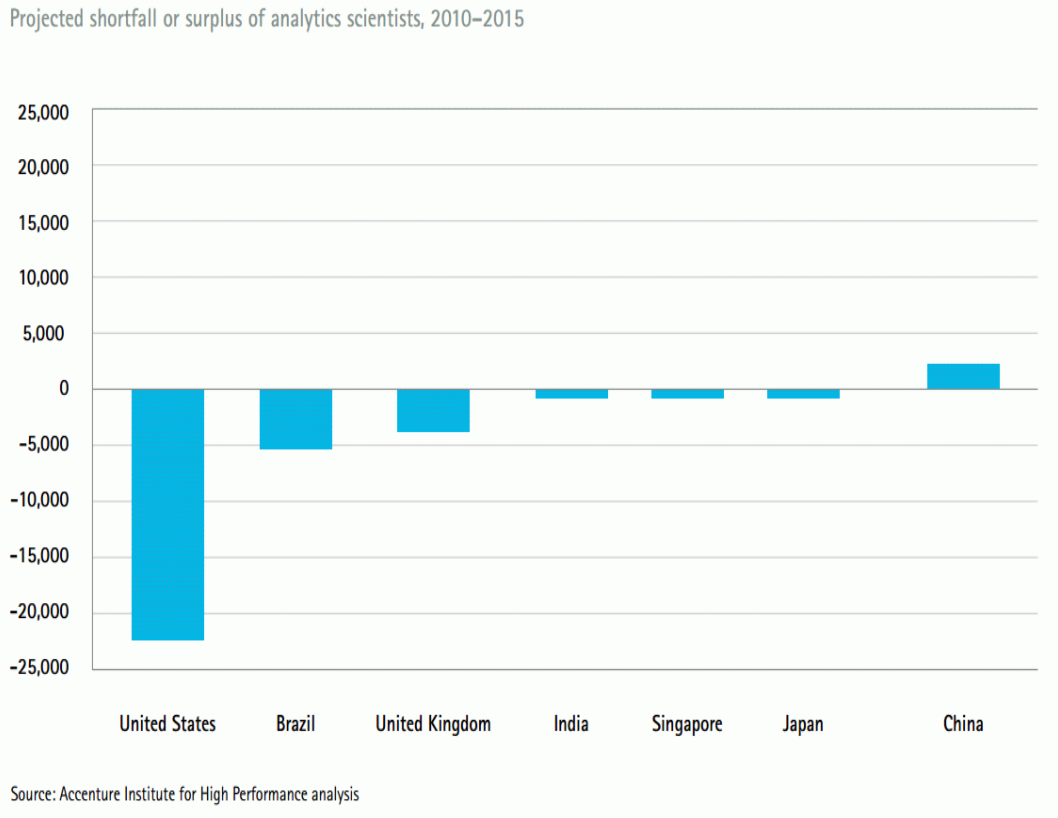

Figure 3. Projected Surplus of Analytics Positions

2.1 Employment Opportunities

In the past several years the general job outlook for various majors has been sporadic at best. However, job prospects for majors that are founded on educational fundamentals of STEM have been reasonably stable, with growth in areas such as analytics. Richie Bernardo reports that the Department of Commerce estimates that STEM "professionals will expand 1.7 times faster than non-STEM occupations between 2008 and 2018" with most lucrative careers in the country that are less susceptible to unemployment and salaries that are "71 percent more than the national" average.[20]

[19] Elizabeth Craig, David Smith, Narendra P. Mulani and Robert J. Thomas, "Where will you find your analytics talent?" Outlook, October 2012.
[20] Bernardo, Richie, "2015's Best and Worst Metro Areas for STEM Professionals." http://wallethub.com/edu/best-worst-metro-areas-for-stem-professionals/9200/. Retrieved January 25, 2015.

The continuing need for target marketing by businesses has created data sources that were not possible only a few years ago. Data collection from web logs, smartphones, social media, business and sales transactions, among others, has created a new data mining industry, and demand for data analysts who can extract meaningful information from data. A Jobs Ohio[21] report that "data-driven marketing now accounts for about 3.3 percent of Ohio's gross domestic product…an industry that employs more than 20,000 Ohioans" buttresses the need for the proposed MSBA program. Additionally, organizations continue to search for methods to gain advantages within their budgeting, forecasting, and planning processes. Increasingly, these firms are turning toward analytics to contribute to attaining this goal. In a separate, recent survey of Northeast Ohio Employers, more than 90 percent indicated that they desire graduate business students to have proficiency in using statistical and analytical tools for data-driven decision making. In addition, this survey reports that analytic skill is among the top five desired by local employers.

Additionally, in our own survey of Northeast Ohio businesses (respondents = 29), the respondents indicated that the cumulative increase in the number of analytics employees within their organizations will be 97.4% over the next three years. In the intermediate to long-term time horizons 48% predict that employment opportunities will "increase dramatically", 48% predict it will "increase moderately", and 4% predict it will remain the same, while 0% believe the employment opportunities will contract. Full results from this survey can be found in Sections 1.4 & 2.2 and Appendix A.

According to the U.S. Bureau of Labor Statistics[22] (BLS) 2022 projections, the fastest growing occupations include healthcare related professions, information technology, and data analytics (information security and marketing). But for medical practitioners like doctors, nurses, and therapists, the common thread among these occupations is data analytics. In the healthcare industry for example, there is strong need for collecting and analyzing patient information in all forms (text, voice, and video) on maladies, diagnosis, and treatment. The data complexity in this realm is exacerbated by government mandated healthcare laws and the deployment of electronic health records, which could be mitigated through analytics.

The BLS[23] 2012-2022 projections of *Job openings by occupational group* report show job openings (from both growth and replacement needs) of about 1,732,900 for healthcare practitioners and technical; 1,155,800 in healthcare support; 898,000 in business and financial operations; and 685,800 in computer and mathematical fields. While the majority of these more than 4 million job openings are expected to be in actual healthcare service provision, a good proportion will be in support services that involve data analytics. With Ohio accounting for about 3% of the US GDP, about 134,000 of these job openings are likely to be in Ohio, with a good proportion being in data analytics. The 2012-2022 expected job growths in select areas that would have need for analytics is presented in Table 5. The proposed MSBA program will provide graduates with the requisite knowledge they need to take advantage of these opportunities.

As briefly discussed in the opening section, projections concerning employment in analytics positions have suggested fast growth in analytical solution deployment in industry, resulting in a widening shortage

[21] Jobs Ohio, "2013/2014 annual report/strategic plan." http://jobs-ohio.com/images/JO_annual_report_2013_14.pdf. Retrieved January 31, 2015.
[22] Bureau of Labor Statistics, "Economic News Release." http://www.bls.gov/news.release/ecopro.t04.htm. Retrieved January 31, 2015.
[23] Bureau of Labor Statistics, "Occupational Employment Projections to 2022." December 2013. http://www.bls.gov/opub/mlr/2013/article/pdf/occupational-employment-projections-to-2022.pdf. Retrieved February 2, 2015.

of qualified analytics professionals through at least 2018. The high growth projections have begun to be realized. The McKinsey Institute conducted surveys in 2012 and 2013 concerning the usage of analytical methods in industry. Figure 4 demonstrates the substantial increase in respondents stating they are deploying some capabilities of analytics in just one year. These results help to validate these very optimistic growth projections.[24] The percent increases of deployment in each analytics capability range from 19% to 85% growth, in just a *single* year. Looking at Figure 4, there does appear to be one process that actually showed a small contraction in deployment; however, the question asked was different between the two compared years. In 2012 they asked about using analytics for 'pricing' whereas in 2013 they were asked about using analytics for 'developing differentiated and dynamic pricing strategies'. Since 'pricing' is the more general term, it would make sense that more respondents would select that option than would have selected the more specific description used in 2013 and probably does not represent a real contraction.

Table 5. 2012-2022 Job Outlook for Analytics Related Occupations

Occupation	Job Outlook	Percent Change	Rate of Change	Median Pay/year
Mathematicians	800	23%	Much faster than average	$101,360
Financial Analysts	39,300	16%	Faster than average	$76,900
Budget Analysts	3,800	6%	Slower than Average	$69,280
Market Research Analysts	131,500	32%	Much faster than average	$60,300
Statisticians	7,400	27%	Much faster than average	$75,560
Operations Research Analysts	19,500	27%	Much faster than average	$72,100
Computer Systems Analysts	127,700	25%	Much faster than average	$79,680
Information Security Analysts	27,400	37%	Much faster than average	$86,170

[24] McKinsey Global Institute, "Bullish on digital: McKinsey global survey results." August 2013. http://www.mckinsey.com/insights/business_technology/bullish_on_digital_mckinsey_global_survey_results. Retrieved January 28, 2015.

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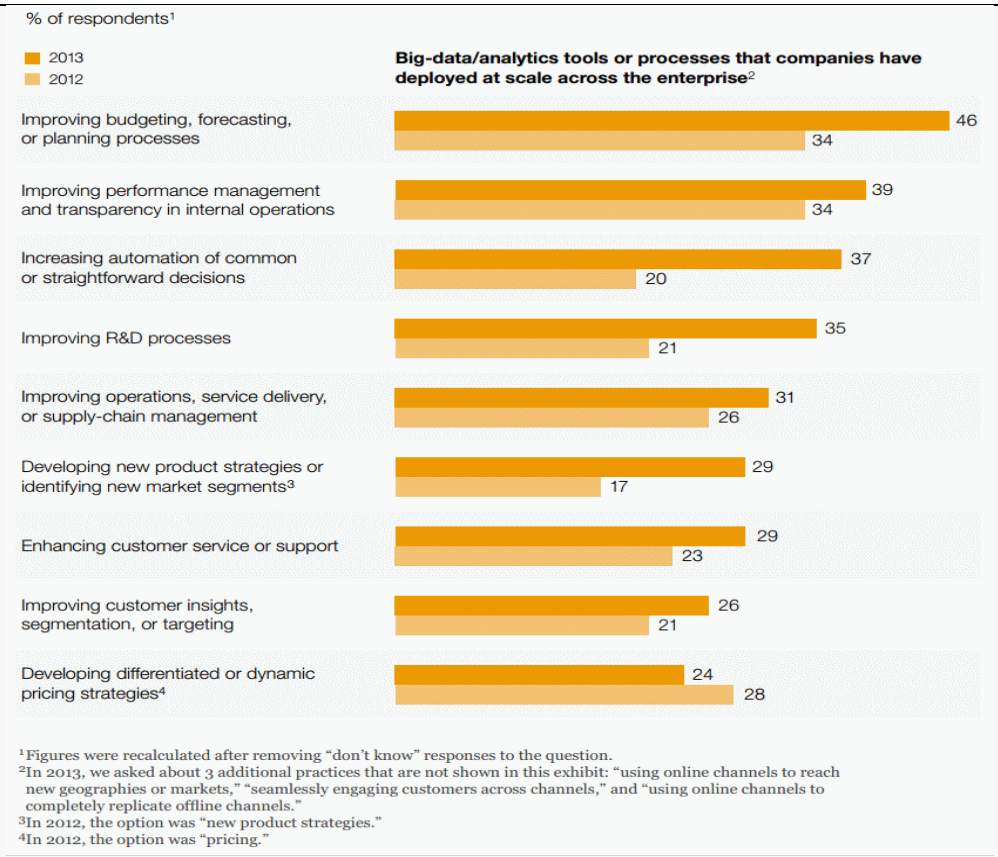

Figure 4. One-Year Growth of Deployment of Analytical Solutions

Subjectively, there appears to be little debate over whether employment opportunities in this sector are currently very good and will continue to increase. Objectively, we note that the University of Cincinnati has impressively reported over a *95% placement* of its MSBA graduates.[25] Programs in other states are also reporting solid placement figures. For instance, North Carolina State University, reports that 93% of students have job offers, sometimes multiple, at graduation. In April of 2014, *ComputerWorld* reported, "the 75 students in the class of 2014, which is nearing graduation, received, in total, 246 job offers from 55 employers."[26] Reported starting salaries are $78,419 and $95,700 (for UC and NCSU respectively). Established programs such as the one at NCSU are also reporting dramatic salary growth and employment opportunity growth, as well as the fact that they are turning away students and cannot meet current demand. The *ComputerWorld* article further reports that the "university [NCSU] received close to 800 applications for its next class, three times the number of just two years ago, when it doubled enrollment to 85. The school will offer admission to 99 or 100 students, for an acceptance rate of just 12.5%."[27]

[25] University of Cincinnati, Linder College of Business, "MS-Business Analytics Program." http://business.uc.edu/graduate/ms-business-analytics.html, Retrieved Nov 11, 2014.
[26] Thibodeau, P., "Career alert: A Master of analytics degree is the ticket -- if you can get into class." *Computerworld*. Apr. 24, 2014. http://www.computerworld.com/article/2488544/it-careers/career-alert--a-master-of-analytics-degree-is-the-ticket----if-you-can-get-into-class.html. Retrieved January 20, 2015.
[27] Ibid.

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Table 6. Summary of Questions and Conclusions from Industry Survey: Local Analytical Capabilities and Employment Opportunities

Question (Click on Question to Go to Discussion)	Assesses	Conclusions
What is the primary industry that your organization participates in?	Sample Validity	The survey results represent diverse and representative industries.
Where is your organization located?	Sample Validity	The respondents are within the Northeast Ohio region.
Approximately how many employees does your organization employ only in Northeast Ohio?	Sample Validity	The results were obtained from a cross-section of organizational sizes.
Approximately how many employees does your organization employ in total (nationally or internationally)?	Sample Validity	The results were obtained from a cross-section of organizational sizes.
What is your position or title within the organization?	Sample Validity	The respondents were generally high ranking technical or executive officers in the firm.
What are your organization's current planned or implemented technologies?	Respondent Analytical Characteristics	These results provide a picture of the current status of analytics-related technologies implemented or planned by the responding firms.
Which of the following business processes has your organization deployed business analytics tools or processes to support?	Respondent Analytical Characteristics	These organizations use analytics broadly across relevant business processes and only very small numbers of organizations believe they will not use analytics eventually for some business processes.
"Analytics Workers" are any employees who spend a significant portion of their work day engaged in analytics activities… What is your best estimate for how many people your organization currently employs in this role?	Respondent Analytical Characteristics	These responses demonstrate the diversity of the sample with current analytics employees ranging from zero to a few thousand.
What is your best estimate of how many additional analytics employees (if any) do you think you will need over the next three years?	Analytics-Related Employment Growth	The respondents expect to nearly double their current employment level of analytical workers in the next three years.
What is your best estimate of the percentage of analytics activities that are currently outsourced by your organization?	Respondent Analytical Characteristics	These responses show that analytics is generally done in-house. Responding firms report that 11.59% of their business analytics work is currently outsourced.
This question is seeking your opinion on the economic outlook for analytics in general rather than relative to any particular program. In general, employment opportunities in analytics will ____?____ over the next 5-10 years, relative to today.	Analytics-Related Employment Growth	*Dramatic* growth is predicted by 48% of respondents and 96% predict some level of expansion of employment opportunities.

2.2 Industry Survey: Local Analytical Capabilities and Employment Opportunities

In July 2014 an industry survey was sent to 112 high-ranking officers (mostly in IT) at local organizations (Northeast Ohio). A total of 63 emails were opened and read and a total of 29 were submitted and used in the analysis. Depending on one's preferences, the response rate with 'total emails sent' in the denominator would be 25.9%, and the response rate with 'emails read' in the denominator would be 46.0%. Many different industries participated in the survey including health care, insurance, consulting, retail, chemical manufacturing, discrete manufacturing, financial services, utilities, software development, and metals and mining (among others). Many large and well-known employers are included such as Goodyear, Eaton, Timken, Lubrizol, Jo-Ann Fabrics, Nationwide Insurance, and EMC Corporation (among others). Smaller organizations are also represented including Chagrin Consulting, DentalOne

Partners, and Findaway World. The survey detail presented separately in Section 1.4 is based on the same instrument so these characteristics apply to those results as well.

This section of the local industry survey focuses on local analytical capabilities and the respondent's perceptions of the employment opportunities. Table 6 displays each question, the issue(s) being assessed and brief conclusions. Full information on the responses and full discussions are included in Appendix A. Clicking on the question text in the table will link the reader to the question's discussion in the appendix.

2.3 Institutional Need

Strategically, many U.S. universities including Kent State are investing in specialty masters programs such as the proposed MSBA; especially since enrollment in the traditional MBA programs remain static at best. Furthermore, the international market presents promising growth potentials for recruiting graduate students, which seems to be more prevalent in specialty masters programs. As discussed later in Section 3, KSU and the College of Business have intensified their national and international marketing efforts and have established offices in some foreign countries that would enable them to grow their programs.

3. Access and Retention of Underrepresented Groups

Historically, underrepresented groups and women do not pursue degrees in STEM disciplines as much as they do in the arts and education. For example, in 2007 "underrepresented minorities comprised… 33.2 percent of the U.S. college age population, 26.2 percent of undergraduate enrollment, and 17.7 percent of those earning science and engineering bachelor's degrees."[28] Several reasons have been advanced for these paltry results including lack of preparedness, inadequate facilities and curricula, and socio-economic background. Solutions have also been advanced such as early exposure to STEM curricula, career advising, faculty mentorship, and scholarships. Most experts agree that this is a national phenomenon with economic and national security implications which will require collaborative efforts between governments, parents, and educational institutions that must start at the elementary school level. Otherwise, the U.S. will not have "scientists and medical practitioners who are responsive" to the underrepresented demographics and will continue to outsource "more jobs, so our economy is going to suffer."[29] This is in the face of the fact that the underrepresented population, according to William Frey of Brookings Institute, is growing faster than that of the majority group, and likely to surpass it by 2040.[30] However, the erosion of U.S. STEM intellectual capital is not limited to the underrepresented population. According to one study on the phenomenon, in 2002 "The United States has one of the lowest rates of

[28] National Academy of Sciences, National Academy of Engineering, and Institute of Medicine of the National Academies. "Expanding Underrepresented Minority Participation." The National Academies Press, Washington, DC. 2011.
[29] Jones, Andrew, "Minority groups underrepresented in STEM fields." http://www.browndailyherald.com/2013/10/30/minority-groups-underrepresented-stem-fields/. Retrieved January 25, 2015.
[30] Shah, N. "Waiting for the U.S. to Become a "Majority-Minority" Nation? You'll Have to Wait A Little Longer." Dec. 10, 2014. http://blogs.wsj.com/economics/2014/12/10/waiting-for-the-u-s-to-become-a-majority-minority-nation-youll-have-to-wait-a-little-longer/. Retrieved January 29, 2015.

STEM to non-STEM degree production worldwide, with STEM accounting for 16.8% of all first university degrees awarded …"[31] compared to the international average of 26.4%.

As part of its diversity initiatives to recruit and retain African American, Latino American, and Native American (AALANA) students Kent State University established the Division of Diversity, Equity and Inclusion (DEI), which is led by a Vice-President. The DEI created the first university Equity Action Plan with the primary purpose of increasing "opportunities for underrepresented and underserved groups" through recruitment, retention, persistence, and scholarship initiatives. These efforts have resulted in enrollment of underrepresented groups in the university increasing from 12.4% in the baseline year of 2009 to 13.8% today for undergraduate students, and 7.3% to 9.7%[32] for graduate students. The MSBA program will gain from these successes and will be actively marketed to this group of students. The degree program would also help underrepresented groups and their peers in the program to combine their analytical skills with business decision-making acumen, which would make them even more marketable to prospective employers.

According to the latest statistics, Table 7, from the Kent State University's office of Research, Planning and Institutional Effectiveness (RPIE) the total fall 2014 enrollment of underrepresented groups and women are about 7.2% and 63.9% of all graduate enrollments, with that of the college (6.1% and 43.7%) trailing the university norms.

Tables 8 show the number of graduate degrees awarded by Kent State University and College of Business Administration in 2014. Again, the college's percentages for underrepresented groups (2.6%) and women (45.5%) trail those of the university (6.1% and 65.1%, respectively). What is not reflected in the tables is that even though graduation of women in the college remained stable from 2011 through 2014, those of the AALANA population were 3.3%, 4.5%, and 4.0% in 2011, 2012, and 2013, respectively. However, it is clear from these Tables that the university and the college have to do more to increase its recruitment and graduation of underrepresented groups and women.

Although the College's enrollment and graduation percentages for underrepresented groups are below those of the university, the college believes that its recent marketing efforts would narrow those gaps in the near future. Furthermore, in recent years some organizations such as the PhD Project have embarked on efforts aimed at recruiting underrepresented groups into graduate programs in business.

The PhD Project is an organization established for the purpose of increasing the number of AALANA full-time tenure-track faculty in colleges of business. Specifically, it is designed to encourage and attract minority students into doctoral programs in business, who upon graduation may become business professors. The premise is that "If you have diversity in front of the classroom, you can diversity the classroom," since diverse faculty attract and retain diverse students. Thus, The PhD Project provides fertile grounds for recruiting minority students into graduate programs in business. Every year hundreds of minority students attend PhD Project sponsored events and conferences that KSU attends in an effort to recruit this group of students into its graduate programs. Many of these students become active in the project as undergraduates.

[31] Kuenzi, J. J., "Science, Technology, Engineering, and mathematics (STEM) Education: Background, Federal Policy, and Legislative Action." Congressional Research Service Reports. Paper 35. 2008. http://digitalcommons.unl.edu/crsdocs/35. Retrieved January 28, 2015.
[32] The disparity between this number, provided by DEI, and the one shown in Table 7, mined by the Department from RPIE website, is probably due to ethnicity classification errors.

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Kent State's College of Business Administration is a member of The PhD Project and has worked with that organization to advance its goals. The college will use its network of PhD Project member schools and non-member schools with predominantly AALANA and women population of students to market and recruit underrepresented groups. Also, the college has strong internship programs for master's level students and underrepresented groups are considered for awarding of scholarships.

Table 7: KSU and Business AALANA Enrollment Profiles (2014)

(a) Fall 2014 Enrollments	Masters		Special (Ed. S.)		Doctoral		Total Graduate	
Kent State University	**4029**		**40**		**1371**		**5440**	
White, non-Hispanic	2706	67.2%	33	82.5%	819	59.7%	**3558**	65.4%
Black or African American	206	5.1%	3	7.5%	60	4.4%	**269**	4.9%
Hispanic or Latino	85	2.1%	0	0.0%	23	1.7%	**108**	2.0%
Asian	45	1.1%	1	2.5%	31	2.3%	**77**	1.4%
Native American/Alaskan Native	12	0.3%	0	0.0%	2	0.1%	**14**	0.3%
Native Hawaiian/Pacific Island	2	0.0%	0	0.0%	1	0.1%	**3**	0.1%
International, non-US Resident	609	15.1%	0	0.0%	392	28.6%	**1001**	18.4%
Other	364	9.0%	3	7.5%	43	3.1%	**410**	7.5%
AALANA	**303**	**7.5%**	**3**	**7.5%**	**85**	**6.2%**	**391**	**7.2%**
Female	**2650**	**65.8%**	**35**	**87.5%**	**790**	**57.6%**	**3475**	**63.9%**
Male	1379	34.2%	5	12.5%	581	42.4%	1965	36.1%

(b) Fall 2014 Enrollments	Masters		Special (Ed. S.)		Doctoral		Total Graduate	
College of Business Administration	**249**		**0**		**46**		**295**	
White, non-Hispanic	140	56.2%			19	41.3%	**159**	53.9%
Black or African American	14	5.6%			0	0.0%	**14**	4.7%
Hispanic or Latino	3	1.2%			0	0.0%	**3**	1.0%
Asian	3	1.2%			2	4.3%	**5**	1.7%
Native American/Alaskan Native	1	0.4%			0	0.0%	**1**	0.3%
Native Hawaiian/Pacific Island	1	0.4%			0	0.0%	**1**	0.3%
International, non-US Resident	81	32.5%			23	50.0%	**104**	35.3%
Other	6	2.4%			2	4.3%	**8**	2.7%
AALANA	**18**	**7.2%**			**0**	**0.0%**	**18**	**6.1%**
Female	**110**	**44.2%**			**19**	**41.3%**	**129**	**43.7%**
Male	139	55.8%			27	58.7%	166	56.3%

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Table 8: KSU and Business AALANA Degrees Awarded (2014)

(a) 2014 Degrees Awarded	Masters		Special (Ed. S.)		Doctoral		Total Graduate	
Kent State University	**1555**		**28**		**145**		**1728**	
White, non-Hispanic	1173	75.4%	23	82.1%	84	57.9%	**1280**	74.1%
Black or African American	75	4.8%	1	3.6%	4	2.8%	**80**	4.6%
Hispanic or Latino	24	1.5%	0	0.0%	1	0.7%	**25**	1.4%
Asian	21	1.4%	1	3.6%	7	4.8%	**29**	1.7%
Native American/Alaskan Native	1	0.1%	0	0.0%	0	0.0%	**1**	0.1%
Native Hawaiian/Pacific Island	0	0.0%	0	0.0%	0	0.0%	**0**	0.0%
International, non-US Resident	-	-	-	-	-	-	**-**	-
Other	261	16.8%	3	10.7%	29	20.0%	**293**	17.0%
AALANA	**100**	**6.4%**	**1**	**3.6%**	**5**	**3.4%**	**106**	**6.1%**
Female	**1048**	**67.4%**	**21**	**75.0%**	**56**	**38.6%**	**1125**	**65.1%**
Male	507	32.6%	2	7.1%	47	32.4%	556	32.2%

(b) Degrees Awarded	Masters		Special (Ed. S.)		Doctoral		Total Graduate	
College of Business Administration	**148**		**0**		**6**		**154**	
White, non-Hispanic	102	68.9%			2	33.3%	**104**	67.5%
Black or African American	3	2.0%			0	0.0%	**3**	1.9%
Hispanic or Latino	1	0.7%			0	0.0%	**1**	0.6%
Asian	3	2.0%			1	16.7%	**4**	2.6%
Native American/Alaskan Native	0	0.0%			0	0.0%	**0**	0.0%
Native Hawaiian/Pacific Island	0	0.0%			0	0.0%	**0**	0.0%
International, non-US Resident	-	-			-	-	**-**	-
Other	39	26.4%			3	50.0%	**42**	27.3%
AALANA	**4**	**2.7%**			**0**	**0.0%**	**4**	**2.6%**
Female	**68**	**45.9%**			**2**	**33.3%**	**70**	**45.5%**
Male	80	54.1%			4	66.7%	84	54.5%

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4. Statewide Alternatives

It was discussed earlier in Section 2.1 that the University of Cincinnati reported a 95% placement for its MSBA graduates with very good starting salaries. Similar experiences were also reported for North Carolina State University. It seems reasonable to use the Cincinnati Metropolitan Area to help understand the opportunities that exist in the Cleveland/Akron Metropolitan Area. The two metro areas are reasonably close geographically as well as in population, with the Cleveland/Akron area being somewhat larger (3,497,711 for Cleveland/Akron area; 2,188,001 for Cincinnati area[33]). Obviously, the national and international employment opportunities would be the same between the two programs. The similarities between the local populations should suggest at least equivalent opportunities given the larger population.

As shown in Table 9, a simple search of a large comprehensive job board, indeed.com[34] in July 2014 on the term 'analytics' yielded 442 current job postings in the combined Cleveland/Akron Metropolitan Area. The same search in the Cincinnati area yielded 416 postings, while Columbus yielded 602 postings. As confirmation, the same search was conducted using the term 'big data', 'statistics', and 'data analysis'. Certainly, it is true some of these postings would not turn out to be analytics related. However, it is reasonable to suggest that these numbers are useful for comparing the relative employment opportunities - even if the actual counts are likely somewhat inflated (for all metros). This simply assumes that the ratio of actual analytics positions for each search term is relatively constant across the state. It is not presented as an exact metric but rather as a proxy for relative job opportunities in each metro area. The results of all searches are shown in Table 9.

This investigation of current relevant job opportunities lends credence to our contention that the Cleveland/Akron market is at least equivalent to the Cincinnati market in regard to job opportunities. Although there is currently no similar program in Columbus, the Cleveland/Akron area eclipses the opportunities in Columbus on two of the four searches.

Table 9. Job Postings in Ohio Metropolitan Areas by Search Term

Metro Area	'analytics'	'big data'	'statistics'	'data analysis'	TOTALS
Cleveland/Akron	442	63	470	266	1241
Cincinnati	416	60	263	182	921
Columbus	602	34	372	290	1298

[33] United States Census Bureau, "Annual Estimates of the Population of Combined Statistical Areas: April 1, 2010 to July 1, 2012." https://www.census.gov/popest/data/metro/totals/2012/tables/CBSA-EST2012-02.csv. Retrieved Nov 17, 2014.
[34] http://www.indeed.com/jobs?q=analytics. Retrieved July 2014.

Finally, several research reports continue to stress the importance of knowledge in data analytics. In one such report the authors concluded that ability to analyze big data "will become a key basis of competition, underpinning new waves of productivity growth, innovation, and consumer surplus."[35] The study further observes that by 2018, the United States could face a "shortage of 140,000 to 190,000 people with deep analytical skills as well as 1.5 million managers and analysts with the know-how to use the analysis of big data to make effective decisions." This study was previously reported graphically in Figure 2. This observation is also supported by the latest U.S. Bureau of Labor Statistics[36] data on job outlook for people with analytics related experiences, some of which were presented in Table 5.

4.1 Prospective Enrollment

The proposed MSBA program will provide working professionals and students from baccalaureate programs opportunities for an advanced degree in business analytics. The program is also complimentary to STEM programs at other Northeast Ohio universities that could serve as feeders.

Northeast Ohio is home to more than 50 hospitals including world-renowned Cleveland Clinic and University Hospitals, over 200,000 healthcare and bioscience workers, and other businesses such as the Good Year Tire and Rubber Company, First Energy Corporation, The Timken Company and many others that are potential sources for enrollment and employment of students of the MSBA program. Further, the more than 100,000 students in Northeast Ohio colleges and universities provide another source for students who would want to gain knowledge in this burgeoning field of study in order to improve their marketability.

At the time of this writing the University of Cincinnati's MSBA program enrolls about 100 students. Given the similarities between metropolitan Cincinnati and Cleveland, Northeast Ohio population advantages noted earlier, survey results from industry, and our marketing efforts we expect that the Kent State University MSBA program could generate enrollment of about 30 students in its first year, with excellent potential for continued growth.

It is reasonable to expect that much of the earlier enrollees for the MSBA program will most likely be baccalaureate degree graduates in business, computer science, digital sciences, and mathematics from Kent State University, similar and engineering programs from the University of Akron and Cleveland State University, local businesses, and through efforts from Kent State University's already established marketing and recruitment offices in China and India.

More enrollments needed to sustain the degree program will also come from marketing efforts to our PhD Project partner institutions, and other organizations and institutions across the country.

[35] Manyika J., Chui M., Brown B., Bughin J., Dobbs R., Roxburgh C., Byers A. "McKinsey Global Institute: Big data: The next frontier for innovation, competition, and productivity." May 2011. http://www.mckinsey.com/insights/business_technology/big_data_the_next_frontier_for_innovation. Retrieved August 12, 2014.
[36] Bureau of Labor Statistics. *Occupational Outlook Handbook: Business and Financial Occupations*. http://www.bls.gov/ooh/business-and-financial/. Retrieved Feb 2, 2015.

4.2 Program Marketing

In the past several years Kent State University has shown renewed commitment to global education and diversifying its international student body by establishing the Office of Global Education (OGE), under the Directorship of an Associate Provost. The OGE has offices across the globe including in China, India and Brazil and several departments in the university have taken advantage of this opportunity to expand their programs. These efforts have resulted in a 227% increase (848 in spring 2009 compared to 2772 in spring 2015) in the population of international students at Kent State University. Although majority of these students come from China (30%), Saudi Arabia (25%), and India (18%) the preponderance of them in recent years have come from India (48%), especially at the graduate level with an increase of 276% in the past two years alone. As have other departments in the university, the M&IS department will capitalize on this resurgence of international interest in KSU education to market the MSBA program, especially in India and China where graduate enrollment growths have been most notable.

Beyond marketing the program globally and to our PhD Project partners as discussed earlier, KSU has strategies for marketing the program nationally. No specific financial information can be provided for marketing the program since the University, through its University Communication & Marketing Office and the College of Business Marketing & Public Relations Office, already have offices charged with this effort for all programs. Other marketing costs will be borne by the program home department (M&IS), which as of this writing has $12,000 earmarked for that purpose.

Local, regional, and national marketing will include leveraging our substantial contacts within businesses and other academic programs as this is likely to be a low cost and high impact method. We will then further identify employers and potential feeder programs that are likely to have an interest in our program. Many will be personally contacted and all will receive program promotional materials. Mass media marketing is a possibility but requires university support that will be determined by the needs of the program once implemented.

4.3 Similar Programs in the State of Ohio

There are currently only two institutions offering master's level analytics degree programs in Ohio (University of Cincinnati (Southwest Ohio) and Bowling Green State University (Northwest Ohio – has two relevant MS programs).Undergraduate specializations are available at The Ohio State (Central Ohio) and Bowling Green State Universities. Other ancillary graduate programs also exist at the University of Akron (9 credit-hour MBA concentration), Cleveland State University (graduate certificate), and Case Western Reserve University (MS in Management-OR & SCM), which do not provide complete immersion as would a full masters business analytics degree program. The proposed MSBA is designed to bridge this gap to meet the needs of students and employers in Northeast Ohio. These programs and their descriptions are presented in Table 10. A comparison of the state's graduate analytics degree programs follows in Table 11. This table (11) provides a comparison between the programs at the University of Cincinnati, Bowling Green State University and the proposed KSU program. As they all provide education in the same central domain there is no surprise that there are some similarities in the coursework. However, it can also be seen that each program has a level of distinctiveness. There are some differences in coursework along with differences in number of total and required credit hours. KSU's distinctiveness in this group includes the more formal way we address the contextual skills (technical and business/management) in the program as well as our holistic approach of addressing each of our defined foci in each course (to a greater or lesser extent depending on the course).

Jobs Ohio[37] reports that "three of the world's largest big data solution providers are located or headquartered in Ohio," and that Ohio is "home to many of the largest consumer product and apparel companies in the world", who depend on data analytics to run their businesses. Higher education has an indubitable role in providing the educated and labor force-ready students these businesses urgently need to remain competitive. The state of Ohio recognizes this urgency by making workforce readiness a top priority. Yet, as shown in Table 10, only 2 out of 13 four year institutions in the state currently have full graduate degree programs in analytics.

Table 10. State of Ohio Analytics or Related Programs

Institution	Baccalaureate	Masters	Comments
Kent State University (Proposed)		30 credit-hour business analytics program integrating data management, data analysis, and decision-making and leadership.	Graduate program. Data analysts with both analytical and strategic decision making skills.
The Ohio State University	5-hour cluster of business analytics courses beyond baccalaureate degree requirements.		Undergraduate program. Far from Northeast Ohio to serve growing needs of the region.
University of Cincinnati		35 credit hours: 21 in modeling and statistics, and 14 in electives.	Comprehensive program but not close to Northeast Ohio to serve growing needs of the region.
Bowling Green State University	Undergraduate specialization in business analytics.	MS in Applied Statistics with a specialization in Business Analytics: 39 credit hours in analytics, statistics, database and project management. -and- MS in Analytics: 33-credit hour, 12 month, full-time	Graduate programs are comprehensive but cannot fulfill growing needs of the region alone. The program is in the northwest quadrant so may not meet the needs of the more eastern part of the state.
Cleveland State University		16 hours certificate program in marketing analytics.	The courses and program are specific to marketing.
Case Western Reserve University		39 credit hours: 9 business core hours (including 3 hours of Marketing Analytics for SCM), 12 hours of operations research, and 18 hours of supply chain.	Program comprehensive but more focused on OR and SCM, and cannot fulfill growing needs of the region.
University of Akron		9 credit-hour MBA-concentration.	The program is only a concentration.
Miami University	An analytics Co-Major is offered by the Dept. of Statistics, Business offers a business analytics minor.		

[37] Jobs Ohio, "2013/2014 annual report/strategic plan." http://jobs-ohio.com/images/JO_annual_report_2013_14.pdf. Retrieved January 31, 2015.

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Table 11. Comparison of Ohio Graduate Analytics Degree Programs

	Kent State University Proposed MSBA	Bowling Green State University MSAS w BA	Bowling Green State University MSA	University of Cincinnati MSBA
Degree Name	M.S. in Business Analytics	M.S. in Applied Statistics with a specialization in Business Analytics (specialization adds 6 cr.)	M.S. in Analytics	M.S. in Business Analytics
Self-description (from website for BGSU, UC or from proposal for KSU)	The disciplinary purpose of the program is to produce graduates that understand and are ready to implement business analytical methods in realistic business contexts. By being 'ready to implement' business analytical methods, we mean that the graduate is not only aware of the analytical methodologies in play but also has an understanding of the challenges involved in choosing the right problems or opportunities to address, selecting the best method(s) for analysis, interpreting the results into actionable solutions, and communicating and promoting the solution to stakeholders. Additionally, graduates of this program should be prepared to provide leadership throughout the entire process. The balance the program strives for would be towards a mixture of 50% Data Analysis (DA) with the other 50% split evenly between both Information and Data Management (IDM) and Decision-Making and Leadership (DML).	BGSU is excited to offer the MSAS with a specialization in business analytics. The explosion of modern computing power and data acquisition techniques has created a profession generally known as business analytics that is in increasing demand. The job market seeks people with a strong background in fundamental statistical training, a solid exposure to operations research, and a firm understanding of management of information systems and business operations. Writing on the growing opportunities in the fields of business analytics and big data, McKinsey & Company, a global management-consulting firm, found that "by 2018 the United States alone could face a shortage of 140,000 to 190,000 people with deep analytical skills." The business analytics specialization at BGSU prepares students for this exciting new career. The specialization adds six credit hours to the standard MSAS curriculum, with courses covering data mining, time series analysis, and linear and integer programming. It also adds additional elective options in economics, business administration and computer science.	PROGRAM STRENGTH AND UNIQUENESS •Full-time, cohort, 12-month program •Focus on hands-on experience and applications •Analytical skills in descriptive, predictive and prescriptive analytics •Technical skills in database management, business intelligence and big data analytics •Soft skills in management and leadership •An integrated experience in analytics projects •Taught by full-time faculty •Collaborations with the Center for Business Analytics	The program is designed to provide a strong foundation in all the areas of business analytics, while allowing considerable flexibility so that students can individually tailor their programs according to their interests or career plans. The program requires the completion of 33 semester credits. Additional graduate hours may be required to meet program prerequisites.

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Table 11. Comparison of Ohio Graduate Analytics Degree Programs (cont.)

	Kent State University Proposed MSBA	Bowling Green State University MSAS w BA	Bowling Green State University MSA	University of Cincinnati MSBA
Total Hours	30	39	33	33
Required Course Hours	24	30	33	23
Elective Course Hours	6	9	0	10
Required Courses	Business Analytics Database Management & Database Analytics Data Mining Techniques Advanced Data Mining and Predictive Analytics Quantitative Management Modeling Analytics for Big Data Analytics in Practice Capstone Project in Business Analytics	Probability Theory I Mathematical Statistics II Business Database Management Linear and Integer Programming Regression Analysis Experimental Design Time Series Analysis Data Mining *Choose 1 of:* Applied Probability Probability Models for Decision Making *Choose:* Thesis or Comp Exam	Regression Analysis Database Management Exploratory Data Analysis Decision Optimizations Analytics Project I - 1 hour Time-Series Analysis and Forecasting Business Intelligence Data Mining Big Data Analytics Analytics Project II - 1 hour Advanced Data Analytics Project Management Analytics Project III - 1 hour	Optimization Modeling Probability Modeling Optimization Methods Statistical Methods Simulation Modeling Statistical Modeling Statistical Computing Data Management MS Capstone
One Semester Full-time Instructional Fees[38]	Resident: $4,516 Non-Resident: $8,274	Resident: $5,084.00 Non-Resident: $8,738.00	Resident: $5,084.00 Non-Resident: $8,738.00	Resident: $9,640.00 Non-Resident: $12,059.00

[38] OhioHigherEd: University System of Ohio. "Fall 2014 Survey of Student Charges for Academic Year 2014 – 2015." https://www.ohiohighered.org/sites/ohiohighered.org/files/uploads/data/statistical-profiles/tuition-finaid/FY15%20Tuition%20and%20Fees%20Survey.pdf. Retrieved January 20, 2015.

Another report by Jobs Ohio Information Technology and Services[39] supports the earlier report, stating that "Ohio is recognized as a global leader in data analytics." However, as is clear from the map of the state's major metropolitan areas in Figure 5, two of the data analytics programs (Ohio State University—undergraduate cluster, and University of Cincinnati—comprehensive graduate) are in the southern half of the state. Clearly, there is unmet need of comprehensive data analytics educational programs in the Northern half (and particularly the Northeast quadrant) of the state to serve the growing needs of students and businesses in Northeast Ohio.

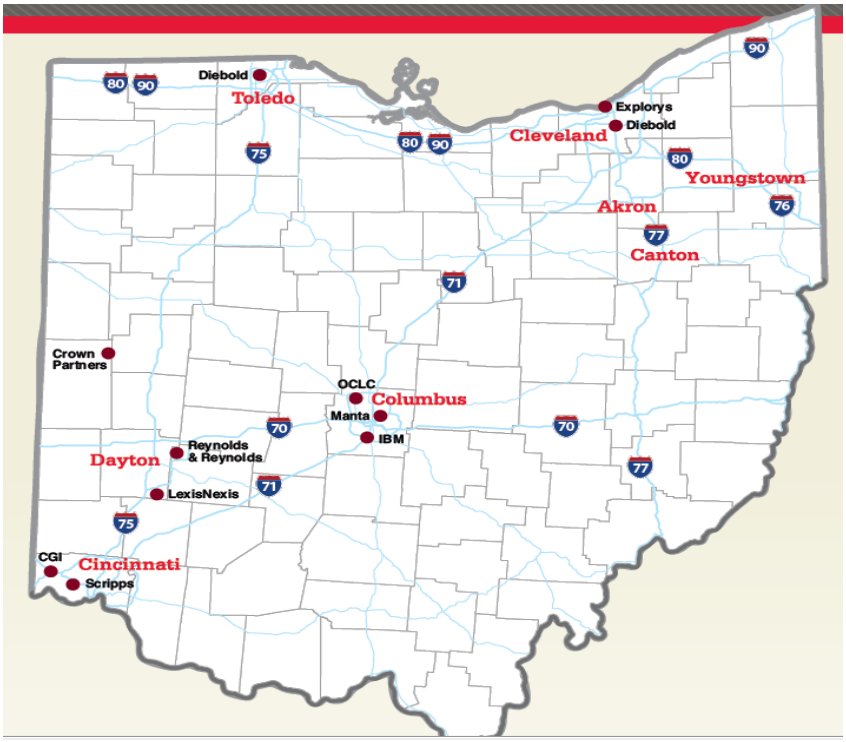

Figure 5. Ohio's Metropolitan Technology Hot Beds.

Figure 6 displays the counties that make up Northeast Ohio. Most of these counties (except the western most and southern most counties in the graphic) are the counties that Kent State believes makes up most of the residential areas that comprise its commuter student base. Currently, 80% of Kent State's students are commuter students.[40]

Regionally, Kent State University primarily serves the area described by the US Census Bureau as the Cleveland-Akron-Canton, Ohio Combined Statistical area which has a population of 3.5 million people (2013 US Census). We note also that KSU serves non-metropolitan counties as well such as Wayne, Trumbull, and Columbiana counties (and further note that we serve a large number of national and

[39] Jobs Ohio. http://jobs-ohio.com/images/information_technology_aug13.pdf. Retrieved January 24, 2015.
[40] Adkins, J. "Commuter students face difficulties on campus." *kentwired.com*. April 28, 2014. http://www.kentwired.com/latest_updates/article_61ef3a42-cf28-11e3-b335-001a4bcf6878.html. Retrieved January 24, 2015.

international students as well). KSU is not the only college or university that serves this region, of course; we note our colleagues at the University of Akron, Cleveland State University, Youngstown State University, Case Western Reserve University and others also serve portions of this region. This actually bolsters our need argument – if it takes this many academic institutions to serve the other academic needs of this population center, it should be expected that at least one analytics-focused graduate degree program is needed for the region. Since we are solely interested in discussing Masters-level Analytics Programs in this comparison, the remainder of this discussion will be limited to institutions that currently offer these programs (Bowling Green State University and the University of Cincinnati) along with the proposed program at KSU.

Figure 6. Counties in Northeast Ohio[41]

[41] Meissner, Paul J. - "Cleveland CSA 2013 v.3 - Template: Own Work Derived from a Previous Edition Created by Eureka Lott." Licensed under CC BY-SA 3.0 via Wikimedia Commons - http://commons.wikimedia.org/wiki/File:Cleveland_CSA_2013_v.3.png#mediaviewer/File:Cleveland_CSA_2013_v.3.png. Retrieved December 17, 2014.

For some students who are willing to change their residence to somewhere outside of their current commuting limits, they may decide to go to any in-state or out-of-state program based on many different criteria. However, for the large numbers of potential students who do not have the luxury to move wherever their educational desires may take them, currently there are few degree options in this heavily populated metro area. Since academic analytics programs are a relatively new phenomenon, we anticipate more than usual demand from older students who are established in the area and are likely unable or unwilling to relocate but still wish to pursue this new opportunity. That is a primary reason the program is designed to include a part-time option.

Obviously, for those unable or unwilling to relocate from the Cleveland/Akron/Canton metro area, attending the program at the University of Cincinnati would not be possible. For the programs available at Bowling Green, two of the western most counties in our described primary service region (18 counties) may also be served by BGSU. However, for the much more population dense counties eastwards toward Cleveland and Akron, commuting to BGSU quickly becomes impractical for most people.

Table 12 makes the case for the need for a comprehensive graduate analytics program in the region Kent State serves (NE Ohio). For local students, who cannot or will not relocate to attend a program, there are no options in the highly populated Northeast corner of the state. This is really a simple question of geography as the table points out. The table displays the one-way commuting distance and time between the physical center of Northeast Ohio counties and both KSU's and BGSU's locations. The University of Cincinnati was not included in the table simply because the distances involved are obviously out of range for commuters. As can be seen, although BGSU undoubtedly serves its regional population in northwest Ohio as well as those who wish to relocate to Bowling Green, the one-way commuting time to all the counties we include in Northeast Ohio**,** except one**,** are greater than 90 minutes (again, each way). While some of these counties also have a significant commute to KSU, they are much more realistic than the commutes to BGSU. The result of this analysis demonstrates that for these counties, there are currently no options for a graduate analytics degree for residents who do not wish to relocate. It is notable that the total population of these counties approaches 4.3 million people (approximately 37% of the total population of the State of Ohio).

4.4 Opportunities for Inter-Institutional Collaboration

This proposal is for a face-to-face degree program. Consequently, collaboration across geographical boundaries would be challenging. However, collaboration opportunity exists for institutions to share best practices that would be mutually beneficial. Through such collaborative efforts institutions could learn from each other in many ways. Plus, with program maturity the proposed MSBA program, if deemed appropriate, could be upgraded to online and blended learning deliveries that would engender more collaborative opportunities.

Given the geographical proximity between Akron and Kent there could be much better opportunities for collaboration with the University of Akron, even with a face-to-face program. Our colleagues at the University of Akron offer a curriculum that has been dubbed the "consumer" side of analytics. On the other hand, the proposed MSBA curriculum at KSU could be seen as the "producer" side of analytics. These programs complement each other and would present great opportunities for faculty and students from both institutions to collaborate on curricula matters, capstone project and internship case analyses projects, and pooling of community partners and resources.

With appropriate coordination from both institutions, this case-based projects approach, such as in the capstone course, with student teams of differing backgrounds provide great opportunity for students from the two institutions to work together and learn from each other. We look forward to exploring this opportunity further with our colleagues at the University of Akron and other institutions.

Table 12. Comparison of *One-Way* Commuting Distance/Time to BGSU and KSU from NE Ohio Counties.

County	BGSU Miles	BGSU Minutes	KSU Miles	KSU Minutes	Time Increase to BGSU	County Population
Columbiana	193	174	46	56	210.7%	107,841
Mahoning	173	164	47	53	209.4%	238,823
Ashtabula	171	163	83	79	106.3%	101,497
Tuscarawas	169	175	64	69	153.6%	92,582
Trumbull	168	159	38	59	169.5%	210,312
Stark	166	151	31	44	243.2%	375,586
Lake	145	144	37	59	144.1%	230,041
Portage	143	137	7	17	705.9%	161,419
Geauga	141	137	25	37	270.3%	93,389
Holmes	139	133	69	78	70.5%	42,366
Summit	134	130	10	24	441.7%	541,781
Wayne	134	120	44	50	140.0%	114,520
Cuyahoga	122	113	29	36	213.9%	1,280,122
Ashland	114	105	60	59	78.0%	53,139
Medina	100	122	37	46	165.2%	172,332
Lorain	95	99	52	58	70.7%	301,356
Erie	93	91	73	72	26.4%	77,079
Huron	67	80	74	83	-3.6%	59,626
					Total	**4,253,811**

5. Institutional Priorities and Costs

The College of Business Administration has five departments—Accounting, Economics, Finance, Management & Information Systems (M&IS), and Marketing & Entrepreneurship each headed by a Chair who reports to the Dean of the College. The proposed MSBA program has the full support of the Dean and the college.

The MSBA program will be housed in the M&IS department. A subcommittee of the College's Graduate Council, made up of graduate faculty from the home department, will oversee curricula matters and qualifications of faculty teaching in the program. All marketing and advising responsibilities for the program will rest with the home department in consultation with the College's Marketing and Public Relations Office and Associate Dean for Graduate Programs.

5.1 Availability and Adequacy of Faculty and Facility Resources

The home department (M&IS) for the proposed MSBA program is the largest of all five departments in the College of Business Administration. The department supports two majors (Business Management and Computer Information Systems) and various minors at the undergraduate level, and Ph.D. in Business Administration in four concentrations—Operations Management, Information Systems, Human Resources, and Business Strategy. The department does not currently offer a Master's level degree program but offers several courses in support of the Master of Business Administration (MBA) program, and several other masters' level concentrations.

Business analytics is a data, technology, and expertise enabled curriculum which requires appropriate resources for success. Kent State University has a world-class library with over 1 million volumes. It is a member of the OhioLink library exchange system and the campus is connected through wireless computer networks. The library and wireless computer networks offer our professors easy access to research monographs and journals. Each of our faculty also has high speed computers in their offices to enable easy access to these resources. For more detail information on the KSU library resources see Appendix E.

The College of Business Administration is a member of the SAP University Alliance, which gives our students and professors access to one of the leading Enterprise Resource Planning (ERP) systems in the world. Since the college partnered with SAP, SAP has been integrated into several programs in the college to expose our students to one of the professional ERP systems they are likely to face after graduation. Germane to the MSBA program is SAP-HANA, SAP's platform for Big Data Analytics, which the MSBA program faculty members and students will have at their disposal. Other research and analytics tools available to faculty and students include SAS, JMP, R and STRATA. See section 1.2.7 for additional discussion of program technologies. However, in order to maintain the technology, data, and advising needs for students in the program, general fees of $1,200 will be assessed on each student per year. In comparison, the University of Cincinnati assesses general fees of about $1,300 per student per year.

The M&IS department has a diverse core of 16 full-time faculty members, ten of who have expertise in operations research and operations management, statistics, information systems, and supply chain management. The list of this 10 faculty core is presented in Table 4, Section 1.5; page 16. This ten faculty core has a combined teaching experience of more than 80 years and published more than 150 papers in the top research journals in their respective fields. Since additional courses will be required for the MSBA program, the college has committed to hiring one (1) more tenure-track full time faculty member with

established research and teaching records in business analytics, and one (1) non-tenure-track full time faculty member to augment the existing faculty core. Other expertise in the college at the disposal of the department for the delivery of elective courses and discipline-based concentrations in the MSBA program includes more than 15 faculty members from marketing, economics, and finance, and several others from mathematics and computer science.

5.2 Need for Additional Facilities and Staff

Five years ago Kent State University switched to the Responsibility Center Management (RCM) financial model where colleges and departments use business-type strategies to manage their operations. Under RCM, costs and revenues are taken into consideration when making decisions about the viability of existing or new programs. The MSBA program will be no exception and will undergo the same scrutiny as other programs. Since the establishment of this financial model, the College's RCM metrics have been consistently favorable. The college is committed to reinvesting some of those monies into faculty and curricula resources such as for the MSBA program.

The department has also been creative in managing and generating sustainable resources. It has performed well under the RCM financial model and is in a position to provide needed resources in support of the MSBA program. Further, the program has the full support of the College Dean and other departments in the college who have interest in, and continuing commitment to the program. At the present, there is a total of ten faculty members in the department with the teaching and research credentials to staff courses in the MSBA program, plus several other faculty members from the departments of Computer Science, Information Architecture and Knowledge Management, and School of Digital Sciences. Also, the college has budgeted to hire within the first year of full operation, a full time tenure-track faculty person and a full time non-tenure track faculty person to fill undergraduate capacity needs when the ten faculty members are redeployed into the MSBA program. To facilitate student advising and placement, we have also budgeted for a program advisor that will spend his/her time between our MBA and the MSBA students and augments our faculty resources. Beyond the resources delineated here, there is no other plan for additional facility resources. But as noted, the College has the capacity to supply any needed resources and will do so when the need arises. This need for more faculty resources will be assessed after the first two years of the program.

5.3 Projected Program Budget

Kent State University has majors in mathematics, business, economics, computer science, information systems, marketing, finance and other disciplines that provide strong foundation for an analytics program. Although the proposed MSBA program and faculty core will be housed in the M&IS department, expertise for offering it will be drawn from across the campus and the Northeast Ohio business community. For example, two of the required courses in the program are offered through the Computer Science Department, and some elective courses are offered through four other departments. Drawing from its strong faculty base in mathematics, information technology, and business, the Kent State University MSBA program will offer its students the tools they need to take advantage of the growing employment opportunities in data analytics. The college has also committed $245,000 toward hiring more faculty members to augment existing faculty core, and provide advising and technology updates for the program. Additional resources will be made available as the program grows. A five-year estimated budget for the MSBA program is shown below in Table 13. To the best of our estimation the proposed degree program is expected to show positive cash flow in its first year.

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Table 13. Fiscal Impact Statement

	Year 1	Year 2	Year 3	Year 4	Year 5
I. Projected Enrollment	30	35	42	50	50
Headcount full time	21	25	30	36	36
Headcount part time	9	10	12	14	14
Full-time equivalent (FTE) enrollment	25.5	30	36	43	43
II. Projected Program Income					
Tuition & General Fees	$312,920.7	$368,142.0	$441,770.4	$527,670.2	$527,670.2
Expected state subsidy	0	$94,860.0	$113,832.0	$271,932.0	$271,932.0
Externally funded stipends, as applicable	0	0	0	0	0
Program Fees	$30,000	$36,000	$43,200	$51,600	$51,600
Total Projected Program Income	**$343,520.7**	**$499,002.0**	**$598,802.4**	**$851,202.2**	**$851,202.2**
III. Program Expenses					
New Personnel:					
• Faculty (e.g., tenure-track, part time)					
Full time (TT): 1	$160,000.0	$164,800.0	$171,392.0	$179,961.6	$190,759.3
Full time (NTT): 1	$60,000.0	$61,800.0	$64,272.0	$67,485.6	$71,534.7
• Non-instruction					
Full time: 0					
Part time: 1 (Program Advisor)	$20,000.0	$20,600.0	$21,424.0	$22,495.2	$23,844.9
New facilities/building/space renovation	0	0	0	0	0
Scholarship/stipend support	0	0	0	0	0
Additional library resources	0	0	0	0	0
Additional technology or equipment needs	$5,000.0	$5,150.0	$5,356.0	$5,623.8	$5,961.2
Other expenses	0	0	0	0	0
Total Projected Program Expenses	**$245,000.0**	**$252,350.0**	**$262,444.0**	**$275,566.2**	**$292,100.2**
Projected Program Net	**$98,521**	**$246,652**	**$336,358**	**$575,636**	**$559,102**

Budget Narrative:

Use narrative to provide additional information as needed based on response above.

- Enrollment in the program is assumed to start at 30 students (21 full-time and 9 part-time) in the first year and modestly increase by about twenty percentage (20%) points and accounts for possible attrition, in each of the subsequent years
- The initial enrollment of 30 was conservatively estimated based on projections from our marketing efforts and enrollments in KSU specialty masters and other similar programs
- Year 5 enrollment is capped at that of year 4 based on our present faculty capacity, but could be allowed to increase with more faculty resources
- FTE is based on 30 credit hours per full time student per year and 15 per part-time student per year (1 FTE=30 credit hours)
- We assumed the full-time one year tuition and general fees rate of $12,271.4 for Ohio resident for all students. Any change due to non-residency can only increase the projected income
- Tuition and general fees are assumed to be flat during the first 5 years of the program
- State subsidy is based on the SSI graduate FTE charge of $6,324 for BES. It is assumed to be zero for the first year, 50% for each of years 2 and 3, and 100% for each of years 4 and 5
- Program fees of $600 is assessed on each student/semester and is assumed fixed for the first five years of the program
- The salaries and benefits for a full-time tenure-track faculty person expected to join the program during the first year is estimated to be $160,000. This faculty person is expected to teach about 2 courses in the program each year
- The salaries and benefits for a full-time non-tenure track person to join the department and relieve other tenure-track faculty persons who will be redeployed from their regularly scheduled undergraduate classes is budgeted at $60,000
- One part-time Program Advisor is needed in the program, with a budget of $20,000, to help with internship coordination and student advising to augment our faculty advising capacity
- In order to account for inflation and other factors, expenses (faculty and advisor salaries, technology, etc.) are assumed to increase by three percentage points (3%) in the second year, 4% in the third, 5% in the fourth, and 6% in the fifth years.

6. Internal and External Support

6.1 Internal Support

The proposed MSBA program has the support of the M&IS Department's Faculty Advisory Committee, College of Business Graduate Council and other curricula bodies following the normal process for curriculum approvals. The proposed program also has the support of the College Dean.

When the prospect of proposing the current MSBA program was in its inception, all colleges, schools, and programs at Kent State were examined to determine if there were any existing academic programs or

courses that would be related to the new program from either a competing or complementary standpoint. Some related programs were identified. The Department of Computer Sciences (CS) offers two related courses, *Data Mining* and *Analytics for Big Data*. The School of Digital Sciences (DSCI) offers a masters-level concentration in *Data Science*. The School of Library Sciences offers courses and degrees in *Health Informatics* and *Knowledge Management* (IAKM), both having some courses with some relationship to analytics.

The prospect of the new MSBA program was discussed with the leadership of each of these identified programs to determine if any duplication or competition was evident. With the exception of the two courses offered by the Computer Sciences Department, it was agreed that these related programs and courses are complementary and, as such, some of these related courses are allowed as electives in the MSBA. When the MSBA is implemented (assuming program approval), it is anticipated that some of the MSBA courses will be available as electives in these complementary programs. The two courses offered by CS were directly related to the proposed MSBA program; however, there are no current plans for CS to offer a full degree program in analytics. To utilize university resources judiciously, the best course of action was determined to be to incorporate these two existing courses into the MSBA program. This arrangement benefits both associated departments and colleges. Letters of support from each of the identified programs are available in Appendix B.

6.2 External Support

The Management & Information Systems (M&IS) department has long standing support from local businesses in northeast Ohio, especially through its Center for Information Systems (CIS). The center, which has been in existence for more than 20 years, has more than 100 members from more than 60 unique businesses. The center has experienced tremendous growth in the past ten years and has collaborated with the department in strategic planning and redesigning of its undergraduate IS curriculum, and providing internship and placement opportunities for our students. Members of the center have also supported scholarships for both our undergraduate and graduate students and we expect that support to extend to students in the MSBA program. In the past several years members of the center have helped to organize Information Technology Expos (IT Expos) geared at educating and encouraging students to pursue careers in information systems and related disciplines.

As discussed earlier in Section 1.3 of the proposal, some of the impetus for the development of the MSBA program came from area industry practitioners and luminary guest speakers at the CIS sponsored events, and results from our industry surveys. Results from these surveys show overwhelming support for the curriculum of the proposed degree program. Some of the businesses in the surveys and the CIS will be tapped to also provide internship and capstone project cases for students in the program.

Several high-ranking officers at prominent local organizations have provided letters of support that very strongly support the general structure of the program. Organizations sending letters of support include Public Insight, Heinen's. Inc., Host.net, and Davey Tree. A few suggestions were also received within these letters. The majority are already being designed into the program but were at a level of detail beyond the information provided to these reviewers. Additionally, most of these suggestions have also been addressed in the responses to similar suggestions in the industry survey (see questions A2.3, A2.4, and A2.6 in Appendix A). We welcome any and all suggestions offered and we look forward to working with these industry representatives and others in the ongoing effort towards fine-tuning and updating the program now and in the future.

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The proposed MSBA program provides the department with a great opportunity to expand its current level of external supports from area businesses. The program will also serve to fill the void identified by external reviewers of the department in 2011. The reviewers noted that offering a master of science in information systems is an opportunity the department may want to consider. Indeed, they concluded that not offering a master's level degree in information systems would leave out some potential students, especially since the department already offers undergraduate majors and minors in the discipline. Although the proposed MSBA program is not an information systems degree, it would be of interest to students in information systems and other disciplines identified earlier.

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APPENDICES

A:	Industry Survey Detail (this document)
B:	Letters of Support (Appendix B document)
C:	Faculty *Curricula Vitæ* (Appendix C document)
D:	Library Resources (Appendix D document)
E:	Response to Comments from PDP Review (Appendix E document)

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Appendix A: Industry Survey Details

In July 2014 an industry survey was sent to 112 high-ranking officers (mostly in IT) at local organizations (Northeast Ohio). A total of 63 emails were opened and read and a total of 29 were submitted and used in the analysis. Depending on one's preferences, the response rate with 'total emails sent' in the denominator would be 25.9%, and the response rate with 'emails read' in the denominator would be 46.0%. Many different industries participated in the survey including health care, insurance, consulting, retail, chemical manufacturing, discrete manufacturing, financial services, utilities, software development, and metals and mining (among others). Many large and well-known employers are included such as Goodyear, Eaton, Timken, Lubrizol, Jo-Ann Fabrics, Nationwide Insurance, and EMC Corporation (among others). Smaller organizations are also represented including Chagrin Consulting, DentalOne Partners, and Findaway World. The survey questions and discussion have been divided into two sections:

- A1: Local Analytical Capabilities and Employment Opportunities
- A2: Curriculum Design and Academic Quality

The respondents were provided with the three-foci model figure (Figure 1, Section 1), the list of required courses and course descriptions (not including foci weighting information for the program or courses), and the following definition for business analytics[42]:

> *"Business analytics involves using sophisticated technology to bring information together and sophisticated algorithms to filter and analyze that information. The outputs can include deep understanding of the workings of the business and its connections to the marketplace, key performance indicators to drive business decisions, dramatic improvements in the performance of the most critical business processes, and insights and innovations that can change the basis of competition."*

[42] nGenera Corp. "Business Analytics: Six Questions to Ask About Information and Competition." Page 2. http://www.sas.com/events/cm/175813/BusinessAnalyticsImperativengen.pdf. Retrieved April 2014.

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A1: Local Analytical Capabilities and Employment Opportunities

Question (Click on Question to Go to Discussion)
(A1.1) What is the primary industry that your organization participates in?
(A1.2) Where is your organization located?
(A1.3) Approximately how many employees does your organization employ only in Northeast Ohio?
(A1.4) Approximately how many employees does your organization employ in total (nationally or internationally)?
(A1.5) What is your position or title within the organization?
(A1.6) What are your organization's current planned or implemented technologies?
(A1.7) Which of the following business processes has your organization deployed business analytics tools or processes to support?
(A1.8) "Analytics Workers" are any employees who spend a significant portion of their work day engaged in analytics activities… What is your best estimate for how many people your organization currently employs in this role?
(A1.9) What is your best estimate of how many additional analytics employees (if any) do you think you will need over the next three years?
(A1.10) What is your best estimate of the percentage of analytics activities that are currently outsourced by your organization?
(A1.11) This question is seeking your opinion on the economic outlook for analytics in general rather than relative to any particular program. In general, employment opportunities in analytics will ____?____ over the next 5-10 years, relative to today.

[Return to Question Table in Appendix] **[Return to Table 6 in Proposal]**

A1.1 What is the primary industry that your organization participates in (e.g. financial services, telecommunications equipment manufacturing, shipping and logistics, etc.)?

Text Response
Information Systems/Infrastrucutre - Big Data - Virtualization
Digital Media
Insurance
Consulting firm that services Communications, Media, Public Sector, Consumer Goods, Manufacturing, Consumer Services
information technology consulting
Consumer and Professional Services
Retail
CPG
manufacturing - checmical industry
Manufacturing
Computers/software development.
Management Consultant, Mobile Technology (541611)
Financial Services
Utility
Manufacturing
IT Consulting
Metals and Mining
Healthcare
Chemicals
Media and advertising
discrete manufacturing
Information Technolgy
Software
Manufacturing - engineered surfaces and performance chemicals
Manufacturing
Manufacturing
Manufacturing
Manufacturing
Information Technology

Statistic	Value
Total Responses	29

Summary, Interpretation and Discussion

The responses to this question allow us to conclude that the survey results represent diverse and representative industries. There are various manufacturing operations represented as well as service operations (banking, healthcare, insurance, and consulting). Additionally, suppliers, manufacturers, wholesalers, and retailers are represented. Finally, one utility is also represented.

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[Return to Question Table in Appendix] **[Return to Table 6 in Proposal]**

A1.2 Where is your organization located (the particular branch/division/etc. where you are employed - not the headquarters if they are different)? Enter City, State and/or Zip code.

Text Response
I am located in [redacted] TX. The local [redacted] office is in Independence, OH
Solon, Ohio
44122
Seven Hills, OH 44131
Beachwood OH 44122
Kent, OH
Hudson, Ohio 44236
North Olmsted, Ohio
chardon, OH 44024
Euclid, Ohio
Valley View OH 44131
Cleveland, Ohio 44139
Akron, OH, 44303
Akron, OH
Beachwood, Ohio 44122
44313
44124
44138
Wickliffe, Oh 44092
44114
Mayfield Heights, OH
Brecksville OH 44141
Westlake, OH 44145
Beachwood Ohio
Solon, Ohio 44139
44316
Akron, Oh
North Canton Ohio
cleveland, ohio

Statistic	Value
Total Responses	29

Summary, Interpretation and Discussion

These responses simply validate that the respondents are truly within the Northeast Ohio region. The first response had the specific city associated with the organization's headquarters and the organization name redacted for privacy.

[Return to Question Table in Appendix] **[Return to Table 6 in Proposal]**

A1.3 Approximately how many employees does your organization employ only in Northeast Ohio?

#	Answer	Bar	Response	%
1	0-50		5	17%
2	51-250		7	24%
3	251-500		4	14%
4	501-1000		1	3%
5	1001-2000		3	10%
6	2001-5000		7	24%
7	5001-10000		1	3%
8	10001-20000		1	3%
9	20001-50000		0	0%
10	greater than 50000		0	0%
	Total		29	

Summary, Interpretation and Discussion

These results show the distribution of organizational size and validate that results were obtained from a cross-section of organizational sizes. The average size of firms in the sample is about 1900 employees with a range of from under 50 to 20000 employees (in Northeast Ohio).

[Return to Question Table in Appendix] **[Return to Table 6 in Proposal]**

A1.4 Approximately how many employees does your organization employ in total (nationally or internationally)?

#	Answer	Bar	Response	%
1	0-50		5	17%
2	51-250		3	10%
3	251-500		1	3%
4	501-1000		1	3%
5	1001-2000		2	7%
6	2001-5000		4	14%
7	5001-10000		3	10%
8	10001-20000		3	10%
9	20001-50000		2	7%
10	greater than 50000		5	17%
	Total		29	

Summary, Interpretation and Discussion

Similarly, these results validate that the sample comes from a good cross-section of firms in terms of total organizational employment (not only in Northeast Ohio). The range here is from less than 50 to greater than 50000 employees internationally.

[Return to Question Table in Appendix] **[Return to Table 6 in Proposal]**

A1.5 What is your position or title within the organization?

Text Response
Manager - Program Delivery - Healthcare
IT Manager
Director, IT Architecture
Managing Director
President and majority owner
CIO
Associate Application Engineer
Sr Manager, Order Fulfillment Systems
is manager
Systems Analyst - Sharepoint Development
Sr. Managing Director
Managing Director
CTO
VP, IT Solutions
Business Analyst
Manager, Network Solutions
Director Information Systems
SVP & Chief Administration Officer
IS Director, Application Services
Director Talent Acquisition
CEO
Campus Recruiter
Senior Applications Leader
Manager, IS Quality Assurance
Technical Support Analyst
Program Manager Principal Business Transformation Global Procurement
BRM
Executive Director

Summary, Interpretation and Discussion

These responses validate that the respondents were generally high ranking technical or executive officers in the firm.

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[Return to Question Table in Appendix] **[Return to Table 6 in Proposal]**

A1.6 What are your organization's current planned or implemented technologies? The judgment on whether a technology is fully or partially implemented depends on your organization's plans - if there are current plans for expansion, then it is partially implemented. Please make one selection per row.

#	Question	I am not familiar with this technology	Not implemented or planned	Not implemented but we are planning on implementing	Partially but not fully implemented	Fully implemented	Total Responses	Mean
1	Enterprise Resource Planning (ERP) system	0	7	0	4	17	28	4.11
2	Data Warehouse or Data Marts	0	4	1	10	13	28	4.14
3	Enterprise-level database (Oracle, DB2, etc)	0	3	0	3	22	28	4.57
4	Schema-less databases or NoSQL databases	5	14	2	1	6	28	2.61
5	Hadoop or MapReduce	8	16	1	1	2	28	2.04
6	PIG	17	11	0	0	0	28	1.39
7	HIVE	17	11	0	0	0	28	1.39
8	HANA	8	13	4	3	0	28	2.07
9	ERP-based Analytics packages	3	10	3	5	7	28	3.11
10	Other Analytics Software	1	6	2	6	12	27	3.81

Summary, Interpretation and Discussion

These results provide a picture of the current status of analytics-related technologies implemented or planned by the responding firms. Most were familiar with these technologies with the exception of PIG and HIVE (PIG and HIVE are both Hadoop query languages). As these query languages are secondary rather than primary analytics technologies, only those individuals working directly with Hadoop would be likely to be familiar with these. Enterprise Resource Planning (ERP), data warehousing, and enterprise-level database systems seem to be mature technologies in the local environment as most have implemented these to some degree (75%, 82%, and 89%, respectively). There are some organizations that have implemented very specific analytical technologies such as Hadoop and HANA. A good percentage (67%) of responding firms have implemented 'other analytics software'. These implementations probably represent a mix of spreadsheet-based solutions and proprietary packages (e.g. Lavastorm Analytics[43]).

[43] http://www.lavastorm.com

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[Return to Question Table in Appendix] **[Return to Table 6 in Proposal]**

A1.7 Which of the following business processes has your organization deployed business analytics tools or processes to support? Check all that apply. If you are both 'currently using' a process and also 'will likely be using within 5 years' then check both columns.

#	Question	Not used and not likely to use	Currently Using	Will likely be using within 5 years	I do not know	Total Responses
1	Improving budgeting, forecasting, or planning processes	3	13	9	1	26
2	Improving performance management and transparency in internal operations	2	12	11	2	27
3	Increasing automation of common or straightforward decisions	4	12	7	3	26
4	Improving R&D processes	10	7	3	4	24
5	Improving operations, service delivery, or supply-chain management.	4	11	11	1	27
6	Developing new product strategies or identifying new market segments	6	14	3	3	26
7	Enhancing customer service or support	4	12	6	3	25
8	Improving customer insights, segmentation, or targeting	3	13	8	2	26
9	Developing differentiated or dynamic pricing strategies	6	9	7	3	25

Summary, Interpretation and Discussion

These responses demonstrate the business processes (the processes listed were taken from the McKinsey Institute's survey discussed in the opening section) for which responding organizations either have or will implement analytical solutions. Conclusions that are supported by this data are that these organizations use analytics broadly across relevant business processes and only very small numbers of organizations believe they will not use analytics eventually for some business processes. For instance, only two organizations report that they are not likely to use analytics for performance and operational management.

The column associated with projections for five-year usage would be concerning, if not for other responses to this survey, as it appears that it forecasts a decline in usage. It should be noted that responses associated with direct questions about the growth of business analytics resulted in an overwhelming aggregate sentiment predicting strong growth (see survey question A1.11 below). It is likely that many respondents who checked that they are 'currently using' analytics for a particular process did not note that, if they expect to be still using the technique in five years, they should check both columns. For instance, for the 14 respondents that are currently using analytics for developing new product and/or market strategies, we do not believe that 11 of them do not expect to be doing that in five years (only three checked they will likely be using it within five years). These three may be either current users who correctly noted the directions, or are not using but expect to be within five years, or any mix of those. For this reason, this entire column is not very interpretable; however, the other columns do provide very meaningful information as noted.

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[Return to Question Table in Appendix] **[Return to Table 6 in Proposal]**

A1.8 "Analytics Workers" are any employees who spend a significant portion of their work day engaged in analytics activities. They may or may not be called business analysts by your organization. Examples of analytics activities include (but are not limited to): data management, data manipulation, creating statistical and non-statistical models, data visualization, data analysis of any type, report generation, and communication of analytical results. What is your best estimate for how many people your organization currently employs in this role?

Text Response
1000's
3
200
15
1
5
I do not know.
100
4
Unsure, but probably quiet a few
10
0
1-2
80
60
1
5
50
45
0
5 to 10 people
Unknown
a few thousand globally

Summary, Interpretation and Discussion

These responses again demonstrate the diversity of the sample with current analytics employees ranging from zero to a few thousand.

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[Return to Question Table in Appendix] **[Return to Table 6 in Proposal]**

A1.9 What is your best estimate of how many additional analytics employees (if any) do you think you will need over the next three years?

Text Response
Unknown
2
300
40
0
2
I do not know.
Unknown
2
Unsure, but probably quiet a few
5
2
1
20
10
1
3
70
15
0
2 to 3 people
Unknown
not sure

Summary, Interpretation and Discussion

These responses follow from the previous question by asking how many *additional* (not total) analytics employees each organization expects to need over the next three years. Organizations who have at least one analytics worker and reported a numeric point estimate or numeric range reported an aggregate increase of 97.4% over current employment levels. In other words, these organizations expect to nearly double their current employment level of analytical workers in the next three years.

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[Return to Question Table in Appendix] **[Return to Table 6 in Proposal]**

A1.10 What is your best estimate of the percentage of analytics activities that are currently outsourced by your organization?

#	Answer	Min Value	Max Value	Average Value	Standard Deviation	Responses
1	Percentage (%) of Analytics currently outsourced.	0.00	50.00	11.59	15.15	17

Summary, Interpretation and Discussion

These responses show that analytics is generally done in-house. Responding firms report that 11.59% of their business analytics work is currently outsourced.

[Return to Question Table in Appendix] **[Return to Table 6 in Proposal]**

A1.11 This question is seeking your opinion on the economic outlook for analytics in general rather than relative to any particular program. In general, employment opportunities in analytics will _____ over the next 5-10 years, relative to today.

#	Answer	Bar	Response	%
1	Increase dramatically		11	48%
2	Increase moderately		11	48%
3	Neither increase nor decrease		1	4%
4	Decrease moderately		0	0%
5	Decrease dramatically		0	0%
	Total		23	

Summary, Interpretation and Discussion

These responses reflect the respondent's intermediate- to long-term (5-10 year) outlook for employment in the analytics profession. No respondents predict contraction and only a single respondent predicts growth will be flat while 48% predict dramatic growth and 96% predict some level of expansion of employment opportunities.

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A2: Curriculum Design and Academic Quality

Question (click on question to go to discussion)
(A2.1) How important do you view each of these areas to be in the MSBA (M.S. in Business Analytics) curriculum?
(A2.2) Assuming the proposed model will be implemented, what percentage of a graduate's knowledge should be associated with each area?
(A2.3) What about the program philosophy is good and should not be changed?
(A2.4) What is the program philosophy missing? What should be changed?
(A2.5) Please provide your opinion as to the importance of each course in the curriculum as a whole:
(A2.6) Please use this space to provide any feedback that you have, positive or negative, concerning any aspect of the curriculum, philosophy, or any other aspects of the proposal.
(A2.7) Given the brief description of the proposed program that you have read as part of this survey, how positive/negative are you concerning the program?
(A2.8) If you were responsible for hiring an entry-level employee for an analytics position in your organization, how interested would you be in interviewing graduates of this proposed program?

[Return to Question Table in Appendix] **[Return to Table 3 in Proposal]**

A2.1 How important do you view each of these areas to be in the MSBA (M.S. in Business Analytics) curriculum?

#	Question	Not Important	Somewhat Important	Important	Very Important / Critical	Total Responses	Mean
1	Information and Data Management	0	3	12	9	24	3.25
2	Data Analysis (or Analytics)	0	2	9	12	23	3.43
3	Decision-Making and Leadership	0	2	14	8	24	3.25

Summary, Interpretation and Discussion

This question was asked to help validate the three-foci model (Figure 6, Section 3 above). The responses indicate that the respondents view each of the three foci to be from important to critical for the program. No organization reported that any of the foci were 'not important' and only a small minority selected 'somewhat important'. A strong majority selected 'important' or 'very important / critical' for all three foci. The computational element, data analysis, had a slightly higher score than the other two due to a higher percentage selecting it in the critical category.

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[Return to Question Table in Appendix] **[Return to Table 3 in Proposal]**

A2.2 Assuming the proposed model will be implemented, what percentage of a graduate's knowledge should be associated with each area? Must sum to 100%.

#	Answer	Min Value	Max Value	Average Value	Standard Deviation
1	Information and Data Management	10.00	55.00	29.58	12.24
2	Data Analysis (or 'Analytics')	20.00	70.00	40.83	12.99
3	Decision-Making and Leadership	0.00	60.00	29.58	12.68

Summary, Interpretation and Discussion

The other metric concerning the three-foci model in addition to importance is the correct weight of coverage in the program. The program is designed to deliver 50% of its content in the area of data analysis and 25% of content in each of the other two areas. While percentages are being used to convey the philosophy of the program these numbers are fuzzy targets as it is actually difficult to measure content this precisely as many topics will serve more than one foci at a time. The philosophy is that data analysis will receive the most coverage but the program will include very significant coverage in the other two areas. The results of this survey would indicate the responding organizations largely agree with that philosophy. The mean percentage selected by respondents would spend slightly less time on the computational portion of the program (41% versus 50%) than the design; however, when the fact that this is a fuzzy target is taken into account, these responses do validate the general program philosophy. The respondents were not informed of the 50%, 25%, 25% design prior to answering this question, as far as they knew, the foci were equally weighted (though that was also not stated).

[Return to Question Table in Appendix] **[Return to Table 3 in Proposal]**

A2.3 What about the program philosophy is good and should not be changed? (if anything)

Text Response
The mix of technical, foundational, and practical topics is good.
All of it is good since these types of data related skills are rarely taught in higher education. Historically, these skills are learned on the job and through employer provided training.
I think everything presented thus far is good.
N/A
statistics, big data methods
Data Analysis Region
The need for balance and a multi-focused approach is great.
I like the interdisciplinary nature of introducing Data management Technology rather than just math or business coursework.
I like it. I rated "Information and data management" lower above because I'm assuming that at a Master level the student would come in with a base in this area already.
The philosophy of the is really good. There is a clear vision.
i think what you have is a good foundation to start with

Summary, Interpretation and Discussion

These comments really speak for themselves. Those who chose to respond to this question seem to like the general philosophy of the program mix and identify several specific individual elements such as data analysis and big data methods that should not be changed.

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[Return to Question Table in Appendix] **[Return to Table 3 in Proposal]**

A2.4 What is the program philosophy missing? What should be changed? (if anything)

Text Response
Decision making and Leadership should be expanded to discuss specific use cases where data methods and analytics can be used.
ERP is a big topic, but it is only one part of business. You can use ERP concepts as a catalyst for teaching critical thinking, data analytics, and hands-on SQL type skills. If you focus on specific ERP systems, such as SAP, then you are limiting these students ability to be employed. Technology changes fast, and cloud ERP is up and coming. I would not hitch the wagon to a particular system.
Analysis of the actual business activities that the company is engaged in. There needs to be subjects that teach how to analyze a business, how to quickly understand how the company makes money. If you do not understand these things, all the analytic tools on the earth will not help you.
N/A
my be included already, but combining non-traditional or non-structured data sources like geographic/mapping or weather
Add more programing classes to CIS - Make them manditory Become expert in MS Products - Word, Excel, Visio, Project, Access, PowerPoint, etc. When presenting data all of those tools will be highly needed. I have also come to find that many people in IT are not fluent on these areas!
While strong leadership skills are good in any mid-level candidate, I envisions graduates of this program leading teams who can analyze and present data in the right manner to ENABLE decision making in OTHERS. Therefore, while some decision-making and leadership courses should absolutely be included, it may be over emphasized as currently depicted. Also, Information and Data Management is presented as a very technical area, based on the example skills. Perhaps this is where courses on data governance and the strategic approach to planning for data analytics, by injecting measurement into all other processes. Perhaps (when considered with my above comment), this is what is intended by decision-making and leadership focus, in which case changing the name of that area to "strategy and data management" might address both points.
It may be hidden under the umbrella of "Project Management", but what I don't see is a focus on the actual process of change. I found a lot of benefit in some of the consulting training I received with [redacted] about viewing change in a very holistic way, even if the solutions seem to be technical in nature. I'd recommend some coursework that guides students in managing change in multi-faceted way like assessing impact on the organization, the technology, the process, etc.
You mention "communication of the solution", but you don't address the "visualization of the information". Is that in there?
I would include a "Meeting facilitation" course/coursework. Not only should the Business Analyst know what to do with the data but how to get it. How to manage a room filled with different personalities and get that data you need from the room. Also what tools to use to document the information that is being received. Such as a Fishbone diagram, process flow diagrams that can visually get the point across and show the customer that the BA actually understands their process/problem.
A fundamental component for success is understanding the business and business processes that are being addressed with analytics. .This is very industry specific and more about gaining experience at the company where the work would be done.

Summary, Interpretation and Discussion

These responses are very insightful and reflect the respondents' real-world perspectives on the topic and what they believe their organization would like to see in a graduate from this program. Each comment will be addressed individually but, in general, many of these comments reflect that the respondents were not given all the individual topics that will be covered in each of the courses. They already had a significant amount of information to digest concerning the program so that providing the general course descriptions rather than full topical detail seemed to be appropriate to avoid information overload issues. Due to this, the response to many of these comments will be that those topics are already being covered in the current design.

This section will address each comment, in order, from the top down (all comments are reproduced unedited except where noted):

Comment: ***"Decision making and Leadership should be expanded to discuss specific use cases where data methods and analytics can be used."***

Response: Currently, the course topics do not contain UML (Unified Modeling Language) concepts so the formal use of 'Use Cases' within this context is not planned (we believe that UML is more relevant to a computer science or information systems program). The idea that each problem should be explored from inception to completion is a central tenet of the program philosophy described throughout Section 3 of the proposal. What business problems, opportunities, and situations may benefit from a business analytics approach will be discussed in relation to every business problem discussed in courses. Although 'Use Cases' is a specific formal method within a larger framework is not included in the

program design, we believe the knowledge imparted by our holistic approach to analyzing business problems to be functionally equivalent.

Comment: ***"ERP is a big topic, but it is only one part of business. You can use ERP concepts as a catalyst for teaching critical thinking, data analytics, and hands-on SQL type skills. If you focus on specific ERP systems, such as SAP, then you are limiting these students ability to be employed. Technology changes fast, and cloud ERP is up and coming. I would not hitch the wagon to a particular system."***

Response: This is an interesting comment that we do agree with 100%. We have emphasized that our students will have access to, and the curriculum will cover, several major categories and brands of software such as SAP and Oracle. We, as a department, have taught aspects of these technologies in other programs and all of these programs, including the proposed MSBA, share a common philosophy in using these software packages. We use specific software to demonstrate general concepts and give students some applied hands-on experience with an example technology. Care is taken to focus on the general underlying concepts with a technology-agnostic view. For instance, the *Database Management and Database Analytics* course that is proposed in this curriculum is a slightly adapted version of a long existing course in the information systems concentration of our MBA program. This course has used Oracle as the main course technology for over a decade. However, due to the technology-agnostic design of the course, there would be no meaningful change to the course topics or pedagogical methods if we had to suddenly change databases to DB2, MySQL, SQL Server, or any relational database. There are, of course, topics specific to Oracle Administration and such that should be covered if this was an 'Oracle Course' rather than a 'Relational Database Course' but these topics are appropriately avoided. Oracle is used as the course example of an enterprise-level database management system and serves as the environment in which students practice their learned general database concepts. This is the same philosophy that we will implement technologies such as SAP and Oracle within our course designs in the MSBA program. We believe that having a little hands-on experience with industry software such as these will only make our graduates more attractive to employers in general; however, we have no intention, and will actively avoid, constructing a curriculum around a specific brand of or type of software. It should be noted that our discussion of the curriculum in Section 1 specifically states we will also use general statistical software such as SAS, R, and JMP as well as more universal software such as MS Excel. Data analysis techniques will generally be explored generically using statistical or modeling software and then, where appropriate, will be further explored by investigating the implementation of that method within a specific environment such as SAP.

Comment: ***"Analysis of the actual business activities that the company is engaged in. There needs to be subjects that teach how to analyze a business, how to quickly understand how the company makes money. If you do not understand these things, all the analytic tools on the earth will not help you."***

Response: Analysis of business activities as the catalyst for the analytical problem definition is a primary focus of the program. All of the data analysis courses will build the business problem (or opportunity) prior to building the analytical problem (which is why the individual data analysis courses are described as being 80% data analysis, the other 20% is devoted to a mix of business and data-oriented topics related to the analysis. There will also be major content associated with this topic in the proposed 'Business Analytics' and 'Analytics in Practice' courses. Finally, this will be applied by the student teams in the capstone course.

Comment: ***"N/A"***

Response: N/A – The same respondent entered N/A for this and the previous question on the positives. The correct interpretation is probably a 'does not wish to respond' sentiment rather than the question not being applicable.

Comment: ***"my be included already, but combining non-traditional or non-structured data sources like geographic/mapping or weather"***

Response: All applicable types of data sources will be specifically covered in the *Business Analytics* and *Database Management and Database Analytics* courses. Problems in the data analysis courses will be selected to cover as many different types of data sources as is practical but all major sources and types of data will be covered conceptually. Unstructured text data will be specifically covered in the *Big Data Methods* course. As the program matures, an elective course on spatial and location data and analysis has been discussed as a possibility in the future but is not part of this initial proposal. The topic will be covered conceptually in the *Business Analytics* course and geographic data will be used in various analytical problems in the data analysis and database courses.

Comment: ***"Add more programing classes to CIS - Make them mandatory Become expert in MS Products - Word, Excel, Visio, Project, Access, PowerPoint, etc. When presenting data all of those tools will be highly needed. I have also come to find that many people in IT are not fluent on these areas!"***

Response: This comment is more aimed at our undergraduate *Computer Information Systems* program (which should serve as one of the feeder programs into the MSBA). We do not think the commenter was suggesting we put rudimentary MS Word content and such in the MSBA program, more that entering students should already have this knowledge. We agree with that but will include MS Excel topics (as relevant to business analytics) and project management tools and concepts within the curriculum. Excel will be used in many of the data analysis courses and the *Analytics in Practice* course contains the primary project management content.

Comment: ***"While strong leadership skills are good in any mid-level candidate, I envisions graduates of this program leading teams who can analyze and present data in the right manner to ENABLE decision making in OTHERS. Therefore, while some decision-making and leadership courses should absolutely be included, it may be over emphasized as currently depicted. Also, Information and Data Management is presented as a very technical area, based on the example skills. Perhaps this is where courses on data governance and the strategic approach to planning for data analytics, by injecting measurement into all other processes. Perhaps (when considered with my above comment), this is what is intended by decision-making and leadership focus, in which case changing the name of that area to "strategy and data management" might address both points."***

Response: The *Decision-Making and Leadership* focus of the three-foci model was difficult to name concisely while conveying its general meaning. The name being less important than the content, we find the name to be adequate if not perfect and will focus the rest of this discussion on the content and importance of this focus. First, the view that this topic is overemphasized in our proposed program does not seem to be a pervasive opinion. Only two individuals selected this as 'somewhat important' and none suggested that it was 'not important'. Further, the mean percentage of the curriculum the respondents thought should be made up by this topic was about 30% (see question A2.2 above) while our design puts it as 25%. The commenter suggests that analysts should do analyses that help others

make decisions rather than making decisions on their own. While this is probably somewhat true of strategic-level decisions, it may not be true in lower level decision-making (for instance, the CEO is probably not interested in making a decision to put two specific products that were analytically determined to be complementary next to each other on a retail shelf). Whoever may have the actual authority to make a specific final decision does not necessarily matter in our view. The analyst would usually not simply pass the results of the various methods and models to the decision-maker for them to interpret and act on. Rather, they would likely be expected to pass recommendations and projections of various decisions to the decision-maker. We would suggest that any interpretation of data, determination of appropriate analytical methods, sequential determinations of the next steps to take, development of recommendations, or determination of which decision scenarios to project results for would all require good decision-making skills to be present in the analyst. The leadership component of this focus is also important in our view. Leadership skills necessary for analysts include the ability to organize and manage teams that may be working on a common problem, the ability to manage complex projects, the ability to identify appropriate analytical projects, prioritize those projects, and being a champion for the most advantageous projects all require, not only knowledge and decision-making ability, but also the ability to lead. Communication of results and solutions as well as being convincing in discussing the merits of an analysis require more than just technical skills, they require leadership and management skills as well.

Comment: ***"It may be hidden under the umbrella of "Project Management", but what I don't see is a focus on the actual process of change. I found a lot of benefit in some of the consulting training I received with [redacted] about viewing change in a very holistic way, even if the solutions seem to be technical in nature. I'd recommend some coursework that guides students in managing change in multi-faceted way like assessing impact on the organization, the technology, the process, etc."***

Response: [Company name redacted for privacy] This comment reflects one of the central tenets of our program and the commenter even employs the same word, 'holistic', as we used to describe the proposed program's approach to problem scenarios. As described earlier, the business issues involved in the inception of the scenario all the way to implementation and analysis of the results of the implementation will all be part of this holistic approach. Additionally, one of the proposed elective courses (MIS 64160 - Leadership and Organizational Change) is directly related and supplements the content in the required courses for those students who choose to take it.

Comment: ***"You mention "communication of the solution", but you don't address the "visualization of the information". Is that in there?"***

Response: We would include visualization of the information (or solution) to be definitely part of communication of the solution. This relies primarily on data visualization techniques that can also be used as projections of solutions. All major techniques of data visualization from simple pie and bar charts to heat maps and streamgraphs will be covered and many will be applied to problems in the various courses.

Comment: ***"I would include a "Meeting facilitation" course/coursework. Not only should the Business Analyst know what to do with the data but how to get it. How to manage a room filled with different personalities and get that data you need from the room. Also what tools to use to document the information that is being received. Such as a Fishbone diagram, process flow diagrams that can visually get the point across and show the customer that the BA actually understands their process/problem."***

Response: There are likely many topics that individual organizations may believe require a full course treatment but a curriculum such as this must be very selective in this regard. We do feel facilitating meetings is a very important topic and coverage of this topic would be found primarily in the *Analytics in Practice* course. The commenter also mentions data visualization techniques and, as stated in the comment directly above, all major visualization methods will have some level of coverage.

Comment: ***"A fundamental component for success is understanding the business and business processes that are being addressed with analytics. This is very industry specific and more about gaining experience at the company where the work would be done."***

Response: We agree entirely with this statement and assume that the commenter realizes that we cannot hope to cover every specific nuance of every industry within our coursework. Our goal of focusing on having the students truly understand the techniques and principles, rather than just learn a sequence of steps to do a particular analysis, is critical if the students are going to be able to adapt the general knowledge conveyed by the coursework to the specific scenario that they find themselves in the field. The holistic approach to problems, rather than over-focusing on the technical aspects of the analysis, aids the program in its goal to provide students with this level of understanding. Additionally, certain industries that are already making heavy use of analytics such as retail and healthcare will have some specific coverage.

[Return to Question Table in Appendix] **[Return to Table 3 in Proposal]**

A2.5 Please provide your opinion as to the importance of each course in the curriculum as a whole:

#	Question	Not Important	Somewhat Important	Important	Very Important / Critical	Total Responses	Mean
1	Business Analytics	0	0	6	17	23	3.74
2	Database Management and Database Analytics	0	3	11	9	23	3.26
3	Data Mining Techniques	0	3	12	8	23	3.22
4	Advanced Data Mining and Predictive Analytics	0	8	9	6	23	2.91
5	Quantitative Management Modeling	0	4	15	4	23	3.00
6	Analytics for Big Data	0	3	14	6	23	3.13
7	Analytics in Practice	0	1	11	11	23	3.43
8	Capstone Design	0	2	9	12	23	3.43

Summary, Interpretation and Discussion

These responses were discussed earlier in Section 1.2.1. This previous discussion emphasized that there was not a single respondent that did not find every one of the proposed courses to be at least 'somewhat

important'. Here we have a bit more detail where we can see the solid majority of responses are above 'somewhat important'. The worst case (though still quite positive) was found for the fourth course on the list, *Advanced Data Mining and Predictive Analytics*. Approximately 35% of respondents indicated that this was only 'somewhat important' (note that 65% reported it as important, very important, or critical).

The proposed program attempts to use university resources judiciously so we have proposed using the existing *Data Mining Techniques* course offered by our Computer Science Department. Even though we can influence the content of the course, we cannot fully control it but are confident that any content appropriately placed there would be relevant and appropriate to our students. We will use our *Advanced Data Mining and Predictive Analytics* course to supplement that content with other techniques we conclude are important, as well as extended coverage of critical topics that were introduced in the CS course. Additionally, the terms data mining and predictive analytics are used relatively interchangeably by some. There are some meaningful differences in that data mining focuses on pattern identification while predictive analytics extends that concept into using those patterns to project business outcomes. This second course will extend the data mining concepts of the first course into the realm of predictive analytics.

In conclusion, the results show all of the courses are generally considered important by respondents. For the one course that was slightly less positive than the other courses we have provided additional information on why we find that course to be important to the program.

[Return to Question Table in Appendix] **[Return to Table 3 in Proposal]**

A2.6 Please use this space to provide any feedback that you have, positive or negative, concerning any aspect of the curriculum, philosophy, or any other aspects of the proposal.

Text Response
I would add predictive analytics and modeling topics to the curriculum. Some of the proposed topics may not be entirely useful or practical in the real world situations. For example, not many organizations use Neural Nets for predictive analytics. Instead, Business Rules Engines (that most likely implement Rete algorithm) are used.
In Database Management and Database Analytics, I recommend including some information about Master Data Management and Data Governance.
that's a lot to cover in 8 courses
I tell every young person I know with a math/technical interest to pursue data science. This is a great and much needed program to develop the talent that is going to be essential in the next decade.
certainly interesting. I probably spend 25% of any given week peforming some sort of analytics. I was not trained classically, so I've gleaned skills from peers and have learned to exploit Excel. I however would call my skills novice compared to what I could probably learn and put to use with some of these courses and/or the entire program.

Summary, Interpretation and Discussion

Each of these comments will be discussed, in order, from the top (all comments are reproduced unedited except where noted):

Comment: ***"I would add predictive analytics and modeling topics to the curriculum. Some of the proposed topics may not be entirely useful or practical in the real world situations. For example, not many organizations use Neural Nets for predictive analytics. Instead, Business Rules Engines (that most likely implement Rete algorithm) are used."***

Response: Business Rules Engines (and the associated rete algorithm) are used for modeling human decision-making using inference engines. This is certainly related to analytics but analytics is more concerned with exploiting discovered patterns in data rather than modeling human decision-making. This

may be addressed conceptually but we believe other techniques are more relevant to our program. A review of several predictive analytics textbooks does not yield much information on rule engine techniques so we conclude that textbook authors seem to agree with this. We will never simply discard such a suggestion from a member of industry so we will look into it further; this is our preliminary conclusion in regards to the method. The commenter also mentions adding predictive analytics and modeling to the curriculum. The curriculum already has a full course on quantitative modeling techniques as well as a course specifically about predictive analytics. Additionally, the data mining course will cover a lot of the same content associated with predictive analytics since they are very related topics.

Comment: ***"In Database Management and Database Analytics, I recommend including some information about Master Data Management and Data Governance."***

Response: The content of the course *Database Management and Database Analytics* does include topics associated with data governance including data administration and database administration activities.

Comment: ***"that's a lot to cover in 8 courses"***

Response: There is no doubt that there is a lot of material in these eight proposed courses. The faculty who contributed to the design of these courses has many years of experience in designing and delivering similar courses. Four of the eight courses have already been taught successfully in the past so we are very confident that these courses are "doable" in a three credit hour per course format.

Comment: ***"I tell every young person I know with a math/technical interest to pursue data science. This is a great and much needed program to develop the talent that is going to be essential in the next decade."***

Response: This comment speaks for itself though we will add that we agree with the commenter.

Comment: ***"certainly interesting. I probably spend 25% of any given week performing some sort of analytics. I was not trained classically, so I've gleaned skills from peers and have learned to exploit Excel. I however would call my skills novice compared to what I could probably learn and put to use with some of these courses and/or the entire program."***

Response: Again, this comment can speak for itself as it basically just complements the program design.

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[Return to Question Table in Appendix] **[Return to Table 3 in Proposal]**

A2.7 Given the brief description of the proposed program that you have read as part of this survey, how positive/negative are you concerning the program?

#	Answer	Bar	Response	%
1	Very Negative - needs major overhaul or abandon		0	0%
2	Negative - major aspects need to be revised		0	0%
3	Neutral - the positives and negatives concerning the program are equal		1	4%
4	Positive - some changes may be necessary but overall the program seems good.		16	70%
5	Very Positive - only very minor changes, if any, need to be made. The proposed program seems well thought-out and seems to be ready to implement		6	26%
	Total		23	

Summary, Interpretation and Discussion

This question simply seeks the overall perceived valence associated with the proposed program as a whole. It is overwhelmingly positive with 96% of respondents describing their opinion of the program as positive to very positive.

[Return to Question Table in Appendix] **[Return to Table 3 in Proposal]**

A2.8 If you were responsible for hiring an entry-level employee for an analytics position in your organization, how interested would you be in interviewing graduates of this proposed program?

#	Answer	Bar	Response	%
1	Not Interested		2	9%
2	Somewhat Interested		5	22%
3	Very Interested		16	70%
	Total		23	

Summary, Interpretation and Discussion

Again, this question seeks the respondents' overall sentiment toward the proposed program by asking if they would be interested in hiring a graduate of this program. The responses were again very positive with 70% reporting they would be very interested and 92% report they would be at least somewhat interested.