BINGHAMTON
U N I V E R S I T Y
STATE UNIVERSITY OF NEW YORK

Academic Business Plan for Master of Science in Data Analytics Program
January 2018

Overview

Through a unique and innovative collaboration between the School of Management, the Department of Mathematical Sciences (in Harpur College), the Department of Computer Science and the Department of Systems Science and Industrial Engineering (in the Watson School of Engineering and Applied Science), the M.S. in Data Analytics (MSDA) curriculum builds a foundation for the methods and techniques of data analytics with a practicum component involving real-world applications and tools to prepare students for the growing need of analytics and intelligence in the business world. The program will be initially offered on campus and expanded after two years to have a parallel online program. Initially, the program will be housed in the School of Management. The program has already been reviewed and recommended by two external reviewers, Prof. Simon Sheather, Academic Director of MS (Analytics) and Online Programs, Texas A&M University and Prof. Rabikar Chatterjee, Associate Dean for Masters and Executive Programs, Katz Graduate School of Business, University of Pittsburgh.

Context

In 2011, McKinsey Global Institute projected a shortage of 140,000 to 190,000 analysts with advanced skills, and as many as 1,500,000 managers and analysts who can analyze big data and use the findings to make informed decisions. While the United States graduates the largest number of students with deep analytical training, about 25,000 per year, the growth in demand is rapidly outpacing the supply. A recent report by IBM (The Quant Crunch:: How the demand for Data Science skills is disrupting the job market, 2017) projects that by 2020, the number of position for data analytics talent in the US will increase by 364,000 to 2,720,000 in 2020.

The needs evolving in the job market are for people with three different skills: technical skills in statistics and machine learning; the ability to analyze big data sets and to find information for business; and the educated insight to pose the right managerial questions and to use the results of data analysis for informed business and policy decisions. The shortage of qualified people is certain to be felt in all sectors of the economy, from Wall Street to manufacturing to health care and education.

The US Bureau of Labor Statistics predicts that jobs in this area will increase faster than the national average between 2012 and 2022. The demand for master's-prepared mathematicians will increase by 23%; for operations research analysts will increase by 27%; for statisticians will increase by 27%; for financial analysts will increase by 16%; for management analysts will increase by 19%; and for market research analysts will increase by 32%.

New York State will have similar shortages in the main industries creating employment; according to the New York State Department of Labor, these include agriculture, manufacturing, health care, and financial services.

Jobs for graduates of a program in large data analytics will expand in all of these industries. More specific data for New York from the NYS Department of Labor shows that jobs will increase faster than average between 2012 and 2022 in fields specifically related to data analytics: the demand for management analysts will increase by 14.7%; for market research analysts will increase by 20%; and for computer systems analysts will increase by 32%.

The program is unique among data analytics programs, for its combination of foundations and coursework from four different fields; it will place students in front of tomorrow's broadly transdisciplinary questions and problems. Binghamton's signature academic focus on Transdisciplinary Areas of Excellence, called "TAEs," has generated intensive collaboration across disciplinary lines. This campus climate has enabled the conversations across schools and disciplines that led faculty to this proposal for a complex approach to data analytics. The program, and the faculty who collaborate in offering it, have clear potential interests in and contributions to two of the five TAEs, Smart Energy and Health Sciences.

The program helps to increase graduate enrollments at Binghamton University, part of the goal to get 20,000 students by 2020. This new program will create a vital new resource for graduate students who want to explore data analytics; it will help employers who need advanced analytics of big groups of unsorted information. Because it combines strengths in computer science, mathematical and statistical analysis, and business modeling, this program will prepare students with unique combinations of highly advanced transdisciplinary analytical understanding.

Benefits

By offering the MSDA Program, the following benefits are seen. The MSDA program will help by:
- Help enhance the "Premier Public" status of university due to the innovative nature of the program.
- Enrich the "Collaborative Culture for Research, Scholarship and Creative Production', one of the four goals of the Binghamton University Strategic Plan due to the multifunctional nature of the program
- Enhancing the "University's economic, social and cultural impact through engagement from the local to the global level", helping with the engagement goals by providing students with skills that are needed for the jobs in New York state and beyond.
- Help with the Data Science Initiative (one of the four strategic University Initiatives outlined in the Strategic Plan Road Map Renewal August 2017) by providing a graduate degree in data science.
- Help reach the graduate enrollment goals of the university.
- Faculty that teach will benefit from the extra service compensation. If the faculty teach on load, then the departments will receive the allocated funds that can be used to achieve department goals.

Teaching

By offering a MSDA program, students will have opportunities to receive high-quality, innovative learning experiences from a multi-functional faculty in the different departments associated with this degree. The courses being offered in the program are being jointly developed by faculty in the different departments and schools to ensure latest cutting edge content. It is hoped that this dialogue between faculty will additionally help enhance the current courses being taught in the various departments.

Research

We do not anticipate a major impact on research. Faculty Teaching in the MSDA Program will become familiar with cutting edge literature in the field of data science and perspectives and approaches that other disciplines use; this can help them in coming up with some innovative multi-disciplinary research, and can lead to collaborations for funded proposals.

Community Service

Some of the data analytics projects that the students will be working on will be provided by local organizations. For example, we anticipate that UHS and Lourdes Hospitals will allow students to work on projects of interest to them, e.g. raising patient health outcomes, improving scheduling and emergency room unitization etc..

University Mission

Binghamton University's mission combines academic excellence and public service. As our Road Map strategic plan explains, "Binghamton University is a premier public university dedicated to enriching the lives of people in the region, state, nation and world through discovery and education and to being enriched by partnerships with those communities (Binghamton University Road Map, 2013)."

The proposed program will advance our mission in academic excellence and community partnership by adding advanced study of the large data sets that shape the world: national hospital readmissions related to age and disease states, for example, or population density studies related to potential mass transit developments. While governments and businesses have always depended on data to make good decisions, they now depend on Big Data; the graduates of our program will not only analyze large data, but also understand how to relate their results to real life decisions.

The multi-disciplinary MSDA program is quite unique in the US, as most other data analytics programs are housed in only one department. This kind a successful innovative program can bring attention to the inventive culture at Binghamton University and strengthen the mission of being a "premier public university of the 21st century". More specifically, this program aligns with the first strategic priority of engaging in "path-breaking graduate education".

The MSDA degree also fulfils the second priority of "providing a transformative learning community that prepares students for advanced education, careers and purposeful living". This is achieved by providing an education that will allow students prepare them for careers and to get jobs in high demand both in New York state and the rest of the country.

Finally, the MSDA proposal aligns with the Data Science Initiative, one of the four new strategic initiatives announced in the Strategic Plan Road Map Renewal August 2017.

Institutional Support

The deans of School of Management, Watson School of Engineering and Applied Science and Harpur College as well as the faculty in the concerned departments have stated their support for this new degree program. The Provost and the Vice Provost and Dean of the Graduate School have also offered their verbal support.

Operating Plan

Curriculum Design

The MSDA program is a 30 credit hour 10 month program. There are five required multidisciplinary courses, two required practicum courses, and three specialization courses that can be taken from existing courses on campus (with the approval of the program director). Since students may have a varied under graduate background, two courses – Introduction to Analytics and Data Science I (Regression Analysis) will be taught in a four week Summer semester before the Fall semester starts. The practicum courses will involve students (under faculty supervision) working on projects that are obtained from partner firms and organizations. These organizations will also be potential employer of the students. The proposed curriculum is attached in Appendix.

The syllabi for all the new courses has been developed by at least two faculty from two different departments, and has been approved by all the participating schools/departments. While developed by a team, it is anticipated that the courses will be taught by one faculty member, with possibly some guest lectures, if needed, from other faculty. Jointly taught courses have not been very effective in our experiences.

The current plans call for expanding the program in Year 3 by adding an online student section. The online students will have two years to complete the program, and they will take the classes along with on-campus students. Lectures will be made available both synchronously and asynchronously. A one-week on campus residence will be required at the beginning of the program to take the Introduction to Analytics course. Required courses will be taught in the evenings for online students to be able to attend synchronously. Students will also work with on-campus students on the practicum projects – these teams will be enabled through the use of technology. Details of the curriculum are provided in Appendix B.

Recruitment

The expected student body for the MSDA program will be reflective of students recruited regionally, nationally, and internationally. However, we anticipate the enrollment to a substantial number of students from New York State and the northeast region.

We plan to advertise the program both on campus and off campus, and we plan to assign a Director of the program in advance of the first class. We feel confident that we can obtain a class of 25 students in the first year, given the huge need for students with both analytics and business background. There is tremendous amount of interest in data science on campus – a voluntary group of students has an email list of 300. We expect that some of the students in the program will come from students finishing their undergraduate degrees on campus. A marketing campaign using search engine marketing, meet-ups in NYC and other towns as well as targeted emails will help us recruit. Our initial vision is to recruit students for the online program in the broader New York City Region, so that these students could meet physically on some selected weekends either in NYC or in Binghamton. This will differentiate the program from fully 100% online programs, and provide a much better "on-campus" like experience.

The enrollment of students from historically underrepresented groups will be encouraged by a recruitment program designed to produce a diverse applicant pool and supported by scholarship aid through the Clifford D. Clark Fellowship program for underrepresented students. We will work with the Division of Diversity, Equity and Inclusion to help recruit under-represented students.

Admissions Requirements

Applicants to this program must hold either a baccalaureate or a graduate degree in mathematics, statistics, or an applied science such as economics, business, management science, computer science, system science, or industrial engineering. Those who have at least 2 years' working experience in the business and industrial setting will be preferred. Some of these major requirements may be substituted by relevant work experience in the related field.

All students applying to the program submit their application materials through the Graduate School. A completed online application, academic transcript(s), two letters of recommendation, current resume, and a personal statement are the minimum requirements to apply. GRE/GMAT scores are strongly preferred but may not be required in all cases, such as a student who has completed high performance in a reputed graduate program. Students are expected to have a GPA of 3.0 or above. International applicants must also submit results from either TOEFL (minimum score of 100) or IELTS (minimum score in Band Seven). No standard will be applied that differs from Binghamton University's minimum admissions requirement.

Staffing

MSDA Program Director: The position of MSDA program director, who will serve as the chief administrator, will be filled by current faculty, who has a doctoral degree in management, computer science, system science or statistics. The Program Director will devote 100% of their time in the "Year 0" startup year to get the program started. Activities will include recruiting students and parent firms, marketing, schedule planning, teaching assignments etc. Once the program gets going, the faculty member will teach two courses a year along with their Director duties.

MSDA Faculty: The participating programs will provide faculty for the teaching, either on-load, or the faculty will be paid extra service compensation.

Program Evaluation

Program assessment will include the following components.
- Each course will be assessed by students using the Binghamton University (or a variant) SOOT form. This form assesses the course and faculty on ten items. There is also a place for extensive comments. The form will be administered through our Learning Management System, MyCourses. These assessments will be shared with the program director.
- A program outcome survey of all graduating students will be administered. This survey will be given to the students before they graduate, and will ask them to respond to program level feedback – program content, its co-ordination across courses, program management, placement services, technology etc.
- Program learning goal outcome will be assessed in courses as outlined in the curricular map. The proportion of students who are at, below and above expectations will be documented. Faculty evaluation committee will meet annually to assess the measures and take steps in various courses to improve the performance.
- Informal feedback from employers after placement of students will be done about one year after the completion of the program.

In the spirit of Total Quality Management, the director and the faculty review committee will review all feedback annually and take corrective actions to improve the program. The findings of these assessments will be shared with the deans and the program faculty.

Cost and Financing

Initially, there would need to be funding for one administrative staff position: an Administrative *Assistant.* The MSDA Program Director will be a current faculty member who receives course releases for serving in this role. Please see Appendix B for a spreadsheet showing an allocation of resources for the first five years. The program is expected to generate positive cumulative cash flow in year 5.

The Year 0 expenses will be invested by the participating schools and or departments. These investments will be paid back (in addition to a 20% return for the risk taken), before revenues are shared between various parties.

The faculty will be paid $10,000 for the extra service payment for each course. If the course is taught on load, then that money goes to the department/ dean to use. For the departmental courses taken for the specialization, the payments to the departments/ deans will be based on the number of students and the courses being taken.

Once the program creates a surplus (in year 5), the Provost and the deans can decide how to allocate the surplus generated.

Appendix A

MSDA On-Campus Student Curriculum

Course Title	Credits	Term	New	Co/Prerequisites
MDSA 500: Introduction to Analytics (Road Map)	3	Summer	X	None
MSDA 501: Data Science I (Regression)	3	Summer	X	MSDA 500
MSDA 502: Data Science II (Data Mining)	3	Fall	X	MSDA 500
MSDA 504: Database and Large Data Repositories	3	Fall	X	MSDA 500
MSDA 510: Analytics Practicum I	3	Fall	X	MSDA500,501
Elective 1	3	Fall		
MSDA 503: Data Science III (Modeling)	3	Spring	X	MSDA502, 504
MSDA 511: Analytics Practicum II	3	Spring	X	MSDA 503
Elective 2	3	Spring		
Elective 3	3	Spring		
Total required credits	30			

Appendix B
MSDA On-Line Student Curriculum

Course Title	Credits	Year	Term	New	Co/Prerequisites
MDSA 500: Introduction to Analytics (Road Map)	3	1	Summer 1	X	None
MSDA 501: Data Science I (Regression)	3	1	Summer 1	X	MSDA 500
MSDA 502: Data Science II (Data Mining)	3	1	Fall 1	X	MSDA 500
MSDA 504: Database and Large Data Repositories	3	1	Fall 1	X	MSDA 500
MSDA 503: Data Science III (Modeling)	3	1	Spring 1	X	MSDA502, 504
Elective 1	3	1	Spring 1		
MSDA 510: Analytics Practicum I	3	2	Fall 2	X	MSDA500,501
Elective 2	3	2	Fall 2		
MSDA 511: Analytics Practicum II	3	2	Spring 2	X	MSDA 503
Elective 3	3	2	Spring 2		
Total required credits	30				

Appendix C
Costs and Revenues

Data Analytics Proposed Masters Program	YEAR 0	Year 1 Summer	Fall	Spring	Year 2 Summer	Fall	Spring	Year 3 Summer	Fall	Spring	Year 4 Summer	Fall	Spring	Year 5 Summer	Fall	Spring
STUDENTS																
On Campus Resident		25	25	25	25	25	25	35	35	35	42	42	42	50	50	50
On Campus International/Non Resident					5	5	5	5	5	5	8	8	8	10	10	10
Total On Campus Students		25	25	25	30	30	30	40	40	40	50	50	50	60	60	60
Resident		0	0	0	0	0	0	12	12	12	16	16	16	20	20	20
International/Non Resident		0	0	0	0	0	0	3	3	3	4	4	4	5	5	5
Total Distance Students		0	0	0	0	0	0	15	15	15	20	20	20	25	25	25
TOTAL STUDENTS		25	25	25	30	30	30	55	55	55	70	70	70	85	85	85
REVENUE																
On Campus Revenue Resident		$67,950	$135,875	$135,875	$67,950	$135,875	$135,875	$95,130	$190,225	$190,225	$114,156	$228,270	$228,270	$135,900	$271,750	$271,750
On Campus Revenue Non Resident		$0	$0	$0	$27,750	$55,525	$55,525	$27,750	$55,525	$55,525	$44,400	$88,840	$88,840	$55,500	$111,050	$111,050
Distance Revenue Resident		$0	$0	$0	$0	$0	$0	$32,616	$32,616	$32,616	$43,488	$43,488	$43,488	$54,360	$54,360	$54,360
Distance Revenue Non Resident		$0	$0	$0	$0	$0	$0	$16,650	$16,650	$16,650	$22,200	$22,200	$22,200	$27,750	$27,750	$27,750
TOTAL REVENUE		$67,950	$135,875	$135,875	$95,700	$191,400	$191,400	$172,146	$295,016	$295,016	$224,244	$382,798	$382,798	$273,510	$464,910	$464,910
TOTAL REVENUE PER YEAR		$339,700			$478,500			$762,178			$989,840			$1,203,330		
Overhead on Summer IFR		$8,834			$12,441			$22,379			$29,152			$35,556		
Minus melded rate on summer expenditures		$19,339			$27,236			$48,993			$63,820			$77,841		
Available Revenue	0	$311,528			$438,823			$690,806			$896,868			$1,089,933		
PROGRAM COSTS																
Director	$150,000	$112,500			$75,000			$75,000			$80,000			$80,000		
Program Manager / Lecturers (2nd half time hire in Yr 4)		$40,000			$40,000			$40,000			$40,000			$80,000		
Secretaries (.5 year 1, then 1 subsequent.)	22,000	$22,000			$22,000			$44,000			$44,000			$44,000		
Tech Support (.5 year 1, then 1 subsequent.)		$32,500			$32,500			$65,000			$65,000			$65,000		
Extra Service Cost at $10K (8/year for 3 years then 16/year)		$80,000			$80,000			$80,000			$160,000			$160,000		
Online Additional Payment to faculty at $5K, 10 online courses								$50,000			$50,000			$100,000		
TA's 10 hours/week, $32/hour for Summer, Fall and Spring (7;7;8;12;12) 14 weeks per semester		$94,080			$94,080			$94,080			$107,520			$161,280		
Distance TA's 10 hours/week, $32/hour for Summer, Fall and Spring (0;0;4;4;6) 14 weeks per semester		$0			$0			$53,760			$53,760			$80,640		
Marketing / Advertising	$100,000	$40,000			$30,000			$30,000			$30,000			$30,000		
Webex Fee for Online Delivery		$0			$0			$0			$0			$0		
Software/ Technology	$15,000	$15,000			$15,000			$10,000			$5,000			$5,000		
One time lab costs -- 30 workstations at $1,500; a server; setup	$60,000							$0			$0			$0		
TOTAL COST		$436,080			$388,580			$541,840			$635,280			$805,920		
Net Surplus/ Loss	($347,000)	-$124,552			$50,243			$148,966			$261,588			$284,013		
Cumulative Surplus / Loss	($347,000)	-$471,552			-$421,309			-$272,343			-$10,755			$273,258		