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The making of a successful analytics master degree program: Experiences and lessons drawn for a young and small Asian university

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DOI: https://doi.org/10.4018/IJBIR.2017070101

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Citation
CHEONG, Michelle L. F.. The making of a successful analytics master degree program: Experiences and lessons drawn for a young and small Asian university. (2017). *International Journal of Business Intelligence Research*. 8, (2), 1-16. Research Collection School Of Information Systems.
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The Making of a Successful Analytics Master Degree Program: Experiences and Lessons from an Asian University

INTRODUCTION

Higher education is considered a critical tool to stimulate economic growth for a country. Over the years, ASEAN nations have placed increased emphasis in training the skilled workforce to support social and economic developments of their countries (Gooch, 2012). In particular, Gopinathan & Lee (2011) described the strategies adopted by Singapore to become a regional education hub, by hosting prestigious institutions, establishing international partnerships, and setting up specialist research centers, all made possible by the heavy investments committed by the Singapore Government.

By 2016, Singapore has increased the number of universities to six, where for the longest time, there were only two, where National University of Singapore (NUS) was established in 1905, and Nanyang Technological University (NTU) in 1981. The QS World University Rankings 2015/16 has ranked NUS and NTU as 12th and 13th respectively (Top Universities, 2015), and the Times Higher Education Asia University Ranking 2016 ranked NUS and NTU as 1st and 2nd in Asia respectively (Times Higher Education, 2016). The constant quest for world class status and how universities in Asia did it were described by Mok & Hallinger (2013).

Singapore Management University (SMU) was setup in year 2000 as the third autonomous university after NUS and NTU. Over 17 years, SMU has established six schools with 9000 students across undergraduate, postgraduates and executive programmes, and entered the QS Asia University Rankings for the first time in 2016 at 60th place, which is considered a remarkable feat for a 16-year-old university then (Top Universities, 2016).

In line with the nation's aspiration to be a regional education hub and the practical need to design, develop and offer the postgraduate professional education programs to support the nation's economic growth, SMU's School of Information Systems (SIS) started to design a Master of IT in Business (MITB) program in 2006, which focuses on training IT professionals to apply IT to solve business problems in different business domains. In 2011, the MITB program launched a specialized track in Analytics, called the MITB(Analytics) program. This paper aims to describe the design process, challenges faced, decisions made, and the key actions taken, which resulted in an extremely successful analytics master program. The experiences and lessons drawn can become valuable references for other universities who are also planning to launch analytics master degree programs. The paper also summarizes the 11 key takeaways which can be used as a strategic guideline.

LITERATURE REVIEW

The rise of data science is briefly described in a Forbes article published in 2013 (Press, 2013), which traces the timeline for the evolution of the term "Data Science" and its use, by listing the major publications, activities and conferences from 1962 to 2012.

By 2009, the world has reached a technological maturity level in terms of the critical mass of people with social network accounts, and the exponential rise in the use of mobile devices to support every other aspects of our lives. Massive amounts of data is created every second,

and data analytics has become the next big thing which cannot be ignored. McKinsey has predicted that "By 2018, the US alone 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" (McKinsey, 2011). It represents an unprecedented need and opportunity for universities around the world to start to offer bachelor and master degree programs to train data analytics professionals.

Data science, business intelligence and data analytics programs have sprung up all over the whole, especially in the US. Some programs are housed in a business or management school, while others are found in engineering, computer science, or information systems schools. Information Week (2013) listed the top 20 programs in 2013 where the split is about 50:50. The first master degree program in Analytics offered in the US is the M.S. in Analytics program offered by the North Carolina State University (NCSU) since 2007. By mid-2017, there are more than 175 master degrees in analytics and data science offered in the US alone (Institute of Advanced Analytics).

Depending on where the program is housed, the focus of each program differs, where programs offered in the business school tend to focus more on the business side of data science and lesser on the deep data analytics techniques. On the other hand, programs which are offered in the computer science or information systems schools tend to focus on the hard core programming and machine learning techniques, and lesser on the business aspects. Gupta, Goul & Dinter (2015) presented three very comprehensive model curricula for three elective BI courses at the undergraduate, MS and MBA levels. In their paper, they differentiated the three courses in terms of their emphasis, where undergraduate BI curriculum will emphasize on the understanding of the BI tools and how they are applied in business context; while MBA BI curriculum will emphasize on understanding how BI implementations can benefit businesses, and gain necessary analytical skills for interpreting business data and managing BI projects; and MS BI curriculum will understand the BI techniques and develop BI applications to solve problems. All three curricula were guided by the methods used in IS2010 (Topi et al., 2010) and curriculum content coverage were guided by the Krathwohl's Taxonomy (Krathwohl, 2002). Each course was presented with details including the course description, learning objectives, and topics which contain Teradata University Network (TUN) resources. Their work will be valuable for schools which are looking for a quick start with minimal effort to launch a course in BI&A.

In terms of the skill sets needed for effective business intelligence and analytics, Chiang, Goes & Stohr (2012) highlighted analytical skills, IT skills, and business knowledge and communication skills. They also presented the challenges facing IS departments, and discussed the role of IS curricula and program development, in delivering BI&A education by partnering with business schools. They proposed three possible options for delivering BI&A education to target different students of different backgrounds, experiences and needs, namely, (1) create BI&A multicourse concentration in existing MSIS program, (2) create a MS in BI&A, and (3) offer a graduate certificate program. They described the BI&A concentration offered in the University of Arizona's MS MIS program which includes three courses, and the MS in BI&A offered at Stevens' Howe School of Technology Management which includes 12 courses designed for students with strong technical background. Their work will prompt schools on choosing the most appropriate option most suitable for themselves.

Sigman et al. (2014) highlighted four key lessons learned through their offerings of a 3-day module at undergraduate level and a 1-week module at MBA level, including, (1) students attending programs in Big Data often come from a variety of background and experiences, so instructors should group students with different levels of technical skills together to better balance the skill sets; (2) the challenge to find the right balance between teaching hands-on skills which require statistics, computer science and data modeling, and teaching the business related skills in asking the right questions and understanding the answers, as both are equally important; (3) professors should focus on specific learning objectives so that students' expectations are properly managed, and (4) development of the curricula should align with the types of careers the students are pursuing. While these key lessons are derived from the delivery of short modules, they are still applicable to any BI&A course or program.

In their most recent article, Wixom et al. (2014) reported on the current state of BI&A in academia. They discussed the results of a survey conducted during the Business Intelligence Congress 3 which assessed academia's response to the market's growing need for BI&A trained students. Their five key findings include (1) the number and depth of BI&A programs has increased dramatically since 2010; (2) the availability and use of BI&A teaching resources has also increased; (3) the demand for BI&A trained students continues to be very strong, outpacing supply; (4) the top five skills employers desired include communications, SQL and query, basic analytics, data management and business knowledge; (5) employers are not completely satisfied with the practical experience of BI&A graduates. These five key findings reported are important for schools to realize the keen competition among different programs and for a program to be successful, students must be trained with good foundational skills and real practical experience.

The paper by Schiller et al. (2015) offered the "hydra corollary" as an alternate view where they assert that a team effort is required to conduct data science in an organization, where several people play different roles. As such, masters programs should admit students of different undergraduate degree backgrounds which can lead to interdisciplinary learning; while undergraduate programs can focus on teaching essential skill sets that serve as part of a data science team. They advised business schools to work with other departments like computer science, information systems or industrial engineering, as they believe that at the center of the hydra corollary is data management.

A very recent paper by Asamoah et al. (2017) shared their experience in designing and delivering a big data analytics course, providing details of the course objectives, pedagogical approach, module design, concepts covered in the course including summaries of four major sample assignments. They also discussed their lessons learned and the feedback obtained from the students. They emphasized that big data analytics skills are essential to most fields of study and practice, including business school students.

While there are existing literatures on the design and development of analytics programs, none of the literatures are Asian focused, and do not highlight the challenges faced specifically by young and small schools which have limited resources (faculty members, academic materials, and funding), and face intense competition for students against other high-ranking universities both locally and overseas, and more importantly how to overcome these challenges. This paper focuses specifically on SMU-SIS, an information systems school within a young and small Asian university which launched the Master of IT in Business (Analytics) program in 2011, which later became the most successful analytics program in Singapore, and probably even in Asia. The curriculum covers business, IT and analytical

skills training, and a 4-to-6 month internship or applied research project to allow students to gain real practice experience, apart from cases within every course which were created in collaboration with industry partners using real data and real problems. The curriculum has been presented several times at AACSB Curriculum Development Series: Data Analytics Seminar in Singapore in 2016, and in Taipei in 2017, and also in AACSB ICAM 2017.

SCHOOL OF INFORMATION SYSTEMS (SIS)

SIS was set up in 2002, two years after the university started. Being the only technology-focused school within SMU, SIS needs to focus on areas of research, practice and teaching, which will contribute directly to the Singapore's economy and manpower needs, as well as aligned with the areas of excellence identified for the entire university.

SIS was the first iSchool outside North America to be accepted as one of the 25 iCaucus Members of the iSchools organization (The iSchools Organization, 2012). iSchools is a collection of Information Schools dedicated to advancing the information field, in the relationship between information, technology and people. Being an iCaucus Member, SIS is recognized as an institutional leader in the field of Information Systems.

SIS offers Bachelor of Information Systems (BSc in IS) degree since its inception, and over time, postgraduate research education programs including MSc in Information Systems (MSc in IS), Master of Applied IS (MAIS) and Doctor of Philosophy in IS (Ph.D in IS), were offered. In terms of the postgraduate professional education program, the MITB program is one that has demonstrated unprecedented growth and success where many valuable lessons can be learnt from.

ESTABLISHING ANALYTICS MASTER PROGRAM AT SMU-SIS

Designing, developing and delivering education programs are mammoth tasks which are undertaken by many educational institutions. Some programs can become wildly successful, while others may have to close down after a few years of operation. Thus, it becomes extremely important and useful for any institution to refer to the best practices of successful programs and to avoid the pitfalls of the unsuccessful ones.

In 2010, SIS recognized the need to establish an analytics master degree program which aims to train IT professionals who can be future ready for the new digital economy which will be data analytics and artificial intelligence driven. At that time, SIS faced many challenges which it has to overcome.

Challenge 1: Overcome Being Young and Small, and Relatively Unknown

SMU is a young and small university as compared to NUS and NTU in Singapore, and many other high-ranking universities overseas. In 2010, it was only a ten-year old university which was still relatively unknown. SMU could not compete directly with the big boys, and thus should identify niche area which it was specifically strong in.

The approach taken was to leverage on the strengths of the school, in terms of its faculty members' experiences, its linkages with the industry, and its research and practice areas.

- SIS has strong linkages with the industry, particularly banks, government agencies, healthcare, consulting firms, logistics companies, sea port and airport.
- SIS has started to do research in data analytics since its inception in 2002. As of today, SIS has 11 research labs which cover research in multiple areas including analytics for business, consumer and social insights; analytics for urban management and sustainability; and analytics for aging and healthcare management.
- SIS has a sizeable pool of practice faculty members (also known as clinical track faculty members), both full-time and adjuncts, who have many years of professional working experience in the industry.

These specific strengths enabled the school to embark on the journey to create and launch the analytics master program.

Challenge 2: Understand Industry Needs

It would be disastrous when the graduates have skills and knowledge which are mismatched with the industry's needs, a problem faced by many universities and countries (Mishra, 2014; CIPD Report, 2015; Economist, 2015). The former Egyptian Minister for Higher Education & Scientific Research, HE Dr Amr Ezzat Salama said that 'Educators should not sit in ivory towers designing curricula that help no one develop their communities or realize their dreams' during his presentation at the 2012 United Nations Economic and Social Council Meeting (Salama, 2012). In his presentation, he also listed six key actions to perform to ensure that graduates' skills and knowledge match the labor market's needs.

In order to understand the needs of the industry, the MITB team conducted consultation sessions with industry experts from several business domains including banks, healthcare institutions (hospitals), hospitality sector (hotels), e-commerce firms, integrated resorts (casinos and theme parks), consultancy companies, airport and seaport, retail sector, and logistics companies. The purpose was to determine the stage at which these different companies have embarked on data analytics and what future data analytics work they would likely move into, and thus determine the kind of skillsets students needed to be trained in for current and future needs.

After months of landscape study and research on other similar programs offered by universities in the US and Europe, SIS launched the second[1] track in Analytics in January 2011, known as MITB(Analytics) program. In fact, MITB(Analytics) was the first analytics master program in Asia, well ahead of NUS and NTU, which launched their analytics master programs only in 2013 and 2015 respectively.

Challenge 3: Ensure Robust and Practical Curriculum Design

From the industry consultation sessions, the team noted that the program's curriculum should include three major components: business domain, technology, and management. These components ensure that the graduates will not only have the technical know-how but also have the ability to plan, manage, and communicate with their business counterparts and senior management.

[1] MITB (Financial Services) program was the first track launched in 2007, and was later renamed as MITB(Financial Technology) program

Curriculum development is defined as 'the process of planning, constructing, implementing and evaluating learning opportunities intended to produce desired changes in learners' by Print (1993). There are many approaches to curriculum development including linear, cyclical, and dynamic models (Biggs & Tang, 2007; Wolf & Hughes, 2007; Print, 1993).

The curriculum was designed with four course series as shown in Table 1, and every student needs to complete 13 courses (a total of 468 in-class hours) over a one-year full-time or two-year part-time period to graduate.

- Series B: Analytics Technology & Applications
- Series C: IT and Project Management
- Series D: General Management for Technology & Operations
- Series E: 4- to 6-month Internship or Research Capstone Project (equivalent to 2 courses)

Note that Series A are courses for the first track in Financial Services, which were later renamed as Financial Technology.

A. Financial Technology	**B. Analytics Technology & Applications**	**C. IT & Project Management**	**D. General Management for T&O**	**E. Internship/ Capstone Project**
A.1 Digital Banking & FinTech	B.1 Analytics Framework & Business Context	C.1 Cybersecurity Technology & Applications	D.1a Financial Accounting*	E.1 Internship
A.2 Retail Banking & Mobile Technology	B.2 Data Analytics Lab[@]	C.2 Spreadsheet Modeling for T&O Decisions	D.1b Management Accounting for T&O Managers*	E.2 Capstone Project
A.3 Corporate Banking & Smart Contracts	B.3 Customer Analytics & Applications	C.3 IT Project & Vendor Management	D.2 Strategy & Organization	
A.4 Financial Markets Systems & Technology	B.4 Operations Analytics & Applications	C.4 Global Sourcing of Technology & Processes	D.3 Finance for T&O Managers	
A.5 Algo Trading & Risk Systems	B.5 Big Data: Tools & Techniques			
A.6 Digital Payments & Innovations	B.6 Visual Analytics & Applications			
A.7 Assets Management & Digital Advisory	B.7 Text Analytics & Applications			
A.8 Product Lifecycle & Dev Ops	B.8 Social Analytics & Applications			
A.9 T&O Risk Management Essentials	B.9 Applied Machine Learning			
A.10 Topics in Risk Management	B.10 Predictive Analytics Using Simulation			

A.11 Big Data Analytics in Financial Services	B.11 Marketing Analytics & Applications			
A.12 Digital Banking Enterprise Architecture	B.12 IoT Technology & Applications			
	B.13 Data Management			
	B.14 Statistical Analysis with R[@]			

[@] *denotes compulsory course* * *denotes 0.5 course module*

Table 1. Courses in the MITB Program

From the list of courses, it can be seen that the program not only offers a comprehensive list of data analytics techniques and applications in different areas in Series B, it also covers the business and management aspects in series C and D. Apart from many industry sponsored cases, with real data and problem sets which are used in the courses, students also have the opportunity to work with the industry during their 4-to-6 month internship, or do an applied research capstone project to apply the skill sets they have learned. In terms of software and platforms, the B series courses use a wide range including SAS EG, SAS EM, SAS OR, SAS Simulation Studio, SAS JMP, Tableau, R, Python, Scikit Learn, MS Excel, Hadoop framework (HDFS and MapReduce), and Hadoop components (Pig, Hive, Spark, and Kafka).

Challenge 4: Overcome Large Amounts of Time and Effort Required

Short (2002) opined that 'practical-oriented or mission-oriented knowledge is considerably more complicated, both in its applications and in its derivation and creation.' Despite the industry experts working closely with our SIS faculty members, the creation of the curriculum materials still took substantial amounts of time and effort. The materials created must include course materials, lab exercises, lab guides, assignments and projects, to achieve the learning outcomes.

To ensure that the program will not be delayed, the first intake in January 2011 was meant solely for part-time students, who will complete the program in 2 years. Full-time students who will complete the program in 1 year, will join one year later, in January 2012. Thus, during the first year, only about half the number of courses were ready, and then in the second year, the remaining courses were added. This phased-approach allowed the program to "buy" time to get the entire curriculum ready.

Challenge 5: Ensure Practical Experiential Learning

Many research works have shown that infusing curriculum with practical hands-on experience in solving real world problems, either as classroom cases and lab exercises, capstone projects or internships, will improve the employability of the graduates (Heyler & Lee, 2014; Higson 2012; Helyer, 2011).

However in 2010, not many organizations, particularly in Singapore, have sufficient experience in applying analytics to solve their real business problems. Crafting interesting analytics related business problems to be used in classroom teaching, and to create industry projects for students to work on in their capstone projects and internships were uphill tasks.

Due to SIS's close linkages with the industry, many companies were willing to explore how data analytics can be used in helping them solve their business problems, something which they were new to and had not done before. With the shared data and domain knowledge, the SIS faculty members were able to create interesting cases and lab exercises for students to work on. Companies also benefitted through the learning experience and became more open to accepting the students to work on projects with them as interns and as capstone projects.

In addition to teaching and practice, SIS has a complete ecosystem in analytics research established in our numerous research labs (SMU School of Information Systems, 2017). All these research labs work on cutting-edge analytics related problems in financial services, insurance, urban management, business, consumer and social. With these research labs, MITB(Analytics) program can include the interesting research findings into the curriculum, and students can have the opportunities to work in the labs for their capstone projects. The result is to train the students not just for today's problems, but also for the future.

Challenge 6: Keep the Program Alive

Competition from both local and overseas universities for quality students is a challenge facing any educational program. Without good student numbers, any program will not be able to survive.

In order to remain relevant and competitive, every program needs to keep abreast of the latest trends in technological advancements and industry movements, to keep reviewing and updating their curriculum. In terms of analytics, new technologies include big data analytics, cloud technologies, Internet of Things (IoT), and deep learning. Thus, it is critical for the program to move together with the industry trends and needs, and offer courses which will ensure that the graduates continue to be well sought after.

Developing and making changes to curriculum have been identified to be cumbersome and inflexible in many universities. Hurlimann et al. (2013) provided a contemporary assessment of barriers and facilitators for curriculum development. Being an autonomous university, SMU takes full ownership of its own development, to become more responsive in tailoring its educational and research agenda to meet national needs and enhancing the educational experience for its students (Ng, 2013). With an autonomous status, the process for curriculum change is less arduous and thus more responsive, making the task of "staying relevant and competitive" more manageable.

The MITB team conducts curriculum review after every teaching term for courses which were taught to determine if any parts of the courses need to be improved, based on the feedback from both the students and the instructors. In addition, a major review is conducted once every year to ensure that the courses include the latest techniques and tools, cases and problems.

Students are the major stakeholders in the running of any educational program. End of term evaluation is carried out for each course to survey students on their feedback on the course

and the instructor, both quantitatively and qualitatively. Such feedback will provide the program the motivation to make adjustments to the courses, and in some instances, change the course content and even the instructor altogether. However, one key thing to note is that disgruntled students may provide biased feedback, thus the program team needs to evaluate the feedback as objectively as possible to arrive at the best decision to take.

To cater for further expansion, a third track in Financial Services Analytics was offered in August 2016, which seeks to combine the relevant courses in Series A (Financial Technology) and Series B (Analytics Technology & Applications), so that students can choose to focus on analytics practices and applications, specifically in the financial services institutions. An initial intake of 33 students in AY2016 suggested that this powerful combination has a strong growth potential.

Challenge 7: Ensure Program Scalability

The MITB(Analytics) program started with 16 part-time students in January 2011. From the January 2012 onwards, each intake allowed both full-time and part-time students to enroll, and the enrolment increased to 28 in January 2012. From Academic Year (AY) 2013, the program decided to have 2 intakes per year, once in August, and another in January the following year. With 2 intakes per academic year, the enrolment numbers swelled to 128 in AY 2016 (see Figure 1).

As the program grows to more than 100 students per academic year, many scalability issues, due to limited resources, being to surface. The major resource constraint is insufficient number of faculty members. At SMU, we adopt a small-sized seminar room teaching style. Each seminar room can only house a maximum of 45 students. With the increased in student numbers, the number of sections for classes will increase. The result is that most faculty members, especially the clinical track professors, will need to take on additional teaching loads.

The rise of MOOCs has opened up an entirely new possibility of education. While there are pros and cons of such online education, many online master programs which started more than ten years ago, especially in the US, have been quite successful. Over the years, many studies have documented the success factors of online programs, and the successful formula seem to lie in the combination of both online and onsite education, aptly named as blended learning program (Means et al., 2010; Means et al., 2013; Waha & Davis, 2014).

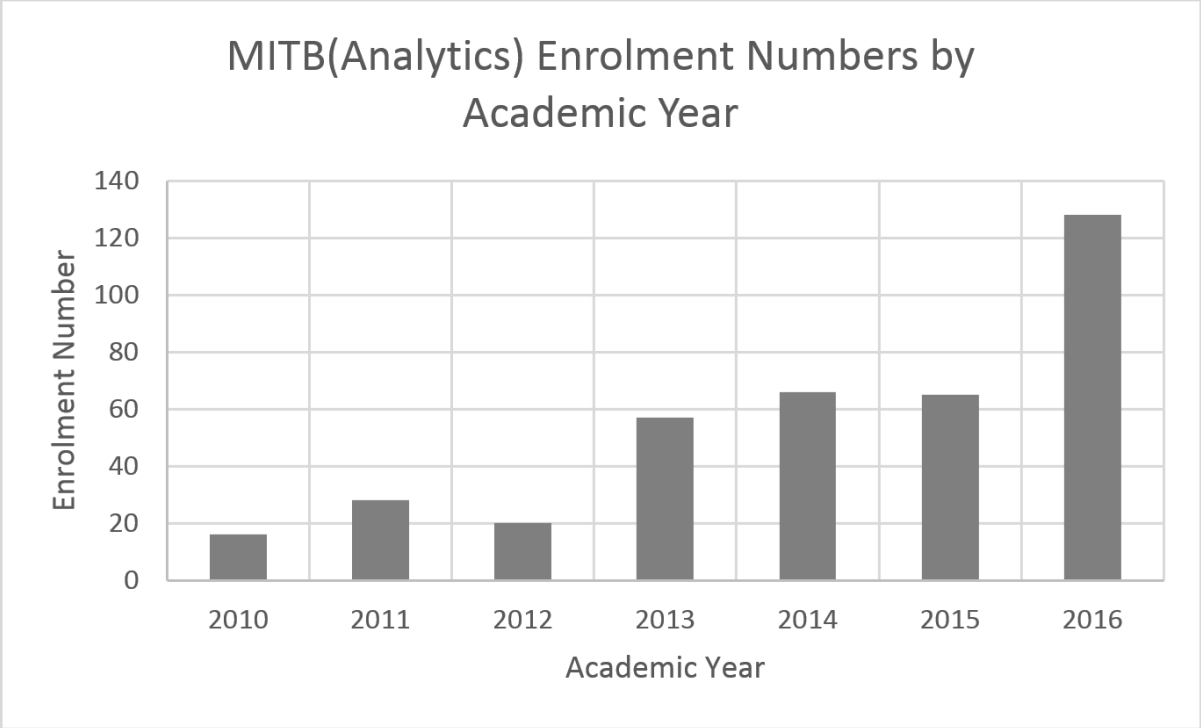

Figure 1. MITB(Analytics) Enrolment Numbers from AY2010 Till AY2016

Recognizing the merits of blended learning programs, MITB has embarked on converting some of the courses into blended learning delivery since 2013. Over two years, six courses were converted into blended learning and delivered to residential program students. With the online materials used as replacement mode teaching, faculty members can now handle twice the number of sections, and increased number of students. The lessons learnt and experience gained have provided the team insights into how to better use technology to deliver blended or even a fully-online analytics master degree program in the near future.

Challenge 8: Ensure Effective Marketing and Outreach

All products and services will require strong marketing and outreach efforts in order to attract the right customers. Stahlberg & Maila (2013) describes the multi-channel marketing ecosystems which aim to create connected customer experiences for effective marketing and outreach. A recent paper by Sarkane & Sloka (2015) described the factors influencing the choice of higher education which will affect the marketing strategies, and presented the statistical results of data collected from the analysis of scientific publications, focus group discussions, surveys of possible future students.

MITB(Analytics) program need to attract the correct group of prospective students who are of high quality and most importantly, are the right type of students who will benefit from the program to land in the professional roles the program will train them for.

Having good working knowledge on the different marketing channels to use including print media (newspaper and magazines), social media (Facebook and LinkedIn), and Internet search platforms (Google Adwords and Google AdSense), is of paramount importance to

generate leads. Roadshows at education fairs and related conferences are also possible platforms to reach to the right prospective students.

After reaching the right prospective students, the next step is even more critical. While it is important to focus the message on what will be taught in the program, it is even more important to show the prospective students what they will learn and do, through experiential learning sessions. Examples of experiential learning sessions include bringing the prospective students through a problem-solving scenario, showing examples of tangible outputs completed by past students, and letting the prospective students sit in a sample class.

Challenge 9: Reaffirm Program Quality

After running the MITB(Analytics) program over a six-year period, several efforts by the faculty members teaching in the program have gained international recognition. Many cases within the program were written together with industry partners using real business problems and real data. One of the cases written for the course "Operations Analytics & Applications" won the inaugural Teradata University Network (TUN) Teaching Innovation Award 2013. The case titled "Effective use of Data and Decision Analytics to Improve Order Distribution in a Supply Chain" by Cheong and Choy (2013), comes complete with the case, teaching notes, lab guide and data sets, and have been adopted by two US universities.

Two simulation games for teaching project management, designed and developed by another faculty member were both shortlisted as finalists for the Wharton-QS Stars Reimagine Education Awards 2015. The two simulation games are "Spreadsheet-based Project Management Simulation Game" and "SCRUM-X: An Interactive and Experiential Learning Platform for Teaching Scrum" (Lee, 2016; Lee 2013; Lee, 2011a; Lee 2011b).

These artefacts and accolades reaffirmed the commitment and effort put in by the faculty members and the support by the program to ensure that students are provided with the best experiential and practice-based learning. Today, the seven-year-old MITB(Analytics) program will welcome its 12th intake in August 2017, and continues to be the program of choice for students in Singapore and the region.

GRADUATES SURVEY RESULTS

A recent survey was conducted in 2016 with our 400 plus graduates and the key responses which measured their success after graduating from our MITB program are shown in Figures 2, 3 and 4 below.

In Figure 2, we surveyed the students to find out how long did it take for them to find a job upon graduating for MITB program. 79% (70% + 9%) of the students found a job within six months after graduation. A recent report (Seow & Zhou, 2015) stated that "57% of Singaporeans and permanent residents who lose their jobs are able to find a job within six months, according to the Manpower Ministry of Singapore. For professionals, managers, executives and technicians (PMETs), however, the proportion was below average at 49% for the same time period." Comparing how MITB graduates fared as compared to the general population, this result is encouraging.
Note that 70% of MITB students are foreign students who would naturally face more difficulty in securing a job in Singapore due to strict employment rules, so with only 18%

who took more than 12 months to land a job, this is not an alarming number. Overall, the employment outlook of MITB graduates is still very good.

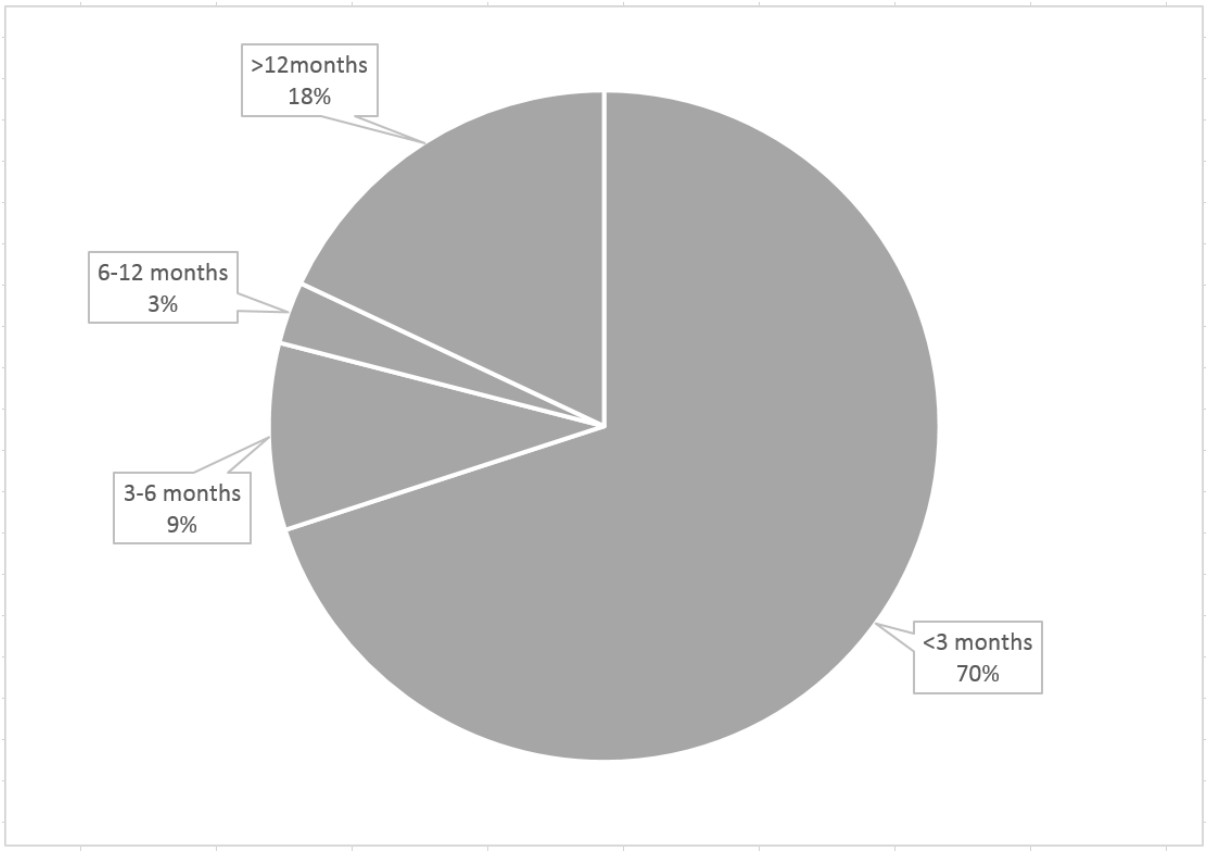

Figure 2. How Long it Took MITB Graduates to Find a Job

In Figure 3, we surveyed the students about their salary in their current job. About 50% of them have annual salary of more than S$75,000. Dividing this by 12 months, the monthly salary will be at least S$6,250 which is more than 1.5 times the monthly median salary of S$4,056 of the people in Singapore in 2016 (Singapore Ministry of Manpower, 2017).

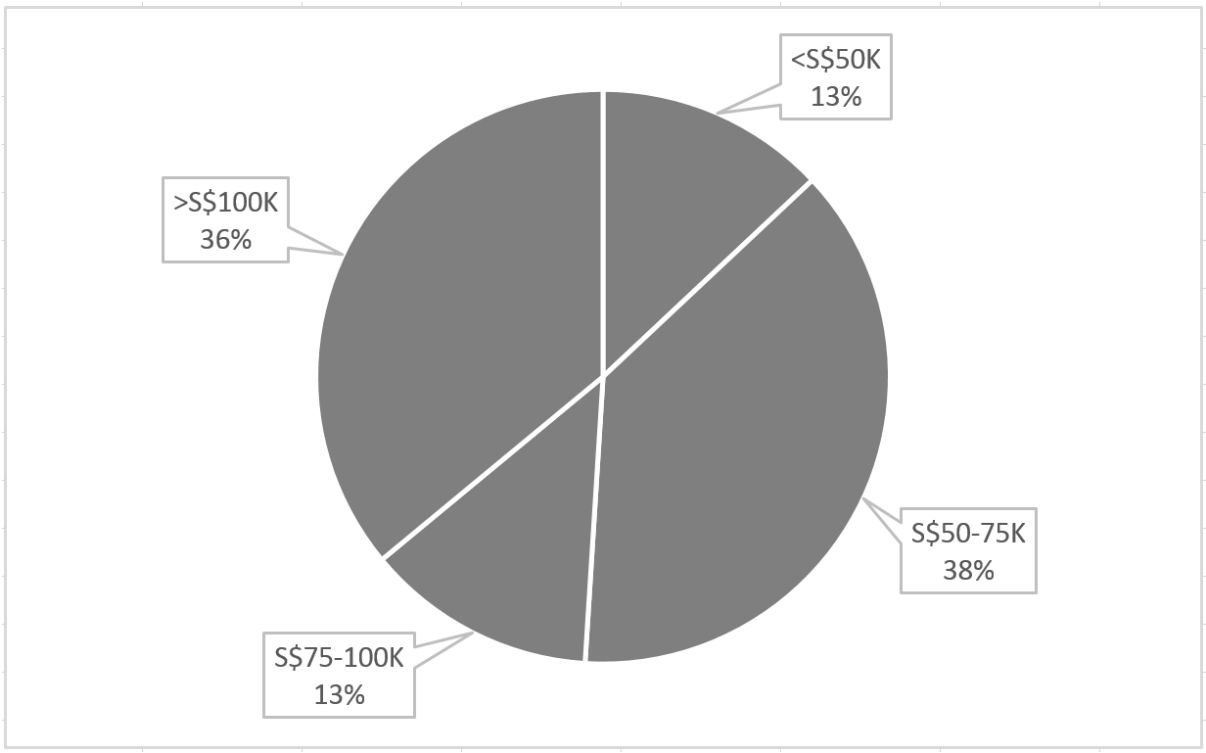

Figure 3. Current Annual Salary of MITB Graduates

In Figure 4, the x-axis shows the percentage increase in salary, from <5%, to 5% to 10%, 10% to 20%, and > 20%. The y-axis shows the percentage of students enjoying these increment in salary.

- The dark bars show the percentage increase in salary immediately after graduating from MITB program as compared to employment before joining MITB program.
- The light bars show the percentage increase in their current salary as compared to the salary of their first employment after grading from MITB program.
- Both sets of bars show that a high percentage (close to 40%) of the students enjoyed more than 20% increase in salary. In total, close to 80% of the students enjoyed at least 5% increase in their salary. Interestingly, the shape of the distribution bars were similar.
- All in all, MITB graduates were able to find employment within a short time and enjoyed relatively high salary compensation, and a large percentage enjoyed substantial increased in their salary upon graduation from MITB.

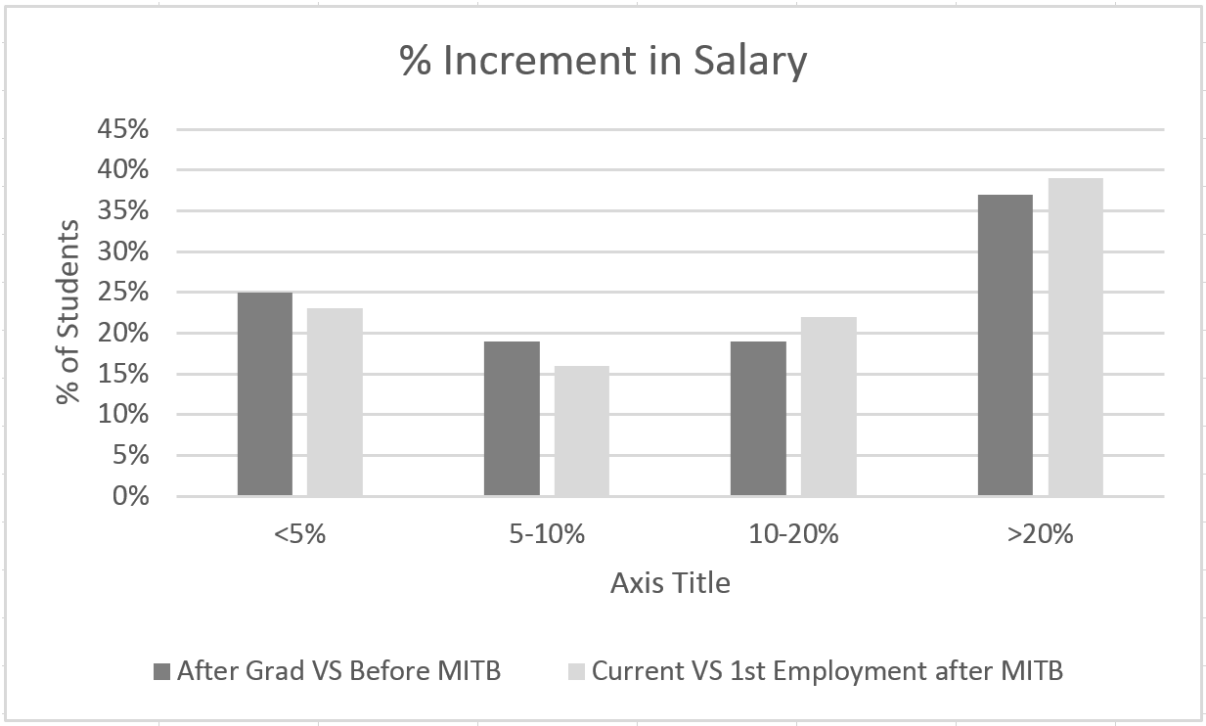

Figure 4. Percentage Increase in Salary for MITB Graduates

KEY LESSONS LEARNT AND TAKEAWAYS

With a good understanding of the design process which MITB(Analytics) program went through in the past seven years, this section will summarize the 11 key takeaways which can be used as a strategic guideline.

1. A clear vision about the type of program the school wants to create, which could be in a niche area.
2. A good understanding of the industry needs in terms of the skillsets required from the newly trained graduates.
3. A good understanding of the school's own strengths and weaknesses in terms of resource availability, infrastructure availability, ecosystem of research, practice and teaching which can be leveraged.
4. Strong linkages with industry to provide inputs, good internships and career opportunities for the students, as well as to provide data and projects which can be written into real cases and lab assignments.
5. A dedicated team of faculty members and administrators who are committed to ensure quality curriculum content and smooth daily operations.
6. Keep abreast of the latest developments in technologies and industry movements to ensure curriculum remains relevant.
7. Keep abreast of competing programs locally and overseas to ensure that program remains competitive.
8. Be informed about students' learning experiences and put in the best effort to ensure that any verified undesirable experiences should be eradicated as soon as possible.
9. Embrace new technologies for teaching and learning to improve students' learning experience and enhance outreach.

10. Strong marketing and outreach efforts to make sure that prospective students know about how and what they will learn and do in the program.
11. Be innovative and creative to create teaching artefacts which can enhance students' learning experience and outcome.

CONCLUSIONS

Being a young school within a young and small university in Asia, SMU's School of Information managed to design, develop and deliver a successful professional master degree program in IT, which grew from a mere 16 part-time students to 128 full-time and part-time students in six years. The nine challenges faced and the solution approaches taken to overcome the challenges will offer insights to other schools and programs. 11 key takeaways were documented and can be used as a strategic guideline which other universities can refer to, hopefully to help them to become as successful.

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