Present State and Future Directions of Online Education within Engineering Management Programs

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Abstract - **The use of web-based technology for educational purposes has been increasingly popular within the past decade. With latest developments in technology, especially video and audio capabilities, web-based education is now within reach of anyone who has an internet connection. Engineering Management (EM) departments have increasingly been adopting online learning tools within their degree programs. In this paper, authors analyze the current state of online EM education based on research on EM degrees awarded. Universities that grant a B.S., M.S. and/or Ph.D. in Engineering Management are explored, and the programs are classified as Live, Hybrid or Online. Following this, a framework is developed and presented for EM programs that wish to adopt hybrid or online delivery systems. The value of the framework is discussed with respect to results from an application within University of Houston-Clear Lake. The paper concludes with a discussion of the significance of online education within engineering management and suggestions for future research opportunities.**

Keywords
Engineering Management, Online Education, Undergraduate Degree, Graduate Degree, Framework

I. INTRODUCTION

For the past ten years, traditional face-to-face classroom education has had a strong competitor in the form of online education (OE). Together with this new approach, the non-traditional classroom experience has been transformed into an alternative delivery medium. Almost twice monthly, *The Chronicle of Higher Education* publishes articles about and discusses news of the state of online education. The recent announcement from the White House of the launch of *Change the Equation* [1] initiative, a public-private partnership that is designed to increase literacy in Science, Technology, Engineering and Math (STEM), shows the level of importance STEM education has on society. The three goals this initiative works towards are 1) Great Teaching, 2) Inspired Learners, and 3) A Committed Nation (Change the Equation website). One of the ways to improve teaching and learning within STEM is to increase the availability of degree programs; online education is one of the major components of offering degrees to broader populations.

A survey conducted by the *Instructional Technology Council* [2] on the impact of eLearning at Community Colleges reports that there has been an 11.3 percent increase in the distance education enrollment between Fall 2006 and Fall 2007. The seventh annual Sloan Survey of Online Learning [3] states that 73% of the institutions they surveyed (more than 2500 colleges and universities) reported an increased demand for *existing* online courses and programs, and 66% of institutions reported increased demand for *new* courses and programs. In the same survey, it is reported that the demand for online offering is greater than that for the corresponding face-to-face offerings, and that 1 out of 4 higher education students has at least taken one online class.

II. ONLINE LEARNING AND EDUCATION STAKEHOLDERS

In addition to national surveys such as the Sloan Survey, the research conducted within academia has expanded greatly. New journals solely dedicated to this topic, such as *Distance Education*, *Journal of Asynchronous Learning Networks*, as well as long-established journals, such as *American Journal of Distance Education* and *Journal of Distance Education* provide mostly empirical research that result in knowledge which is either applied directly (e.g. an online delivery tool), or is used as starting point for other research. Research on OE so far has focused on four main stakeholders: Faculty (instructors), students (learners), the academic institution, and the discipline, which provides context.

From the perspective of *faculty* members involved in online learning and education, academic and practical research results are not always in agreement with each other. The results from the Sloan Survey [3] show that since 2002, there has been little increase in support for

online education provided by faculty. This may be because the teaching philosophy and style of some teachers may be more appropriate in a face-to-face delivery medium, while others may be more comfortable and skilled in online deliveries. However, research conducted by [4] on faculty perception of online courses showed that only around 11% of the faculty members stated that they would not like to teach an online course. A study conducted by [5] suggests that when instructors have taught the same course both online and face-to-face, they tend to transfer pedagogical strategies from the online medium to the face-to-face medium. The same study also concludes that when an instructor teaches an online class, he/she tends to incorporate technological components to traditional classes.

When looking at OE from the *student's* perspective, there is no consensus either. Some students definitely prefer to be in a "real" classroom and interact with the teacher and their class mates; while others prefer the anonymity and flexibility online education provides them. Reference [6] conducted a research where students stated that using multiple tools within distance education would motivate them to participate in discussions and meetings. In a survey study conducted by [4], undergraduate students considered the following five issues as important when deciding to take online classes: Timely feedback to questions, accreditation of the institution, access to information, organized and systematic presentation of materials, and flexibility of schedule to accommodate work responsibilities. Furthermore, issues such as electronic submission of assignments and flexibility of schedule to accommodate social activities were also reported to be more characteristic of an online course.

From the *university* perspective, the analyses are conducted at a much higher level. The Sloan Survey [3] reports that the trend for institutions and universities to include online education as part of long-term strategy and goals has been almost a plateau. This is interesting, since research also shows that OE proves to have a significant effect on budget issues that favors the university. Reference [7] has identified several economic factors that drive the enrollments in online and hybrid programs. Tuition, state funding, financial aid and endowments are among the many factors that impact enrollment in these non-traditional programs. They further stated that in order to provide long-term sustainable programs, the colleges and universities should balance academic quality and accountability with online education. A survey study conducted by [8] shows that faculty satisfaction within an online teaching environment is mainly affected by student success and student satisfaction. Therefore, student and faculty motivation and satisfaction are also interrelated issues.

III. ONLINE EDUCATION IN ENGINEERING MANAGEMENT

The *discipline* within which the online program is established is an important parameter, since not all disciplines may be appropriate or flexible enough to provide online courses or offer fully online degrees. Having said that, the Sloan Consortium survey reported that online degree programs are mostly evenly distributed between different disciplines. However, engineering discipline is slightly lower than the others. Reference [9] notes that the lack of online engineering programs, especially beyond Master's level, may be due to the fact that most engineering education requires laboratories with hands-on teaching and learning. Also, traditional engineering courses such as mathematics are more difficult to teach (and learn) through an online medium. The multidisciplinary nature of Engineering Management (EM) brings forth this issue as the discipline is a combination of qualitative and quantitative subjects. Figure 1 represents the main domains of engineering management, according to the *Guide to the Engineering Management Body of Knowledge* [10].

Figure 1. Engineering Management Body of Knowledge

From the more traditional engineering-related classes of EM (such as Cost Engineering, Operations Research, Statistics, etc.) to the more management-oriented classes (such as Project Management, Organizational Analysis, Leadership and Ethics, etc.), EM encompass the qualitative-quantitative spectrum. This can be a challenge by itself, regardless of the delivery medium. However, with more EM-appropriate teaching methods such as the use of case studies, teamwork, group projects, role playing etc., online delivery may seem to present more challenges. On the

other hand, considering the student profile of most EM graduate programs, which are mostly working professionals and adult learners, the online classes do provide flexibility and convenience. Even though an online component is absent from the Bachelor's degree, there still is an increasing trend for the B.S. in EM degrees awarded (Figure 2). According to the American Society for Engineering Education (ASEE) data published in the Profiles of Engineering and Engineering Technology Colleges [11], 309 Bachelor degrees in Engineering Management were awarded.

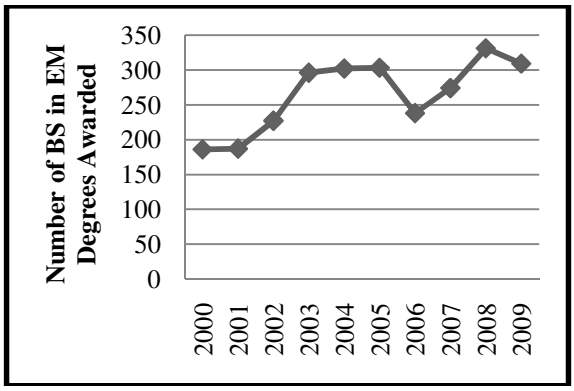

Figure 2. Bachelor's Degree in EM awarded (Data from ASEE)

The degrees that are tangentially related to engineering management, such as Industrial Engineering, or Technology Management, are not considered within the study to avoid ambiguity. For instance, the Engineering Management and Leadership specialization within Purdue University was not included, since it is not a full degree. The schools that grant a B.S. in Engineering Management, M.S. in Engineering Management, Master in Engineering Management (M.E.M.) and a Ph.D. in Engineering Management were within the scope of this study.

IV. METHODOLOGY

The purpose of this study is to examine the current state-of-art of online education within Engineering Management degrees. Different sources have been used to ensure an all-inclusive list. The two main sources of data were the EM list provided in the website of American Society of Engineering Management (ASEM) [12] and the list of Graduate and Undergraduate Engineering, and Engineering Technology degree programs published by ASEE in 2008, similar to [13]. Through these two main sources, a list of 100 schools was obtained. In order to ensure a comprehensive review, the methodology presented in Figure 3 was followed.

The database developed was divided into three main components: Bachelor's, Master's and Doctoral programs. These programs were furthermore divided into *Live*, *Hybrid* and *Online* categories. *Live* represents the category in which the EM degree is offered through face-to-face classes. *Hybrid* (or Blended) is the category in which some of the classes within the degree are offered online, or the classes have online components within them. *Online* represents the degree in which all classes are available within the online delivery medium. Usually, departments advertise these as *100% Online* or *Fully Online*. In order to populate the database, data were collected through the websites of these programs. If there was any uncertainty involved in whether a degree was offered 100% online or partially online, confirmation was obtained through personally contacting the department and validating the information. It is important to note that this database is dynamic in the sense that new Engineering Management departments are in the process of being developed, or existing programs are starting to offer 100% online degrees, as in the case of Master's in Engineering Management offered by University of Houston-Clear Lake. Due to the cross-sectional nature of this research, only a snapshot analysis can be provided. The results presented in this study reflect the state-of-the-art of online education in Engineering Management as of Fall 2010.

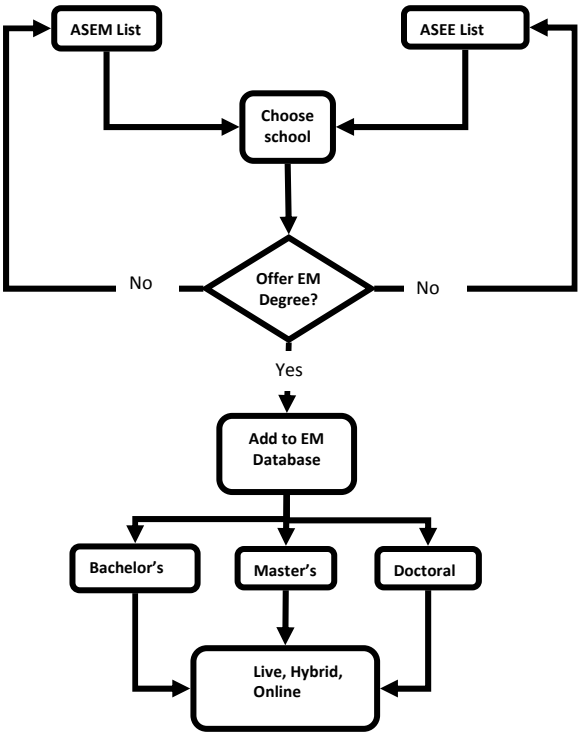

Figure 3. Data Collection Methodology

V. RESULTS

As seen in Figure 4, 19% of the schools offered a face-to-face Bachelor's in Engineering Management degree, and none of these undergraduate programs offer a hybrid or fully online program. The Master's degree is offered live in 72% of the schools, and finally 9% of the schools offer a Ph.D. in Engineering Management through live classes only. There was no single school that offered all three degrees. The combination was either Undergraduate and Master's, or Master's and Doctoral degree.

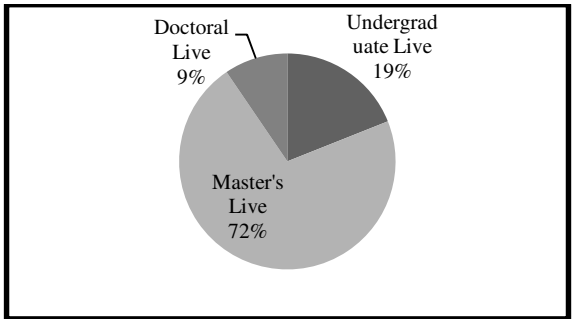

Figure 4. Live Delivery Distribution

Figure 5 shows that 71% of the schools offer a hybrid Master's degree, and 29% of the schools offer a hybrid Doctoral degree. The hybrid degree in this research does not include fully online degrees, and there is always a face-to-face component present within the course throughout the semester.

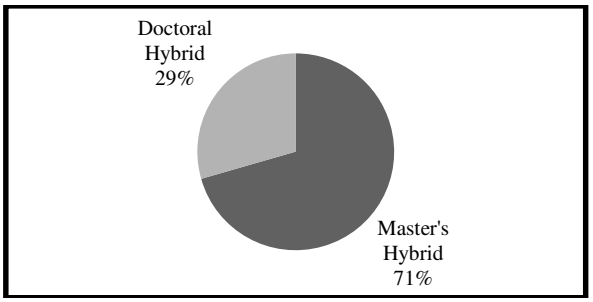

Figure 5. Hybrid Delivery Distribution

Considering the fully online delivery medium, only 8% of the schools offer a fully online Doctoral degree (Figure 6). Considering the additional requirements beyond class work of a Ph.D. degree, this is expected. Since the target student population of Engineering Management is generally adult learners, they are mostly part-time students, and the applicability and relevance of a Master's degree in EM is higher than a Doctoral degree.

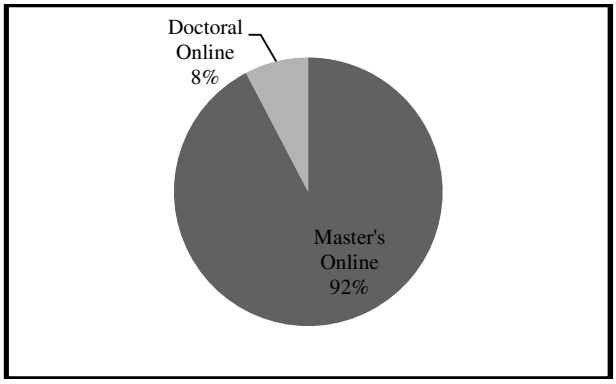

Figure 6. Fully Online Delivery Distribution

Figure 7 also provides interesting results. The number of fully online Master's programs is much higher than hybrid Master's programs. The number of live degree programs is still the highest; however more Master's degree programs are using a fully online approach rather than a combined approach. This may be due to the fact that there are more working professionals enrolling in Master's degrees than any other degree, and the schools are adapting their programs accordingly. The requirements of completion of a master's degree may be different in each university, providing a choice between a Thesis and a Capstone project, or substitution of a number of extra courses instead of the thesis. This

also makes the Master's degree more flexible in terms of the need for the student to be physically present in the academic institution.

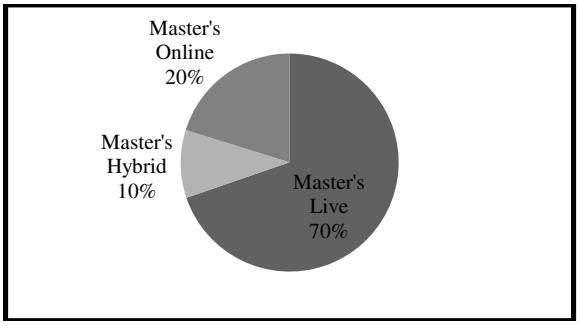

Figure 7. Masters Degree Delivery

Regardless of the delivery medium, data from ASEE shows that there were 2,240 Masters Degrees in EM awarded in 2009. Compared to Aerospace Engineering (1,075), Chemical Engineering (1,084) or Computer Engineering (1,880), this number is quite high. As seen in Figure 8, Part Time enrollment in the Master's in EM programs is much higher than Full Time enrollment. This is expected, due to the nature of the discipline.

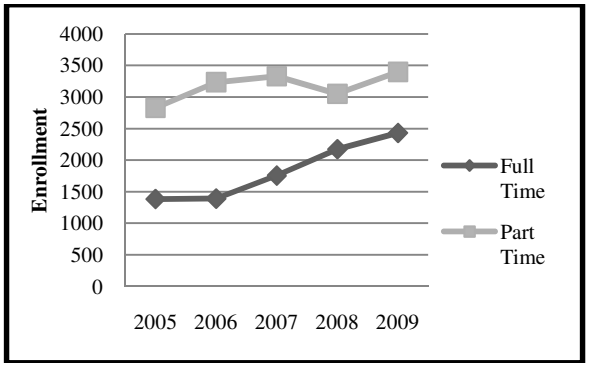

Figure 8. Full Time vs. Part Time Master's in EM Enrollment (Data from ASEE)

However, Doctoral degrees do not follow the trend of the Master's degree when it comes to hybrid vs online programs. It can be seen in Figure 9 that there are more hybrid Doctoral programs than fully online programs. The coursework required to complete a Doctoral degree, which includes dissertation research hours, in principle, will mean that the student needs to be present within reasonable geographical limits to the academic institution. The magnitude of effort and time that goes into dissertation research is supported by interactions and meetings with advisors and committee members. This interaction and support structure is more evident and possible in hybrid programs, rather than fully online programs.

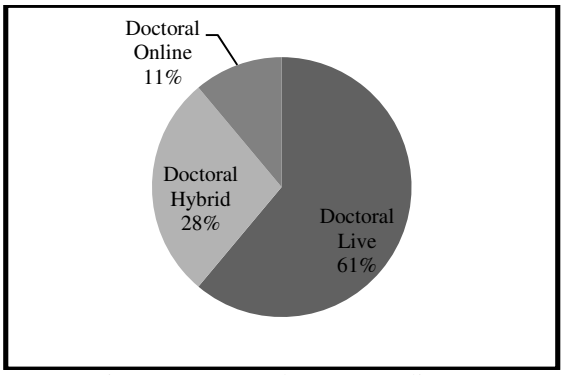

Figure 9. Doctoral Degree Delivery

Through analysis of colleges and universities that award Undergraduate and Graduate degrees in Engineering Management, we obtained a cross-sectional look on the current state of online education within EM. The percentages of programs offering live, hybrid or fully online degrees are consistent with the demand from industry and students. Considering these results, the following section discusses the development and application of a framework to be used when planning on initiating future online degree programs.

VI. A Framework for Online Education Adoption

According to [3], although there has been significant increase in the enrollment and demand for OE during the last decade, the number of degree programs that offer live delivery still surpasses the number of programs that offer the hybrid or fully online delivery. It is, naturally, not expected nor necessary for all live courses and programs to adopt online technologies. However, in the same survey, majority of the master's and doctoral institutions' chief academic officers considered the OE as part of their long-term strategy. This indicates the strong possibility that more higher education institutions may enter the hybrid and/or online education market in the future. However, developing the online programs initially requires significant time and effort. Hence it would be useful as guidance if there is any online education framework for those universities that wish to offer either new online courses, or modify existing courses into online courses. Authors believe that many EM programs will be direct beneficiaries from this framework.

The *Engineering Management Online Education Framework (EMOEF)*, based on the recent fully online EM program development experience at University of Houston-Clear Lake (UHCL), provides a structured methodology for the development of online programs. As seen in Figure 10, the four main stakeholders are interacting with each other through the three levels of

OE. The first and highest level is *Program,* indicative of a situation when a complete degree program wants to offer a hybrid/online degree. The second level is *Partial Program,* where only a part of the program is going to be offered hybrid/online. The last level is the *Courses*, where only one or few courses are either being modified based on an existing live course, or a new hybrid/online course is being offered. Framing all these levels are the four stakeholders of OE as discussed previously: the faculty, the students, the university and the discipline. The framework presents a holistic view of the considerations at three different groups depending on the level of change and the implications to the stakeholders. Each level has the same considerations except the strategic alignment, which is considered only at the program level.

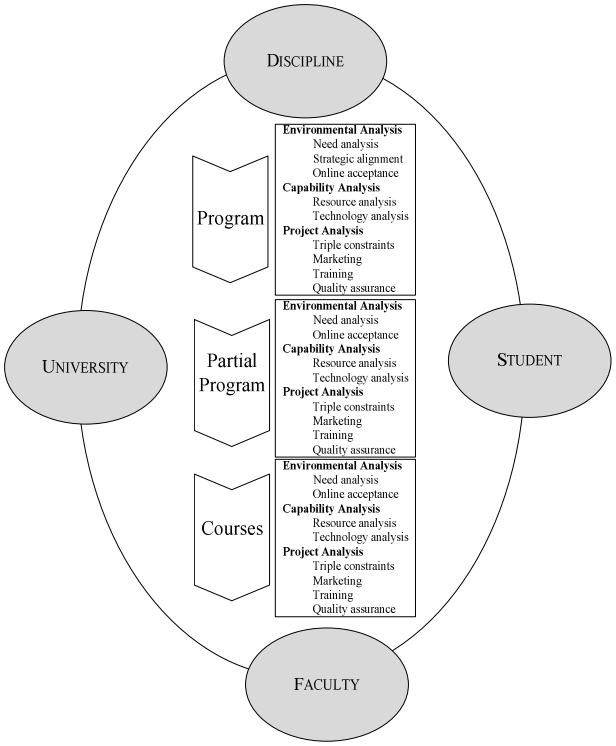

Figure 10. Engineering Management Online Education Framework (EMOEF)

The first group is referred to as the *environment analysis*, investigating whether your internal and external environment is appropriate for OE or not. The goal of the need analysis is to understand the students' needs and to effectively communicate them to the stakeholders. The output of this step is a set of students' and/or consumers' need statements in a specific discipline. To successfully implement this step, the institution may need to classify its potential and prospective students into several different segments (e.g. traditional students, nontraditional students, etc) and to identify the needs from each segment. Diverse information collection approaches such as interview, focus group and survey could be used. Once those needs are identified, the institution needs to check whether the OE is aligned with the institution's long-term strategic goals or not. This is particularly important when the entire program-wide OE is considered. For example, many baccalaureate institutions have consistently reported the most negative opinions toward OE [3]. Without this strategic alignment, it will be difficult for the OE development plan to have full support from the organization and senior leadership. It is also important to evaluate faculty and student's acceptance rate of OE. Some faculty members do not recognize the value and legitimacy of the OE. They believe that OE could not deliver the same quality of education as in the face-to-face environment regardless of the enabling technologies and teaching methods. The online acceptance is a complex issue related to many educational theories and stakeholders' personal characteristics. Hence before undertaking any OE development plan, it is important to understand diverse opinions and interests from stakeholders and to reduce the gap between them. According to Sloan survey (2009), the faculty's acceptance rate for the OE slightly increased from 28% in 2002 to 31% in 2009 whereas the negative perception decreased from 28% to 17% in the same period. However, majority of the surveyed still remained neutral.

The second group of the considerations, *capability analysis*, summarizes your organization's capability in terms of the resource and technology. Unlike the face-to-face education, the successful OE requires well coordinated support from diverse resources to design, develop, deliver and maintain the contents. These resources include the faculty, content development supporting staffs, technical supporting staffs, and quality assurance (QA) staffs. The OE typically uses more visualized multimedia-oriented teaching materials to increase the learning effect and the development of these materials sometimes requires significant technical skills beyond faculty's knowledge in the discipline. The technical support resource is to provide all technical supports and services to faculty and students to guarantee their accessibility to the online course platform (OCP) – the software that provides the virtual classroom service. For example, the seamless accessibility to this online course platform is a basic requirement. Hence some for-profit universities provide 24/7 technical service for this. The QA resource is responsible for developing and applying the quality standards for teaching environment (e.g. course materials, faculty-student interaction etc) to improve the quality of education. Technology analysis refers to all activities to prepare the infrastructure for the successful

OE. It includes the selection of the online course platform, online connectivity improvement, and relevant hardware and software development and maintenance. The online course platform (OCP) is the course management system which provides a virtual classroom service to faculty and students. There are three different types of the systems: commercial software (e.g. WebCT, Blackboard, and Prometheus), Open source software (e.g. Moodle) and the locally developed software (e.g. Stellar at MIT, CourseWork at Stanford University). The selection may depend on the cost and features of the systems as well as the scope of contents delivered online (e.g. hybrid or online).

Once the analysis for the first two groups is done, the project management level considerations are analyzed. The popular triple constraints (i.e. scope, time, and budget) are to be considered at this time. The scope (e.g. what courses and how many courses are considered for online in the discipline? what level of visualization is required in the courses?) needs to be decided first. Then, the time – duration required to complete the planned scope – is usually estimated in terms of semesters and/or quarters, and the budget requirement is estimated at rough order of magnitude (ROM) level. The plans for marketing and training for faculty, staffs and students should be also developed. The course designers and developers must recognize the importance of the training here. The training for legal issues (e.g. copy right law) should be included in addition to technical issues. The quality assurance (QA) activities define and address the standard for online materials, teaching evaluation development, faculty responsiveness for student feedbacks, and quality improvement plan as part of the continuous improvement.

Table 1 summarizes the sample questions to support the framework in Figure 10. These questions could be used to collect and analyze the information related to the framework. The sample questions are developed with considerations of all four stakeholders and could be used at all three levels. Each organization may customize them based on its need. Suppose that an organization provides both face-to-face and online options. Then, authors believe that there may be strong interaction between the demands from these two options. For example, it may be rare that the new online program or course has strong demand when the equivalent face-to-face program or course has weak demand from the local students. Hence this interaction should be considered in the marketing strategy and scope of OE. That is why authors put the question "Does the face-to-face class have consistent demand?" in the Need analysis.

Table 1. List of Sample Questions to be Asked

Factors	Discipline	University	Faculty	Student
Need analysis	• Who are the main target students? • Does the face-to-face class/program have consistent demand? • Are the discipline, programs, partial programs and courses appropriate for OE? • How does OE help your students, faculty, university and discipline?			
Strategic alignment	• How does this relate to the long-term strategy and goals of the Division/School/University? • Does OE have strong support from senior management?			
Online acceptance	• Do faculty and students recognize the value of OE? • Do faculty and students think OE is comparable to face-to-face? • How to maximize the advantages of OE? • How to minimize the disadvantages of OE? • Does faculty prepare to learn new tools and teaching methods? • How to overcome the negative perception if any			
Resource analysis	• How to secure additional faculty? • Does institution have enough staffs to support OE content design, development and maintenance with faculty? • How to secure additional staffs? • What is the current IT maintenance lead time and how to reduce it based on demand increase?			
Technology analysis	• Which OCP is considered? • How to evaluate the OCP? • How to increase the campus-wide online accessibility if needed? • How to increase the reliability, security and user-friendliness of OCP?			
Triple constraints	• What/how many courses are considered for online? (scope) • What visualization methods and techniques are considered? (scope) • How to secure additional budget for OE development, implementation and marketing (budget) • Does organization provide compensation for online content development? (budget) • When to provide the OE? (time) • Is the scope feasible in terms of budget and time?			
Marketing strategy	• How to advertise this? • What media are considered for advertisement?			
Training	• What trainings are needed? • Are the technical staffs trained sufficiently enough to provide the trainings to faculty? • Legal and ethical issues are prepared? • Is the training environment realistic enough? • How to provide the training for students?			
Quality assurance (QA)	• Does the organization have a standard procedure for QA? • Is teaching evaluation appropriately updated? • How to connect QA to the continuous improvement plan?			

VII. Discussion of Framework Development and Application

In this section, the authors briefly describe the experience of the Engineering Management online program development at University of Houston-Clear Lake, which drove the development of EMOEF. The EM program at UHCL was established as a master level program based on the requests from CEOs of the local companies in the fall 2007 with few local resident students. The school is located in Clear Lake, the southern Houston area which is well-known for its aerospace industry cluster based on National Aeronautical Space Administration Johnson Space Center (NASA-JSC) and its contractors such as Boeing, Lockheed Martin, and Honeywell, SAIC etc. The program grew with around twenty students in Fall 2008 and more than thirty students were enrolled in Spring 2009. The majority of its students are working professionals from nearby industries with few international students.

The senior leadership of the university made a strategic decision to add online components to several existing programs in 2008, and EM was one of those programs. To support and implement this strategic decision, the project team was established. The team consists of faculty members from those programs selected, online program supporting staffs from the university information technology supporting department (UITSD) and the online program director (OPD). As a short-term goal, the school intended to increase the demand by providing easily accessible quality OE programs to the local working professionals. As the intermediate and long-term goals, it intended to extend its current student spectrum using OE by attracting more distance learners, as well as international students. These goals are well aligned with the university's mission statement: "The University of Houston-Clear Lake is a student-centered, community-minded, partnership-oriented university that offers bachelor's, master's and selected doctoral programs to enhance the educational, economic, and cultural environment of the Houston-Galveston metropolitan region". As part of the project team, the faculty in EM has strong experience with OE in terms of teaching methods and technologies, and recognizes the value of the OE when it is appropriately developed and delivered to the right students. Following the student survey conducted, it was discovered that many current students preferred the face-to-face offering, but would like to selectively choose the online course depending on their working schedules. Hence, faculty members decided that OE could trigger more demand from local residents by providing another convenient channel while it still has a chance to attract more distant students too. To be aligned with this need analysis, the EM program decided to offer both online and face-to-face sections simultaneously for most courses. This decision required an additional full-time faculty member.

The project was well supported by the Office of the Provost in terms of resources and technology. Hiring a new EM faculty became a high budget priority. Also faculty members who design the courses could work together with their counterparts in UITSD any time during the development cycle. The Provost's Office also prepared the budget for the faculty compensation for online course development and the OCP upgrade. In terms of the technology, WebCT was initially selected, and it was upgraded to the Blackboard later.

Since each program has its own unique characteristics and different online acceptance rate, the online program development schedule may be different from program to program. The EM program requires 10 graduate level courses for master degree and has the hybrid curriculum from several disciplines such as business, systems engineering and software engineering. Since the business courses from the School of Business were already offered online, the EM program needed to develop only six EM online courses. The EM faculty proposed the five semester schedule from summer 2008, and planned to provide the 100% online master program from Fall 2010. This schedule was collaborated with all project stakeholders through the OPD.

In the beginning of the online program project, all faculty members were trained for WebCT, copyright law and online ethics. Then the faculty developed the syllabus and learning modules with the support from the UITSD. The UITSD provided very diverse technical supports (e.g. video streaming technology for lecture and WebCT/Blackboard customization based on faculty's request). At the end of the development cycle, the online program director conducted the QA activity based on the predetermined online program quality standard. Based on the results, the compensation was issued to faculty members. The university also advertized the new 100% online EM master program in parallel with the face-to-face program. Diverse advertizing media were used including the university website, university's open house events, local education program fairs, on-campus invitation for human resource representatives from local companies, and online education fair using online social networks (e.g. Facebook). It is important to recognize that the collaboration between the program faculty and the marketing representatives is very important, since students always want to hear the direct voices from the program faculty. Through this collaboration, faculty could increase the opportunity to meet with the prospective students directly.

Through the collaborated team works, the enrollment of EM and other programs with the online option significantly increased in fall of 2010. In case of

EM program, the number of domestic applicants almost tripled including four applicants to the 100% online program. It was also noticeable that the number of international applicants almost doubled in this period. Faculty also noticed that many local students who chose the face-to-face master program registered for online courses to manage their schedules particularly when they took multiple courses. Authors believe that although there may be several external and internal factors that have positively contributed to the significant demand increase in the program, the online option in parallel with the face-to-face option was one of those success factors. Authors also recognize the value of the well collaborated, systematic workflow within the UHCL, which leads to the development of the EMOEF.

VIII. CONCLUSION

The purpose of this research was to take a snapshot of the state of online education within programs that award either an Undergraduate or Graduate degrees in Engineering Management, and according to the results obtained, develop a framework that could be utilized by academic institutions who wish to expand their programs via online education. According to the analysis of one hundred colleges and universities, a Masters degree in EM surpassed either a Bachelors or a Doctoral degree in all three mediums (live, hybrid and fully online). When comparing hybrid and fully online degrees, the difference of percentages between Master's and Doctoral programs was vast in fully online degrees. Even though this study is not a longitudinal study, therefore the results do not indicate a *trend* per se, it can still be concluded that either a fully online or a hybrid degree is now the choice that is on demand.

The Engineering Management discipline is a constantly evolving, dynamic discipline; adapting to the current needs of both industry and academia. The schools that offer either undergraduate or graduate degrees in EM may adhere to certain standards in order to ensure the continuous improvement of both the discipline and the academic program. One of the main standards is the ASEM Certification Standards, developed in 2002 for the purpose of recognizing quality within EM Master's programs [14]. Out of the hundred schools surveyed in this study, five schools have been certified: Stevens Institute of Technology, Old Dominion University, Missouri University of Science and Technology (formerly University of Missouri-Rolla), St. Cloud State University and George Washington University. Both fully online and hybrid education are important components that may contribute to the success of an EM department. The inclusion of online education within the certification standards may be considered in the future. Another future research area is the efficiency and effectiveness of the hybrid and fully online degrees from both the faculty and student perspectives. EM programs that newly start offering fully online degrees have the perfect opportunity to measure student and faculty success and satisfaction through questionnaires. Studies that compare face-to-face and online classes that specifically focus on EM programs also can find support from different industries in which most students work.

The non-traditional class delivery system, whether it is a fully online program or a hybrid program, is a suitable fit for the student profile of Engineering Management. Since the degrees are oriented towards professionals working in the industry, the flexibility provided by this type of delivery is one of the main strong points to be considered. The use of current technological advances such as video conferencing tools also provide means for collaboration between faculty members and students who are not within the same geographical area. Eliminating geographical and physical boundaries will allow disciplines such as Engineering Management to more forward and also enhance the opportunities to contribute to the Body of Knowledge.

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