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A Case Study Using Systems Theory For Understanding The Institutionalization Process Of Engineering Certificate Programs In A Public Texas University

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A CASE STUDY USING SYSTEMS THEORY FOR UNDERSTANDING
THE INSTITUTIONALIZATION PROCESS OF ENGINEERING
CERTIFICATE PROGRAMS IN A PUBLIC
TEXAS UNIVERSITY

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Michele Carolynn Williams

2018

DEDICATION

To my son George and my daughter Sofia, who immensely inspire me every day. Love you!

To my nephews, Rodolfo and Eduardo who remind me to have fun, and that life is too short.

To my nieces Alyssa, Samantha and Lexi, who make me want to be a worthy role model, a kind mentor, a fierce protector, a loving godmother, and an awesome Tía...

Love you all!

A CASE STUDY USING SYSTEMS THEORY FOR UNDERSTANDING
THE INSTITUTIONALIZATION PROCESS OF ENGINEERING
CERTIFICATE PROGRAMS IN A TEXAS
PUBLIC UNIVERSITY

by

MICHELE CAROLYNN WILLIAMS, BS, M.Ed, MS

DISSERTATION

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The University of Texas at El Paso
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of the Requirements
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Department of Educational Leadership and Foundations

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ABSTRACT

A case study involving practices supporting the institutionalization process of graduate engineering certificate programs in a Texas public university, and the factors that influence their institutionalization was viewed through a systems theory lens. Although certificate programs have increased in popularity, research on the topic has to date been limited. Engineering certificate programs have served as a convenient mid-career educational niche model for closing gaps between technological knowledge growth and professional practice know how. The data was collected in eighteen semi-structured interviews, along with document reviews and observations. Organized in three themes, the data analyses yielded a list of practices and impact factors. The themes were: certificate rationale; program buy-in and advocacy; and capacity building. The findings showed polarized views regarding the academic value of certificates, due to their purpose being incongruent with research merit. Faculty commitment at all levels of the organization was crucial to the continuity and sustainability of certificate programs. Importantly, successful initiation and implementation occurred when a single faculty program advocate championed certificate creation and rallied the support needed for proposal approval, along with new course preparation and instruction. Institutional recommendations for policy and practice include ensuring clearly established administrative leadership, and encouraging programs to offer both face-to-face and online formats, as these were most successful. Future research engaging stakeholders, including certificate program alumni, is suggested.

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CHAPTER ONE: INTRODUCTION

Background and Rationale for the Study

This research reports a case study for understanding the process of institutionalization of graduate engineering certificate programs at a Texas public university, through the application of systems theory. For the purpose of this dissertation, the Texas public university is referred to as 'The University'.

Educational Demands for Engineering Professionals

Providing engineers with academic opportunities is crucial to advance their technical competitiveness. Career challenges of the 21st century stem from the demands of the global economy necessitating for more competitiveness in engineering innovation (Feller, 2011). The most salient career challenges for engineers include social responsibility, endangered environment, working and communicating in globalized markets, multidisciplinary technological developments, and the increased proliferation of information (Rugarcia, Felder, Wodds, & Stice, 2000). Galloway (2007) stresses the importance for engineers to complete their Master's degrees due to the inadequacy of Bachelor's programs in engineering today. Bachelor's degrees require on average of 128 credit hours, when in the late 1990s these required at least 140 credit hours. In addition to the lower credit hour requirement in Bachelor's degrees, it is estimated that most engineering content becomes somewhat obsolete within two years, due to technological advances (National Academy of Engineering, 2016). Furthermore, in the US, only about 6% of all Bachelor's degrees are in science or engineering (Hrabowski III, 2013) when the job demand exceeds 20% in Texas alone (Academy of Medicine, Engineering & Science of Texas, 2008). With a shortage of engineers, their salaries have increased; averaging from \$70,000 to \$86,000 annually (National Academy of Engineering, 2016). As a consequence of the supply and

demand gap, non-technically educated workers are filling in for the technical employment gap (National Academy of Engineering, 2016). In other words, non-engineers are employed in technical engineering jobs. Due to the market demands in engineering careers, “it is incumbent upon institutions of higher education to transform engineering education in a sound and insightful way to prepare students for the challenges ahead” (Benson, Becker, Cooper, Griffin, & Smith, 2010, p. 1042). Colleges and universities must strategically create educational opportunities to close the engineering industry demands and knowledge gap for engineers to succeed in their practice (National Academy of Engineering, 2016). According to Tryggvason and Apelian (2006), entrepreneurial engineers must “know everything”, “be able to do anything”, “work with anybody anywhere”, “to make imagination a reality” (p. 16). Lastly, regarding engineers in leadership roles, “graduates do not have the broad background necessary to understand, take charge of and drive large-scale projects to completion in an economic fashion” (Gordon & Silevitch, 2009, p. 18). Consequently, these examples, bring the topic of graduate certificate programs as a possible solution to the educational needs for engineering graduates.

Graduate Certificate Programs as a Viable Educational Model

According to Reed and Stanchina (2010), graduate engineering certificate programs provide professional development opportunities to enhance technical background while addressing challenges of a competitive market. A certificate program is referred to as a program wherein certificate is earned upon the successful completion of prescribed coursework in a college or university (Carbone & Gholston, 2004). A certificate program is designed to provide a competitive advantage to professionals that may have time or financial limitations for pursuing a full degree (Murray, Long, Elrod, & Akula, 2011). Typically, these non-degree programs require

about half the credit hours needed to complete a Master's degree program and have less admission requirements (Singh & Hamada, 1996).

With advances in technologies and the need to better prepare engineers, graduate certificate programs in engineering have increased their popularity nationwide in the last decade (Murray et al., 2011). As indicated in a national report, at least 15% of college graduates complete a certificate program (Carneval, Rose, & Hanson, 2012). According to the report, employees with the highest education and income levels get the least number of certificates; around 10%. Also, because certificates are typically serving mid-career education, the age of enrollees is about 18% between the ages of 30-39 and 16% at age 40 or above (Carneval et al., 2012). As the popularity of certificates advances, research focused on certificate programs can serve as a guide to assist university administrators making decisions to implement certificate programs effectively. Even more critical, is the fact that these academic programs will fail to achieve core outcomes if they are not effectively initiated and sustained (Braxton, Luckey, & Helland, 2002).

The literature reviewed provided insights into the functional definition of institutionalization used for measuring academic program success. Institutionalization is a concept that helps explain organizational change. Specifically, institutionalization refers to the process whereby a new reform or program –in this case, engineering certificate programs– becomes integrated and sustained in an institution (Curry, 1992; Goodman, McLeroy, Steckler, & Hoyle, 1993; Slaghuis, Strating, Bal, & Nieboer, 2011; Swerissen, 2007; Yin, 1979). While the literature clarified the terms used to define the process of integrating programs in institutions, it was unclear how these new graduate certificate programs become institutionalized. Few studies offered practical insight beyond the certificate program rationale and initial

implementation (Reed & Stanchina, 2010; Singh & Hamada, 1996). Reviewed studies typically presented approaches to surveying certificate market demand (Carbone & Gholston, 2004; Vickers & Kisenwether, 2007); program course content (Gordon & Silevitch, 2009; Rosado, Sanchez, Mellado, & Medina, 2015); evaluating existing programs (Murray et al., 2011); and certificate worth, in terms of securing employment (Carneval et al., 2012). Consequently, this study provides value in focusing upon and addressing practical matters that influence the continuity of certificate programs at one university.

The University has created numerous certificate programs. Some of these programs have succeeded and others have become dormant or failed. A case study at The University can aid program faculty and administrators charged with creating and sustaining certificate programs and help them to do so more effectively. In turn, engineering students will have access to the educational opportunities needed to remain competitive in a very dynamic field. To meet long term student needs, certificate programs at The University have to not only exist but persist. Listing certificate programs in the catalog is not enough. Certificate programs must be sustained and managed to be useful to the students.

Understanding institutionalization of certificate programs at The University

In order to prepare students to meet lifelong intellectual, ethical, and career challenges in the 21st century, academic programs need to be created, revised, sometimes replaced and eliminated. In colleges and universities, new academic programs are offered, and while some thrive, others may be phased out (Curry, 1992; Seymour, 1988). According to The University records, forty-three graduate certificate programs have been added to the academic catalog, the majority being added the last decade, between 2008 to 2018. Additionally, 21% of these certificate programs were in the field engineering, and four of these were created within the last

four years. Understanding the institutionalization of new educational programs can guide and expedite implementation and promote success of such programs while optimizing resources (Shediac-Rizkallah & Bone, 1998).

The literature on creation of certificate programs and how they became integrated and were sustained by institutions is limited (Carneval et al., 2012). Most of the literature regarding certificate programs described new certificates, alignment to industry demands, and only a handful provided some insight into the institutionalization process. Seymour (1988) noted that research and writing in higher education has not concentrated on the creation of new programs but rather on how to assess or evaluate ongoing programs. According to Schofer and Meyer (2005), research in higher education program expansion may have often times been ignored and even been taken for granted, due to the nature of institutionalization. Explanatory research in program institutionalization has not been extensive (Schofer & Meyer, 2005).

Many challenges arise during the process of institutionalization of a program in any university (Barlett & Chase, 2004; Garrison & Vaughan, 2013). For example, one of the greatest challenges is resource allocation needed to sustain such programs (Evashwick & Ory, 2003; Seymour, 1988; Shediac-Rizkallah & Bone, 1998). Often times, new academic programs in higher education have been implemented with the support of additional external funding, referred to as ‘soft money’ – and then cease as soon as the funding support ends (Evashwick & Ory, 2003). However, some new programs become fully institutionalized and sustained beyond external funding, using ‘hard money’, in this case, supported by a state budget. Upon review of the Handbook of Operating Procedures for The University’s academic affairs, one finds that the approval process of new academic programs is fairly straightforward (See Appendix A). Approval of proposals is expedited, as long as the program proposal does not require additional

university resources (Singh & Hamada, 1996). As shown in Appendix A, the formal process steps for seeking a new certificate program proposal were clearly written. However, it was the practices needed to advance from one step to the next that were unwritten, but realized by the faculty and administrative actors involved. A university is a social organization where there are legitimate, formal processes and informal, legitimized practices (Kezar, 2001). This study focused on precisely these legitimized practices that describe how graduate certificate programs become institutionalized. As an example of such factors, a more influential faculty member leading a program approval process would secure approvals and produce overall better outcomes (Curry, 1992). Therefore, it was important to gain an understanding of not only the written formal process, but additionally the unwritten practices used to guide practitioners in similar tasks. Furthermore, contrary to the program approval process, it is difficult to predict, and therefore plan, for the approval of funds and resources needed to sustain such programs. The problem of sustaining initiatives beyond soft money is not rare (Evashwick & Ory, 2003), yet one that deserves attention. The literature reviewed was sparse in providing solutions or even insights into the problem of how to support programs beyond their approval process. Studying the factors surrounding the institutionalization process at The University can shed light on strategies used to address any challenge in support of certificate programs.

Summarily, universities institute a wide variety of engineering graduate programs in order to better prepare engineers for the career challenges of the 21st century (Feller, 2011; Galloway, 2007; Vest, 2005). Certificate programs have become a popular educational model for mid-career engineering professionals. Understanding the institutionalization of graduate engineering certificate programs at The University can more strategically expedite education to engineering professionals. Additionally, shedding light on the factors that influence the process

of program institutionalization is crucial for decision making when creating and sustaining educational programs in the engineering field. It is crucial to expedite engineering educational programs as a response to market needs (Rugarcia et al., 2000). Furthermore, although this study is limited to one institution, the lessons yielded can be considered as a guide for helping to create successful new programs at other institutions. Lastly, engineering certificate programs will continue to be created as the communities served and technological advances demand them (Reed & Stanchina, 2010).

Definition of Terms

I relied on the following central concepts throughout the dissertation, which are defined here for purposes of clarity.

Certificate program – is referred to an educational model awarding a certificate upon the successful completion of prescribed coursework in a college or university (Carbone & Gholston, 2004).

Institutionalization – is a concept that refers to the process whereby a new reform or program –in this case, engineering certificate programs– becomes permanent and sustained in an institution (Curry, 1992; Goodman, et al., 1993; Slaghuis, et al., 2011; Swerissen, 2007; Yin, 1979). In Chapter 2, I expand on this definition provided by the perspectives from different scholars.

Systems theory approach is referred to as an explicit perspective of studying the institutionalization process, a complex dynamic system, with interdependent and interacting elements, that when synthesized, provide a unified view of the whole (Ackoff, Addison, & Curley, 2010; Forrester, 2016; Jackson, 2006; Kim, 1999; Kossiakoff, Sweet, Seymour, & Biemer, 2011; Senge, 2006).

Sustainability – is referred to as a multidimensional, multi-factorial, dynamic process regarding program benefits, continuation, permanence, adaptability, and endurance, while partly constrained by the hosting institution (Evashwick & Ory, 2003; Pressman & Wildavsky, 1979; Shediak-Rizkallah & Bone, 1998; Shocker & Sethi, 1974; Swerissen, 2007).

Purpose of the Study and Research Questions

The purpose of this case study was to understand how graduate engineering certificate programs are institutionalized at a Texas public university. Institutionalizing new educational programs is a rather lengthy and complex process (Goodman & Steckler, 1987/1988; Shediak-Rizkallah & Bone, 1998). The institutionalization process of new programs in institutions of higher education is neither new nor rare. However, the institutionalization process of new graduate certificate programs in higher education has occurred mainly since the 1990s (Carbone & Gholston, 2004). The study focuses on the supporting practices, and factors that influence the institutionalization of new programs, with special emphasis on engineering graduate certificate programs. The following were the research questions for the study:

- 1) What does the process of institutionalization look like for engineering graduate certificate programs at The University?**
- 2) What factors influence the institutionalization process of engineering graduate certificate programs at The University?**

It is important to clarify that with these research questions, the intention was to capture the legitimized rituals or accepted informal practices of the institution (Kezar, 2001). Here I am referring to the current practices and decisions that may not be documented and therefore are of a more informal nature. I viewed any interpretation deviating from the written formal policies and

procedures as an informal practice: gaining insight into any impacts that challenge the process can inform decision-making and expedite the creation, approval and sustainability of new programs.

Summary

In engineering, with the tremendous technological advancements, and the inadequacy of undergraduate programs (Galloway, 2007; Gordon & Silevitch, 2009; Rugarcia et al., 2000), universities have instituted a wide variety of graduate programs in order to better prepare engineers for the career challenges of the 21st century (Feller, 2011; Galloway, 2007; Vest, 2005). Certificate programs have gained popularity as a graduate level educational model for engineers to address career challenges due to technological advances (Reed & Stanchina, 2010). Their popularity is due to the shorter completion time, lower admission requirements, employment appeal, and content alignment to professional practice (Murray et al., 2011). There are several advantages provided in offering certificate programs to engineers. The students gain skills in an engineering discipline while employers get access to better prepared professionals. The University offers nine graduate certificates in engineering, the focus of the study. Understanding how these programs are institutionalized can aid administrators to strategically expedite new programs at The University to more adequately respond to market demands in the dynamic engineering field.

Research has been limited on how to institute new academic programs (Schofer & Meyer, 2005) and focused mostly on program evaluation (Seymour, 1988). This research involves a case study for understanding the process of institutionalization of graduate engineering certificate programs at a Texas public university, applying systems theory. The overarching research question is: How are engineering graduate certificate programs institutionalized at The

University? The purpose of this research is to make sense of the informal, legitimized practices and factors dealing with institutionalization of graduate certificate programs in engineering.

CHAPTER TWO: REVIEW OF LITERATURE

The literature review is divided into five sections focused on the phenomenon of institutionalization of engineering programs in The University: (a) background, (b) synopsis of relevant research, (c) theory, (d) conceptual framework, and (e) summary of the literature. These sections reflect a gradual narrowing to the focus of the dissertation. Figure 2.1 shows a thematic concept map of the main sections reviewed in the literature.

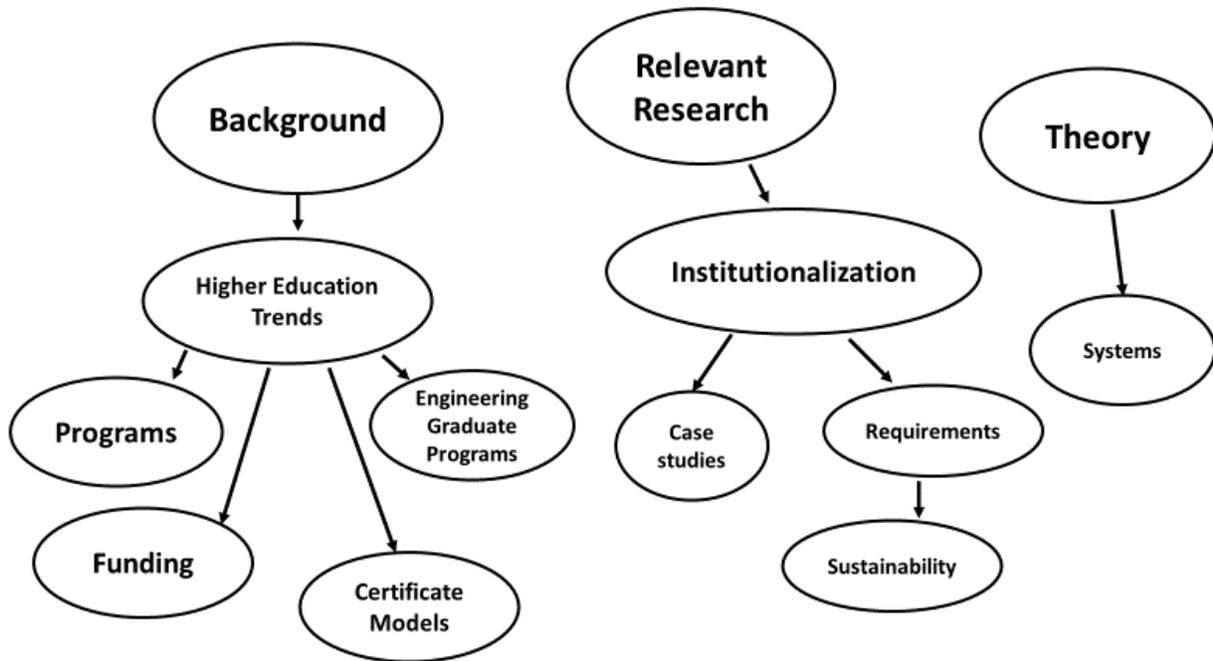


Figure 2.1 Thematic concept map of literature reviewed

Background

To introduce the literature, this section begins with a description of the historical setting surrounding the case. The topics addressed here are: a brief history and trends in program demand; trends regarding graduate engineering education; the rationale for certificate programs; relevant studies; and lastly, funding challenges impacting program sustainability.

Trends in demand for new programs in higher education

Worldwide, from the year 1900 to 2000, tertiary students increased from 500,000 to 100 million, or from 1% to 20% of college-age people (Schofer & Meyer, 2005). The US had significantly more gains than others in student enrollment, new programs, and institutions (Schofer & Meyer, 2005). Nationwide, Gumport et al. (1997), Cahalan and Perna (2015) show in their national reports a general massification and upward trend for students enrolling in degree-granting higher education institutions. Their studies show that from the 1950s to the 1990s, enrollment grew five times (Gumport et al., 1997). Gumport et al. (1997) provided reasons for such an upward trend in enrollment or massification: expansion of the middle class; the GI Bill; increased women and minority rights; increased part-time students; and increased federal dollars to fund research, and thus the need for additional doctoral programs (Rincon & George-Jackson, 2016). The process of massification in higher education basically meant that education is also for the masses and not just for an elite group of Americans. As a result of this massification of public higher education and additional funding for research, institutions grew into complex organizational structures (Ackoff et al., 2010).

Although institutions continued to expand after massification, from about 1975 to late 1980s, their growth rate was much slower and entered to a maturation phase (Gumport et al., 1997). Similarly, the student body also diversified to include more women, minorities, former military, part-timers and distance learners (Gumport et al., 1997). The most significant trend during the maturation era would occur in the diversity of the student body, in the rates of part-time enrollment, and in the cost of college tuition, setting the stage for the trends that appear in the current post-massification era.

With the increase of enrollment, public institutions experienced the most growth: growth in number of institutions, institutional capacity, and general expansion of programs at all levels (Gumport et al., 1997). As of May, 2014, the US Department of Education reported a total of 4,726 degree-granting institutions (Cooley, 2015). In the fall of 2013, public institutions accounted for 76% of national enrollment (Cahalan & Perna, 2015). Although there was an increase of new programs in institutions, very limited literature was found regarding the creation of such new programs and how they became an addition to the institutions (Seymour, 1988). Seymour (1988) concurred that research and writing in higher education have not concentrated on the creation of new programs but rather on how to assess or evaluate the ongoing ones.

Graduate level engineering education

The worldwide expansion of science in the past two centuries, or scientization, has been an important trigger in the massification trend in higher education (Schofer & Meyer, 2005). Scientization increased the utility of higher education programs, when linking university knowledge to work practice, both at the individual and organizational levels (Schofer & Meyer, 2005). Emerging technologies and industry demand adequate preparation of engineers at all levels (Vest, 2005). Engineers are increasingly and intimately creating and shaping a multidisciplinary, multi-faceted and highly-integrated world (Sheppard, Pellegrino, & Olds, 2008). This is due to the new developments in nanotechnology, biotechnology, material science, and photonics (technology for harnessing light), as carrying potential for prolonging healthier lives and improving human living conditions overall, and therefore, “engineering and engineers have never mattered more” (p. 231).

Because the engineering skillset requirements and work environments are continuously and rapidly changing, engineering educational opportunities must be continually redefined

(Redish & Smith, 2008). Furthermore, in redefining educational opportunities, online course delivery options can provide closer alignment to student needs, based on their profiles, travel demands and workloads (Hall, Jones, Amelink, & Hu, 2013). The ongoing technological advances warrant colleges and universities to offer a variety of educational models to enhance graduate engineering education (Vest, 2005). For example, at The University, the College of Engineering encompasses 7 distinct undergraduate programs, whereas there are 19 distinct Master's degree programs, 9 graduate certificate programs, and 8 doctoral degree programs. It is at the graduate level where The University provides a greater variety of engineering specializations within three graduate level educational models. The majority of the certificate programs have been created between 2013 and 2018 and close to half are offered with online delivery.

Additionally, Mulder (2006) stresses that as engineers take on leadership roles, they lack political rationality due to their technical and scientific focus. Furthermore, because demands of the society are dynamic (Mulder, 2006), and decision-making requires a more multidisciplinary approach, engineers require training to generate social solutions, along with technological ones (Hrabowski III, 2013; Vest, 2005). As engineers assume entrepreneurship and leadership roles, different non-technical skills are required, such as for people and project management (Rugarcia et al., 2000; Singh & Hamada, 1996; Tryggvason & Apelian, 2006). In summary, it is crucial that institutions of higher education provide academic opportunities for engineering graduates to advance their professional development. This is essential to meet career challenges due to technological advances and societal demands, and to improve competitiveness.

Rationale for Graduate Certificates in engineering

There are multiple reasons for students to enroll in certificate programs. Regardless of whether students have already earned a graduate degree or not, by earning a certificate, students enhance the breadth of their studies, increasing their appeal to potential employers (Carbone & Gholston, 2004). This is especially true within the engineering field, due to the rapidly growing technological advancements (Benson et al., 2010). Additional courses in a certificate format provide professional development opportunities in order to remain competitive (Reed & Stanchina, 2010). For working engineers, the certificate model “fills a void in the education of graduate engineers, most of whom are employed at the time” (Singh & Hamada, 1996, p. 114). Similarly, students enrolled in a certificate program may explore a field of study prior to the commitment of a full Master’s degree or become incentivized to do so (Reed & Stanchina, 2010). Daughton (2007) adds that from the student’s perspective, the graduate certificates serve as a safe way to explore graduate programs while avoiding the trauma of admissions exams, such as the Graduate Record Examination (GRE) admittance exam. For working professionals, the idea of having to take a test and starting a full Master’s program may be too much, especially if they have been out of school for a number of years. But the idea of easing into a short graduate program is very appealing. Furthermore, certificate students without having taken the GRE exam perform the same or better than Master’s students, who have taken the exam (Daughton, 2007). For example, with the purpose of helping engineers develop the leadership mindset to succeed within their organizations, Northeastern University created an Engineering Leadership certificate program, with a one-year long project requirement (Gordon & Silevitch, 2009). The purpose of the project requirement was for students to practice the theory, similar to a medical internship.

Certificates attempt to close the skills gap between market practice demands and workforce readiness (Murray et al., 2011).

A graduate certificate is not a certification. Certificates are different than other labor market credentials. These are often confused with industry-based certifications (Carneval et al., 2012). A graduate certificate is a form of acknowledgement by the institutions of higher education that the student has completed a set of courses in a specialization area. It is a post-baccalaureate education model that addresses technical training while connecting to engineering practice (Reed & Stanchina, 2010). A certification is an industry-based license that is typically earned with the successful completion of training, an exam, and practical experience (Carneval et al., 2012). Depending on the field of work, certificate holders working in their trained fields may earn a lot more than with the Bachelor's degree alone (Carneval et al., 2012). In electronics, for example, certificate holders can earn 48% more than those with only a Bachelor's degree. Similarly, in computer and information services, certificate holders earn about 59% more than those with only a Bachelor's degree.

Colleges and universities in the US offered over 2,000 graduate certificate programs to an estimated market of 40-50 million students (Murray et al., 2011). In the US, certificates serve as a mid-level education credential, as 12% of the professionals earning certificates have earned a Bachelor's and 3% have also earned a Master's degree (Carneval et al., 2012). Besides providing benefits to students, certificate programs also provide benefits for the departments of colleges and universities that offer them (Murray et al., 2011). Murray et al, (2011), stated that "Unlike degree programs, certificates require far less bureaucratic red tape often seen in university settings" (p. 51). Also, unlike degree programs, departments retain administrative control of certificate programs and sometimes serve as a revenue stream (Murray et al., 2011). Based on the

literature reviewed, the rationale for adopting the certificate program model for graduate engineering education involves the benefits to not only students, but also to colleges or universities offering them, and industry employers.

Review of empirical studies

In this section, a review of different empirical studies builds a cumulative picture of how certificate programs are conceptualized to provide educational opportunities, and the lessons learned about the steps to institutionalization.

Certificate program in construction engineering and management. According to Singh and Hamada (1996), certificate programs have merit, and that good program management is required for their successful implementation. In their article, they described in detail the long process and criteria required in preparing, approving and managing the new certificate program. Similarly, they claim that certificate programs have merit in addressing market demands. To better prepare local engineers, The University of Hawaii in Manoa created a certificate program in construction engineering and management (Singh & Hamada, 1996). Experienced engineers hired from the US mainland could not afford to live in Hawaii, and would leave within 2-3 years. This turnover was very disruptive to construction projects. The high turnover prompted the General Contractors Association to partner with the university to find a solution. They surveyed demand and industry needs, and a 15-credit hour certificate program was the best option. The admissions and completion requirements were the same as for their Master's degree programs, such as prerequisites and overall minimum grade point average. The reason for this was to easily transfer completed certificate courses to a Master's degree plan. Because of budget cutbacks, the program proposal would require no new faculty or other resources. This decision was made to maximize chances of approval. In partnership with local industry, a certificate program was

designed to provide benefits for students, local industry and the university. The article offered some insight into the challenges the faculty faced in establishing the new certificate. Some challenges were related to assessing needs, funding, and getting the program approved. This article provided insight into the process of establishing a new certificate program, but lacked the insight into the long-term sustainability and institutionalization process, as defined in the literature.

Online course redesign for a certificate program in nuclear engineering.

In 2007, Virginia Tech responded to immediate needs from the nuclear engineering industry, with undergraduate and graduate courses (Hall et al., 2013). In their article “Educational Innovation in the Design of an Online Nuclear Engineering Curriculum”, Hall, et al. (2013) describe the development and implementation phases of online courses for a graduate certificate program at Virginia Tech. Because most students worked in remote nuclear facilities, their travel requirements, workloads and poor teleconferencing transmissions, an asynchronous online certificate program provided an ideal educational model responsive to their needs (Hall et al., 2013). The course redesigns for online included a research-based approach in aligning content delivery with students’ profile, prior knowledge, and their course expectations. This article described in detail the factors considered when redesigning the courses for online, such as lifecycle model, motivation, and use of technology. This was an example of how a university uses the certificate educational model to best address the student needs while responding to very specific engineering industry demands.

A certificate program that aligns research with critical education needs.

An article by Reed and Stanchina (2010) about an eight-course engineering graduate certificate designed at The University of Pittsburg, included research components. The program

began with strong industry collaboration, that quickly developed into funding support. The certificate program prepared students in smart grid technology integration. The program employed experts in the field to teach as adjuncts, while tenure track professors focused on integrating research in the program.

Instituting an interdisciplinary graduate certificate program.

A graduate certificate in healthcare policy and management was launched to prepare healthcare administrators from diverse backgrounds, such as medicine, engineering, law, and business (McFadden, Chen, Munroe, Naftzger, & Selinger, 2011). The focus of the certificate program was to expose healthcare leaders to a variety of perspectives as they explore healthcare issues through the lens of different disciplines. The study provided a detailed method for launching an interdisciplinary program. There were three stages to instituting the certificate program: (1) Needs assessment by surveying healthcare administrators, (2) Program design and (3) Course development and marketing of program. To confront the complexity of healthcare problems more effectively, the program encourages students to engage in systems thinking. Additionally, the courses were team-taught by faculty from four different disciplines. While this was an example of a certificate program focused on healthcare rather than engineering, the lessons imparted in implementing interdisciplinary graduate certificate programs in general are valuable to my study. The lessons are important to my study because three engineering certificates at The University involve more than one discipline.

A certificate program as the first step towards a full-fledged degree.

A team of three professors identified the need for students in their universities to acquire skills in sustainability, renewable energy, sustainable design, and green building (Goodman, Fox, & Cowan, 2014). To ease the strain of thin budgets, they decided to share the work of developing

courses. Then they proposed a certificate program first, with the long-term goal of instituting a new Master's degree program. By doing this, the faculty tested the courses and assessed the demand and student interest. This case provides an example of the usefulness of certificate programs, from the institution's perspective, when considering new graduate degree programs. While this article presented the rationale for utilizing a certificate program in preparation for a Master's program, it did not provide the insight for instituting certificate programs.

All these examples provided the rationale for utilizing certificate programs as the means to close the gap between a knowledge gap between students and their professional practices. There were challenges discussed with the initial program setup, such as needs assessment, preparation of program proposal, approvals, and online course preparation.

Synopsis of Relevant Research

Next, a summary is provided of research studies focused on investigating the phenomenon of institutionalization of programs. Because of similarities in academic setting and established research goals, the studies reviewed in this section were deemed pertinent to serve as a guide for my study.

Selection of definitions related to the program institutionalization process

To conduct a study that emphasizes certain terms that have many definitions, it is important to select a specific definition and to provide rationale for the selection of such definitions. Herein the additional definitions used in this study are shared, and the rationale for the selection of the definitions is established. Further, in this section, definitions of institutionalization and sustainability were summarized for reference.

Institutionalization.

The term institutionalization refers to the long-term viability and integration of a new program within an organization (Goodman & Steckler, 1989b). Institutionalization can be defined as the “gradual adaptation of the organizational context, including structures and processes to the new work practice” (Slaghuis et al., 2011, p. 3). Yin (1979) stresses that institutionalization occurs as an organizational change by which new practices become standard business in a local agency. Whether the process is called routinization, institutionalization, incorporation, or some other term, it is central to all organizations (Yin, 1979).

Program institutionalization implies that a program becomes embodied within, imbedded within, an integral part of, the hosting organization, in order for programs to become sustained and durable (Goodman et al., 1993). Swerissen (2007) envisions institutionalization of a program as a short-term intervention, or an organizational change that produces permanent effects in the organization. Similarly, Curry (1992) describes institutionalization of an innovation or change in higher education organizations as a matter of permanence and longevity.

A summarized definition can then be established from this compilation of concepts regarding institutionalization: Institutionalization is a gradual process of a legitimized organizational change, in this case certificate programs, becoming permanent and sustained within an institution (Curry, 1992; Goodman et al., 1993; Slaghuis et al., 2011; Swerissen, 2007; Yin, 1979). The selected definition was achieved by selecting the main ideas shared by the scholars. From this summarized definition, the two major characteristics or components for institutionalization are visualized: sustainability and permanence.

Sustainability. Institutionalization and sustainability of programs are closely intertwined. Figure 2.2 shows three different views of how institutionalization and sustainability are related or linked, according to the literature (Curry, 1992; Fleiszer, Semenic, Ritchie, & Denis, 2015;

Goodman, McLeroy, Steckler, & Hoyle, 1993; Shediac-Rizkallah & Bone, 1998). As indicated in Figure 2.2 by the arrows on the left, some authors view sustainability as a characteristic or requirement for institutionalization (Goodman et al., 1993). Other scholars view sustainability as a model in which the institutionalization of the program is a characteristic of sustainability, as shown with the middle arrows (Curry, 1992; Fleischer et al., 2015), rather than separating these terms, as the two parallel arrows on the right (Shediac-Rizkallah & Bone, 1998).

See Figure 2.2 below:

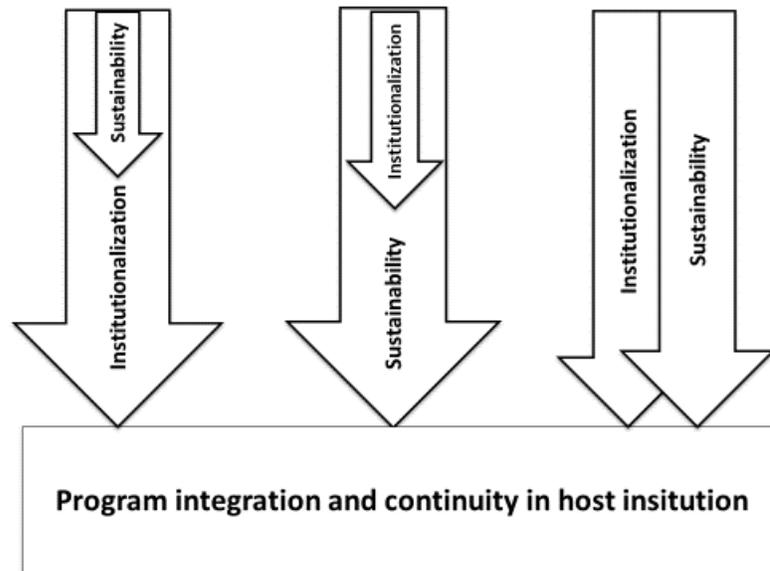


Figure 2.2 Views on the links between institutionalization and sustainability

For this study, as indicated by the selected definition for institutionalization, sustainability is seen as a characteristic or requirement of the insitutionalization process. This is shown with the arrows on the left in Figure 2.2 . The rationale with selecting this view for my study has to do with viewing insitutionalization as the complete process. The study refers to a program integrating within an insitution, therefore called program insitutionalization.

Sustainability has little to do with integrating a program within an institution but has more to do with how a program adapts to changes, once integrated. Therefore, for this study, sustainability is viewed as a requirement of institutionalization, a more comprehensive concept. Because of how both terms relate to each other, it is important to note the similarities and differences.

Sustainability may very well be the dynamic process involved in program continuation, because it deals with the reason programs adapt to their environment over time, and may or may not be bounded by the institution (Pressman & Wildavsky, 1979). Swerissen (2007) claimed that sustainability is dynamic and not static and that there is a tension between continuity and change in organizations. Institutionalization is more static, because it is seen as a gradual organizational change, yet with the end goal of program continuity targeting permanence. Also, compared to institutionalization, more static, the nature of sustainability, more dynamic, suggests a living entity with adapting capabilities, just like a program must adjust to new circumstances to survive (Shediac-Rizkallah & Bone, 1998).

Evashwick and Ory (2003) refer to sustainability as the endurance of the program since its inception. Shediac-Rizkallah & Bone (1998) refer to sustainability as a multidimensional concept regarding program continuation, which deals with permanence and time. Additionally, the program increases chances of being sustained over time, if it provides benefits (Shocker & Sethi, 1974). For example, if students view a certificate program as useful in preparing them for employment or promotion, then enrollment increases, and so are the chances of sustaining the program.

I selected a summarized definition from this compilation of concepts regarding sustainability: Program sustainability is a multidimensional, multi-factorial, dynamic process regarding program benefits, continuation, permanence, adaptability, and endurance, while partly

constrained by the hosting institution (Evashwick & Ory, 2003; Pressman & Wildavsky, 1979; Shediak-Rizkallah & Bone, 1998; Shocker & Sethi, 1974; Swerissen, 2007). Sustainability as partly constrained by the hosting institutions refers to the limitations dictated by the institution, as programs adapt to changes, factors, and circumstances within the hosting institutions (Pressman & Wildavsky, 1979). In summary, sustainability deals with program adaptability and is a key requirement to the institutionalization process.

Taking a closer look at the selected definitions for institutionalization and sustainability, both terms include a process with the notion of continuity, or gradual permanence over time, and the notion of a legitimate organizational change because of the benefits it provides. The main differences are: institutionalization is more static and sustainability is a multidimensional, multi-factorial dynamic process; institutionalization is constrained by the institution, while sustainability may or may not; and for this study, sustainability is seen as a requirement of the institutionalization process.

Permanence.

Permanence comes with program legitimacy and its longevity (Curry, 1992). Longevity refers to the time or life span of a program. A program must undergo multiple academic cycles or routinization (Yin, 1979) for the permanence of innovations or organizational changes in higher education (Curry, 1992). Yin (1979) stresses that institutionalization occurs as an organizational change by which new practices become standard business in a local agency. It takes time for a program to gradually integrate into the organization. The academic program, seen as an organizational change, becomes embodied within, an integral part of, the hosting organization, in order for programs to become sustained and durable (Goodman et al., 1993).

Legitimacy of a program refers to the benefits it provides. A program is viewed as legitimate as long as it contributes to the organization goals and mission (Rincon & George-Jackson, 2016). Furthermore, a program increases chances of being sustained over time, if it provides benefits (Shediac-Rizkallah & Bone, 1998). In the case of certificate programs, stakeholders must perceive benefits in order to support such programs, over time.

Figure 2.3 shows an outline of the definition for institutionalization as guided by the literature reviewed, a definition that includes permanence and sustainability as the main requirements for institutionalization. Additionally, although these requirements are described very similarly, in terms of benefits, continuity and endurance, I further broke down each concept, to aid in data analysis.

In breaking down each concept, program legitimacy and longevity can be viewed as key components of permanence, and adaptability a key component of sustainability.

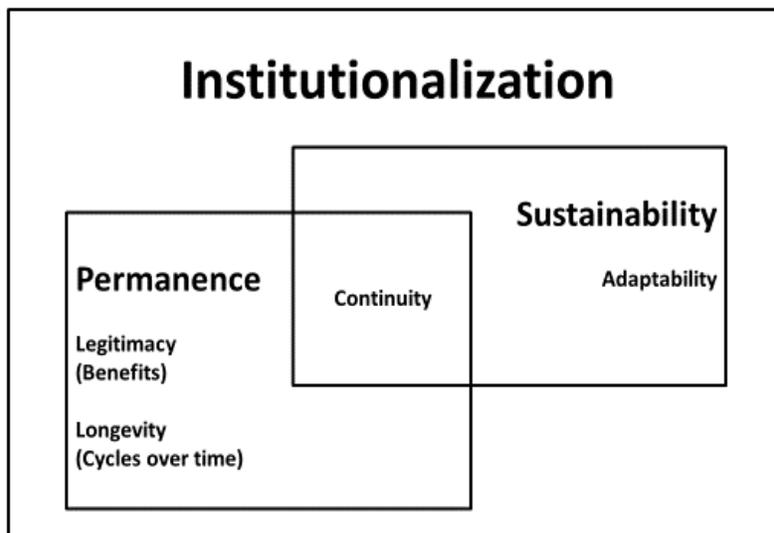


Figure 2.3 Requirements for Institutionalization

As indicated in figure 2.3, permanence encompasses legitimacy (benefits) and longevity (cycles over time), for program continuity. Sustainability involves program adaptability to

changing conditions in its environment, also to support program continuity. As long as a program continues, it becomes institutionalized.

Factors for Institutionalizing Programs

In this next section of the literature review I discuss the factors identified as influencing the process of institutionalization of programs.

Political, economic and social environment.

It is important to consider the political, economic, and social environment surrounding programs. Programs are impacted by their environment, such as the hosting department and the college within the institution, the community, and the university system (Kezar, 2001). The program will be impacted by depth and range of relationships within the political, economic and social environment between community members and the program (Shediac-Rizkallah & Bone, 1998). For example, the student demographics, industry partnerships, university leadership, and even market demands make up the landscape of the program environment.

Organizational Commitment and support.

It is only through the sustained commitment of the organization over time that a institutionalization of any reform effort can be realized (Zlotkowski, 1996). Programs will be prioritized with hard funds when the upper level administrators such as department chair, dean, and provost, validate the purpose of the program as a necessary entity within the institution (Bailey, Matsuzuka, Jacobs, Morest, & Hughes, 2004).

Evashwick and Ory (2003) identified the factors that influence whether these types of programs can be sustained over time. From their findings, they reported that the value of commitment and leadership, although evident, could not be quantified in a budget. Their

recommendations from their lessons learned included using experienced leadership, committed to the success of the program.

Institutional strength. From their study of health organizations in the US., Goodman and Steckler (1989b) found that stable, mature organizations were more likely to promote program institutionalization. Similarly, institutional strength referred to institutions that worked well, with program goals consistent with institutional goals, and had experienced leadership (Shediak-Rizkallah & Bone, 1998). Additionally, mature institutions typically have more resources, such as expertise, space, intellectual property, and especially funds (Cooley, 2015). These resources are needed in setting up laboratories, creating new courses, surveying markets, and supporting new programs.

Alignment and contribution to organizational goals and mission.

A program is viewed as legitimate as long as it contributes to the organization's goals and mission (Rincon & George-Jackson, 2016). The organization will then link the program to funding, staffing, and resources, and its legitimacy becomes cyclical (Rincon & George-Jackson, 2016). Cyclical refers to, for example, the annual budgets. It is this cyclical legitimacy that increases sustainability over time. The likelihood of integrating a new program may be influenced by how comparable the program's goals are when compared to organizational mission and functions (Braxton et al., 2002).

Program champions or strong political leadership.

According to Goodman and Steckler (1989b), the process of program institutionalization is very politically oriented and is one of promotion for the continuation of a program. Such promotion or goodwill seems to be most effectively garnered by influential individuals within the implementing organization acting as program advocates or champions (Shediak-Rizkallah &

Bone, 1998). The characteristics describing program advocates or champions included: commitment to build support for the program; having negotiating skills; and working in a leadership position within the organization.

The work of Curry (1992) outlines a three-stage model on the factors that influence the permanence of innovations and organizational changes, in higher education. These are mobilization, implementation and institutionalization. From Curry's (1992) model, she envisions institutionalization as the final step to a full implemented program, and it is mainly influenced by the leaders, their support, decisions, and dissident voices. She claims that nonconforming, dissident voices help create a balance between vision and the realities inside and outside the organization, thus the target of political activity (Curry, 1992). As a result, it is the people leading the change that get programs instituted.

Relevant and current curriculum. A strong argument regarding sustainable engineering education came from scholars in Australia (Desha, Hargroves, & Smith, 2009). Desha et al. (2009), insist that rapid curriculum renewal is strategic for engineering education programs to remain relevant and therefore increase their sustainability appeal. Kerka (2000) stressed that relevancy of course content is a critical issue in short-term engineering programs, such as the certificate programs. Universities that offer certificates should revise and retire programs that do not align to current content and technologies. Vest (2005) believes the US has to count on brainpower, organization and innovation in order to discover new technological and scientific knowledge better and faster than anyone else, in order to remain competitive. As a result, to maintain a current and relevant curriculum, innovation and creativity in engineering education must be improved by utilizing systems thinking, focusing more on sustainable energy research, and incorporating more humanities, arts, and social sciences.

Interdisciplinary and multidisciplinary programs.

More and more, engineering programs require multiple disciplines, both within engineering and outside of engineering (Vest, 2005). In order to address the challenges of the 21st century workforce, Hainline, Gaines, Featehr, Padilla & Terry (2010) point out that new engineering curricula must include the integration of different disciplines. Models are needed that allow institutions to make better informed decisions to not only support effective new ones, that are multidisciplinary, but also eliminate ineffective programs (Hainline et al., 2010).

Resource allocation is often dictated by discipline boundaries. Resources are generally linked to particular colleges or disciplines, therefore limiting the interdisciplinary nature of sustainability (Barlett & Chase, 2004). The fact that resources are bounded by discipline negatively affects the access to resources by competing disciplines. Institutions with set budgets and unclear priorities create an atmosphere of competition between the different programs seeking sustainment (Barlett & Chase, 2004). A clear funding model is needed from each college sharing programs. In reference to the finance and budget, Hainline et al. (2010) stress how the costs of education are being scrutinized in order to find the most cost-effective opportunities, due to the decline in public funding for institution of higher education in general. They recommend a model to find who is teaching what and at what cost, in order to fund programs accordingly. In summary, when dealing with inter- and multidisciplinary programs, some issues arise when instituting and sustaining these programs. Allocating resources for programs that are shared with other departments or colleges is not easy, as boundaries are clear for each department or college, but not for support of shared programs.

Funding challenges impacting program sustainability

Although demand for certificate programs has increased (Carneval et al., 2012), in universities, resources are scarce and budgets are fixed (Cooley, 2015). New programs must compete with other departments and programs for those resources. This is when political influence is needed to yield more favorable resource allocation (Malatesta & Smith, 2014; Salancik & Pfeffer, 1977). State universities are becoming more dependent on tuition due to state budget shortfalls (Rincon & George-Jackson, 2016). From 2008 to 2013, 48 states reduced funding for higher education. Of those, 36 states, including Texas, reduced funding by over 20% (Oliff, Palacios, Johnson, & Leachman, 2013). Shortfalls in university budgets may yield to hiring freezes, program elimination, and termination of certain services. This trend in state university funding impacts the viability of new certificate programs to become institutionalized and sustained.

Vossensteyn (2004) claimed that the demand for higher education services exceeded the public budgets, creating fiscal stress. According to a national report by Gumport et al. (1997), in the late 1980s federal funding shifted from higher education to K-12 education, prisons, and medical services, such as Medicare. One way that universities compensate for funding shortages is to increase tuition (Rincon & George-Jackson, 2016). Unfortunately, such increases in tuition may adversely impact student enrollment, and with low enrollment, programs are at risk of becoming eliminated (Cahalan & Perna, 2015).

Public scrutiny of institutional spending. Political critics claim that reduced public funding will force universities to be more cost efficient, and more accountable in their delivery of quality education and access (Gumport et al., 1997; Vossensteyn, 2004). Vossensteyn (2004) concurs that efficiency is an option to alleviate fiscal stress in universities: do more with less. He

claims that by making universities more efficient, they also become more competitive. In policy discussions, legislative critics, and other stakeholders question the purposes of American colleges and universities; their ability to adapt to changing market demands; and whether the state should regulate spending practices in public postsecondary education (Gumport et al., 1997). Although Vossensteyn (2004) believes universities must be more efficient, this public scrutiny represents a challenge when instituting new programs.

Bureaucratic cyclical budgeting practices. According to Pfeffer and Salancik (1974), universities have resource allocation practices as a result of bureaucratic criteria. Bureaucratic practice is exemplified by preparing next year's budget based on last year's budget. Last year's budget has been approved, and therefore legitimized (Pfeffer & Salancik, 1974). This bureaucratic practice favors the sustainability of those programs already included in the budget. Often times, programs are initiated with soft funds and their permanence depends on whether or not the program expenses are supported by hard funds within approved budget. In such cases, sustainability must be planned from the beginning. The prospects for long term program continuation are created by enhancing the conditions for sustainability early on in the planning and implementation of a new program (Shediak-Rizkallah & Bone, 1998). Additionally, they recommend evaluating those long-term prospects periodically, as per the dynamic nature of sustainability. Seymour (1988) stresses that new programs need to be given a chance to succeed by incorporating such activities in the overall operating budget, "Integrate planning for academic programs with planning for finances and facilities" (Seymour, 1988, p. 11).

Funding agencies constrain resource allocation. In public organizations such as universities, allocation of external funding may be constrained by state legislature or other government agencies (Pfeffer & Salancik, 1974). For example, if funding is provided for

construction of a building, it must be spent on that building. In general, more established universities enjoy more freedom in their decision making when it comes to resource allocation, than the smaller and less established ones (Pfeffer & Salancik, 1974). At The University, funding for programs originates from diverse sources. By studying multiple programs in this dissertation, a broader source of data will yield more realistic findings.

As stated before, sustainability is seen as a requirement of the institutionalization process (Evashwick & Ory, 2003). Studying the factors influencing program sustainability is key to understanding the institutionalization process. Therefore, funding constraints, routine resource allocation practices, political influence, and early planning for program sustainability are important factors to explore (Malatesta & Smith, 2014; Pfeffer & Salancik, 1974; Seymour, 1988; Swerissen, 2007).

Systems theory

For this case study, systems theory was employed to better understand the multi-level and multi-factorial program institutionalization process in The University. The process of program institutionalization can be seen as an organizational change (Kezar, 2001; Swerissen, 2007). The literature reviewed revealed that organizational change theory supplemented with a systems perspective was applied to better explain complex phenomenon (Forrester, 2016; Kezar, 2001; Shediak-Rizkallah & Bone, 1998; Swerissen, 2007).

Upon completing a review of multiple theories, such as institutional, resource dependency, organization change, and others, systems theory was selected as the dominant and preferred theory. Systems theory was selected because (a) it is comprehensive enough to frame this study; (b) it has the language and techniques to explain the complex and dynamic nature of the elements involved; and (c) it offers a selection of tools to provide visual representations of

the findings (Forrester, 2016; Manni & Cavana, 2007; Kezar, 2001). Lastly, the rigor of the research increased with the application of systems theory. This is due to the analysis of system components, besides the holistic approach to understanding the organizational processes involved (Ackoff et al., 2010; Forrester, 2016; Jackson, 2006; Vest, 2005).

Systems theory is different from a traditional analysis and linear thinking. A systems theory is very different from a traditional analysis approach (Forrester, 2016). Linear thinking is a non-systemic approach that ignores the dynamic nature of organizations, as complex and adaptive systems (Forrester, 2016). A traditional analysis approach focuses on the separate pieces of whatever is under study. In contrast, a systems theory approach not only focuses on the separate pieces but also on how these pieces interact with each other (Kossiakoff et al., 2011). According to Kim (1999), systems theory not only assists with studying the interconnections between parts of a system but also synthesizes them into a unified view of the whole. Jackson (2006) stresses that this systemic approach with a holistic focus produces a more robust understanding of processes within complex organizations. Furthermore, a systems theory expands the view to include how whatever is under study interacts with other elements in its environment (Ackoff et al., 2010, 2016; Monat & Gannon, 2015). This approach provides decision makers with deeper multi-level insights when confronted with complex, turbulent and diverse organizational issues (Jackson, 2006).

Essentially, systems theory is the opposite of linear thinking (Monat & Gannon, 2015). Forrester (2016) claims that we live in a network of complex systems that behave very differently from our expectations. This is due to our experience and intuition primarily based within simple systems (Forrester, 2016). Reed (2006) attributes this phenomenon to unrealistic leaders who demand simplicity and certainty in a complex and uncertain environment.

Organizational processes have a more dynamic nature, and they tend to be unpredictable, and disorderly, “because of unique actors, political situations, and random events that interfere with implementation” (Anderson, Crabtree, Steele, & McDaniel, 2005, p. 3).

With systems theory, I gained a deeper understanding of the dynamic nature of the system. The use of the systems theory, its language and techniques, were more than adequate to frame the research for this study, organize data and provide visual representations of the findings (Ackoff et al., 2010; Anderson et al., 2005; Forrester, 2016; Manni & Cavana, 2007).

Systems language and techniques. In this section, selected techniques used in the study are discussed. Systems theory involves its own unique language to better understand behaviors in the real world around us, and techniques for visually capturing those behaviors (Kim, 1999).

A system is any group of interacting, interrelated or interdependent parts that form a complex and unified whole that has a specific purpose (Kim, 1999; Kossiakoff et al., 2011). The whole is always more than the sum of its parts. A system can be simple or complex; open or closed; and natural or human-designed (Kossiakoff et al., 2011). Systems need all their components arranged and working in a certain manner in order to achieve their purpose (Ackoff et al., 2010). Also, systems constantly attempt to maintain stability, equilibrium or balance, by self-correcting from feedback mechanisms (Kossiakoff et al., 2011). The system in this case is the institutionalization process of graduate certificate programs in engineering at The University.

Conceptual Framework

Scholars have prepared multiple models and frameworks in an attempt to better understand the influences affecting institutionalization and sustainability of programs. Fortunately, some of these models and frameworks have already been successfully applied and tested. Although the contexts may differ, a lot can be learned from those models and the research

that followed. For example, in an effort to gauge the level of integration of a program into non-profit organizations, Goodman & Steckler (1989a) devised a level of institutionalization scale. Based partly on the work of Goodman, Steckler, and Curry, Shediac-Rizkallah and Bone (1998) formulated a framework of factors influencing sustainability of programs in organizations. Evashwick and Ory (2003) utilized the work of Shediac-Rizkallah and Bone (1998) to better understand sustainability, referred to the endurance of the program since its inception. From the numerous models and frameworks reviewed, it makes sense to employ a framework to organize the findings in a systemic way for the study.

Figure 2.5 shows the two research questions (RQ1 and RQ2) in a conceptual framework. This conceptual framework shows the multi-level and multi-factorial features of the process within a systems perspective. Note that the multi-level feature of the system is shown on the left side. For example, the academic programs reside in departments. Program departments are part of a larger system, the College of Engineering. Then, the college is part of The University and the former is part of its environment. In the center, the formal process for approving programs is shown as an arrow with a solid outline. The formal process can be found in The University's written policies and operating procedures. Then the informal process (RQ1) are represented by a larger dashed arrow that surrounds the formal process. These are the unwritten, but legitimized practices that support the formal process, from one step to the next. Lastly, the second research question (RQ2) involves the factors (F) that influence the process, at any system level, represented by arrowed squares.

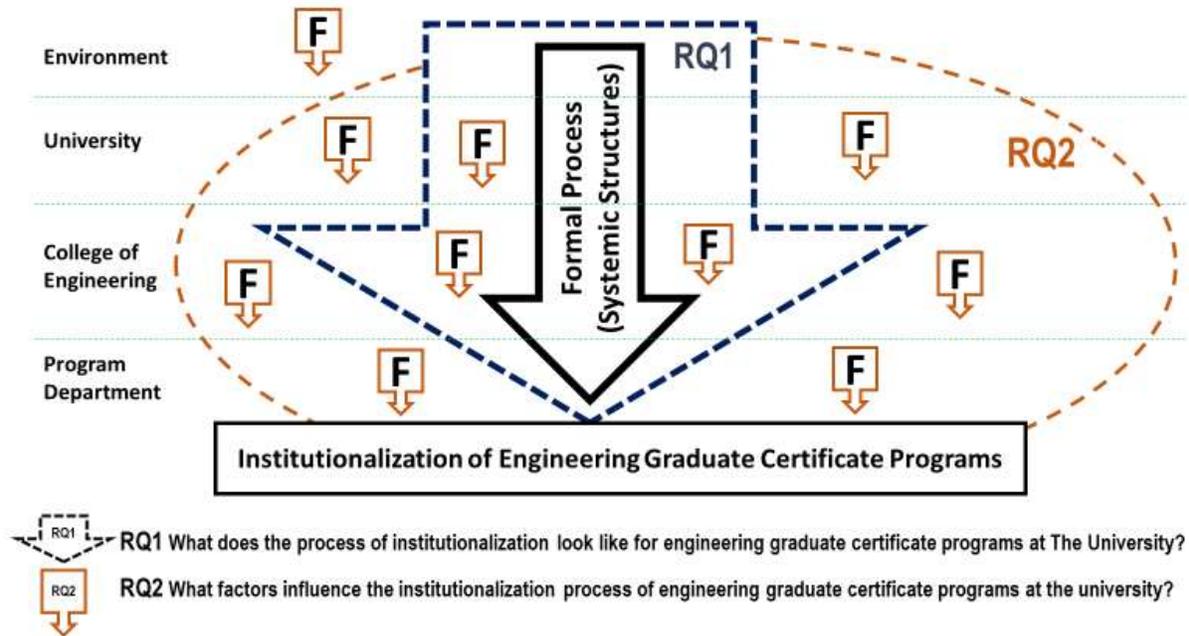


Figure 2.5 Conceptual Framework and Research Questions (RQ)

The use of case study approach was an attempt to make sense of how engineering certificate programs are institutionalized at The University. Although this case study may yield a very small piece of academic knowledge, it may lead to a meaningful understanding of our current practice within the institution.

Summary

New educational programs increased nationally after a general massification and upward trend for students enrolling in degree-granting higher education institutions for several decades (Cahalan & Perna, 2015; Gumport et al., 1997). Although the number of institutions and programs has increased, little literature was found regarding the creation of such programs (Seymour, 1988). Also, although state universities have more programs and increased enrollment, their funding has decreased (Rincon & George-Jackson, 2016; Oliff et al., 2013). As a result of this massification of public higher education and additional funding for research,

institutions grew into complex organizational structures (Ackoff et al., 2010). Many educational programs are faced with challenges. Understanding the process of institutionalizing and sustaining new programs is important. This is a case study of the process of institutionalization of engineering certificate programs at The University.

Institutions of higher education often implement innovative initiatives, projects or programs (Curry, 1992; Seymour, 1988). According to Curry (1992), regardless of the level of project success, sometimes projects get abruptly discontinued. This is frequently the case with projects that were initiated with soft funds. Curry (1992) speculates that power, politics, and administration dictate the reasons for termination, rather than a project's utility. Yin (1979) argues that in order for a project or program to become a permanent component of an organization, the program requires routinization, institutionalization, or incorporation. It is only through the sustained commitment of the organization over time that a sustained institutionalization of any reform effort can be realized (Zlotkowski, 1996).

Many agree that the process of institutionalization involves organizational rituals and routines, both formal and informal (Curry, 1992; Evashwick & Ory, 2003; Sadovnik, 2007; Seymour, 1988). More importantly, research from many scholars also concur that the main challenge for programs to gain longevity and permanency in organizations is continued funding (Elrod & Kezar, 2016; Evashwick & Ory, 2003; Oliff et al., 2013; Swerissen, 2007). Rincon and George-Jackson (2016) claim that when the organization sees the program as legitimate, then the program will be linked to funding, staffing, and resources, and more importantly, legitimacy becomes cyclical.

According to the literature reviewed, deductively reducing the definition of institutionalization, the main requirements in program continuity are permanence and

sustainability. For permanence, legitimacy and longevity is essential; and so is adaptability for sustainability. At the center of institutionalization, then is continuity; a common element between requirements.

A list of factors was identified from the literature and begin making sense of the process of institutionalization of programs. These were: Political, economic and social environment; organizational commitment and support; institutional strength; alignment and contribution to goals; program champion; relevant and current curriculum; funding; and inter- and multi-disciplinary curriculum.

CHAPTER THREE: METHODOLOGY

Research Design

I selected case study methodology because the research questions seek further understanding of a phenomenon (Creswell, 2012; Yin, 2006). The case study methodology is typically used within a real-life context, offering the ability to examine a situation first-hand, and providing deeper understanding of the 'case' (Yin, 2006). Case study methodology is very useful when the unit of analysis is a collective entity such as an organization or a community (Aaltio & Heilmann, 2010). The use of case study in this research design was very similar to an example provided by Creswell (2012) in which a 'case' may represent a process consisting of multiple steps, such as a college curriculum process. Aaltio and Heilmann (2010) stressed the use of the case study methodology when studying organizations, when data are gathered in natural, real-life situations. Also, the researcher's observations and discussions may be used as instruments within the study, with an objective of revealing "unexpected issues" (Aaltio & Heilmann, 2010, p. 67). For this study, the phenomenon to focus on was precisely a process within an organization. Furthermore, case study design methodology provided the means for the case definition, case design type, and its bounded context.

Case studies can be exploratory, explanatory, or descriptive, according to Yin (2006), depending on the purpose of the study. The exploratory case study involves defining questions, hypotheses and even testing out a research procedure. The explanatory case is used to explore how events happen and seeks cause and effect relationships. The descriptive case study, as the name implies, is used to describe phenomenon in a particular contextual setting. A descriptive case study methodology was the most appropriate for this study, because the purpose of the study was to describe the phenomenon, in order to better understand it.

A crucial component of this case study research design was the inductive nature of data analysis to describe the phenomenon under study. The application of inductive theory principles forces the search for explanations, for new constructs, and for a name of the phenomenon (Eisenhardt, 1989). The use of systems theory as an analytical tool to organize ideas and capture the inner workings surrounding the case was a very practical application for this case study. The systems theory is explained within the data analysis section in this chapter.

Defining the case.

According to Yin (2006), there are three basic steps in order to design a case study. The three steps are (1) case definition, (2) case design type, and its (3) bounded context.

The first step is to define the case and the contextual conditions. The ‘case’ is the process of program institutionalization at a particular public Texas university. In other words, the ‘case’ encompasses certain processes within The University, and about The University’s inner workings regarding the establishment and support for continuity of its graduate engineering certificate programs. Thus, the institutionalization process at The University is the case, or unit of analysis (Baxter & Jack, 2008).

The research site - The University. Since opening its doors in 1914, according to its website, The University’s enrollment has grown from 27 engineering students to nearly 24,000 undergraduate and graduate students, and that number continues to increase each year. Housing six colleges and two schools, The University offers a broad selection of degree programs – 72 Bachelor’s, 73 Master’s and 21 doctoral degrees. Besides the traditional degree programs, The University offers an array of 43 graduate certificates and various state certification programs. The College of Engineering consists of seven departments that offer seven undergraduate degree programs, nineteen Master’s degree programs, eight doctoral programs, and nine distinct

graduate certificates. The nine engineering certificates made up 21% of the certificates offered campus-wide. A case in point is that within the six months when this case study was completed, three additional graduate certificates were approved, including the ninth certificate in engineering: The Certificate in Nanotechnology in Materials Development.

Table 3.1 lists the different departments in the College of Engineering; the certificates offered; if there is an online option; whether they are inter- or multidisciplinary; and the credit hours required to complete them.

Table 3.1
Engineering Graduate Certificates offered at The University

Engineering Department	Graduate Certificate Name	Online Option	Inter- or Multi-disciplinary	Credit Hours Required
Civil Engineering	Construction Management	Yes	No	15
Computer Science	Cyber Security	No	No	15
Electric & Computer Engineering	Electric Power & Energy Systems	No	No	12
Engineering Education & Leadership	Innovation and Entrepreneurship	No	Yes 2 colleges	15
	Engineering Education	Yes	Yes 2 colleges	18
Industrial & Systems Engineering	Systems Engineering	Yes	No	15
	International Manufacturing	No	No	15
Mechanical Engineering	3D Engineering & Additive Manufacturing	Yes	No	15
Metallurgy, Materials and Biomedical Engineering	Nanotechnology in Materials Development	No	Yes 2 departments	15

Determining the case study type.

The second step in designing a case study involved two decisions (Yin, 2006). The first decision was to determine whether the study included a single case or multiple cases. Because

the case was set in the context of a single university, and the phenomenon under study was one process, this was clearly a single case.

The second decision, according to Yin (2006), was to either keep the study ‘holistic’ or to include ‘embedded’ sub-cases (Baxter & Jack, 2008). This was a holistic, single-case study. The purpose was to understand one process, program institutionalization, at one university. The case, guided by systems theory, was seen as a system, and therefore studied holistically. More importantly, the systems theory approach, as previously stated, offered: flexibility in framing this case study, the language and techniques to explain the real-life complex and dynamic nature of the phenomenon involved, and a selection of tools to provide visual representations of the findings (Forrester, 2016; Kezar, 2001; Manni & Cavana, 2007).

Although, embedded cases were not utilized for the proposed study, a strong consideration for including sub-units was the fact that findings could be much more robust (Baxter & Jack, 2008; Yin, *Case Study Methods*, 2006). A case study with embedded cases allows the identification and study of sub-units and increased level of inquiry (Yin, 2006). Analysis within, between, or across sub-units would better illuminate the case, overall. One practical disadvantage of committing the study to selected sub-cases is that more time is required for each sub-case to increase the level of inquiry and analysis. By not using sub-units, that additional time can be dedicated to further elaborate on certain topics that merit extra attention, and may also lead to robust findings (Anderson et al., 2005).

Contextualizing and binding the case.

The case was a phenomenon occurring in a bounded context (Huberman & Miles, 2002). Creswell (2007) also defines the case as a bounded system. He refers to bounded as “separated out for research in terms of time, place, or some physical boundaries” (p. 465). In order to avoid

such a broad topic with too many objectives in a single study, Stake (1995) also proposes placing boundaries on the case, by framing the time and activity of the case. Similarly, the case may be a relatively bounded process, a phenomenon specific to time and space (Ragin & Becker, 1992). By following these recommendations on binding the case, it made the scope and breath of the study more reasonable to complete (Baxter & Jack, 2008).

The data collection effort required for this case was specific to graduate programs, in engineering, and in certificate format. Although the case was bound to engineering programs, the sources of data came from different functional levels, and were campus-wide. The study dealt with a phenomenon that involved multiple engineering departments, one college, several campus-wide committees, and various academic administrators. The site where the research took place was physically bounded by The University campus. Data collection took place within the campus, from March to June 2018. It is important to note that the very nature of the case study methodology recommends binding the case while allowing revisions to the boundaries, as research unfolds (Ragin & Becker, 1992).

The use of a conceptual framework.

Yin's (2006) third step of case study design involves a major decision: whether or not to use theory development. He adds that this decision will dictate selection of case(s), the development of data collection protocol, and organization of initial data analysis strategies. In order to make this decision, the following issues were considered: Yin (2006) recommends the adoption of some theoretical perspective for the less experienced researchers doing case studies; the researcher could then attempt to build, extend, or challenge the adopted theoretical perspective (Yin, 2006; Stake, 1995). Upon reviewing the listed issues, this study did not attempt to build, extend or challenge a theory.

I selected case study methodology because the research questions seek further understanding of a phenomenon (Creswell, 2012; Yin, 2006). The case study methodology is typically used within a real-life context, offering the ability to examine a situation first-hand, and providing deeper understanding of the 'case' (Yin, 2006).

Case study methodology is very useful when the unit of analysis is a collective entity such as an organization or a community (Aaltio & Heilmann, 2010). The use of case study in this research design, was very similar to an example provided by Creswell (2012), in which a 'case' may represent a process consisting of multiple steps, such as a college curriculum process. Aaltio and Heilmann (2010) stressed the use of the case study methodology when studying organizations, when data are gathered in natural, real-life situations. Also, the researcher's observations and discussions may be used as instruments within the study, with an objective of revealing "unexpected issues" (Aaltio & Heilmann, 2010, p. 67). For this study, the phenomenon to focus on, was precisely a process within an organization. Furthermore, case study design methodology provided the means for the case definition, case design type, and its bounded context.

Case studies can be either exploratory, explanatory, or descriptive, according to Yin (2006), depending on the purpose of the study. The exploratory case study involves defining questions, hypotheses and even testing out a research procedure. The explanatory case used to explore how events happen and seeks cause effect relationships. The descriptive case study, as the name implies, is used to describe phenomenon in a particular contextual setting. A descriptive case study methodology was the most appropriate for this study, because the purpose of the study was to describe the phenomenon, in order to better understand it.

A crucial component of this case study research design was the inductive nature of data analysis to describe the phenomenon under study. The application of inductive theory principles forces the search for explanations, for new constructs, and for a name for the phenomenon (Eisenhardt, 1989). The use of a systems theory approach as an analytical tool to organize ideas and capture the inner-working surrounding the case was a very practical application for this case study. The systems theory is explained within the data analysis section in this chapter.

Delimitations and Assumptions

This study was limited in part to one Texas public university. The study focused on the institutionalization process of graduate certificate programs in engineering. The innerworkings of how certificate programs are created, approved, and sustained, within The University. The study was limited to graduate level certificate programs offered by the College of Engineering, as of the summer of 2018.

Generalization.

According to Yin (2006), the behavior of a particular group of people in a particular entity may or may not reflect the behavior of similar entities. The main delimitation of any case study, is that the findings may be suggestive of what may be found in similar organizations. Therefore, additional research would be required to verify whether findings from this case study would generalize elsewhere (Stake, 1995; Yin, 2006). Also, delimitations of case studies include the point that the researcher cannot make causal inferences from findings due to the possibility of alternative explanations (Baxter, 2008; Yin, 2006).

Systemic processes in colleges are similar.

In The University, all graduate programs from different colleges within the university become established using the same policies and procedures. The process to establish and

institutionalize new graduate programs is the same throughout the different colleges at The University. For example, the Graduate Council Committee is the same for all curriculum changes across the university colleges. The factors that influence sustainability of different new graduate programs from different colleges in this university are similar, because the formal process is the same and occurs in very similar contexts, within The University.

There was a good source of participants for the study.

The eighteen participants selected for the study were members of the university faculty and administration who had not significantly changed in the last decade. These participants allowed the gathering of rich data about the university processes that represented the institutionalization process more accurately. Participants such as deans, department chairs, and curriculum committee members, would ideally have provided richer experiential testimonials, and therefore prioritized. Basically, if there were two potential participants targeted to inform about one certificate in a department, I selected the participant that had more experience in the process or longevity in The University.

Participants were willing to disclose.

Most importantly, the assumption regarding data from participants, was that they were willing and truthful during interviews. By following research protocols, participant anonymity and confidentiality were preserved. Additionally, participants were volunteers who could withdraw from the study at any time and with no ramifications.

Document availability and access.

The availability and access to documents and participants drove the quality and richness of the data set. Only pertinent documents and artifacts were considered. Because the study was conducted in a public university, most pertinent documents were available on public websites.

Emic perspective.

This case study yielded a constructive interpretation of the data collected. It is important to disclose that at the time of this study, I was a working member of the university, and therefore, an active participatory observer. This emic or insider perspective during data collection and analysis may deviate data interpretation due to personal prejudices, interests, and biases. During fieldwork, the researcher's participation can be perceived as using a "lantern to shine light into the dark places" (Shank, 2006, p. 166). Shank (2006) also recommends that in case studies, the lantern approach allows the participant to lead the conversation and then the researcher immediately makes follow-up questions in order to gain deeper understanding of unexpected but valuable discoveries during interviews. In addition to Shank's (2006) recommendations, I followed the strategies from Peshkin (1988) on how to deal with subjectivity, found in subsequent sections.

Data Collection and Analysis

A unique advantage of the case study methodology was the ability to rely on multiple sources of evidence, expanding the breadth and depth of data collection, and enriching understanding through triangulation (Stake, 1995; Yin, 2006). The different sources for data regarding the case included semi-structured interviews, document review, and observations of pertinent curricular committee meetings. The data collection procedures are described in the following sections.

Data analysis begins the instant data collection begins (Merriam, 1998). This instantaneous analysis approach allowed the researcher to dig deeper, and re-focus as needed, while the participants were interviewed (Yin, 2006). The transcribed interviews, verbal notes, setting clues, and descriptive field notes from observations were included for analytical sense

making (Miles & Huberman, 1994). An overview of the data analysis is provided following the data collection procedures sections.

This study, with the use of case study methodology, yielded a constructive interpretation of the data collected. During fieldwork, researcher participation can be perceived as using a “lantern to shine light into the dark places” (p. 166). Shank (2006) also recommends that in case studies, the lantern approach allows the informant to lead the conversation and then the researcher immediately makes follow-up questions in order to gain deeper understanding of unexpected but valuable discoveries during interviews.

Semi-structured Interviews

The primary source of data collected came from semi-structured interviews. Eighteen interviews of targeted participants provided insight into the processes regarding certificate program efforts and their continuity outcomes. The interviews were audio recorded using an Olympus digital voice recorder, model WS-853, and transcribed using a web-based service at Trint.com. The transcriptions performed by Trint.com were accurate, especially for those participants with no foreign accents. Some editing was required, in particular to distinguish the sections by the interviewer from the interviewee.

Participant selection-purposeful sampling and snowball sampling.

In developing an in-depth understanding of a phenomenon, Creswell (2007) discusses the value of qualitative inquiry. Contrary to quantitative inquiry, he adds that the researcher has more flexibility in selecting the type of participants for qualitative inquiry. Qualitative research generally involves selecting key participants that best help the researcher explore the phenomenon (Creswell, 2007). Common sampling approach used for qualitative research is purposeful sampling. In purposeful sampling, the researcher intentionally selects individuals to

help illuminate the system under study. Creswell (2007) further refined types of purposeful sampling, and the strategy of choosing individuals based on "membership in a subgroup that has defining characteristics" (p. 216) as homogeneous sampling.

For this case study, participants were selected from within The University. Criteria for selection of participants included (a) participants involved in each and every graduate certificate program in engineering (8 total, at the time of data collection); (b) participants involved in committees dealing with graduate and engineering program approval; (c) at least one administrator from the college of engineering dean's office; (d) campus-wide officials from Provost office, Graduate school, and relevant campus offices heavily involved in the process. Although the study originally targeted fifteen participants, three additional participants were deemed key to be included in the study because of their role in the process. These three additional participants were identified and selected through snowball sampling (Lewis-Beck, Bryman, & Futing Liao, 2004). Snowball sampling is a technique for gathering research subjects whose names were provided by other study participants (Lewis-Beck et al., 2004), during the interview process.

Participants were given a pseudo name, depending on their current role within The University, at the time of the interview. Table 3.2 shows the different participant roles and experience at three different levels. For example, a participant was a department chair, engineering tenured faculty member, and the certificate program advocate. The pseudo name he received was Chair C. The highest current role for this participant, at the time of the interview, was that of Department Chair, who happened to be the third Chair interviewed hence 'C'. Chair C was also included in the engineering tenured faculty and certificate program advocate counts. I

included the additional role of Certificate Program Advocate/Champion because of its relevance to the study, although this was not a real job title.

Table 3.2

Participants in different roles and experience by level

<i>Department Level</i>	<i>Count/Total</i>
<i>Engineering Tenured/Tenure-track Faculty</i>	<i>11 out of 18</i>
<i>Certificate Program advocate/champion*</i>	<i>8 out of 18</i>
<i>Program Director / Graduate Advisor</i>	<i>8 out of 18</i>
<i>Department Chair</i>	<i>7 out of 18</i>
<hr/>	
<i>College of Engineering Level</i>	
<i>Dean, Interim Dean or Associate Dean</i>	<i>5 out of 18</i>
<i>Curriculum Committee Chair or member</i>	<i>3 out of 18</i>
<i>Staff working with Curricular Programs or Finance</i>	<i>2 out of 18</i>
<hr/>	
<i>University Level</i>	
<i>Provost Office- Curricular Programs Administration</i>	<i>3 out of 18</i>
<i>Graduate School Council Chair or member</i>	<i>4 out of 18</i>
<i>Graduate School Administration (Dean / Director)</i>	<i>2 out of 18</i>

*This is not an official title. It is a role relevant to the study.

Priority was given to participants with experience with the phenomenon: initiating programs, funding programs, approving programs, and advising students in programs. Of the eighteen selected, eleven were engineering faculty, mostly graduate advisors and certificate program champions. Five participants had administrative roles at the college level. Six participants had administrative roles campus-wide, or university level, and of those, three reported directly to the Provost.

Interview procedures. Upon receiving IRB approval, I contacted the participants in the target list. I first sent electronic messages petitioning participation in the study with an interview, with a brief rationale for selecting that participant. The electronic messages included the Letter of Introduction (Appendix B), the Consent Form (Appendix C) and the Interview Protocol (Appendix D). Within a day or two, I followed up with participants verbally, in person, or by phone, providing more details and confirming their participation in the study. Once participants

agreed to participate, I scheduled a meeting of 45 to 60 minutes in their offices. I sent confirmations for appointments by electronic mail. All participants contacted by phone or in person agreed to participate. Only one participant had to reschedule. All interviews were completed within a four-month period.

At the beginning of the interview meeting, I asked participants to review and sign the consent form. The written informed consent form, found in Appendix C, clearly states that the interviews were to be audio recorded and transcribed but that participants' anonymity would be protected during this process. Their names were not audio recorded. The informed consent form also clearly states that the participants' identities would not be disclosed in the applied dissertation. Upon completion of the interviews, I requested any pertinent documents that would corroborate or supplement understanding of the phenomenon. Field notes reflected the responses to the request.

I shared the interview protocol, found in Appendix D, with participants prior to the scheduled meeting and a hard copy was provided at the meeting. This allowed interviewees to prepare and be informed of what to expect during the interview. Upon completion of the transcriptions, and data analysis, I sent a copy of the transcription to the participants. Participants had the opportunity to review their transcribed interview, and to provide me with any corrections or clarifications. This practice supported inter-subject understanding, as a strategy for soundness.

The semi-structured interview was an appropriate data collection method for this study. The answers from participants often prompted additional questions and clarifications. This exercise was especially important when considering the different roles that participants played in the process under study. The last question of the interview protocol, "Is there anything you would like to add?" provided a wealth of information. This question opened the door for

unexplored topics and an opportunity to highlight their views, perceptions, feelings, and motivations regarding the institutionalization of certificate programs. Additionally, participants shared names of study participants to consider. This yielded three additional names of people to interview.

Review of selected documents

Another source of data came from review of selected documents. Analyzing documents involved extracting the essence pertinent to the research focus (Lichtman, 2013). The main documents reviewed were those that provided contextual background regarding programs, the college and the formal processes, policies and procedures to establish and support certificate programs. Because this is a public institution, these documents were available to the public, and most of them in webpages. Prior to the interviews, the documents I reviewed included The University mission, policies and procedures; graduate program proposal forms; the rules and regulations of the board of regents; by-laws of the graduate council and assembly; official program catalog; college curriculum committee agendas and minutes, graduate council agendas, minutes, and participants CVs. The documents with policies and procedures provided me with the steps involved in the formal process of approving certificate programs. The formal processes found in documents provided me with the background and the context to begin making sense of the data collected during interviews and observations. These multiple data sources then slowly converged, each contributing to my understanding of the whole phenomenon (Baxter & Jack, 2008).

A couple of participants provided pertinent documents, which were added to the study. For example, a participant from the Provost office provided the official list of the forty active graduate certificate programs at the time, whereas the catalog in the website only listed thirteen.

As I reviewed the documents deemed key to the study, I gave them an identification code and inventoried them in a reference list. Once I analyzed them and extracted data, I safely stored these documents, in a binder, in a locked cabinet. The data management procedure is discussed further in a following section.

Observations

The phenomenon under study involved many steps occurring in a period of time beyond the four-month timeframe of this study. For this reason, observations yielded the smallest amount of data. Nonetheless, there was a select set of committee meetings at the department, college and institution levels that closely intervene with institutionalization of programs. These committees are tasked with reviewing new program proposals, curricula change requests and other program related issues. Because these meetings typically occur monthly, I could only observe a handful of meetings within the four-month data collection timeframe.

I attended four meetings for observations. Three were from the graduate council and one from the college curriculum committee. I contacted the chair of both committees for permission to attend and observe, although these meetings were open to the public. During the three graduate council meetings, three different graduate certificate program proposals were discussed. All three proposals were approved, which included two new certificates and a revision to an existing one.

By conducting observations of these meetings, I observed the discussions of concerns with programs, which the agendas and minutes may not necessarily have reflected. I took field notes during these observations. Furthermore, these observations allowed me a peek into the political environment of such committees. During the committee meetings, I observed the certificate program advocates in action. These observations also shed light on the characteristics

of people working within organizations that can only be seen or felt. The convergence of all data pieces added strength to the findings (Baxter & Jack, 2008) and promoted a greater understanding of the institutionalization of programs.

Data analysis overview

In case studies, good data management during analysis is very important (Merriam, 1998; Yin, 2006). Thus, the information generated by interviews, observations and document reviews needed to be organized and integrated in the analysis. The data collected was kept organized in files in digital form, password protected, as well as in a binder, stored in a locked cabinet, secured from public. The documents were given an identification code and added to a reference list.

Theme development.

Creswell (2012) refers to data analysis as a spiral, because the researcher cycles from reflecting, interpreting and then, from that point, making decisions about the research. Guided by the interpretive approach, the main goal of the data analysis process was for themes to emerge (Merriam, 1998; Stake, 1995). The ancient hermeneutic approach is adequate for developing themes in this case. Both intuitive and analytical skills are required in forming such themes (Merriam, 1998; Ryan & Bernard, 2003). According to Ryan & Bernard (2003), themes emerge from both, an inductive and an a priori approach. Themes surfacing from the data result from the inductive approach (Miles & Huberman, 1994). A priori themes develop from the researcher's prior theoretical understanding of the phenomenon under study, common sense constructs, definitions found in literature review, and even the researcher's values (Ryan & Bernard, 2003). These are the major steps in how the themes were developed (Graneheim & Lundman, 2003):

1. I utilized a spreadsheet to organize data pieces from interviews, documents, and observation field notes. A priori themes developed from my prior theoretical understanding of the phenomenon under study and by the definitions selected from the literature review (Ryan & Bernard, 2003).

2. I pieced apart the text from transcriptions, documents, and field notes. A row in the spreadsheet included the pseudo name or data source, the intact piece of text, and a very general construct. The use of a spreadsheet allowed for easy manipulation of distinguishable pieces of data. Conveniently, during analysis, data rows could be sorted, moved, or grouped in different ways. According to Merriam (1998), analyzing data requires a constant comparison of the data in an attempt to make sense or finding meaning from it. For this study, interview data were compared to data from documents, and then compared to what was learned from the literature review.

3. Once data were pieced apart, I began to summarize the rows with the same constructs or idea. I carefully selected participant quotes, and inserted them in the summary. The summaries included the words or statements that related to the same central meaning, or content unit.

4. I then extracted the summaries from each central meaning from the spreadsheet and copied them onto a Word document to begin developing themes.

5. As per the inductive process, I analyzed these summaries to create broader sub-themes and then themes. Following an example provided by Graneheim and Lundman (2003), I used a table with five columns: meaning unit, condensed meaning unit, interpretation, sub-theme and theme (p. 108). The summaries made up the first column, the meaning unit, or content unit. In the second column, the condensed meaning unit, was a simpler and shorter version of the first column, the content unit. In the third column, I abstracted an interpretation of one or more

condensed meaning units or content. In the fourth column, I prepared sub-themes by combining several interpretation rows in the table. Lastly, in the fifth column, I inductively prepared themes that represented the set of meaning units in the table (Graneheim & Lundman, 2003). This iterative process required shuffling content pieces to better fit them together for the themes.

6. Lastly, I synthesized the findings to appropriately answer each research question using the themes that I constructed.

With the purpose of elevating the rigor of the analysis, I applied two systems tools to better understand the findings: Diagramming and the Iceberg Model. I selected the Iceberg Model as a supplemental method for viewing the findings with systems theory.

Iceberg Model or Levels of Thinking. A popular technique for contextualizing a systems perspective is referred to as the Iceberg Model, also known as Levels of Thinking (Manni & Cavana, 2007). Monat & Gannon (2015) studied 30 seminal works in systems thinking techniques and highly recommend the use of the Iceberg Model for gaining understanding of organizational systems. The Iceberg Model uses levels on an iceberg to represent separate features of a system. This is a powerful framework for viewing phenomenon in a system at deeper levels (Manni & Cavana, 2007). This view supplements the analysis of the data. This model is shown in figure 2.4 below.

Event Level. The first Level of Thinking is the Event level. This is the phenomenon, situation, or problem that can be seen or observed, similar to the tip of the iceberg, above water. By employing the Iceberg Model, the analysis of the phenomenon is pushed deeper, below the water, avoiding incorrect assumptions, or ineffective quick fixes.

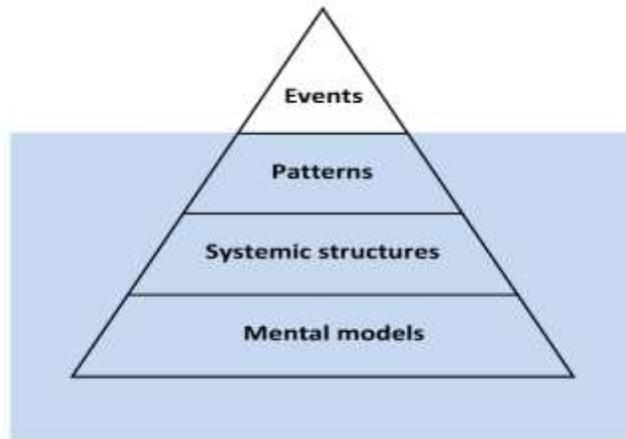


Figure 2.4: Iceberg model adapted from Maani & Cavana (2007)

Patterns. The second level, the Patterns, are the trends based on the history of events taking place over time. This level is below the Events, and below water. Patterns refer to observable behaviors. For example, surveying program needs prior to preparing a program proposal, or program promotion efforts. By studying events over time, patterns emerge, and from these, events can be forecast.

Systemic Structures. The third Level of Thinking is the Systemic Structures. Systemic Structures include system elements and the interactions amongst them, which lead the patterns, that in turn are seen by observable events. Systemic structures include tangible, physical things, such as buildings, land, equipment, and people. Also, systemic structures include the intangibles, like policies, procedures, organizational structure, intellectual property, rituals, and behaviors. Systemic structures explain how the system works.

Mental Models. The fourth Level of Thinking is the Mental Models. This is the human factor level, and includes the attitudes, beliefs, views, morals, expectations, assumptions, feelings and motivations. The Mental Models are at the bottom of the iceberg, the most hidden, and sometimes people may not even be aware of they exist.

Leverage points. Leverage points are points at which to intervene in a system that could lead to systemic transformation (Ackoff, Addison, & Curley, 2010). In the Iceberg Model, it is at the lowest level, the Mental Models, where the highest leverage points are. Interventions at this level will yield that largest systemic transformation (Manni & Cavana, 2007; Forrester, 2016).

Contextualizing this technique in a university setting is very useful to frame the study with a systems theory approach. For example, the high-level university system administrators and legislators had a vision or mental models of how the universities should operate, regarding certificate programs. From these mental models, values, attitudes and beliefs, policies and systemic structures were set in place. It is at the systemic structures level that the research study is primarily focused on. Here is where the system's policies, practices, and rituals are found. These rituals constitute acceptable practices within the system. These practices regarding new programs can be detected from patterns and observable events. The Iceberg Model was used as an additional analysis, applying a systems theory approach, enriching the understanding of the phenomenon under study.

Diagrammatic models. The use of diagrammatic models is an important and practical feature of a systems perspective (Walliman, 2010). To better understand interrelationships of the components of a system, its environment, a visual model can show causal links between them (Kim, 1999). Walliman (2010) stresses that models not only describe the phenomenon under study, but also serve as a structure to organize and analyze data. Diagramming promotes understanding of complicated real-life situations, interrelationships, and the manner in which they influence each other. It is useful to have at least a diagram as an attempt to document a complex organizational process in a simpler visual format (Walliman, 2010). For this study, the Iceberg Model was selected to aid the researcher in the analysis and presentation of the findings.

The literature supported the idea of utilizing diagrams and modeling techniques to visualize the process of program integration within a university (Kim, 1999; Seymour, 1988; Swerissen, 2007; Walliman, 2010).

Strategies to Ensure Soundness

The main strategies to ensure soundness while performing the research activities included: triangulation by the use of multiple sources of data; transparency by the use of a case study data set; clear evidence trail, from findings to report; and inter-subject understanding, by checking transcriptions.

Triangulation.

Triangulation is a form of validation (Denzin & Lincoln, 2005). Triangulation involved checking what is being learned about the phenomenon matches with what is already known (Stake, 1995). In order to do so, the use of several forms of data can build confidence in the overall interpretation and contextualization of the phenomenon. Triangulation made possible by multiple data collection methods provided stronger substantiation of constructs (Eisenhardt, 1989). For the data collection, three forms of data were gathered: interviews, observations, and document reviews.

The availability and access to public documents, curricular meetings, and selected participants drove the quality and richness of the findings. Only documents and artifacts pertinent to the study were considered. I interviewed eighteen participants who experienced the institutionalization process for one or more graduate academic programs within The University. With this approach, findings were corroborated by multiple sources, almost as replications or deliberate contrasting comparisons (Yin, 2006).

A case study data set.

As discussed in previous sections, I kept the data files organized and secured from public. The documents were given an identification code and added to a reference list. This control and safekeeping of data provides transparency and strengthens reliability (Yin, 1979). This data set included all research materials, such as field notes, transcribed interviews, documents, signed consents, subjectivity cards, and document analysis notes.

A chain of evidence.

The findings reported from the research were easily traceable to the data collected and analyzed (Walliman, 2010). Because of the systematic method utilized in the labeling and processing of all data items and sources, the chain of evidence was easily traceable.

Inter-subject understanding.

This requires that the researcher does not distort the participants' intended meaning during the interpretation of the data. During the interview, as needed, I repeated what was heard and understood in order to verify meaning. This approach increased success in capturing the phenomenon (Miles & Huberman, 1994).

Furthermore, interviewees received their transcribed interview, for review and verification. This assured that the subject's story or picture was as clear and meaningful and as free of my own biases as possible (Stake, 1995).

Strategies to ensure soundness were carefully planned, prior to data collection, analysis and interpretation. I reviewed a checklist with required documentation prior to interviews. Allowing sufficient time to conduct interviews and testing recording equipment beforehand was important. Also, I completed transcriptions of interviews shortly after ending, in case follow-up was needed.

Strategies to Deal with Subjectivity

To conduct research properly, data collection and interpretation must be as objective and unbiased as possible (Aaltio & Heilmann, 2010). Researchers bring their own set of values, beliefs, and sometimes even ideas of how data should look like, and therefore, to some degree, biases. Because I was an active participant in the case under study, great efforts to remove potential biases had to be in place prior to research activities. Peshkin (1988) advocates awareness of when subjectivity becomes a problem while conducting research activities. He adds that a change in emotions, such as excitement or anger, could be a warning sign that the researcher may become biased or subjective. Additionally, Peshkin (1988) shares his strategy to document those instances: write feelings and reactions in separate cards, at the moment these occur. Later, during data analysis, these notes can help remind researcher to reduce subjectivity and interpret data more objectively. For this study, the data collection and analysis included the feelings and reactions note taking protocol, upon sensing that emotions were arising. In preparation for interviews, a set of cards were labeled with the participant's pseudo name. Then, during the interviews, as each question was asked, any field notes regarding subjectivity concerns were jotted in the cards, as needed. By following this procedure, the timely note taking served as a reminder to reduce any biases.

Strategies to Protect Human Subjects

There were several practices included in the study to protect human subjects. First, I completed The University Course in The Protection of Human Research Subjects. Upon acceptance of my research proposal by my dissertation committee, I submitted an application to the Institutional Review Board. I sent each participant documentation regarding their involvement in the study. These documents included: general information about the research

study, an explanation of the purposes of the research, the expected duration of the subject's participation, and a description of the planned procedures. Lastly, a signed consent form was required and obtained prior to conducting interviews.

Summary

The research design consisted of a case study: a single, holistic, descriptive type case. The case was defined by all the inner workings, steps, processes encompassed in program institutionalization at one public Texas university. Specifically, the research focused on institutionalization, as defined by the literature review, of graduate, engineering, certificate programs.

The activities for data collection included semi-structured interviews, review of selected documents and observations. Eighteen participants were interviewed. Fifteen of these participants were selected based on the eight engineering certificate programs and other purposeful-sampling criteria, such as their role in reference to the process under study. The last three participants were selected using a snowball sampling method. The interviews were audio recorded, transcribed, and available to participants for edits, if needed. The data collected were analyzed by using an inductive and a priori approach, to construct themes. To ensure soundness, triangulation, a case study data set, clear evidence trail, and inter-subject understanding were used. To reduce subjectivity, separate notes were kept while interviewer became aware of emotions arising. Lastly, to protect human subjects, The University guidelines and research protocol were strictly followed.

Systems theory was selected from the several theories studied and considered for this case study. Systems theory provides a lens to examine multi-levels, multi-factors, and multi-

faceted organizational changes. The Iceberg Model (Levels of Thinking) is a systems technique selected in analysis and presentation of findings.

CHAPTER FOUR: PRESENTATION OF DATA

Chapter Introduction

In this chapter, I present the data around three major themes identified during data analysis: (a) rationale for certificates (b) program buy-in and advocacy, and (c) capacity building. As a reminder to the reader, the research questions were:

1. What does the process of institutionalization look like for the engineering graduate certificate programs at The University?
2. What factors influence the institutionalization of engineering graduate certificate programs at The University?

The three themes below offer insight into these questions, which I elaborate with analysis in Chapter 5. The findings are first organized in sub-themes and then I list the key factors, as found within each theme.

Theme 1: Rationale for Certificate Programs

Across the data, participants discussed their views and importance of offering engineering certificate programs at The University.

Certificate programs used as a response to market demands. In the case of three certificate programs, data showed that The University responded to industry partners' requests to prepare workforce in engineering fields. The first certificate came from a local employer request. According to a document I reviewed, one of the region's largest construction firms contacted The University president and requested a preparation program that addressed construction management. As a result of such a request, the Civil Engineering department created a

Construction Management certificate, delivered face-to-face and online, according to their website.

The second certificate was requested by a national defense contractor. Records show that this University partner provided over two million dollars to the Industrial Engineering department to establish a Systems Engineering graduate certificate and Master's degree. A faculty advisor shared that "Lockheed and that group in particular, air systems integration, they wanted to pull in new graduates at the graduate level" (Program Director F). The quickest way to address this request was to create a certificate with five courses and to hire an expert in that field to support instruction. According to Program Director F, the company's systems 'bootcamp' training dictated the content for the first course. The department was then renamed Industrial, Manufacturing and Systems Engineering and offers the Systems Engineering Master's degree, as well as a Systems Engineering graduate certificate with both face-to-face and online options. There was a demand for systems engineers: "They wanted to pull in new graduates so they would put in place an active program to have students over for internships in the summer, and then to hire them afterwards." (Program Director F).

The third certificate was a result of an international alliance with the Society of Manufacturing engineering and Mexican maquiladoras to provide trained workforce for manufacturing jobs. The International Manufacturing Engineering certificate was created with the support of grant funds, as stated by one participant: "So, we created that because we got a grant from the Society of Manufacturing engineering; where we promised to create a certificate at the undergrad and graduate level." (Chair B). As of today, this certificate program is dormant or inactive, because there is no faculty in the department with the expertise to teach the manufacturing courses: "People retire. We have the same thing in manufacturing. How many

faculty members right now have manufacturing [expertise]? Zero” (Chair B). Additionally, funding ended, together with the desire to continue with the alliance: “So, we have those opportunities...but someone has to start to continue doing those contacts, and for faculty tenure track that was not important for ten years...so we just stopped doing it” (Chair B). Interestingly, the demand for manufacturing engineers continues, “It happens not because we're trying to do it; is because the companies still are interested in sometimes recruiting our students, not because we want to, actually.” (Chair B). Dean C proposed the employment of professors of practice to teach certificate courses, “Because in my opinion the certificates should be a professionally oriented proposition, I think professors of practice would be the best” (Dean C). This certificate is still listed in the catalog, although it is not promoted and the courses are not being offered, therefore, it is referred here as dormant.

Most participants emphasized the importance of how new certificate proposals must clearly demonstrate market demands: “based on a survey or a study to find out, there was a need to have a certificate program. So, I guess with this survey that we also look into the national data to determine if there's a need to pursue.” (Program Director B). Because the rationale for certificate programs includes the response to market demands, these demands must be clearly demonstrated and addressed in new certificate program proposals.

Certificates are designed to strengthen specialized content knowledge for engineering practice. As indicated by the examples provided, the rationale for a certificate program is to address the regional professional practice needs. The graduate certificates provide a training format that addresses specific fields of study in local professional practice. In explaining the rationale for the Electric Power & Energy Systems certificate, a participant said, “...part of it was the interest to establish some closer ties with [local] Electric Company at the

graduate level. We use the certificate as a way to provide the credential for mostly professionals, initially. They want to provide something for people that they don't want to do the Master's; but they want to take a short sequence of courses and get some sort of recognition.” (Chair C).

There was consensus among participants regarding the practicality of such certificate programs: “The truth is that they are very useful as ways to package programs and sell them” (Dean A). A campus director stated: “There is a big push to establish more certificate programs here” (Director B). To support this statement, as observed during Graduate Council Committee meetings, two new graduate certificate proposals were approved, as well as a curricular revision of a third one. These certificate proposals clearly addressed professional practice needs and focused on closing a knowledge gap. For example, one of the approved certificates during observations, the Graduate Certificate in Healthcare Management for Non-Business Students, as the name implies, provides management content to healthcare students.

New certificates require new custom-made courses. As indicated by the examples, in order to address new job market demands and technological innovations, new courses and curricular changes are necessary. These can be done by updating existing courses with new content or by creating new and unique courses. However, one of the participants explained the advantages of certificate programs sharing courses with a degree program. He stated, “The certificate typically ... either are existing programs that just take sections of, so you allow the students to do a short version, half ways of our Master's program.” (Chair B). There was a strong link between certificate longevity and course integration in the Master's program. The greater the overlap of courses with Master's degree plans, the greater the chances of certificate to continue. This is simply due to the fact that the courses are offered regardless of the certificate enrollment. Similarly, some of the standalone certificates, with all new courses, tend to have low enrollment

and therefore more likely to be under threat. However, Dean A insisted that “we should be striving as much as possible to avoid duplication” (Dean A) when referring to creating a new certificate program. Basically, new certificates must offer something new and unique. There probably has to be a balance between utilizing existing courses and creating new ones when conceptualizing new certificates, in order to enhance the chances of program longevity.

Certificates are mainly custom-made and homegrown. The custom-made feature supports the rationale of the certificate of addressing specific local market needs at an opportune time: “Some topics come up and they're super popular for a while...and later the enthusiasm ends” (Director C). According to The University system policy, five courses is the limit allowed to develop and approve certificates within The University, hence homegrown. Seven out of the eight graduate certificates in engineering require five or less courses, which did not require approvals beyond the campus, decreasing implementation time. Because certificates respond to local market needs, and “This is the kind of thing that you could have going for a certain number of years and then once the market changes, you have access to the local market, then you can think of something else” (Dean C). As indicated in the Handbook of Operating procedures, proposals of no more than five courses reduces implementation timeline by keeping approvals in house.

The University is slow in updating curricular programs to address emerging technologies in the market. A program director highlighted the long time it took for The University to earn an accreditation required prior to teaching cyber security. He stated, “eight years later, we succeeded to have that [security] designation from NSA; and also, because at that time I was a graduate program director, I created that program cyber security certificate” (Program Director C). New technologies in the engineering field are constantly emerging. The University is not

adapting to the field fast enough to offer unique, relevant course content in current technologies, while addressing market needs. Another participant stated: “University does ok at aligning programs with market demand, but it can do better” (Dean C).

Certificate serves as a recruitment tool for Master’s programs. Most participants admitted to using the appeal of short specialized programs, such as the certificates, to attract more students into their courses, with the hope of recruiting them for the Master’s degree programs. A participant chairing an engineering department referred to the certificate appeal as: “...it is a way to bring more bodies to the classroom” (Chair C). Certificates are used as a practical academic format or education model to improve specialized content knowledge for working professionals. Adding to the certificate appeal, a staff member shared information about the certificate program admission requirements, “The application process is very simple: it requires the submission of a CV and a transcript. We don't even ask them for letters of recommendation... even GPA is less.” (Staff A). Additionally, documents that I reviewed showed that certificate programs require an average of five courses and are approved in-house. These features add to the recruitment appeal and usefulness of certificate programs for packaging professional preparation programs, and sometimes preamble to a Master’s program. Certificate popularity in The University is evidenced by its records, indicating that the forty-three graduate certificates have already been instituted.

The certificate is sometimes appealing to students in other engineering departments. A program director shared: “So, for example, if some electrical engineering student takes one or two or three courses of the systems engineering courses, often they come to ask or they come to know about the certificate, probably through the college website, and so forth, and then they'll come and ask, what can I do to complete my certificate in systems engineering while finishing

the Master's?" (Program Director F). Program Director F argued that certificate courses provide students with a wider variety of elective courses and even program concentrations within a Master's degree plan. In summary, the certificate courses from one department or college provide options for enriching a Master's program in another department or college for a more interdisciplinary or multidisciplinary approach.

As per university policy, courses may only be used once for degree programs, but it is not the case for certificates. The courses utilized for a certificate may fit or qualify and therefore be reused towards a Master's program. Interestingly, two participants reported that some students take two or three additional courses beyond their Master's degree plan, to complete a certificate in a different area of expertise (Chair C & Program Director F).

Institution name recognition attracts students. A program director provided his views, "Certificate programs depend on how well the university is recognized. Certificate programs offered by community college, don't carry too much weight. The certificate program from Harvard, people may just go there, to get a certificate." (Program Director B). A certificate program from highly recognized university attracts more students than from a third-tier university "A certificate program from UT Austin will weigh more than a certificate from our program, particularly if this certificate program is not unique or it doesn't carry any merit" (Program Director B). Branding is important for selecting institutions of higher education, "if we are a third-tier university offering a certificate program of no significant value, it's hard to bring in students. How well your organization is being recognized?" (Dean A). In an effort to recruit students for certificate programs, institutional name recognition came up. Similarly, the confusion of what certificates are and are not, also came up: Certificates are not state certifications. A college administrator said it best: "It's a certificate, not a certification. So, those

two words may be confused by a lot of people. We are not certifying people...” (Dean C).

Unlike certificates, a certification typically requires accreditations and licenses (Carbone & Gholston, 2004).

Factors that influence the rationale for certificates. The factors identified under this theme were: dynamic field, employer demands and support, student demand and enrollment, and certificate name.

Dynamic field. In order to “Update programs, because in science and engineering, the field is very dynamic” (Chair C) and course relevance matters, “Program names, course names, and content must be revised periodically” (Director B). Unfortunately, as mentioned previously, “The University is not as dynamic with programs as it should be, in creating new programs and eliminating programs that are not really viable anymore” (Chair A). There is no incentive to officially close certificate programs, or update them, although departments can change course name, content, and modify certificate program to better address market demand. A chair said it best: “Closing programs takes work, without incentive, why bother?” (Chair B).

Department chairs and college deans are more likely to support “What is hot in the market, such as 3D printing” (Staff A). This upper level support reinforces the perception that unique certificates that address a market niche carry more merit, thus increasing the legitimacy of such programs. Because the role of certificates is to address regional demands for trained workforce in current technological advancements, curriculum content must be new and unique, and to “make course decisions based on market” (Program Director D).

Employer demands and support. A college staff member shared that “Employers want to see better prepared students with the latest technologies, for employment and internships” (Staff A). Understandably, the job market is ultimately what drives the students to pursue

preparation programs. For one of the certificates, a participant said that “There was a need from the community. It was based on some discussions with the alumni” (Program Director B). As provided previously, there were three examples of how employer demands prompted collaborations with The University in creating new certificate programs.

Employers not only demand a prepared workforce in specialized fields, but they also sometimes support The University in creating programs to do so. Program Director F shared that “with the strong money coming in with the corporate sponsorship the first five years, that was a lure that would actually lure students from other departments” (Program Director F). From across participant feedback, it was clear that employer supports The University with experiential expertise, and jobs for students. This invaluable support is the result of partnerships and alliances delineated by written agreements. The College of Engineering employs a full-time staff member to reach out to employers for support and collaboration opportunities: “We have director of outreach for companies” (Staff A).

Student demand and enrollment. Simply put, “If there is no demand, the program will die” (Program Director E). For certificate continuity, there needs to be students enrolled in the courses. Program continuity and longevity depend on a healthy pipeline of student cohorts interested in completing certificate courses, “If there is no demand, and have faculty qualified to do courses, they couldn't do it...” (Chair B). Another participant added that as long as there is student demand, programs continue, “if students continue to demand the program, then the department know that there is again, a group of students are interested in pursuing that degree, then they would continue doing it.” (Chair C). A program director reflected on demand and enrollment: “Computer security becomes higher and higher in demand...my computer security courses used to be like 20 students but this semester I have 80 students” (Program Director C).

Similarly, a participant provided insight into how cohorts sustain program continuity, “there's a steady flow of new cohorts tapped every year. Again, certificates don't have to have a minimum of people.” (Committee Member A).

Certificate name. Adapting to market needs includes naming the certificate as close to the job title and the industry moniker. A graduate advisor explained “If 'systems engineering' is what is used in industry, then it's part of the job title of many engineers out there” (Program Director F), so the certificate name is very important to students. Also, using the industry moniker is how students perform web searches for programs. This simple practice can really bring in interested students, increasing enrollment and therefore, increase chances of program longevity.

Theme 2: Program Buy-in and Advocacy

Most study participants emphasized on how it takes a champion to effectively initiate, create, and rally support to approve certificate proposals and secure needed faculty collaboration for teaching courses. Similarly, department buy-in was found essential for programs to be supported from the start. This buy-in was in part related to the faculty’s perceptions and value placed on certificate programs with respect to their own goals.

A passionate faculty and program advocate, takes ownership of new certificate programs. Dean B’s statement sums this practice best: “Faculty own programs and most often drive, initiate, and champion creation of new courses and certificates they are experts on and passionate about” (Dean B). During interviews, participants were clear about who was in charge of each certificate initiated at the college. Most often the person pushing for a certificate was either the department chair or a faculty member within a department, whose passion and field of expertise aligned with the main certificate course content. Furthermore, with program ownership,

comes program management, such as catalog updates. After inspecting the online catalog, only thirteen certificates of the forty were shown. A response to that was “If the department does not care for posting the correct information in the catalog, then it is not going to happen” (Chair C).

There is no incentive in maintaining an accurate published program catalog. The University expects departments to review and update certificate programs in the official catalog. Neither the catalog, nor the college and department webpages are updated as frequently as programs change and “It is up to the departments to do this” (Dean A). The official online catalog showed thirteen graduate certificates, but according to a report provided by the provost office, there were actually forty. Program advisors may not even use the official program catalog anyway. One program advisor expressed that: “Even if it is in the catalog, students get advised and not necessarily go by the catalog” (Chair C). As mentioned earlier, there is no incentive to revise or close programs. There is no incentive to officially close certificate programs, or update them, although departments can change course name, content, and modify certificate program to better address market demand. According to the polices, The Texas Higher Education Coordinating Board reviews program completion output, and for graduate programs, if there are less than fifteen graduates within five consecutive years, programs are flagged for institution to consider closing. A chair said it best: “Closing programs takes work, without incentive, why bother?” (Chair B).

Program advisors greatly influence student enrollment and program completion. Students listen to advisors; if advisors do not value the certificate program, then they will not promote it. A participant stated that “if my advisor is telling me that this would really help and you can incorporate it into your Master's program, you're going to have a lot more students, because they want what's going to help them get a job” (Director C). Also, program advisors have great

influence on producing graduates, as they guide students to completion and demonstrating program outcomes, “There must be real outcomes for internal buy-in” (Dean B). The importance of demonstrated outcomes is presented in the last theme. Similarly, program directors must value the certificate program, “if they don't value that program they will get neglected and it will fall apart... so you need to have a program director who values this program.” (Program Director C). When the program director is also the advisor and champion, then likelihood of certificate program continuity improves.

The program advocate, a champion, rallies for program support at university committees and at different levels. The process of preparing and approving a new certificate proposal “is not that complicated” (Chair C). The process is straightforward, involving different steps, at different levels (See Appendix A). The process takes typically several months, as committees meet once monthly within the nine-month academic year: “I have worked with other programs and basically you need to have a champion who will take the responsibility of going through the process of the proposal” (Chair C). More importantly, it involves a passionate faculty member to rally support at the different administrative levels and committees, basically a program advocate or champion, “the faculty need to initiate it and they need to make a good case to the dean” (Program Director D). In all eight engineering certificate cases, there was a faculty champion pushing things forward, rallying people and getting support from their department, college and university, “In all cases that I've seen, you know, there is a strong person who recently championed the initiative and those individuals continue to be here ... they are also leaders, that rally people behind it, and they are in positions to effectively influence the University for support” (Dean B). Similarly, the wrong faculty member presenting a proposal for approval may not be as effective: “another reason why programs sometimes hit the rocks, is, if

the people who are presenting them do not have absolute clarity about what the program actually is.” (Chair B). The program buy-in of faculty presenting proposals to committees can also influence the approval outcome. The first asked during interviews related to participants role in The University. Based on the roles that participants provided during their interviews, and from review of their CVs, most participants have served in the multiple curriculum committees; have led multi-million-dollar research projects; and served in administrative positions in The University.

Data collection yielded numerous tips for preparing and approving new certificate proposals. First, time can be saved when the proposal champion consults the committee chairs and stakeholders, prior to committee meetings, very early in the process, to get buy-in and valuable feedback: “Involving the Provost’s office early on when writing proposal can really improve and speed proposal process.” (Director C). The committee members and university administrators involved in the proposal reviews can inform new program advocates of the likelihood of proposal approval success and any issues or concerns that need to be addressed. To have a good rationale for creating a new certificate, to preferably include a market study. Director A insisted that when preparing proposals, to “...delineate what the certificate is and it is not” (Director A). Regarding length, to prepare proposal “...very simply and in only one page.” (Dean A). In the event that two departments or colleges collaborate in a proposal, to “Include a written agreement...” (Director A) at the time of the proposal review in any committee meeting. She added that when seeking support, “Secure support at both the top and the bottom of the organization...” (Director A). Lastly, that prior to submitting a proposal to find and “Allocate resources needed prior to offering the program...” (Dean B).

Factors that Influence the Program Buy-in and Advocacy. The factors identified under this theme are: department buy-in, faculty commitment, research merit, and online option.

Department buy-in. The advice of one participant was to “seek entire faculty and departmental buy-in for proposals” (Staff A), to “go ahead and have a strong proposal, because it's not just from the faculty member, it is from the department” (Staff A). Certificate unique course offerings require collaboration from several faculty members, and without it, it is difficult to create and maintain certificate programs, “It's not a commitment but our commitment” (Program Director A). Changes in key personnel causes loss of program continuity. Program champions, advisors and chairs leave, or change roles, and department dynamic changes. The higher the departmental buy-in is, the stronger the chances of program continuity, “the key thing is that there needs to be a strong dedicated core of faculty members who want to continue, who want to participate in it, who find value in it, who are publishing in that field, are getting grants, recruiting students...really passionately, care about something,...they should be persistent, they should stick to it” (Director A). To increase departmental buy-in, a respected, diplomatic champion can rally support within the department and secure faculty collaboration.

It is at the department level that the certificate program work is done. The engineering faculty must engage in curricular updates needed to support technological advances. An administrator said that “The provost, the president can talk all they want, but in the end, we're not going to do the actual work that's going to be done by faculty, and so their engagement with it is the key” (Dean A). Similarly, updating courses, certificates, catalog and websites also requires faculty engagement, regardless of incentive, “a proposal is a grassroots effort” (Director A). Similarly, another participant explained “it comes back to people as I said earlier that it's people that drive programs. This certificate is a work in progress.” (Program Director A)

Faculty commitment. It takes committed faculty to create, promote, and teach new and unique courses. This commitment is based on faculty's professional agenda: "Is this somehow going to fit within their overall workload, overall commitment to their own role as a faculty member?" (Dean B). Another participant stressed that "self-promotion and self-preservation" (Program Director A) are at the center of that faculty agenda, and added that "People do not want to be in charge of a program, they just want the accolades of being involved in it..." (Program Director A) and that "There is a lot of talk about collaboration and partnerships, but in reality, faculty want and need to be the top dog and get the credit" (Program Director A). Yet another professor added that academic ego drives faculty collaborative actions: "Political and academic ego, if program is not the faculty's baby or if it doesn't help them advance, they will not support it." (Program Director E). So, commitment and buy-in towards continuity of certificate programs is directly related to who is involved and their academic ego, professional agenda, field of interest, field of expertise, and support for department.

Programs need a "strong core faculty who are passionate and publishing in that field, getting grants, and recruiting students" (Director A) because "tenure track faculty will not want to teach additional certificate courses with no incentive or extra pay" (Program Director B). Some tenure-track faculty placed very little academic merit to certificate programs. According to data from interviews, participant perceptions regarding the academic value of certificate programs was very mixed. While certificates may improve student professional practices, "they do not carry the academic merit due to lack of research focus" (Program Director C). Another participant stated that "although certificates have been around for quite some time now, 20 years or so, and they have yet to actually acquire the legitimacy of actual degrees" (Dean A).

The data yielded strong perceptions that certificate programs improve professional practice of students but do not contribute to research and scholarly activities. A participant stated, "We are not a trade school. Certificates are inconsistent with the mission of a university" (Dean A). Additionally, as certificate courses deviate from faculty area of expertise and interest, these courses become a burden to them. Similarly, faculty resent new programs, initiated by administration: "Few of them started from the faculty the way it should be and goes all the way up. A lot of them were initiated by the dean and a lot of times the administration, because some donor comes and say that that is like a new program to pay" (Program Director D).

Research merit. Mainly tenure-track faculty argued that "the certificate program creates extra workload to their faculty, and that it has no research value" (Program Director B), basically that there is "limited academic value" (Program Director B). Therefore, tenure-track faculty may not be too eager to support certificate programs. However, another program director, also tenured professor shared a different view, "Need to bridge the world of certificate professional practice with research, so many of those students are potential Master's student, so I see it is a continuum" (Program Director A).

Online option. This topic also came up with mixed reviews. On one side, new course development requires additional work, especially for online delivery instead of face-to-face. When referring to developing online courses for the 3D Manufacturing one, a chair expressed his concern, "So, I think the risk is more just being able to have a vehicle to put it online that doesn't become so cumbersome that we can't really do it." (Char A). However, the online option allows students outside the region to enroll in the certificate programs, thus increasing enrollment, according to Program Director A. Four of the eight engineering graduate certificate programs offer an online option.

Theme 3: Capacity Building

This section describes what the data revealed in terms of capacity building. The main topics include program support, goal alignment, faculty expertise, and challenges with multidisciplinary programs.

The University supports certificates with perceived contributions to overall goal attainment. Certificates that address innovative and current topics are perceived to be more beneficial and valuable. Buy-in from key stakeholders increases the chances of certificate's program sustainability. For example, at least three participants shared their enthusiasm for the new 3D Engineering and Additive Manufacturing certificate, "I fully support it. Right? It was not my idea, but I do fully support it and they need the person in my position to at least be the advocate for it, both administratively and publicly, right?" (Chair A). It was referred to as an innovative, highly demanded new program, with an enrollment cap at fifty students per year, because of equipment and lab restrictions: "if you put 50 people in there, it will be very expensive, because the materials alone are very expensive" (Chair A). The department is creating the new courses and plans to offer them online. The perception of benefits toward overall goals increases chances of program sustainability. Support is driven by research agendas, "College decides research areas, particularly at the graduate levels. The college research agenda will dictate support and funding." (Dean C).

Faculty goal diffusion does not support The University's rationale for certificate programs. As previously discussed, tenure-track faculty do not focus on improving the local professional practices, especially where there is no added incentive. A faculty member stated, "Providing students with internship opportunities in industry is just not that important" (Chair C). Another added that "A course may no longer be offered because nobody is interested in

teaching it...” (Chair B). Most importantly, the dean of the College of Engineering expects faculty to engage in scholarly activities that overall support college goals (Chair C). Besides teaching, these activities include research, publications, and grant proposals.

Although certificate programs do not support research related goals, their purpose does align to The University mission and college goals related to student preparation for employment and forming alliances with community. The University’s website states four goals. Two goals relate to preparing students for jobs and forming partnerships. The other two goals relate to research and scholarly activities. Certificate programs are aligned to these two goals: “1) Innovative educational programs that contribute to effective learning for our students and that prepare graduates to be leaders and innovators in a variety of fields, and 2) Active partnerships and collaborations with educational, government, non-profit, and commercial organizations, maintaining a commitment to diversity.” For certificates to address the preparation of students to be leaders and innovators in a variety of fields, the courses must address the market demands as new technologies emerge.

Administrators leverage existing resources to sustain programs they value. Financial support goes to those programs that the college prioritizes, depending on research agenda and fields of interest: “For some reason, there’s always money and resources...when higher level administration wants it. New programs require leaders that have been engaged and know how to leverage resources” (Dean B). These leaders can be a department chair, a dean, or another university administrator with access to resources and that has a vested interest in the program and finds money somewhere in the budget. Also, the dean shared that “Sustainability is easy to accomplish when you clearly understand how to leverage limited resources” (Dean B).

The University does not directly fund certificate programs and lacks surplus budget flexibility. Regarding personnel, “Universities don't hire people to teach certificate programs” (Dean B) and “Faculty have to fight for staff to support them and those are the programs that stay and go farther” (Program Director A). According to the budgeting policies, The University does not fund academic programs directly. It funds departments: the personnel, space, utilities, supplies and such. Therefore, when a new certificate program is created, the department typically absorbs the cost, or better said, departments leverage the resources they already have. Furthermore, “if certificate program requires new money, it will probably go away, as the college does not have extra funds.” (Program Director E). This funding practice demands department buy-in and faculty commitment in order to sustain certificate programs.

There are little chances and almost no incentive for the college or university to provide funding, once soft funds are exhausted. A program director stated that “If the certificate program was developed because of a grant that's a bad sign ... like ours in general, there aren't resources... if it depended on the grants resources to get the certificate operational, and unless the grantor got guarantees from the college and university that the program will be sustained then typically there aren't resources to sustain it and the program dies on the vine.” (Program Director E).

Similarly, “Even when a proposal is approved with university funding, often times, the requesting department does not get it” (Program Director D). Because firm institutional commitment is required to financially support programs beyond external funding, it is good practice “to negotiate in writing how this may occur, when writing proposals” (Staff B). Participants from the provost office stressed the importance of keeping detailed communication and commitments from all stakeholders, because when personnel changes, priorities change, and these commitments may be forgotten. For example, in order for The University to offer the in-

demand and highly popular Cyber Security certificate, the institution had to first invest in accreditation requirements and find expertise to develop and teach new courses. It took over eight years for the institution to be ready to offer this certificate. Fortunately, as previously stated, there is a healthy demand and student enrollment in the program.

Regarding funding and budgets, a participant explained, “It’s based on historical [budgets]. It’s been the same budget” (Staff B) for about nine years, and that there is only “flexibility to get positive responses with the instructional teacher assistants and part time lecturer budget” (Staff B). Typically, large universities have multiple sources of financial support, large engineering faculty and staff, space, equipment, expertise available, to list a few; basically, tangible and intangible assets that improve odds of new program sustainability. For this university, participants agreed that resources were limited, and fixed historical budgets have little or no room for negotiation. Staff B elaborated more about the budget: “It’s been the same budget for years, it’s historical... for the past eight, nine years, the number of faculties has been the same. It varies from one to two. But it’s always been 83, 84.” (Staff B). Then, the key for sustainability is in the leveraging of existing resources, with shared visionary goals in mind, as one participant explained, “I think the programs that keep going are those that don’t need the extra funding from the beginning because they already use the resources that already exists in the unit.” (Program Director C).

Increased program enrollment does not increase funding to departments. This is due to the budgeting and funding practices described earlier. Despite increases in programs and enrollment, budgets remain the same because funding has not yet been linked to program performance or demand: “We don’t fund programs but we do fund productivity. Or we are moving in the direction of a budget model that reflects semester credit hours.” (Dean A). The

operating budget is still based on historical data, rather than by credit hour production, or by academic program. This is the response from a high rank administrator, to a follow-up question regarding the enrollment necessary to sustain certificate programs: “At least 20 students enrolled per year to make it permanent.” (Dean A). Although this may be the case, based on budget policies, The University receives the additional income and utilizes historical budgets to fund colleges. Then, the college dean also uses prior budgets as a guide to fund departments. Increased enrollment may be a point of contention when departments request additional financial support. A professor expressed his discontent with increased enrollment and faculty shortage: “We are bringing a significant amount of research for The University. We have three or four times more students and same faculty for the last nine years, regardless of new programs and enrollment numbers” (Program Director D).

Factors that Influence the Capacity Building. The factors identified under this theme are: shared visionary goals, faculty expertise, and inter- and multi-disciplinary collaboration.

Shared visionary goals. In order for the institution to leap forward, leaders must provide the clear vision of where the institution is headed, and support the activities and programs that align to that vision. Regarding a new program, simply stated, “How does it fit in the framework of what it is we want to do?” (Chair C). One participant commented on precisely the lack of vision: “inability of dean and VP of research and sponsored projects to plan strategic goals that are bigger than individuals and even departments”. Because the field of engineering is constantly changing, the need for clear visionary goals is crucial for establishing program priorities. These visionary goals may influence the sustainability of certificate programs. For example, referring to the Entrepreneurship and Innovation certificate, a participant shared, “I don't think that the

current dean has an interest in promoting The University as a via success in venture competitions” (Program Director E).

Faculty expertise. This quote explains it well: “University must offer certificates and programs that it can handle: for example, not nuclear physics, but applied physics” (Program Director D), because it lacks the expertise and any type of lab and equipment needed. He added, “Do we need a biomedical degree over here at [The University] when there are six of them in this state? Each one of them they have 20 faculty?” (Program Director D). Sometimes, the expertise is not available because of course loads, and faculty leaving The University: “The factors that will allow [certificate] permanence will be continued support from the administrators, no loss or attrition of faculty or experts in any field in that area.” (Committee Member A). Staff B added to the recurring topic about faculty shortage, “You are going to see that for the past seven years, eight, nine years, the number of faculty has been the same. Varies from one to two” (Staff B). Lastly, a closing comment, addressing the strain on faculty, “We get into the situations we don't have the faculty to teach, we don't have the expertise, only one person” (Program Director D).

Inter and multi-disciplinary collaboration. Certificate programs that involve two departments in the college or two colleges face multiple challenges, primarily because colleges and departments are very siloed. As one participant put it: “We are siloed enough in departments, and even more siloed in colleges, and simply, the day to day communication will suffer” (Program Director F). Another participant added another challenge, “They require a great deal of good faith on the part of everyone” (Program Director E). And probably the hardest hurdle to overcome: “Faculty must recognize where their tenure evaluations will come through, and that is their home” (Program Director E). Working away from a home department may have

devastating consequences, as a participant explains, “So I'm in Civil Engineering and I start working all the time with Electrical Engineering, then I may not get tenure. The current chairman will say, what are you doing for me?” (Program Director D). The two certificates that are multidisciplinary have not been supported, from the moment that one college lost interest. For instance, regarding certificate course offerings, “Because it was offered by some professor not in this department and this professor didn't want to teach that course anymore.” (Program Director C). And lastly, regarding recognition for faculty contribution to a program, the “institution to have interdisciplinary program is very hard, because the structure of the university is very departmental...and I understand why, because in some way they were contributing to the program but they didn't get any credit for it.” (Program Director C). Furthermore, legitimacy issues came up with multidisciplinary programs, when a participant commented that “engineering education has to fight all the time for academic intellectual respect” (Program Director E).

Summary of Findings in Response to Each Research Question

Findings were presented in three themes (1) rationale for certificates; (2) program buy-in and advocacy; and (3) capacity building. Here, I present the findings in response to each research questions.

Research Question 1.

In response to the first research question: What does the process of institutionalization look like for the engineering graduate certificate programs at The University? These are the main ideas I found:

Rationale for certificate programs: (a) to strengthen specialized content knowledge for engineering practice; (b) to respond to market demands in partnership with industry employers;

and (c) to serve as a recruitment tool for Master's programs. At The University, certificate programs are used as a response to market demands. In three separate cases The University collaborated with employers to create a certificate program to better prepare engineers with specialized knowledge. Because the engineering field is dynamic, The University creates new certificate programs with new courses. The steps to incorporate certificates to The University catalog was found to be very straightforward. Certificate programs also serve as a recruitment tool for Master's programs. Study participants used helpful strategies to speed the approval of proposals.

Program buy-in and advocacy: (a) effective program advocate rallies support at different levels and lobbies committees to approve and sustain new and existing certificate programs; and (b) departmental buy-in supports new course development, instruction, advising, curricular updates, and certificate program administration. It is the program advocate or champion that rallies support at the different levels and committees to find support for programs. Buy-in from the department hosting the certificate determines success in new course development, teaching courses, advisors promoting programs with students, and maintaining the graduate catalog.

Capacity Building: (a) The University supports certificate programs with perceived benefits, and alignment and contribution to overall mission and goals; and (b) Administrators leverage existing resources to sustain programs they value. The academic value placed by faculty is related to program goal alignment to overall goals. The continuity of any certificate program is strongly linked to the faculty commitment and especially to the program advocate, or champion. Not surprisingly, the effectiveness of such champion is at the center of the process, leveraging resources and maneuvering systems in place.

Research Question 2.

In response to the second research question: What factors influence the institutionalization of engineering graduate certificate programs at The University?

Rationale for new certificate programs:

- Dynamic field – market demands are impacted by technological advancements
- Employer demands & support – partnership collaboration facilitates process
- Student demand & enrollment – pushes for programs to start or continue
- Certificate name – to closely align to industry moniker

Program buy-in and advocacy:

- Faculty commitment – required from proposal to managing programs
- Departmental buy-in – consensus needed to continue supporting program
- Research merit – incentivizes tenure-track faculty commitment and engagement
- Online option – a popular course delivery method for working engineers

Capacity Building:

- Shared visionary goals – facilitates program continuity
- Faculty Expertise – to develop new courses in a dynamic engineering field
- Multidisciplinary collaboration – more difficult in a siloed environment

The main factor in the institutionalization process was faculty commitment. Faculty commitment was found to be essential for the creation, promotion, teaching and sustainability of certificate programs. Faculty commitment is determined by their field of expertise, interest, incentive, research agenda, workload, and overall level of ownership in championing the

program. At The University, certificates are popular and useful as a practical educational model to provide specialized content knowledge for engineers. While certificates may improve student professional practices, they do not carry the academic merit due to lack of research focus. Therefore, certificates lack scholarship incentive to meet tenure-track faculty research demands.

Capacity building was an overarching theme dealing with goals and program support. Data provided a better understanding of how programs are sustained financially. Basically, departments must leverage what they already have, to support certificate program. Similarly, university administrators find ways to support programs they value.

CHAPTER FIVE: CONCLUSIONS & RECOMMENDATIONS

Chapter Introduction

The purpose of this case study was to gain insight into the process of institutionalization of graduate certificate programs in engineering at one public Texas university. By applying techniques from systems theory, it was possible to get a richer, deeper understanding of the institutionalization process.

In this final chapter, I summarize the findings, addressing each research question. I then discuss the implications of findings, links to the relevant literature, and conclusions. Thereafter, I provide a discussion of institutional recommendations for policy, practice, and future research. The chapter ends with the limitations of the study and a final summary.

Links to Relevant Research

The relevant research enunciates a broader perspective of the role and purpose of the certificate when contrasted with the findings. In regards to the basic definition of a certificate the findings and the literature showed common agreement. Reed and Stanchina (2010) define certificates as a “post-baccalaureate education model that addresses both technical training while connecting to marketplace challenges, enhancing their appeal to potential employers” (2010, p. 2). One difference between research and findings is that the research also showed that certificate programs are useful to enhance careers causing a shift in position or promotions (Murray et al., 2011); while the data from the study only yielded understanding emphasizing that certificate programs enhance student knowledge for professional practice.

In order to discuss the academic value of certificates, it is important to distinguish between a certificate, a certification, and a certificate program (Carbone & Gholston, 2004).

While only one participant in the study noted the distinction between certificate and certification, in at least two of journal articles reviewed, the two words were used without distinction. A certificate, according to Carbone & Gholston (2004), is ostensibly a training lasting from a few hours to a few days, and the provider is not affiliated with an institution of higher education. A certification involves award of a credential or license, which is earned by a combination of academic achievement and applicable work experience. Lastly, a certificate program requires prescribed courses leading to a graduate certificate provided by an institution of higher education (Carbone & Gholston, 2004). The data yielded strong perceptions that certificate programs may improve professional practice of students but have very little academic merit, due to lack of research focus. A reason provided by participants was that the short length of certificate programs prohibits lengthy research agendas. Reed and Stanchina (2010) created a certificate that included a research component; one of few found in the literature. The certificate required 8 courses, on average 3 more courses than that required for The University certificates. Lengthier programs may support the opportunity to include focus on research activities.

The study findings and the relevant research concur with The University program administrators' perspective of the certificate program appeal as being a tool to recruit students. Daughton (2007) added that certificates serve as a safe way to ease into graduate courses while avoiding the Graduate Record Examination (GRE) admittance exam. Moreover, the online option plays a significant factor in recruiting students because of the convenience and access from long distances. At The University, half – four out of the eight – certificates are currently offered online. Records showed that the two certificates with highest enrollment offer both delivery formats: face-to-face and online. The sustainability of these programs appears assured.

A key requirement for institutionalization of a program is legitimacy (Rincon & George-Jackson, 2016; Shediak-Rizkallah & Bone, 1998). A program is more legitimate when the stakeholders perceive that it provides benefits. Working students seeking jobs or promotions or requiring supplemental education to perform in the engineering industry may find certificate programs very appealing, and therefore, legitimate. Employers may find certificate programs legitimate if they cover their employee training needs, as shown by the three examples of new certificates customized for them. Tenure-track faculty do not necessarily find certificate programs as legitimate as Master's degrees. This is primarily due to the lack of research focus in certificate programs. For this reason, findings showed that some faculty are not incentivized to promote and contribute to these programs.

From the literature reviewed, there was a strong consensus that engineering programs must be continuously revised to better prepare students in current technologies (Galloway, 2007; National Academy of Engineering, 2016; Redish & Smith, 2008; Vest, 2005). Desha et al. (2009) insist that rapid curriculum renewal is strategic for engineering education programs to remain relevant. Galloway (2007) stressed the importance for engineers to complete Master's degrees due to the inadequacy of the average engineering Bachelor's programs. The data showed that the trend is to specialize with post-baccalaureate education programs. The University offers only seven undergraduate programs in engineering, but nineteen Master's degrees and nine graduate certificates. Both the findings and research support the trend that engineering industry demands graduate programs in varied fields of expertise. The data did not show, however, that The University proactively adapts to the dynamic engineering market demands. Clear evidence of this was the case of the International Manufacturing certificate. Students demand the program, but no faculty member currently has the expertise or incentive to teach manufacturing courses

(Chair C); therefore, The University failed to address the regional industry demands in this specialized field.

Findings showed that The University has collaborated with industry in creating new certificate programs to address specific needs. Typically, new certificates include new courses, with a certificate name that mimics industry moniker. According to Reed and Stanchina (2010), engineering graduate certificate program courses must not only be designed with industry collaboration, but also taught by adjuncts, experts in the field. The findings showed that The University's responses to requests from employers may be contingent upon employer financial support, and The University's in-house available expertise. This in-house expertise or lack thereof, determines in part, how the institution can respond to such curricular revision needs. For example, the Cyber Security certificate was in high demand, but the department did not have faculty expertise in the subject, and The University lacked a cyber security accreditation. It took eight years to launch the certificate and courses. Given a university may be up to date in terms of utilizing all technological advances, it may be reasonable to focus on the most salient regional needs, in accordance to The University mission and goals.

There is a misalignment between findings and the published research in terms of goal alignment. As the program alignment to university mission and goals increases, the likelihood of instituting the program increases (Goodman & Steckler, 1989b). Unfortunately, the program's caretakers may have other goals in mind. Findings show that faculty do not embrace the goal of meeting market needs as much as meeting tenure-track research demands. The incorporation of a program occurs when institutional values and norms related with the program are embedded in the culture of the organization (Braxton et al., 2002). Because certificate programs have a low research merit, these may not become embedded in the culture of the organization. Faculty

perceptions of certificate academic value reduces the likelihood of program longevity, continuity, and therefore, institutionalization.

Faculty engagement is therefore crucial in the adaptability to regional market demands. An example of inadequate faculty engagement is with the International Manufacturing certificate. Lack of faculty engagement made the certificate dormant. Although the manufacturing facilities demand manufacturing engineers, there is no faculty member in the department interested in teaching the International Manufacturing certificate courses. Once the faculty expert retired over ten years ago, courses were no longer offered and the certificate program has no enrollment. The adaptability to market demands is closely related to the faculty goals, their field of interest and expertise.

Furthermore, at The University, findings indicated that the level of integration of certificate course into graduate programs predicted the level of faculty interest and overall chances of program continuity. Standalone certificate courses are, therefore, the most fragile in terms of longevity. However, a new certificate program that is in great demand and with healthy enrollment is perceived as legitimate and more easily supported.

Kezar (2001) pointed out that it is important to consider the political, economic and social environment because a program interacts with its environment, such as the upward levels within an organization, a community, a system of universities, and so on. Also, that the program will be impacted by depth and range of relationships within the political, economic and social environment between outer community members and the program (Shediak-Rizkallah & Bone, 1998). The data revealed elements of political or social nature. The rallying for new program support during the approval process and departmental buy-in are two elements that can be seen

as social and political in nature (Curry, 1992). As an example, the program advocate or champion is as effective as its political influence within the institution.

The participation of a program advocate or champion in the process of instituting a new program was by far the single most salient item that both the research and the data agreed upon (Goodman & Steckler, 1989b; Shediak-Rizkallah & Bone, 1998). The common lesson shared about sustaining and institutionalizing programs was to have a respected engineering faculty member leading the effort (Curry, 1992). The program advocate, or champion, must be a political leader, typically holding a mid- to upper-level administrative position within the organization, who can build a sense of compromise necessary to build support for programs, and definitely have good negotiation skills (Goodman & Steckler, 1989b; Shediak-Rizkallah & Bone, 1998). Based on the roles that participants provided during their interviews, and their CVs, most participants have served in the multiple curriculum committees; sometimes chaired them; have led multi-million-dollar projects; and most have served in administrative positions within the different levels in The University. Their political leadership experience plays a key part for program champions to get departmental buy-in and upper level support needed to approve and sustain certificate programs.

Findings showed that a program advocate or champion is incentivized to take ownership of the new program proposals and effectively maneuver the layers of bureaucracy until approvals are completed. This is a lengthy process, so the program champion must be a committed and engaged political leader, passionate about the permanence and continuity of the certificate program.

Evashwick and Ory (2003) refer to sustainability as the endurance of the program since its inception. Participants highlighted the challenges faced by staff and challenges of inadequate

budgets, a topic that also arose in analysis of the previous theme, relating to building capacity in program sustainability. The data showed that The University faces multiple hurdles in sustaining certificate programs. Data and records showed that three out of four certificate programs went dormant immediately following ending of external funding. Also, as faculty members retire, or depart, sometimes so do their specific courses; for example, this was the case with the International Manufacturing certificate. As indicated earlier, the college retained the same overall number of faculty members for about nine years, regardless of increased numbers of programs, courses and enrollments. Departmental program buy-in was found to be crucial in program continuity and sustainability. This buy-in enables favorable decisions in leveraging resources within the department to keep the program advancing.

A program is viewed as legitimate if it contributes to the organizational goals and mission (Rincon & George-Jackson, 2016). The organization links program legitimacy to funding, staffing, and resources, and its legitimacy becomes cyclical (Rincon & George-Jackson, 2016). It is this cyclical legitimacy that increases sustainability. This cyclical legitimacy translates into historically supported budget lines and items at The University. Once an item is part of the approved budget, it is considered established and thereby deemed institutionalized. This bureaucratic practice is thereafter exemplified by preparing next year's budget based on the prior year's budget. Since the prior year's budget has been approved, it is therefore legitimized (Pfeffer & Salancik, 1974).

Both the research and data showed that planning for program sustainability must be incorporated from the beginning. The prospects for long term program continuation are improved by enhancing the conditions for sustainability early on in the planning and implementation of a new program (Shediak-Rizkallah & Bone, 1998). In this case, it was found

paramount that the leveraging of existing resources to be key to sustaining certificate programs in this institution. Data showed that the institutionalization of certificate programs relied heavily on the sustainability component. As indicated in the conclusions, sustainability was the main challenge in the institutionalization of these programs.

Implications of Findings

This study contributes to the research literature in two ways. First, most of the research base has been focused on certificate program demand, creation, content, and evaluation, rather than the practices needed for a more long-term institutionalization process. Few studies offered insight beyond the certificate program rationale and initial implementation (Reed & Stanchina, 2010; Singh & Hamada, 1996). Studies presented approaches to surveying certificate market demand (Carbone & Gholston, 2004; Vickers & Kisenwether, 2007); course content (Gordon & Silevitch, 2009; Rosado, Sanchez, Mellado, & Medina, 2015); program evaluation (Murray et al., 2011); and overall certificate worth (Carneval et al., 2012). Therefore, this study provides value in focusing upon and addressing practical matters that influence the continuity of certificate programs at one university, long term, beyond implementation.

Second, the results may suggest that we need to rethink the viability of the definition established for institutionalization, specifically when referring to graduate certificate programs. The definition for institutionalization used was that it is a gradual process of a legitimized organizational change, in this case certificate programs, becoming permanent and sustained within an institution (Curry, 1992; Goodman et al., 1993; Slaghuis et al., 2011; Swerissen, 2007; Yin, 1979). Scholars agreed that permanence was a key requirement for the institutionalization process. And according to Curry (1992), permanence comes with program legitimacy and its longevity. Therefore, for certificate programs to become institutionalized, they must first have

some kind of longevity, to then somehow determine permanence. A minimum length of time was never specified either in the literature or the data. In the case of graduate certificate programs, longevity (continuity) and legitimacy may be more appropriate than is permanence. Moreover, based on the findings, certificate programs are fairly easy to create, but much harder to sustain. Also, the rationale for certificates also indicates that some certificate programs were designed for a short life, therefore may never become permanent. This is the case for those certificates created as a stepping stone to a Master's degree program. Consequently, a revised definition for institutionalization could be assumed: the gradual process of a legitimate certificate program to continue and become sustained within an institution.

Conclusions

Through this research, I acquired insights into the institutionalization process of graduate engineering certificate programs at The University, and the main factors impacting such processes. Here, I list the three key conclusions from the study findings.

First, certificate programs created in collaboration with industry partners are useful educational models for delivering specialized engineering content to students. The certificate programs typically consist of an average of five courses, and are approved in-house. The certificate programs serve as a recruitment tool for Master's degree programs. The online option was found to be an attractive feature of these programs.

Second, faculty commitment at all levels is by far the most essential element and strongly impacts the process. The faculty is at the center of all university decisions and activities. A program advocate in the department commits to preparing the program proposal, rallying support for approvals and long-term sustainability. The departmental buy-in dictates the overall successful management of the program. The faculty teach and develop new courses, while the

advisors promote the program. Similarly, faculty tend to support programs aligned with their personal goals and scholarly agendas. The pressures of scholarly activities for self-promotion, steer faculty away from students, their developing careers and engagement with certificates. This goal diffusion seemed naturally inherent in the tenure-track faculty process.

Third, I found sustainability as the predominant requirement and challenge in the institutionalizing of certificate programs. The University supports certificate programs with perceived benefits and contributions to goals. In order to sustain programs, administrators leverage existing resources. The systemic structures in The University does not easily support inter- and multi-disciplinary collaborations; therefore, these programs fail to continue and become institutionalized.

The Iceberg Model

I gained further insight by applying the Iceberg Model, or the Levels of Thinking framework, and I employed it to supplement findings. Following its application, I analyzed the phenomenon further, deeper below the water, thereby avoiding incorrect assumptions. Organized in Table 5.1 are the four Levels of Thinking within the Iceberg Model and a column for each research question. The findings have been grouped as either Patterns, Systemic Structures or Mental Models.

Event Level. This is the phenomenon, situation, or problem that can be seen or observed, similar to the tip of the iceberg, above water. In this case, the Event is the phenomenon under study: the institutionalization process of graduate certificate programs in engineering at this university.

Patterns. The main patterns identified from the findings include: (a) certificates are useful as a response to employer demands in providing specialized content knowledge within a

dynamic field; (b) a program advocate is needed to champion programs and promote enrollment; and (c) certificates serve as a recruitment tool.

Table 5.1

A Synopsis of the Findings applying the Iceberg Model or Levels of Thinking

Levels of Thinking	Research Question 1: What does institutionalization process look like?	Research Question 2: Factors that influence event?
Event	<i>Institutionalization of graduate certificate programs in engineering</i>	
Patterns (History of events, Trends)	<i>Certificate programs are useful in responding to market demands and in preparing workforce in specialized engineering content knowledge. Certificate appeal serves as a recruitment tool. A program advocate takes ownership of certificate programs and rallies for program support at different levels and committees. Program advisors greatly influence student enrollment and program completion.</i>	<i>Dynamic field Employer demands & support Certificate Name Student demand & Enrollment</i>
Systemic Structures (Physical things, Policies, Processes, Procedures, Rituals, Behaviors)	<i>University is slow in updating curricular programs to address emerging technologies in the market. University does not directly fund certificate programs and lacks surplus budget flexibility. Increased program enrollment does not increase funding to its department. Colleges and departments are very siloed.</i>	<i>Online Option Faculty Expertise Inter-and multi-disciplinary collaboration</i>
Mental Models (Attitudes, views, beliefs & assumptions)	<i>Tenure-track faculty place low academic value on certificate programs. Faculty goal diffusion does not support the university's rationale for certificate programs. University supports certificates with perceived contributions to overall goal attainment. Administrators leverage existing resources to sustain programs they value.</i>	<i>Research merit Faculty Commitment Shared visionary goals Departmental buy-in</i>

Mental Models. The Mental Models from the findings indicate that: (a) faculty commitment and departmental buy-in are directly related to a perceived certificate value, such as research merit and (b) support for certificates is linked to the perceived contribution toward goal

attainment (faculty, college, or university goals). It is the Mental Models that dictate the value placed on certificate programs by faculty.

The results from the interviews show that faculty at all levels of the organization exert a tremendous influence toward the programs that they want and do not want. The perceptions of usefulness in instituting certificate programs were mixed. Some participants shared how these programs are helpful in recruiting, building alliances, and in preparing engineers for practice demands. However, tenured and tenure-track faculty were more apprehensive in focusing their effort in meeting market demands, rather than in their research. Most participants did not place the same value to certificate programs, as they did to actual degrees. Furthermore, the two highest ranked participants, in politically influential roles, expressly declared their dislike for certificate programs.

Leverage points. In the Iceberg Model, it is at the lowest level, the Mental Models, where the highest leverage points are. Interventions at this level will yield the largest systemic transformation (Forrester, 2016; Manni & Cavana, 2007). Because leverage points are places of system interventions, these easily translate to recommendations for system improvements. These are discussed in the next section.

Discussion of Institutional Recommendations

The results of this study showed that the certificate programs are useful in providing educational opportunities to engineers while addressing market demands. Faculty commitment at all levels was found essential to the successful preparation of proposal, approval, and support for instituting certificate programs. Lastly, The University supports those programs deemed valuable. In this section, I discuss the institutional recommendations for policy and practice.

Recommendations for Policy

Get consensus for shared visionary goals. Shared visionary goals stipulate the focus to prioritize research agendas and graduate academic programs for the types of industry, engineering fields, or technological advances. It is at the graduate level that there is the most flexibility for introducing such new and unique content (Director B). The college of engineering and its departments must continually advocate for innovative visionary goals that are bigger than one faculty member, one program, one department or even the college (Program Director A). In the lowest level of the Iceberg Model, the Mental Models, is where the greatest point of leverage is found: when the stakeholders of the system believe and value the shared goals (Dean B).

On paper, the four goals of the college align well to The University's goals. There are two goals that deal with the fundamental blocks of institutions: faculty, students and careers. Two goals deal with research activities and two goals address The University's commitment to prepare students for their careers and to partner with their employers to aid the process. The University, students, and employers benefit from the strategic development of certificate programs (Dean A).

Incentivize faculty to commit and support to certificate programs. Based on the candid reflections from participants in this study, the reality was that most tenured and tenure-track faculty members are not on board with focusing their efforts in preparing students for their careers through the use of certificates (Project Director B, C and D). There is just no recognition, no incentive nor any form of individual accountability (Chair B). To alleviate this, the college should incentivize faculty to support the institutionalization of certificate programs. Incentives include summer pay, stipends, lab space, recognition and general support (Program Director D).

Graduate certificate programs are a useful educational model for this university.

Graduate certificate programs can be a practical solution in fulfilling the commitment to prepare students for their careers, in very specialized engineering fields (Dean C, Program Director C, Staff A). These are a way to package new and existing courses for a quicker turnaround than Master's degree programs. This is especially true for introducing new topics, in a fairly short amount of time, and at a fairly low cost (Director C). Besides, these programs have shown to be preamble to a Master's degree and attract working professionals back to school (Chair C, Program Director F).

Recommendations for Practice

Addressing local market needs must be a proactive endeavor. As new certificates are considered, department chairs and college deans must be very clear about the benefits they provide: to students, to the community and of course, to the institution (Dean A, Program Director B). Program administrators must assess the strengths within the institution in regards to the requirements for the new certificate (Program Director D). They must consider the competition (Program Director B). And because part of The University's mission is to precisely enable social mobility, preparing students for their current jobs and future career is important (Dean B). Therefore, program administrators at The University need to be more proactive and dynamic, in creating adequate programs and eliminating those that are outdated and not useful (Staff A). Basically, The University must maintain certificate programs to be marketable and relevant. Similarly, it needs to aggressively improve outreach to regional employers in different industries (Staff A). These industries consistently require employee technical training and may provide a flow of student cohorts, with tuition reimbursement programs, and possibly research topics with funding opportunities for those interested faculty (Program Director F). However, for

over ten years, The University has not tapped into the manufacturing market, by addressing employee needs and taking advantage of partnership benefits (Chair C).

Tips for preparing and approving certificate proposals. Regarding the preparation and approval processing of new proposals, the research leads me to provide some useful tips collected from participants' feedback from interviews:

- To propose new certificate programs that are unique addresses a niche in the market, therefore avoiding duplication (Program Director B, Dean A).
- To clearly delineate what the certificate is and is not (Director A).
- To prepare the rationale for proposal very simply and in only one page (Dean A).
- To secure support at both the top and the bottom of the organization (Director A).
- To involve the Provost office early on in improving proposal prior to review (Director C).
- To seek proposal feedback from key committee stakeholders, and revise prior to submission (Director C).
- To have entire faculty within the department review and revise it, while getting consensus, and buy-in prior to submitting proposal (Staff A).
- To plan allocation of resources needed prior to offering the program (Dean B).
- To make sure there is faculty qualified, willing and able to teach courses (Program Director D).
- To include a written agreement indicating, at the time of the proposal review in any committee meeting, if new certificate includes courses from other departments (Director A).
- To send the “right person” to the committee meetings to effectively present proposal and most importantly, to answer any questions adequately (Chair C).

Tips in addressing sustainability. One participant advised the assessment of existing resources before asking for more: “Look at what I have right now. What are our current strengths within the department and the college and even within The University.” (Director A). Another participant added that “Sustainability is easy to accomplish when you clearly understand how to leverage limited resources.” (Dean B). And the most creative advice, “You do have to think creatively and about how can I meet The University halfway in making this happen? ...That's usually when people are successful it's because they found a way to contribute to it not just ask.” (Director A).

Increasing enrollment and demonstrating outcomes. Find cohorts of students by reaching out to outside organizations and build a pipeline of students (Committee member A). Also, show outcomes, by having graduate program advisors work closely with students to ensure their course completion and application for certificate (Dean A, Director B). Certificate completers are reported to public databases such as IPEDs and build that historical data, setting a precedent and strengthening the department with higher outcomes (Director B). These outcomes can serve as leverage for needed support. Although certificate completers do not contribute to the funding formula, the total credit hours taught do (Staff B).

Select a graduate advisor that values certificate programs. Graduate program advisors greatly influence students in their programs and course selections. Graduate program advisors can influence the success of a certificate program, by steering students towards or away from certificate courses. This will depend on how they value the program and their professional goals and personal agenda (Dean B). So, the certificate program advisor must be a program champion, or at least be an unbiased adjudicator.

Recommendations for Future Research

Results of this study suggest that further knowledge can be gained from examining the perceptions of benefits regarding graduate engineering certificate programs from the perspectives of enrolled certificate students, alumni, and industry employers. These perspectives can shed light to the curricular usefulness of the certificate programs, especially for the local region (Carbone & Gholston, 2004). Furthermore, due to the controversy surrounding certificates and their expected growth in the US, more research can facilitate understanding of their role and their value (Carneval et al., 2012). Additionally, the significant and recent popularity of these non-degree programs has raised questions regarding their effectiveness in skill development, increased salaries, and their recruitment appeal for Master's programs (Murray et al., 2011). Research in this topic can inform stakeholders of certificate program effectiveness in recruitment, employment, and promotions in students' professional practices.

Also, another angle of such research could seek evidence related to how the completion of certificate programs supports employment and desired promotion in the region—in other words, the links between certificate completion and job attainment and promotion, again, from the perspective of both, alumni and employers. Even more interesting could be a research study combining the perceptions of benefits with actual gains in employment and promotions.

Although there was a lot of discussion regarding multidisciplinary programs, most participants were discouraged by the multidisciplinary challenges. Because The University has had different struggles with different models, university administrators shared that they were looking to get advice from other institutions that have already done it. It would be useful to research the different models for multidisciplinary collaboration, funding structures, and how to

steer away from the siloed mentality. More than just the siloed mentality, the current systemic structures within The University do not encourage or incentivize multidisciplinary programs.

Increasing research focus on certificate programs may improve their legitimacy. Research on how to bridge the gap between research-focused and practice-focused certificate programs may provide needed insights. A solution for the low academic merit of certificates, as perceived by tenure track faculty, can strengthen chances of faculty support in program continuity. Solutions can be explored by connecting certificate course topics to research activities (Reed & Stanchina, 2010). The collaboration with industry can also generate shared interests and new research opportunities and support.

To supplement the understanding of how tenure-track faculty members perceive and therefore support certificate programs, research regarding goal diffusion might be in order. As tenured and tenure-track faculty have to balance research related activities with preparation of student for professional practice. It may help to study the true level of alignment of goals from the university and tenure-track faculty members, while balancing promises of academic freedom.

Another topic for investigation is the success and factors dealing with certificate programs initiated by faculty, a more grassroots effort compared to certificates initiated by a top approach. From the data, the certificates initiated by a top approach seemed to be prioritized and better sustained. Examples of these top down approach, were the three certificate programs that initiated as a response to market demands.

Lastly, the same study can be replicated in another university setting. Findings could then be compared and contrasted to either reinforce the possibility of generalization or to generate deeper insights into the phenomenon under study. The study of an institution's strength alone can shed light on the viability of certain certificate programs.

Limitations of the Study

There were a few limitations to this case-study approach. The first limitation deals with the subjective nature of the semi-structured interviews as a data collection method. Yin (2006) stresses that interviews may suffer from response bias, inconsistencies due to participant's failure to recall details, and reflexivity (when participants answer with what they believe interviewer wants to hear). There were eighteen participants that not only answered the questions in the interview protocol, but also provided in one form or another, whether slightly or very significantly, their own experiences and insights about the phenomenon under study. Participants selected for the study were members of The University administration who have not significantly changed in the last decade. These participants allowed the gathering of rich data about The University processes that could represent the current practices more accurately. Participants such as deans, department chairs, and curriculum committee members, provided richer experiential testimonials and therefore were prioritized. Although there was a good source of participants for the study, participants' biases and inaccuracies are, nonetheless, a noted concern.

Second, as an insider participating in the process under study, I may have inhibited specific participants from openly expressing their views, perhaps fearing being perceived as critical and non-supportive. The assumption made from the beginning of the study was that participants were truthful and willing to share their experiences. To assist the validity of this assumption, when following research protocols, the participants remained unnamed.

Third, if time was not a constraint, I would have observed more curriculum committee meetings. These meetings occur once a month, for the 9-month academic calendar. The data collection took place within a four-month period in 2018, and therefore limited the number of committee meetings that I could attend and observe.

Summary

By applying systems theory, the data analysis revealed a much clearer picture of what institutionalization looks like and the factors that support and influence the institutionalization process. From the data analysis, I developed three overarching themes. Then, from this enlightened view, I prepared several institutional recommendations for policy and practice.

The institutional recommendations for policy were (a) get consensus for shared visionary goals; (b) incentivize faculty to commit to and support certificate programs; and (c) use of graduate certificate programs as a convenient educational model for The University.

The topics for recommendations for practice included: (a) the necessity of addressing local market needs as a proactive endeavor; (b) tips for preparing and approving certificate proposals; (c) tips in addressing sustainability; (d) increasing enrollment and demonstrating outcomes; and (e) the need to select a graduate advisor that values certificate programs.

The recommendations for future research dealt with the current issues with graduate certificates: their perceived value to students, institutions and employers, regarding added skills, employment and promotions. Also, research in seeking best models for supporting multidisciplinary programs and replicating this case study in similar institutions.

One of the main concerns by tenure-track faculty, with certificate programs, is the lack of research merit, which deters their engagement and commitment to these non-degree programs. Therefore, future research is recommended in finding ways to increase overlap between the research activities in certificate programs. This may increase their legitimacy in higher education.

Certificate programs at the graduate level provide numerous advantages to students, regional employers, and institutions. The success of instituting these programs is dictated by the

alignment to overall goals, but mainly the commitment and engagement of faculty to leverage resources to sustain them. Data showed that the institutionalization of certificate programs relied heavily on sustainability.

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APPENDIX A - APPROVAL PROCESS TO CREATE A GRADUATE CERTIFICATE

College Level Approval

1. Forward the memo, approval page, proposal, and attachments to your department chairperson or program director. Please archive all proposals in your department.
2. Following signature by your department chair or program director, forward the proposal to your college curriculum committee for review and signature by the committee chairperson.
3. The chairperson of your college curriculum committee should forward the proposal to your College Dean for review and signature.
4. The chairperson of your college curriculum should then forward the signed proposal to the Office of the Provost in hardcopy to Administration Building, Room 310 and via email to curriculum@university.edu. Please see the proposal submission deadlines.

University Level Approval

1. The Provost's staff and the Dean of the Graduate School review the program proposal concurrently. Collaboratively they edit the proposal and develop questions, if necessary. Edits, suggested changes, and questions are then returned to the Dean's office for proposal revision.
2. Once revised, the Dean's office resubmits the proposal and course forms to the Provost. Upon the Provost's approval, the proposal is sent to the Graduate Council for consideration. A representative from your department must be present at the Graduate Council meeting to introduce your proposal and answer questions.
3. The Graduate Council reviews all documents and either approves the proposal or proposes edits and returns the proposal to the College Dean's office. If approved, it will be held one month, awaiting approval of the Graduate Council minutes.
4. Upon approval by the Graduate Council of the Graduate Council meeting minutes, the Dean of the Graduate School will draft an Action Report consisting of all of the items approved in the minutes.
5. The Action Report will then be sent to the Chair of the Graduate Council, Provost, and President for endorsement.

External Approval

1. Following internal approval, the Office of the Provost will notify other public institutions within a 50 mile radius 30 days prior to submitting it to the Board of Regents.
2. Upon completion of the 30-day notification, the Office of the Provost will forward the proposal to the UT System's Executive Vice Chancellors.
3. If approved, the UT System's Offices of Academic Affairs and Health Affairs process the proposal, and then electronically submit the proposal to the THECB.
4. After the proposal is approved by the THECB, the Registrar's Office will make the appropriate changes in the Catalog and on Banner.

APPENDIX B - LETTER OF INTRODUCTION TO STUDY

Dear (Staff or Faculty):

My name is Michele Williams and I am a doctoral student here at The University. I am selecting and recruiting participants to be interviewed for a study on higher education policy regarding establishment of new programs. The research study is a crucial component of the dissertation requirement for the completion of a doctor in education degree.

The ideal participant would be willing to be interviewed, for about 60 minutes, about processes than incorporate educational programs into the institution and how these programs are sustained. Because of your role(s) in The University, your input is valuable to this study and to me. The goal of the study is to better understand how the institutionalization of new academic programs. Experiences with programs that initiated with external funding or soft moneys are of particular interest for this study.

Participation is totally voluntary and anything you say will not be associated with your name. You will be given a pseudonym (fake name) to ensure that your identity will remain anonymous.

If you are interested in participating, you will be asked to sign a consent form.

If you have any questions about the study, please contact me at (915)-747-5333 or e-mail me at mcwilliams2@university.edu.

Michele C. Williams
Doctoral Student
Educational Leadership and Administration
University

APPENDIX C - CONSENT FORM

Informed Consent Form for Research Involving Human Subjects

Protocol Title: A case study using a systems theory approach for understanding institutionalization of engineering graduate certificate programs in a Texas university.

Doctoral Student: Michele Carolynn Williams

Program: Educational Leadership and Administration

INTRODUCTION

This research study is conducted by Michele C. Williams from The University to fulfill the dissertation requirement for the degree of Doctor in Education. The general research focus is higher education policy.

PURPOSE OF THE STUDY

The purpose of the study is to understand how graduate programs are created and become permanently incorporated and sustained at this university. By gathering information from staff and faculty who have participated in such processes, a better understanding can inform how to establish new programs, such as graduate engineering certificate. You were selected as a possible participant in this study because of your professional role(s) here.

STUDY PROCEDURES

If you volunteer to participate, you will be asked to meet for an interview. You will be asked to meet with researcher (me) for one interview. The interview will be scheduled at your convenience and in a private space. During this interview, you will be asked to answer mostly open-ended questions regarding (a) your understanding and experiences in establishing new programs, (b) your perspectives on how programs can be sustained, and (c) challenges with multi-disciplinary programs. The interview will last approximately 60 minutes. If you agree, the interview will be audiotaped. If you do not want to be audiotaped, handwritten notes will be taken. You do not have to answer any questions you do not want to. You may be contacted for a follow-up after the interview, to clarify some answers and to see if you have any thoughts to add. The audiotaped interview will then be transcribed and sent to you for your review. In the event that an interview is not possible, but you wish to participate, then the questions can be answered in writing and forwarded to researcher.

POTENTIAL RISKS AND DISCOMFORTS

There are no other foreseeable risks or discomforts to participating in this study. The only inconvenience might be setting aside time to talk to the researcher.

POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY

You will not directly benefit from your participation in the study. However, some participants appreciate the opportunity to share their perspectives with an objective listener. In addition, your insights have the potential to inform research and policy related to higher education policy at this university.

PAYMENT/COMPENSATION FOR PARTICIPATION

You will not be paid for participating in this study.

CONFIDENTIALITY

Any identifiable information obtained in connection with this study will remain confidential and will be disclosed only with your permission or as required by law. I will assign a pseudonym (pretend name) to ensure anonymity for interview participants.

When interviews take place in a public place, there is a chance that individuals outside of the study may intervene and identify study participants. Additionally, confidentiality cannot be guaranteed if you decide to discuss the contents of your interview outside of the research period.

Only the researchers and The University's Human Subjects Protection Program (HSPP) may access the data (e.g., audiotapes of interviews and transcripts). The HSPP reviews and monitors research studies to protect the rights and welfare of research subjects.

The data will be stored in a locked filing cabinet or on a password protected computer. You have the right to review audio recordings or transcripts of your interview. Data will be maintained indefinitely and may be used in future research studies. If you are not comfortable having your anonymous data used in future studies, please let the researcher know and your data will not be retained after the present study concludes.

When the results of the research are published or discussed in conferences, no information will be included that would reveal your name.

PARTICIPATION AND WITHDRAWAL

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you do not want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so.

ALTERNATIVES TO PARTICIPATION

Your alternative is to not participate.

IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about this research study, please feel free to contact Michele Williams at (915) 747-5333 or mcwilliams2@university.edu.

RIGHTS OF RESEARCH SUBJECTS

If you have questions or concerns about your participation as a research subject, please contact the Institutional Review Board (IRB) directly at (XXX-XXX-7693) or irb.orsp@university.edu.

AUTHORIZATION STATEMENT

I have read each page of this paper about the study (or it was read to me). I know that being in this study is voluntary and I choose to be in this study. I know I can stop being in this study without penalty. I will get a copy of this consent form now and can get information on results of the study later if I wish.

Participant Name _____ Date _____

Participant Signature _____ Time _____

I consent to allow my anonymous data to be kept for future studies. If know that if I change my mind, I can tell the researcher and my data will be destroyed.

Participant Signature _____

I consent to allow my interview to be audiotaped: Yes ___ No ___

Participant Signature: _____

Consent form explained and witnessed by:

Researcher Name _____ Date _____

Researcher Signature _____ Time _____

APPENDIX D - INTERVIEW PROTOCOL

Interview Protocol * – The case of engineering graduate certificates

Participant Pseudonym: _____ Date/Time: _____
Interview Location: _____

- 1) Please tell me about your current or past role(s) here at The University that pertained to program development, approval, administration or budgeting.
- 2) Which programs have you participated in establishing here?
 - a. In your opinion what made these programs get approved and supported (or not)?
 - b. What would you have done differently to improve the outcomes?
- 3) Regarding programs at The University, what is the process to permanently establish a graduate certificate program in engineering? How does this differ from other graduate programs?
- 4) Who and in what roles play a key role in establishing graduate certificate programs?
- 5) How do you know if and when a graduate certificate program has been fully incorporated into The University?
- 6) What do you think are the main factors that influence the permanence of a program?
- 7) How do you know if a graduate certificate program is fully sustained? What does that look like, here at The University?
- 8) What do you think are the main factors that influence the sustainability of a program?
- 9) In your opinion what are the issues, if any, with instituting multi-disciplinary programs?
- 10) What would you recommend to do to implement a new graduate certificate program?
- 11) Is there anything you would like to add?

*This protocol will be used in semi-structured interviews, and may vary from informant to informant.

VITA

Michele Williams earned a Bachelor's in Industrial & Systems Engineering with honors from the Instituto Tecnológico y de Estudios Superiores de Monterrey. She spent over a decade working in the computer industry in varying positions of leadership while also owning and managing two successful small businesses. Ms. Williams, has spent several years pursuing various degrees at UTEP starting with an MS in Computer Science. Seeking a career change, Ms. Williams returned to UTEP in 2005 and was the first student to successfully complete the online Alternative Teacher Certification leading to employment with El Paso ISD. While at EPISD, she taught Math and Computer Science, worked as an Advanced Academics facilitator, and developed curriculum. In 2008, she completed a Master's in Mathematics Education.

Ms. Williams joined UTEP as staff and lecturer in 2012, and enrolled in the Educational Leadership and Administration doctoral program in 2013. Overseeing a federal grant, she led a team to prepare STEM teachers across 16 Texas districts. Ms. Williams served in district advisory boards, facilitated numerous trainings, and presented in multiple conferences. The grant's innovative engineering focus earned Ms. Williams an invitation to the White House in 2017; and a featured video appearance as a teacher effectiveness leader in the US Department of Education's website.

Ms. Williams collaborated and authored three publications in engineering education and higher ed policy journals. Her dissertation utilizes systems theory for understanding institutionalization of engineering graduate certificate programs, with Dr. Rodolfo Rincones as chair. Contact: Mcwilliams2ms@outlook.com.

This thesis/dissertation was typed by the author, Michele Carolynn Williams.