

INDUSTRY – UNIVERSITY ENGAGEMENT
IN MULTICULTURAL ENGINEERING PROGRAMS: AN EXPLORATORY STUDY

by

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B.A., Grambling State University, 2006

M.S., Kansas State University, 2008

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF EDUCATION

Department of Educational Leadership
College of Education

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Manhattan, Kansas

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Abstract

Facing the rapidly increasing globalization of world economies and a steadily diversifying domestic consumer base, U.S. corporations have embraced the benefits of hiring more employees with diverse perspectives and experiences. Particularly in industries dependent upon knowledge of science, technology, engineering, and mathematics, recognition has grown that the American work force is seriously constrained by the clear underrepresentation of minority participants. In engineering, the most prevalent attempt to address these issues is through the establishment of multicultural engineering programs (MEPs), often designed as partnerships between universities and major corporate entities. These programs strive to identify, recruit, retain, educate and ultimately employ significant numbers of students of color to strengthen industry innovation and competitiveness.

This investigation was initiated to expand the limited research literature on MEPs and the nature of their partnerships with industry. Using qualitative methodology, an exploratory viewpoint, and the lens of the Commitment-Trust Key Mediating Variable Model (KMV) of Relationship Marketing, the relationships of five mature and highly regarded university MEPs and one of their self identified primary industry partners were examined.

Leaders of the National Association of Multicultural Engineering Program Advocates, the national representative body for MEPs, identified exemplary MEPs in the organization's five regions; using a selection paradigm, five institutions were chosen for study selected from four of the regions. Each institution then identified a primary industry partner. Participants responded to in-depth interviews (MEPs) and questionnaires (industry) with respect to the nature, benefits, and challenges to both entities in the partnerships. Documents were reviewed for each program and industry. Responses were coded, crosschecked, and analyzed for patterns and themes. In

particular, the study explored the issue of how commitment and trust are established in these partnership relationships.

Twenty-four patterns and three themes emerged. Clearly, university-industry multicultural engineering partnerships are viewed as engendering important employment opportunities for underrepresented program graduates, promoting a well-developed pipeline of minority employee talent for industry, and increasing funding both for university multicultural programming and minority student support.

The study also reports on the broad range of activities these partnerships practice. It suggests avenues for further study to enhance university-industry engagement.

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Table of Contents

| | |
|---|------|
| List of Figures | xii |
| List of Tables | xiii |
| Acknowledgements..... | xiv |
| Dedication..... | xv |
| Chapter 1 - Introduction..... | 1 |
| Problem Statement..... | 8 |
| Guiding Research Question and Sub-Questions..... | 9 |
| Sub-Questions..... | 9 |
| Purpose Statement..... | 10 |
| Methods | 10 |
| Limitations..... | 11 |
| Summary..... | 12 |
| Chapter 2 - Review of the Literature | 14 |
| University-Industry Engagement: A Brief History..... | 14 |
| University-Industry Engagement: Financial Implications..... | 19 |
| University-Industry Engagement: Defined..... | 20 |
| University-Industry Engagement: Benefits | 23 |
| University-Industry Engagement: Barriers..... | 27 |
| University-Industry Engagement: Engineering | 32 |
| University-Industry Engagement: Summary | 34 |
| Minorities in Engineering: Overview | 35 |
| Multicultural Student Services..... | 38 |
| MEPs: Multicultural Engineering Programs..... | 40 |
| MEP-Industry Engagement..... | 42 |
| Conceptual Framework: Relationship Marketing Theory | 46 |
| Summary..... | 54 |
| Chapter 3 - Methodology..... | 55 |
| Study Design Overview | 55 |

| | |
|--|----|
| Guiding Research Question and Sub-Questions | 57 |
| Sub-Questions | 57 |
| Site Selection | 57 |
| Participant Selection | 60 |
| Data Sources and Collection of Related Information | 60 |
| Analysis | 61 |
| Protection of Human Subjects | 62 |
| Validation of the Study | 62 |
| Background and Role of the Researcher | 63 |
| Summary | 64 |
| Chapter 4 - Case Descriptions | 66 |
| Introduction | 66 |
| University 1 | 67 |
| Industry 1 | 69 |
| University 2 | 69 |
| Industry 2 | 71 |
| University 3 | 72 |
| Industry 3 | 73 |
| University 4 | 74 |
| Industry 4 | 75 |
| University 5 | 76 |
| Industry 5 | 78 |
| Summary | 79 |
| Chapter 5 - Data Analysis | 80 |
| Introduction | 80 |
| Data Analysis Procedures | 80 |
| Documents and Artifacts | 81 |
| Interviews and Questionnaires | 81 |
| Relationship Termination Cost | 87 |
| Relationship Benefits | 89 |
| Shared Values | 92 |

| | |
|--|-----|
| Communication..... | 94 |
| Opportunistic Behavior..... | 97 |
| Acquiescence | 99 |
| Propensity to Leave | 101 |
| Cooperation..... | 103 |
| Functional Conflict | 107 |
| Uncertainty..... | 109 |
| Barriers..... | 111 |
| Summary of Patterns across The Commitment-Trust KMV Model of Relationship Marketing | 113 |
| Themes Derived from the Commitment-Trust KMV Model of Relationship Marketing | 115 |
| Theme 1: Partnering engenders employment opportunities for underrepresented students. | 115 |
| Theme 2: Partnering promotes a well-developed talent pipeline..... | 115 |
| Theme 3: Partnering fosters increased funding..... | 116 |
| Summary..... | 120 |
| Chapter 6 - Conclusions..... | 121 |
| Introduction..... | 121 |
| Discussion of Guiding Research Question | 121 |
| Discussion of Sub-Question 1..... | 123 |
| Discussion of Sub-Question 2..... | 125 |
| Significance of the Study | 128 |
| Implications for Practice..... | 129 |
| Implications for Personal Practice | 131 |
| Recommendations for Future Studies..... | 131 |
| Recommendation 1 | 131 |
| Recommendation 2 | 132 |
| Recommendation 3 | 132 |
| Recommendation 4 | 132 |
| Recommendation 5 | 132 |
| Recommendation 6 | 133 |

| | |
|---|-----|
| Recommendation 7 | 133 |
| Summary | 133 |
| References | 134 |
| Appendix A - Interview Questions for Director or Designee of the University MEP | 140 |
| Appendix B - Industry Partner Questionnaire | 143 |
| Appendix C - Invitation Letter to Nominators..... | 145 |
| Appendix D - Invitation Letter to Director or Designee of the University MEP | 147 |
| Appendix E - Industry Letter to Industry Partner | 149 |
| Appendix F - Informed Consent Form..... | 151 |

List of Figures

| | |
|--|----|
| Figure 2.1 The KMV Model of Relationship Marketing (Key Mediating Variable). | 49 |
|--|----|

List of Tables

| | |
|--|-----|
| Table 2.1 Types of University-Industry Relationships | 22 |
| Table 5.1 Summary of Main Codes | 83 |
| Table 5.2 Relationship Termination | 88 |
| Table 5.3 Relationship Benefits | 90 |
| Table 5.4 Shared Values | 93 |
| Table 5.5 Communication..... | 95 |
| Table 5.6 Opportunistic Behavior..... | 98 |
| Table 5.7 Acquiescence | 100 |
| Table 5.8 Propensity to Leave | 102 |
| Table 5.9 Cooperation..... | 104 |
| Table 5.10 Functional Conflict | 108 |
| Table 5.11 Uncertainty..... | 110 |
| Table 5.12 Barriers..... | 112 |
| Table 5.13 Summary of Patterns across The Commitment-Trust KMV Model of Relationship Marketing..... | 113 |
| Table 5.14 Themes Derived from The Commitment-Trust KMV Model of Relationship Marketing..... | 115 |
| Table 5.15 Themes and Supporting Patterns | 117 |

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Chapter 1 - Introduction

Throughout most of their respective histories, U.S. industries and universities have supplied highly American-centric employees and leaders. Both entities focused heavily on promoting success by using the advantages of a resource rich nation and educational meritocracy. Much of their individual and joint efforts in the sciences, broadly construed, were concentrated to produce efficient and effective goods for our citizens and for export to other countries far and near. The fusion of industry and academe galvanized the creation of knowledge aimed at strengthening our physical, financial, political, and health infrastructures.

In recent times (in our historical context), significant changes have brought an awareness to both industry and university entities of the need to respond to what might be described as a new world order for business and higher education. Some have bid adieu to the fleeting practices of mainland business decorum and traditional university structure and eagerly or reluctantly embrace the quickly expanding global marketplace. The rapidly growing influence of international banking/finance, a greatly imbalanced import/export ratio, a decline in American dominance in production and manufacturing largely due to reduced labor costs in foreign nations, and, particularly, the plateau effect of information and expertise saturated in the ubiquitous access allowed by the world-wide web (internet) has alerted the United States that its reputation and influence, and ultimately the quality of life for its citizens have become dependent on our ability to adapt to a global economy.

The implications of these understandings are staggering in many ways. Contemplative views proclaiming that a former abstract and near omnipresent ‘American view’ of industry and academy will prevail to match this relatively new environment are becoming obsolete. Both industry and the universities serving their needs have increasingly come to recognize that

divergent and expanded visions are needed to maintain and globally compete in today's global marketplace. Through strategic and meaningful partnerships, U.S. universities and industry have broken barriers and joined forces to be a global contender in technology, engineering, innovation, and creation. According to Davis (2002), "Technology, globalization and virtualization are just a few of the factors that will help define the university of the future" (para. 4).

In the quest to define tomorrow's U.S. university, industry is pressuring institutions of higher learning to revamp curriculum that supplies work ready graduates who can instantly deliver solutions, make effective changes, and compete in 21st century competition (White, Haynes, Keller, & Pouraghabagher, 2000). Universities are petitioning industry for resources, both financial and in-kind, to help recruit and produce field ready graduates and to conduct cutting edge research among other initiatives. Today, industrial globalization, once an emerging phenomenon, is now routine practice, with a heavy demand for diverse U.S. talent that encompasses traditional underrepresented groups and women. The harsh reality is that, "If higher education does not supply the number and quality of degree holders to meet these needs, employers have an array of options to access them internationally" (Chubin, May, & Babco, 2005, p. 73). Such pressure calls for universities and industry to unite and creatively strategize about how they do business together. However, both parties have to be cognizant of their original intent and purpose and maintain autonomy (Casey, 2004; Newfield, 2004).

Defining the university of the future has placed pressure on both universities and industry, especially in the STEM disciplines. A substantial issue in the STEM arena is the relative absence of minorities in the field and in the pipeline. How are institutions and industry partnering to bridge this gap? What is being done to engage, recruit, retain, and graduate students

of color in STEM? Minority engineering programs on university campuses were established to address this issue. These programs, along with their respective industry champions, have contributed greatly to the objective of producing a significant number of minority engineers.

Today, job forecasts indicate the continuing prospect for a lack of diversity in STEM. In response, industry and academe have joined forces to restore diversity to the talent pool before the supply of minority participants almost entirely depletes itself. Americans of color have always pioneered inventions and enterprises at the forefront in enabling our modern existence. Yet over time, certainly proportionate to their presence in the country, people of color are increasingly a rarity in our STEM disciplines. Why? Did the field become less attractive? Have people of color begun to perceive the nature and return on investment of training and academic environments as less than desirable? How has the issue of access to higher education affected people of color and their interest in STEM? What have institutions of higher learning and industry done to address these concerns? To begin exploring these questions, it is helpful to try to understand some of the many historical factors pertaining to people of color in the United States and their journeys to achieve what once seemed impossible (i.e., a higher education).

In the United States, a nation with a long history of gender inequality and racial segregation, educational systems have not only routinely suppressed opportunities for minorities seeking higher education, but also have often implied that the recruitment, retention, and graduation of minority students in STEM was perhaps even farfetched. One of the main obstacles for minorities has remained accessibility. The Morrill Act of 1862 enabled the origination of land grant institutions designed provide access to a wide range of people (Thelin, 2004). When Congress acknowledged that this Act did not reflect ethnic diversity in the southern states, a second land grant act evolved. This act, known as the Morrill Act of 1890,

appealed to the historically black colleges and universities (HBCUs) that emerged in the South. The Morrill Act of 1890 benefited African American schools but it also tremendously neglected them. African Americans had access to education but only within the boundaries of segregation (Thelin, 2004). These institutions lagged behind their traditional majority institutional counterparts in areas of staffing, quality of facilities, salaries, and limited resources for conducting research. However, it was one of the first steps towards addressing a diverse population in higher education.

Nationwide, engineering schools have recently realized that to respond to the big picture and in order to attempt to dispel negative stereotypes, a major focus on diversifying the student body was imperative. These forward-thinking programs recognized that international students – not U.S. citizens – were the dominant diverse group of their student body. They realized that not only were students of color and women not attracted to these programs, they were often discouraged and made to believe that their ability was inadequate. Unfortunately, in some cases, due in large part to a lack of minority role models, students of underrepresented groups succumbed to these discouraging behaviors and sought other fields of study or strayed away from the notion of obtaining a higher education altogether. In efforts to address the lack of minorities entering the engineering pipeline, college preparatory programs, K-12 outreach, and minority base scholarships were formed to help recruit students of color to university engineering schools. These efforts eventually lead to the creation of minority engineering programs (MEPs). Multicultural engineering programs were not only designed to recruit, retain, and graduate engineering students of color, they also emerged to face the audacious task of connecting industry to students who represent diverse backgrounds. This connection was

achieved through meaningful relationships, rooted in commitment and trust, and dedicated to the plight of minority engineers.

In today's global economy we not only see an increase in university – industry relationships, but there is also a sense of urgency desiring intentional and frequent interactions. This is very apparent in the science, technology, engineering, and mathematics (STEM) sector. Global competition, new technologies and groundbreaking innovations have caused university – industry engagement to soar to the top of their priority list. Corporate alliances within the university community have proved to produce rewarding returns. Devier (1999) indicated, “corporate partnerships are an excellent way...to provide much needed training to serve the needs of industry and students” (p. 22). According to Ryan and Heim (1997), “Over the last hundred years, universities – both public and private – have been actively engaged in broad-based partnerships that have been beneficial both to themselves and the broader constituents they serve” (p. 42). We find this to be increasingly true today. Engineering and technical solutions that emerge from university–industry collaborations not only serve the global citizens of today, but they are leaving behind a legacy of knowledge that will impact the global economy for years to come.

How did university and industry relationships become relevant? From a historical perspective, Westmeyer (1985) indicates, “research studies have found that by far the major purpose of students in college and universities is to end up with better jobs than they would be able to obtain if they did not have college degrees” (p. v). Today, many college students are likely to say that one of their goals is to establish a career that would allow them to provide for themselves and their families. The notion of school-to work and building careers has led to industry opportunities and a quest to climb the corporate ladder for many people. Others journey

into careers in education, politics, non-profits, small business, medicine, and government agencies, to name only a few. Through the years, academe has developed a reputation and expectation to develop relationships with industry and other sectors that can yield promising livelihoods for potential employees. Whether it's practical training, such as specific skills and trades learned at a community college or formal in-depth training with a classic philosophical approach commonly found at four-year institutions, industry, coupled with other sectors of employment, and academe have a supply and demand relationship that is steadily evolving the purpose of higher education.

University-industry collaborations, today more than ever, are vital to the lifeline of an academic institution as a whole. These collaborations exist in the form of formal and informal programs, mentoring, research centers and alliances, internships, outreach, and recruiting and retention initiatives to name a few. Such partnerships command a great deal of time, energy commitment, and require balance. They also require an effective checks and balances system to ensure that involved parties are accountable, mutually satisfied, and producing desired results. This checks and balances system translates into relationship building.

Experience strongly suggests that building relationships between academe and industry entities can be a tedious process and can impede time sensitive opportunities. To allow these collaborations to thrive, Liew, Shahdan, and Lim (2012) indicated that partnership champions are essential to the longevity of the relationship. These champions are vital and must exist on both sides of the partnership. These relationships have been characterized in a theory known as relationship marketing. The literature defines relationship marketing "as an approach to establish, maintain, and enhance long-term associations with customers and other stakeholders" (Zinkhan, 2002, p. 83).

Relationship marketing theory builds on the theme of customer satisfaction (Zinkhan, 2002). In university-industry partnerships, both parties play the customer and the seller at varied points in the relationship. Harmony is achieved when each party can function effectively in a fluid and interchangeable buyer – seller relationship. However, perfecting such a seamless transition requires a great deal of diligence, patience, creativity, and vision. Unfortunately, some university – industry relationships experience waves of personnel turnover that can either strain or strengthen the relationship. According to Morgan and Hunt (1994), the commitment-trust theory of relationship marketing implies that commitment and trust must coincide to produce a relationship that is meaningful, fruitful, and sustainable. This theory, with relationship commitment and trust at its core, consists of ten tenants that contribute to or hinder healthy relationships. They include: “relationship termination costs, relationship benefits, shared values, communication, acquiescence, propensity to leave, cooperation, functional conflict, uncertainty, and opportunistic behavior” (Morgan & Hunt, p. 22). Therefore, it is essential to ensure that the partnership is grounded in shared goals and a clearly defined strategy that is central to the organization and not just the individuals involved. Then and now, we find some of the most promising examples of university – industry engagement in the science, technology, and engineering disciplines.

All these varied concepts matter because since the history and purpose of higher education in the United States have a complicated past and have been derived from a wide variety of motives affecting minority participation and recognition in academic environments, including STEM. However, today, one thing that is easily recognizable by both academe and industry is that to successfully compete in the global marketplace, a diverse pool of talent and

leaders is needed. Nowhere is this more evident than in STEM disciplines. According to Chubin et al. (2005):

Diversity for its own sake may speak to morality and fairness, but that is a *condition*. Better that we think of diversity as an asset, an enabler that makes teams more creative, solutions more feasible, products more usable, and citizens more knowledgeable. Diversity arguably makes any profession, but especially science and engineering, more competent. (pp. 73-74)

So the question becomes: how has this issue of diversity in STEM been addressed and how does it continue to be relevant and persistent? Who has taken this challenge head on? In part, engineering programs at universities across the United States have formulated and produced a promising solution to answer this call, i.e., multicultural engineering programs. These programs and their relationships with industry have strategically and significantly contributed to the multicultural STEM talent pool and continue to do so today.

Problem Statement

Multicultural or minority engineering programs (MEPs) have been at the forefront of the attempt to encourage traditionally underrepresented minorities into the engineering field. Whether identified as a program, department initiative, or an individual, an emphasis is placed on recruiting, retaining, and producing multicultural engineering graduates into the workforce. This charge is not easily accomplished. Those who take on this responsibility are in the trenches working to create a stable and inviting environment for minority students in engineering. Multicultural engineering programs serve as a safe haven for engineering students of varied ethnic backgrounds. In some cases, these programs emulate a one-stop shop model for students who otherwise might not engage with any other student or academic services department on campus. They are often viewed as the lifeline for students of color and have a direct finger on the pulse of the issues that hinder successful matriculation and retention. In addition, these

programs often serve as the first point of contact for employers seeking multicultural candidates for internships and full-time employment.

Multicultural engineering programs, like many other university programs, are expected to do more with less and engage industry at various levels for support to develop meaningful relationships. Many of these relationships evolve from MEP alumni, university alumni, and corporate diversity affinity groups among others. Such support materializes in the form of monetary sponsorships, in-kind donations, outreach efforts, and board or committee participation. While many programs are making great strides and have long-standing industry partnerships, others are barely scraping the surface and are seeking effective strategies to help remedy this issue. In efforts to identify successful strategies in industry engagement, MEP programs rely on a network of peer institutions to provide a platform to informally and formally learn best practices. It was this network that formed the basis for the creation of the National Association of Multicultural Engineering Program Advocates (NAMEPA).

Guiding Research Question and Sub-Questions

Guiding Research Question

What is the nature of industry engagement within university multicultural engineering programs?

Sub-Questions

1. How do industry and university multicultural engineering programs develop trust in their relationships?
2. How do industry and university multicultural engineering programs establish commitment in their relationships?

Purpose Statement

The purpose of this study is to explore the nature of industry engagement within university multicultural engineering programs (MEPs). Many multicultural engineering programs emulate a practitioner-based model that focuses on program planning, implementation, and best practices to aid in the recruitment, retention and graduation of underrepresented students. Historically these students have been identified as African American, Hispanic, and Native American. Today, while many programs have continued to serve this traditional demographic, other programs have expanded to become inclusive of all diverse populations including international students. Such efforts demand strategic and meaningful partnerships between academe and industry to sustain a promising pipeline of diverse talent. Since industry engagement and support are two main tenants in a MEP operation, research in this area on how such engagement occurs and prospers would inform MEPs and industry of how universities and industry can partner even more effectively to achieve their goals.

Methods

The study utilized an exploratory, qualitative approach. The study used methods most consistent with case study. The researcher structured the study around the Commitment-Trust Key Mediating Variable Model (KMV) of Relationship Marketing and its ten main elements. Main sources of data were derived from interviews and questionnaires. The researcher analyzed the data utilizing qualitative strategies prescribed by Creswell's (2013) data analysis spiral. This technique includes: organizing the data; reading and memoing; describing, classifying and interpreting the data into codes and themes; interpreting the data; and representing and visualizing the data.

The participants in this study included representatives of five institutions of higher education that hold or have held institutional membership in the National Association of Multicultural Engineering Program Advocates (NAMEPA). Three field experts, i.e., current and past NAMEPA national presidents, nominated these sites. NAMEPA is an organization of major institutions with a multicultural, diversity, or minority serving engineering program with a primary goal of increasing multicultural engineering graduates into the STEM fields. This organization is divided into five regions and has a membership of approximately 75 public and private institutions. These institutions include some of the most prestigious and largest engineering programs in the nation (e.g., Harvard, Princeton, Cornell, MIT, New Jersey Institute of Technology, Georgia Tech, Purdue University, The Ohio State University, The University of Texas, Louisiana State University, and Kansas State University). Once the sites were determined, directors or designees of the multicultural engineering programs were contacted for a phone interview. MEP participants then identified industry partners to participate in an electronic questionnaire. There were a total of five directors or designees and one industry partner from each institution for a total of 10 participants.

Limitations

There were, of course, limitations to this study. First, to identify the nature of industry engagement, only MEPs with ‘strong’ reputations for industry partnerships were examined. MEPs with weaker partnership reputations might have revealed additional understanding of MEP-Industry engagement. Secondly, only current members of one organization were involved. The nominators may not be knowledgeable about all sites and nominate only those with which they were familiar. Third, reliance on interviews (perceptions) and questionnaires were the main sources of data collection. No actual observations were conducted. The degree of openness of

the participants may have varied. Participants' comfort with revealing information may have limited the range of information collected.

Time and financial constraints did not allow in-person interviews or visits to the institutions/sites. The format of the interview or questionnaire (electronic) might have inhibited the depth of discussion. While seeking to collect information that yields beneficial insight from the industry perspective, the researcher also acknowledges that interviewing industry representatives posed significant time constraints as well. In efforts to maximize results, the researcher constructed a brief questionnaire that was distributed electronically to the nominated industry representative or designee. Parameters for industry representatives were not specified (except identification by a MEP partner) so there were likely varied characteristics among participants. Lastly, documents collected varied according to participant preferences and were from individual websites. Participants with vital information might not have volunteered to participate.

Summary

In summary, Chapter 1 indicated the significance of the study, provided brief background information and historical context. This chapter also highlighted the proposed methodology, limitations, and introduced the study's theoretical framework. Chapter 2 is a review of the literature pertaining to the following: an historical overview of university and industry engagement; financial implications of university and industry engagement; types of university and industry engagement; benefits to university and industry engagement; barriers to university and industry engagement; minorities in engineering; multicultural student services; multicultural engineering programs; multicultural engineering programs and industry engagement; and relationship marketing theory.

Chapter 2 - Review of the Literature

University-Industry Engagement: A Brief History

Higher education in the United States, as well as in others parts of the world, dates back hundreds of years and derives from of a wide variety of models. Many of the earliest models were derived from religious organizations. Some others largely were vanity creations by the wealthy that exuded self-promotion and some were established to prepare a workforce with a specific skill set to contribute to society. There have been a host of attempts to describe the purpose of higher education in the United States. Many have argued debate that classical pedagogy, comprised of philosophy and theory, was the purpose of higher education (Diener, 1986). Some claimed that higher education's mission was to provide practical instruction to support a growing nation and future workforce. Other early opinions of higher education in America depicted a significant religious premise that coincided with the core foundation of the American colonies (Westmeyer, 1985).

Early American institutions of higher learning such as Harvard, William and Mary, Yale and Princeton were religiously governed, classical oriented and European influenced (Brickman & Lehrer, 1962; Diener, 1986; Westmeyer, 1985). Harvard University resembled the structure of Emmanuel College of Cambridge while William and Mary replicated the Queen's College model of Oxford University. Harvard and Yale were both Puritan colleges, William and Mary was Anglican, and Princeton (formally The College of New Jersey at Princeton) was Presbyterian. William and Mary and Princeton were both originated under English charters unlike Harvard and Yale who opted to maintain private management (Westmeyer, 1985).

In addition to the debate of royal charters and religious affiliations, was the discussion of purpose (Westmeyer, 1985). What was the purpose of higher education in America? Would the

institution be called a university, college, or school? How would instruction be delivered? What were the goals and objectives? Who would have access? Would institutions be public or private? Westmeyer (1985) explained that while originally vocational oriented, American higher education was designed to produce educated clergy members to lead churches. According to Diener (1986):

In the beginnings of our country, men of learning, wealth, and power pushed for the creation of colleges and universities to serve private and public purposes. For the private good, they yearned for a college education which would mold the character of young men and give them the classical learnings then thought to be so essential to a cultivated and elegant gentleman. For the public good, this prescribed classical curriculum served very well to prepare the young male citizen for responsible leadership in government and the professions of law, medicine, and the ministry. (p. 3)

These concepts introduced the notion of access to higher education that throughout history led to challenges for people of color, women, and those of low socio-economic backgrounds.

One argument that remains relevant today just as it did hundreds of years ago, involves the practicality and applicability of a degree in higher education. During the colonial period, America was considered a very practical country with low tolerance for the idea of research and other pedagogy from European counterparts (Westmeyer, 1985). However, before long, formal instruction and theoretical principles along with practical training became relevant and important. One of the first universities to attempt to accomplish this ideal was the University of Virginia under the leadership of Thomas Jefferson (Westmeyer, 1985). Brickman and Lehrer (1962) described the University of Virginia to be America's first true state university due to its revolutionary standards and practices. According to Westmeyer (1985), "Under Jefferson's ideal the institution would have both diffused knowledge and advanced knowledge" (p. 27). With this concept in mind, eight schools were created within the university structure including: "ancient

languages, modern languages, mathematics, natural philosophy, natural history, anatomy and medicine, moral philosophy, and law” (Westmeyer, 1985, p. 27).

As America continued to grow, so did the needs and demands of its people. In addition, conflict began to surface and wars emerged. Wars had a huge impact on molding the shape and status of higher education in America both financially and organizationally. The Revolutionary War left behind financial hardships and forced some institutions to call on state and private support (Westmeyer, 1985). Early examples of private donations and industry engagement appeared during this period. Donations were both monetary and in-kind in nature such as produce. The “Kenyon Circles of Industry,” a sewing circle and supporters of Kenyon College, were an early example of private support (Westmeyer, 1985). Through their efforts, money was raised to support Kenyon College, but other institutions were not as lucky.

“Prior to the American Civil War it was clear that the purpose of colleges in this country was to serve the people” (Westmeyer, 1985, p. 35). According to Brickman and Lehrer (1962), by the 20th century the purpose of American higher education introduced a new contender, service. Service was described as service to mankind through the sciences and humanities (Brickman & Lehrer, 1962). These fields, with the addition of technology, became more prominent in American higher education in the 1800s (Westmeyer, 1985). According to Westmeyer (1985):

The United States Military Academy opened in 1802...Rensselaer Polytechnic Institute in 1824, Massachusetts Institute of Technology was chartered in 1861 and opened in 1865; Harvard, Yale, Dartmouth, and Brown all added technical schools to their programs, as did the University of Pennsylvania. (pp. 24-25)

To keep up with the rapid changes in science and technology, these newly created institutions and schools needed materials and equipment to provide students with a proper learning environment conducive for research and testing (Westmeyer, 1985). Initial “investigations in the

applied sciences...produced discoveries as diverse as hybrid corn and anti-polio vaccine” (Brickman & Lehrer, 1962, p. 27). However, this new phenomenon still posed significant financial woes. Institutions such as Harvard continued to turn to the state for support with hopes of approval. Harvard President, Edwin Everett, approached the Massachusetts legislature to request funding for scientific equipment for students arguing that growth of the field necessitated such requirements (Westmeyer, 1985). Unfortunately, his request was denied.

While this approach did not yield positive results, according to Westmeyer (1985), “Science was probably the primary instrument in causing universities in name to become universities, indeed, centers of learning and research” (p. 36). Some would agree that the deep roots of science and technology at the core of American higher education created strong branches with industry and engendered fruitful relationships for society as a whole. Others would say such relationships tainted the ideas of pedagogy and interfered with academic freedom. Nonetheless, today the global community continues to benefit from the advancement of science, technology and engineering: a service that is partially attributed to the collaboration of academe and industry.

The notion of university and industry engagement is not a new phenomenon (Liew et al., 2012; Perkmann, et al., 2012). “Concerns about the university’s business deals are as old as the university itself, but never have they been as widespread as they are these days” (Newfield, 2004, p. 37). Today’s trade, commerce, inventions, and emerging technologies are no longer thought of as country specific silos. We currently live in a rising global marketplace that is comprised of diverse talent, cultural influence, and new age thinking. Recently, rapid changes brought on by globalization have required these partnerships to be more purposeful and strategic to endure the changing tides. This type of collaboration is most prevalent at institutions that

have historically emphasized practical and technical education such as U.S. land grant institutions (Perkmann et al., 2012). In addition, community colleges, also known as junior colleges, have traditionally demonstrated strong ties to industry as well. These institutions are commonly known to cater to industry needs and produce skill specific graduates in a relatively short period of time.

For over a century, academe and industry have collaborated in efforts to be friendly neighbors and lend a helping hand when needed (Edmondson, Valigra, Kenward, Hudson, & Bellfield, 2012; Newfield, 2004). One of the notable moments in university-industry engagement was the passage of the 1980 federal Bayh-Dole Act (Liew et al., 2012; Newfield, 2004). This act was paramount in enabling universities to retain title to the inventions of their employees (Newfield, 2004). This act introduced a shift in the playing field. Universities could now patent vanguard technologies that could be licensed to potential industry partners for financial gain (Newfield, 2004). While there were many debates about this “for-profit” model within the university system, it opened the floodgates to pursue research and development alliances in both the government and private sectors.

Historians described the higher education sector in the U.S. to be coarse and materialistic as reflected in American culture. “Business and industry were the dominant influences of the time” (Westmeyer, 1985, p. 77). “One contributing factor that lead to the emergence of many universities during these decades was industry – the discretionary wealth generated by American corporations and enterprises in the late nineteenth century” (Thelin, 2004, p. 112). There was also a tremendous increase in the amount and value of philanthropic donations. Generous donations sometimes led to management challenges. Once million dollar donations had been made, a university had to be created from the ground up, often with little knowledge of how to

actually manage such an institution. “The pioneering industrialists had already indulged their whims of funding a campus that would be an architectural memorial. There was less glamour associated with gifts for the prosaic functions of running a campus” (Thelin, 2004, pp. 134-135). Some of these donations were acts of vanity that did not completely process what would happen to the institution after the brick and mortar was set and dried.

The development of new institutions was exciting, but came with serious financial implications that are still commonly seen today. An increasing need for financial reprieve eventually lead to the question, “Why can’t a college be run like a business?” (Thelin, 2004, p. 113) This question once plagued the higher education field during the late 1800s and still does today. Newfield (2004) indicated:

the university’s core mission is noncommercial and not-for-profit. To pursue its educational mission, the university cannot be a business; in the 1990s, calls to make the university resemble corporations failed to grasp how universities work. Business language and goals have come to have too much influence on the core of the educational mission. Even as the university must work with business, and acknowledge that it can learn much from the best business practices, it must clearly distinguish educational from commercial goals. (pp. 39-40)

Through the years, many prestigious donors and university presidents alike have aspired to implement business-like strategies in the education arena (Thelin, 2004). Today, many universities have utilized particular business-like approaches to improve certain practices. However, some academics hold steadfast to the ideals of keeping the two worlds separate.

University-Industry Engagement: Financial Implications

Then and now, thanks to university and industry engagement, universities attempt to make up for deficits the lack of state and federal funding leaves behind. Unfortunately, available state funding has steadily decreased at historic proportions (Richter & Donnerberg, 2006). “This problem is further compounded by a decrease in capital expenditures for new buildings and

laboratory facilities for undergraduate education by state governments” (Richter & Donnerberg, 2006, p. 1). Lack of funding and available state support, has consequently led to extreme increases in tuition costs and fees incurred by students, resulting in extreme debt for many. Universities have been forced to become self-revenue generating enterprises. “Through revenue generating strategies, ‘government-funded’ universities now earn up to 50% of their local revenue from non-government sources” (Parker, 2002, p. 607). Because of these partnerships, universities are able to have access to exclusive research sites, build new infrastructure, gain state of the art equipment, and develop recruitment and outreach programs that without such partnerships would not be a reality. “The challenge is to strike a balance between managing threats to valued elements of the university lifeworld while availing ourselves of opportunities that may both change and enhance crucial elements of our interpretive schemes” (Parker, 2002, p. 614).

University-Industry Engagement: Defined

Davis (2002) defined engagement as outreach. “Engagement involves an exchange and application of knowledge that can be creatively utilized to advance our society and solve a variety of technical and social problems” (Davis, 2002, para. 10). University and industry collaboration involves person-to-person collaboration (Perkmann et al., 2012). Engagement can be described as traditional, non-traditional, financial or non-financial. There is also a wide variation of engagement activities, including but not limited to: student internships/co-ops, research consortiums and projects, recruitment/retention initiatives, advisory board participation, mentoring, and curriculum development (Liew et al., 2012; Perkmann et al., 2012). Prager and Omenn (1980) pointed out several relevant factors that contribute to the type of engagement relationships established. These factors include:

the size, structure, and profitability of the industry, the nature of its business, and the progressiveness of its research program; and the type, size, and financial health of the university, the relative size and stature of its science and engineering programs, and the orientation of its research and researchers. External factors such as geographic proximity, the location of the university alumni in key industrial positions, and migration of university faculty to industry and vice versa may be very influential. (p. 25)

In addition to the aforementioned factors, Prager and Omenn (1980) also provided a table that highlights the types of university-industry relationships. The table is broken into four main categories: corporate contributions to university; procurement of services; cooperative research; and research partnerships (Prager & Omenn). The following table synthesizes some of the commonly used approaches with brief descriptions of each category.

Table 2.1

Types of University-Industry Relationships

| <i>Corporate contributions to university</i> | <i>Cooperative research</i> |
|--|---|
| Undirected corporate gifts to university fund | Cooperative research projects: direct cooperation between university and industry scientists on project of mutual interest; usually basic, nonproprietary research. No money changes hands; each sector pays salaries of own scientists. May involve temporary transfers of personnel for conduct of research |
| Capital contributions: gifts to specific departments, centers, or laboratories for construction, renovation, equipment | Cooperative research programs: industry support of portion of university research project (balance paid by university, private foundation, government); results of special interest to company; variable amount of actual interaction |
| Industrial fellowships: contributions to specific departments, centers, laboratories as fellowships for graduate students | Research consortia: single university, multiple companies; basic and applied research on generic problem of special interest to entire industry; industry receives special reports, briefings, and access to facilities, for example |
| <i>Procurement of services</i> | <i>Research partnerships</i> |
| By universities from industry: prototype development, fabrication, testing; on-the-job training and experience for students; thesis topics and advisers; specialized training | Joint planning, implementation, evaluation of significant, long term research program of mutual interest and benefit; specific, detailed, contractual arrangement governing relationship; both parties contribute substantively to research enterprise |
| By industry from university: education and training of employees (degree programs, specialized training, continuing education); contract research and testing; consulting services on specific, technical, management problems | |
| Industrial associates: single university; usually multiple companies; industry pays fee to university to have access to total resources of university | |

(Prager and Omenn, 1980, p. 381)

University-Industry Engagement: Benefits

Regardless of the model or institution type, successful university and industry relationships provide tremendous direct and indirect benefit for institutions of higher learning, industry, and ultimately society. According to the report, “Making Industry-University Partnerships Work: Lessons from Successful Collaborations” the following partnership themes exist: partnerships that impact teaching and learning; partnerships that develop new funding streams; partnerships that rethink the role of the research university; and partnerships that go strategic (Edmondson et al., 2012). Casey (2004) indicated:

University-industry partnerships are essential for universities, industry, and the United States. Universities benefit from their interactions with industry, particularly for faculty and students. Industry derives benefits in the form of project deliverables from their partnerships with universities. Local communities, regions, and the entire United States benefit from these partnerships through the next generation of a highly trained workforce and the resulting economic benefits of growth (job growth, business growth, and profitability). (p. 2)

Cyert and Goodman (1997) described such alliances as proliferating. Industry engagement can create funding opportunities to support university research, while university engagement allows corporations to collaborate on mutually beneficial research and development projects that explore the frontier of science.

Why do universities and industry collaborate with each other? What do they gain?

According to the literature, the following describe some benefits to university-industry collaboration:

- **Advisory boards (Hughes, 2001)**

Industry advisory boards provide tremendous insight for university partners. They expound on recruitment trends, new technology and business trends, and curricula needs. In some instances, these advisory boards are made up of mostly university

alumni. One of the board's main focal points is to generate new funding streams for university research and programs (Hughes, 2001).

- **Curriculum input and design projects (Richter & Donnerberg, 2006)**

When industry and universities partner on curriculum structure and design projects, everyone wins. This type of collaboration fosters an atmosphere that directly connects industry needs to student learning in order to produce a primed workforce (Richter & Donnerberg, 2006). Faculty get the opportunity to further develop and teach about cutting edge technology, industry acquires students who have an updated knowledge base, and students become technically savvy and marketable for future jobs.

- **Faculty development and training (Mutter & Pruett, 2011)**

According to Mutter and Pruett (2011), continued faculty development and training aides in student development as well. When faculty and staff work directly with industry, they are equipped with first hand knowledge and experiences that can better explain techniques and expectations to current and future students.

- **Faculty incentives and rewards (Casey, 2004; Perkmann et al., 2012)**

University and industry partnerships can lead to financial and in-kind incentives for faculty. Faculty are motivated by monetary supplements, research advancement, and the opportunity to utilize resources and equipment (Perkmann et al., 2012). These incentives also provide pedagogy enhancement of potential opportunities for hands-on instruction. In addition, such incentives and rewards can positively attribute to faculty retention (Casey, 2004).

- **Grant proposal support and funding (Perkmann et al., 2012; Richter & Donnerberg, 2006)**

Universities rely on grants to help financially support research and niche programming. During the proposal development process, universities strategically seek letters of support from multiple sources including but not limited to: industry, peer organizations, and other institutions to enrich their case for sponsorship.

According to Perkmann et al. (2012), “government funding agencies...look positively upon grant proposals that involve industry interaction” (p. 427). Solid relationships with industry can lend a corporate perspective to the proposal planning process and research/project design. These relationships can also yield supporting documentation and additional financial support when needed (Richter & Donnerberg, 2006).

- **Industry and university infrastructure (Casey, 2004)**

Industry and universities often engage each other for infrastructure needs. “For many companies, it is simply more cost effective to contract out research to universities that have the research infrastructure in place rather than building from the ground up or renovating existing research facilities” (Casey, 2004, p. 5). Similarly, academic institutions with limited research equipment or facilities rely on local industry partners to host sites for student training and research or product development.

- **Research and development (Casey, 2004; Cyert & Goodman, 1997)**

Industry and university infrastructure and research and development often coalesce. This type of activity, along with other outsourcing strategies, allows companies to achieve research goals and/or competitive market demands (Casey, 2004). In addition, it provides an opportunity for faculty to further develop research techniques

and introduces students to real world applications. For some partnerships, this results in the creation of research centers or alliances. Formation of such entities creates potential organizational change for industry and the university. “For the corporation, this change may be in terms of new products, application policies, or practices. For the university, it may be in terms of a new research agenda, new curricula, or better ways to train students” (Casey, 2004, p. 46).

- **Skilled workforce pipeline including internships and co-ops (Casey, 2004; Hughes, 2001; Richter & Donnerberg, 2006)**

According to Casey (2004), “universities provide a ready pool of graduate and undergraduate students that industry may access from their work demands. In return, students receive essential workforce training that is not available in classroom courses” (p. 5). This pipeline of talent is created and molded through classroom activities, internships and co-ops that are a result of industry and university collaboration. It is important to determine early on if the internship/co-op experiences will be recognized by the participating university (Hughes, 2001). In any instance, such opportunities “allow employers to survey potential employees before hiring them” (Richter & Donnerberg, 2006, p. 3).

- **Technical opportunities for faculty, staff and industry (Casey, 2004; Cyert & Goodman, 1997)**

Many technical opportunities arise for faculty and staff through university and industry engagement. According to the Cyert and Goodman (1997), industry partners with academia “because they want access to scientific knowledge, new tools, new methodologies, new products, and the like” (p. 48). In some instances, academic

institutions cannot support the infrastructure needed to fully support research or other technical needs. Industry partners help remedy these issues by providing materials, facilities, and technical opportunities for university faculty and staff (Casey, 2004).

As described above, there are benefits to university and industry collaboration.

Ultimately, a pool of diverse talent is created that industry can access for an evolving workforce.

These relationships materialize in opportunities to faculty and students that result in solution-based research and development projects. Because research and innovation plays a significant role for university and industry partners, both seek collaborative opportunities because they value one another's infrastructure. Alliances such as these provide tremendous cost benefit to industry partners and universities with scarce resources. Engaging with industry often promotes the service mission of university and builds connection with their respective communities.

Depending on the nature, scope, and impact of the partnership, university-industry engagement can also stimulate the local, regional, and national economy. Simply put, when done effectively and rooted in mutual benefit, university-industry partnerships can be a win-win for all involved.

However, win-win outcomes do not come easy, there are barriers that can impede progress (Casey, 2004).

University-Industry Engagement: Barriers

The demands of globalization present opportunities and obstacles within university-industry partnerships. The driving force behind each is clearly different, but when in sync can affect change and inspire innovation around the world. Differences can ignite vigor in relationships, but can equally provoke chaos. To be successful, differences must be identified, harnessed, and strategically managed. It is imperative to initially define intended purpose and

desired outcomes and set parameters to ensure mutual benefit. Cyert and Goodman (1997)

explained:

The basic functions of a university are to create new knowledge and disseminate established knowledge. Relationships with industries should be formed only if one or both of these functions are expected. The alliance should not be entered into merely as a way to finance research or help solve a problem that a commercial company cannot solve on its own. (p. 50)

Considering this idea, university and industry partners should strive for long-term mutual goals verses interim individual solutions. Such efforts are more easily manifested through effective communication.

There are many barriers that taint university-industry engagement. Poor communication is often the culprit that causes relationships to deteriorate (Casey, 2004). University and industry representatives often have stereotypical visions of the other that hampers communication for effective project finalization and execution (Casey, 2004). Without effective communication, the relationship either remains stagnant or disintegrates. One author suggests the “Achilles heel” of university-industry engagement is that the foundation of these relationships is based on the university value system with little regard to the importance of meeting industry needs (Hughes, 2001). Discounting the wants and needs of all parties involved is a prescription for failure. While, Hughes (2001) indicates that poor communication and ambiguous objectives are two main tenants that halt university-industry engagement, the literature points out several others, including:

- **Conflict of interest (Casey, 2004)**

Conflict of interest in any setting can encumber a meaningful alliance. Casey (2004) noted that the potential of corporate scandals and financial risk sometimes cause some

universities to carefully contemplate the notion of industry partnerships. Neither industry nor academe want unethical pitfalls to tarnish their respective reputations.

- **Cultural differences (Casey, 2004; Cyert & Goodman, 1997)**

The presence of cultural differences in a partnership between university and industry not only impedes communication but can also stifle growth. There are also legal distinctions to consider among non-profit academic institutions versus for profit corporations (Casey, 2004). Cyert and Goodman (1997) noted, “The differences manifest themselves in divergent goals, time orientations, languages, and assumptions” (p. 47). Universities are thought to have longer unstructured timelines while, some corporations, in contrast, equate time as quarterly goals and short-term benchmarks (Cyert & Goodman). The dialect of research appeals to members of the academy while dividends, profit margins, and market forces are primary terms for industry constituents (Cyert & Goodman). Since the cultural climate of both parties vary greatly, blind navigation can lead to the demise of the relationship. Therefore, it is essential to recognize these differences, seek possible solutions and create a unified territory in which the partnership can thrive.

- **Exclusive relationships (Casey, 2004)**

The notion of exclusive relationships in university-industry partnerships can be problematic. In some instances, one partner may demand exclusivity in the relationship while the other partner wants to duplicate the effort elsewhere or bring another member on board (Casey, 2004). This type of relationship can be intense but can be resolved when boundaries and terms are initially negotiated.

- **Financial risk (Casey, 2004; Hughes, 2001; Prager & Omenn, 1980)**

Financial risk is a key concern of any partnership. Both parties equally consider time, financial implications, and potential profit, be it tangible or not (Prager & Omenn, 1980). Casey (2004) explained that, “It is financially riskier for universities to work with industry rather than government” (p. 7). The government is often viewed as a relatively reliable source for research funding when potential state or federal budget cuts are not likely. With this in mind, some universities choose to pursue federal grants verses pursuing industry relationships. Industries tarry over financial endeavors with universities due to the lack of consistency and unrecognized programs. For, example some companies provide significant resources for internships or other experimental learning programs that are not even recognized by the institution, leaving a bitter taste with corporate partners (Hughes, 2001).

- **Lack of consistency (Casey, 2004)**

According to Casey (2004), universities often are considered by industries to be fluid organizations that lack consistency. Lack of consistency from university or industry at any level can threaten the collaboration. High turnover of employees or administration, sudden agenda changes, varied missions, and public verses private university structure can make achieving consistency with industry challenging. When individuals move on to other opportunities not affiliated with the partnership, chances of decreased moral, commitment, and structure can erode the relationship.

- **Secrecy, public dissemination of knowledge, patent rights (Casey, 2004; Cyert & Goodman, 1997; Liew et al., 2012)**

University-industry engagement activities stimulate numerous learning opportunities. “Learning can impact the organization’s strategic thinking, culture, problem-solving skills, and knowledge base” (Cyert & Goodman, 1997, p. 50). Unfortunately, these learning opportunities lead to unique discoveries that introduce debates over ownership. Cyert and Goodman (1997) pointed out that proprietary issues sometimes hinder expected outcomes for universities. Universities, as academic institutions, have a strong desire to publish their programs or research. If faculty lose the opportunity to own and publish their research, industry potentially risk the loss of promised technological deliverables or services from subsequent research (Cyert & Goodman; Liew et al., 2012). Corporations, as consumer driven organizations, have the distinct desire to compete and seek profitable opportunities that cause new ideas and creations to remain secret (Casey, 2004). These varied approaches can make it difficult to negotiate research agreements that are a win-win for both entities.

- **Trust/Fear (Casey, 2004)**

Casey (2004) claimed, “Both parties, either through culture, prior experience, or stereotyping, often fear doing work with the other” (p. 6). It could be the fear of being vulnerable with information with the other group or the idea of cultivating a new relationship. Whatever the case, establishing trust in the infancy stage of the partnership is essential otherwise it may never fully mature.

- **Undeliverable goals and products; limited follow-through (Liew et al., 2012)**

According to Liew et al. (2012), “lack of cohesiveness and continuity...” cause collaborations to stumble (p. 409). Some partnerships neglect the essential element of follow-through and fall prey to a series of undeliverable goals and products. “This boils back to the point regarding the strong peer-to-peer relationship or network which is strongly advocated upon by industrial members as part of essential tool to improve communications and working outcomes of the project through free flow of knowledge transmitted between both parties” (Liew et al., p. 409).

These barriers as well as many others inhibit the creation and longevity of university and industry relationships. Understanding the dynamics of university and industry cultures sets the tone for the relationship. Individuals who understand and can operate in both worlds are the conductors that keep the partnership on track (Edmondson et al., 2012).

Hughes (2001) stated:

Neither the university culture nor the culture of industry is completely right or completely wrong. These cultures are what they are, but they are undeniably different. Not understanding these cultural differences and not acknowledging and responding to them will continue to ensure that university-industry relationships consistently underperform their potential. (p. 1)

When university and industry are equally invested, progressive relationships are characterized as long-term, strategic, and are built around a common vision with identifiable and reachable goals.

University-Industry Engagement: Engineering

University-industry alliances are considered to be a staple development in science and technology (Liew et al., 2012). In the STEM fields, industry engagement is essential to, and most commonly found, in applied research (Perkmann et al., 2012). Engagement at the research level can take the form of collaborative research, contract research, or consulting. High

technology areas such as nanotechnology and materials science and engineering are highly sought after research domains. Lee as quoted by Perkmann et al. (2012), explained that

science and engineering faculty at US research universities collaborate with private partners for two main reasons: (a) to access resources relevant to their research activities via additional funds, equipment and support for students, and (b) to access learning opportunities, such as field-testing opportunities for their own research and obtaining new insights. (p. 429)

Student internships and co-ops appeal to both university and industry needs. Hughes (2001) argued that university-industry engagement works best when the emphasis is placed on the benefits of the students and not solely on the faculty. An example of a student-based partnership is the biomedical engineering-industry partnership at Marquette University (Waples & Ropella, 2003). The biomedical engineering program implemented a co-op experience that was designed to give students professional engineering experience and introduce them to the healthcare industry. Waples and Ropella (2003) indicated that establishing a successful cooperative education experience requires an intimate university-industry collaboration that begins in the infancy phase of a student's college career. A great deal of time, human capital, financial capital, and the aspiration to educate students in unprecedented ways is required. In order to attract industry partners for the co-op program, university personnel employ a purposeful labor-intensive strategy. This approach is multi-faceted and resembles grass roots efforts including telephone calls, site visits, and written and verbal communication. In addition, Marquette relies heavily on their alumni network to gain traction in establishing these relationships.

Another example of engineering university-industry engagement is the Knowledge Integration Community (KIC) model at Cambridge and at the MIT Institute (Acworth, 2008). This approach uniquely includes a U.S. institution and an institution from abroad with both

industry and governmental influence. It challenges the notion of geographic location and proves that partnerships can also be virtual in nature (Acworth, 2008). This model truly embodies globalization in the classroom. This partnership is described as being business-led and focused on commercial based research and development. The Knowledge Integration Community model demonstrates effective knowledge transfer. The purpose of KIC is address a significant challenge in science or technology. The main goal KIC is to produce research-based solutions to real-world problems. The interactions between colleagues and students at two prominent institutions, coupled with industry and government liaisons create a very rich and meaningful experience (Acworth, 2008).

University-Industry Engagement: Summary

Without a doubt, university-industry relationships were formed for a variety of reasons. Some were established to produce a viable workforce; some were based on religious beliefs and organizations; others were created to soothe egos of the wealthy that established institutions grounded in conceited intentions. Early opinions of higher education in the United States were aimed at practicality. According to Westmeyer (1985), higher education was originally vocational oriented. The belief was that practical, vocational education led to jobs. “Research studies have found that by far the major purpose of students in college and universities is to end up with better jobs than they would be able to obtain if they did not have college degrees” (Westmeyer, 1985, p. v).

Despite the reason, today, most can agree that the common goal of higher education in the United States is to equip graduates with the tools needed to be a productive and valuable asset in society (Scott, 2006). The reality is that state and federal financial support for U.S. higher education is declining without any indication of heading in the other direction. The need

for financial assistance will eventually fade the current blurred lines between university and industry, especially in engineering and other technical fields. Newfield (2004) perhaps summarized it best with this quote from Gould:

The search for important knowledge in technoscience is not going to slow down. University bureaucracies are not going to look less like corporate bureaucracies in the future. Students are not going to cease to search for credentials for the workplace. Neither are they going to cease to search for credentials for the workplace. Neither are they going to have fewer problems financing their education. Discipline-based knowledge in the arts and sciences is not going to become less professionalized. The old ideal of a liberal education as something that is pursued for its own sake is most unlikely to have a revival. (pp. 41-42)

Minorities in Engineering: Overview

It seems evident that university-industry engagement has future implications for what our universities will teach and how our industries are managed. It seems even more evident that in the U.S. globalization is the new way of doing business, particularly in engineering and technology. Who is going to sustain this era? How will they be trained? How will universities and industry attract future students, especially minority students, into science, technology, engineering and mathematics careers? Universities and industry are finding themselves asking these very same questions and turning to each for answers.

Increasing student interest in the STEM fields has been a steady challenge.

Engineers from diverse backgrounds and experiences are needed to devise creative solutions to the challenges posed by a diverse and more interconnected world. Recruitment of diverse engineering workforce includes the successful recruitment, retention and graduation of a diverse engineering student population. (Weatherton, Daza, & Pham, 2011, p. 1)

Domestic technical talent has become unavailable, underutilized and/or replaced with foreign expertise (Korpela, Suryanarayana, & Anderson, 2008). In 2008, U.S. Caucasian men made up 70% of the science and engineering workforce, but only 40% of the overall workforce.

Caucasian women comprised 15% of the science and engineering workforce and 35% of the

overall workforce. Traditionally underrepresented groups (African American, Hispanics, Native Americans) and persons with disabilities together, made up 24% of the population but only 7% of the science and engineering workforce. Needless to say, much work has to be done to ensure that minorities become a vital part of the technical workforce (Korpela et al., 2008).

One of major barriers prohibiting minorities from pursuing STEM careers has been access to higher education. A critical component of the history of U.S. higher education was the Morrill Act of 1862 (Brickman & Lehrer, 1962). Other acts such as the Hatch Act of 1887 and the second Morrill Act of 1890 changed the landscape of higher education (Brickman & Lehrer, 1962). The Morrill Act of 1862 provided:

1. support in every state for at least one college devoted to agriculture and the mechanic arts,
 2. public lands or land script equal to 30,000 acres for each senator and representative under the 1860 apportionment (a total of 17,430,000 acres of public land),
 3. the funds, except for 10 percent which could be used initially to buy land for sites, to be set up as an endowment at no less than 5 percent interest,
 4. if not used the funds to be returned to the federal government in five years.
- (Westmeyer, 1985, p. 61)

This movement was momentous and provided access for many people who might have otherwise been denied a higher education. Brickman and Lehrer (1962) stated, “It made possible the higher instruction of the children of workers and farmers and thus enabled social mobility and the equality of educational opportunity to become realities in a political democracy” (p. 11).

Signs of stagnation led to the 1887 Hatch Act, which made provisions for agricultural experiment stations at land-grant colleges. The Morrill Act of 1890 authorized founding of additional land-grant institutions and replenished funding for previously established land-grant schools (Thelin, 2004). The second Morrill Act applied to the black colleges of the South. This was very significant because these states were not eligible for land-grant funding during the Civil War. The Morrill Act of 1890 benefited the African American schools but it also tremendously

neglected them during a very sensitive time of racial tension (Thelin, 2004). People of color had enough societal challenges attending college to obtain a liberal college degree, let alone a technical degree.

Today, some of those same societal factors still affect how minorities feel about pursuing careers in science, technology, engineering in mathematics. What are the barriers that prohibit minorities from persisting in STEM fields? One barrier is the concept of “ethnic isolation” (Landis, 1988, p. 757). Ethnic isolation is when students seclude themselves by virtue of their ethnic backgrounds. Minority students sometimes have no other choice but to separate their academic and personal lives. Due to this, they are more vulnerable to experience negative interactions with peers who are in less demanding majors, have limited interaction with faculty, and avoid engaging their non-minority counterparts (Landis, 1988).

In addition to these challenges, a study conducted by Weatherton et al. (2011) addressed perceived barriers for underrepresented groups in engineering. This study surveyed high school STEM teachers, high school students in STEM courses, and undergraduate engineering students. The teacher and undergraduate student group responses were divided into minority and majority groups for specific questions. The survey results identified what both groups perceived as barriers to underrepresented groups in engineering along with other intended results. The high school student survey did not question perceptions on barriers to minorities in STEM, instead it focused on their interest in STEM fields.

In the area of “Perspectives on Underrepresented Ethnic Minorities”, minority teachers perceived that lack of family role models, lack of financial resources, peer influence, lack of school encouragement, and feeling like they do not fit in were some of the main barriers prohibiting minorities from pursuing STEM fields. Minority undergraduate engineering students

responded that they perceived the following were significant barriers for minorities in engineering: pursuit of alternate degrees, lack of financial resources, feeling like they do not fit in, the curriculum failing to consider learner differences, instructional methods fail to consider learner differences, and tracking out of the necessary classes. Lastly, high school students in STEM courses indicated the following: they enjoy and earn As and Bs in science and math classes and are interested in pursuing STEM fields in future studies (Weatherton et al., 2011).

While the latter survey results give us hope for the future, there is critical concern for those who are further along in the pipeline. How can we help motivate minority engineering students to press forward despite the barriers they face and eliminate self-doubt? Self-doubt is arguably one of the most dangerous and self-destructive barrier there is.

Too frequently, minority students realize that they have not been able to work up to full potential; their self-confidence is eroded and their enthusiasm for engineering diminished. Worse yet, because they are forced to adopt a lone-wolf approach to their studies, they may not develop the leadership and communication skills so valuable to a successful career in business and industry. (Landis, 1988, p. 758)

In response to this dilemma, universities have established programs and/or appointed individuals to focus on the recruitment, retention, and graduation of minority engineers. Such programs were established to promote a “wolf pack” mentality vs. a “lone-wolf” approach.

Multicultural Student Services

Holistically, universities have progressed and espoused an intentional commitment to diversity efforts throughout the institution and service community. Purposeful strategies have been made across university campuses nationwide to implement and deliver accessible, informative, and inviting services for multicultural students. Some of these efforts have been established employing a top down organizational approach including but not limited to: diversity

provosts, college/school diversity deans, diversity program directors and coordinators, and ethnic or multicultural specific student organizations.

The need for multicultural student services, a branch of student affairs, has a deep-rooted historical context that represents an inimical time in our nation's history.

Underrepresented racial and ethnic students encountered issues and concerns related to adjustment to college, academic performance, financial resources, feelings of loneliness and isolation, racial/ethnic identity development, racial hostility, issues of entitlement, and a lack of connection to the college environment. (Shuford, 2011, pp. 31-32)

Some may argue that the formation of such services was designed to pacify or even mute the outcries from students of color that faced racial adversity throughout their collegiate matriculation. Nonetheless, according to Shuford (2011), "Multicultural student services (MSS) offices have played a significant role in supporting underrepresented populations on campus and in developing systemic change around multicultural issues within institutions" (p. 29). Such responsibility comes with the added pressure of ensuring that MSS personnel are culturally competent and intrinsically astute.

The cultural climate on a university campus remains in a perpetual state of motion with significant ebbs and flows contingent upon the nature of the campus community. This constant state of change presents both advantages and challenges to the successful acclimation of underrepresented groups, especially in a majority setting. Stage and Manning (1992) indicated that there are five recommendations for acclimating multicultural students into a predominate environment including:

- (1) Bringing members of a particular group together during orientations and focusing on their special needs,
- (2) working closely with the parents of multicultural students and with faculty and administrators to build a network of support that connects the campus support group with the family,
- (3) identifying multicultural faculty and administrators, introducing them to students, and asking them to serve as advisers and mentors,
- (4) encouraging students in racial and ethnic minority groups to socialize with one another

and form support networks and clubs, and (5) encouraging students in these groups to participate in campus activities with predominantly mainstream students. (p. 10)

However, while effective in certain capacities, these strategies are not effective at mitigating such complex issues. The following issues stated by Stage and Manning (1992) describe problematic causes:

(1) Assuming that diverse students must change, (2) making multicultural students, faculty, and administrators already in the institution responsible for socializing new multicultural students, (3) encouraging multicultural students to adapt to the dominant culture, (4) helping only “identifiable” multicultural students, (5) failing to provide equitable educational opportunities to all students admitted to the institution, and (6) failing to educate those of the dominant culture about their multicultural colleagues. (p. 11)

These recommendations for acclimation and commonly flawed assumptions when carefully considered can either boost or hinder meaningful progress for multicultural students. This frame of thinking is trickled down from university wide initiatives to college and departmental programming. One example that amalgamated both multicultural student services with a generally sparse population of underrepresented students in the field was the creation of university multicultural engineering programs.

MEPs: Multicultural Engineering Programs

Multicultural engineering programs, also known as minority engineering programs (MEPs), were initially created as interventions designed to help minority engineering students navigate through academic and social challenges (Chubin et al., 2005; Dakich, 1993). MEPs emerged during a time when engineering schools were suffering from a downward spiral of minority student attrition (Morrison & Williams, 1993). Previously, industry partners provided financial resources to universities to support diversity recruitment and retention. These financial commitments were often made without strategic direction and barely attracted minority students to engineering schools (Dakich, 1993). Lack of intentional planning, structure, and commitment

eventually led to the demise of such initiatives and generated the concept of a more focused approach.

Official MEPs debuted in the early 1970s. The California Minority Engineering Program, founded at California State University, Northridge in 1973, is credited with being the grandfather of MEPs (Chubin et al., 2005). These programs were meant to, and still do, function as safe havens to help students escape from environmental pressures and foster a sense of community (Korpela et al., 2008). Today the MEP model has been successfully duplicated at over 100 universities. Landis (1988) indicated that the MEP model has three primary objectives: “1) build MEP students into a supportive academic community, 2) deliver appropriate academic support, and 3) facilitate the personal and professional growth of MEP students” (p. 759). According to Chubin et al. (2005), MEPs have the following key structural elements: “a formal orientation course for new freshmen, clustering of underrepresented students in common sections of their classes, a student study center, and structured study groups” (p. 80).

Multicultural engineering programs also place a huge emphasis on freshman year transition. Many programs kick off the transition year, with pre-college or summer bridge programs that introduce students to engineering and campus life (Dakich, 1993; Morrison & Williams, 1993). MEPs, in most instances, also serve in an advisory role for minority student organizations such as: the National Society of Black Engineers (NSBE), the Society of Hispanic Professional Engineer (SHPE), and the American Indian Science and Engineering Society (AISES). These student organizations allow MEPs to help promote professional development and leadership skills (Landis, 1988).

Although multicultural engineering programs have made great strides towards the advancement of minorities in engineering, insufficient funding poses potential challenges to

maintain signature programs and events (Dakich, 1993). MEPs, like other university departments, depend on external funding streams and in-kind donations to operate and serve a potentially growing student population. Some of this funding derives from alumni giving, grants, and industry engagement.

MEP-Industry Engagement

Multicultural engineering programs like many university units have some level of engagement with industry. While there is limited literature available in this area, there are several examples that reveal specific types of engagement. Some of these examples pertain to advisory boards, summer bridge partnerships and varied interactions throughout general MEP programming. Over 20 years ago, the National Action Council for Minorities in Engineering, Inc. produced an article entitled, “*Minority Engineering Programs: A Case for Institutional Support.*” This article provided insight on the MEP student enrollment, organizational structure, programs and activities, and funding streams. Some of the reported findings yielded industry engagement activities (Morrison & Williams, 1993).

According to Morrison and Williams (1993), MEPs play a role in helping students secure summer employment through industry connections. Some of these opportunities include local and major organizations, government agencies, or research opportunities. Findings also showed that professional development activities such as co-ops, internships, and career related presentations are enriched through industry support and the support of MEP alumni. In addition, a majority of MEPs reported some level of engagement with industry. Advisory boards, internships, and scholarship funding were the most commonly identified areas. Lastly, MEPs reported that a portion of their financial resources is supplied by private funds from industry, foundation or individual donors (Morrison & Williams, 1993).

In addition to this article, national conferences conducted by the American Society for Engineering Education have served as a platform for MEPs to report unique interactions with industry. North Carolina State University has detailed several key elements about partnering with industry regarding advisory boards. The MEP at North Carolina State University has a National Industry Advisory Board, which at the time had been functioning over 12 years. According to Mitchell, Flannigan, Wooten, Pearson, and Daniel (2007) the national industry advisory board is comprised of corporate representatives, committed to diversity, who actively recruit undergraduate and graduate students for internships, co-operative education, and full-time positions. The board also has permanent placement for the chapter presidents of the three MEP student organizations: the American Indian Science and Engineering Society (AISES), the National Society of Black Engineers (NSBE) and the Society of Hispanic Professional Engineers (SHPE) which gives industry preferred access to members of these organizations.

Mitchell et al. (2007) describe the purpose of the board and the types of engagement activities. The purpose of the board is to:

- Be a support body that provides advice on engineering and corporate programs, employment needs, & trends;
- Participate as is reasonable in MEP programs and activities;
- Support program needs related to minority engineering student success; and
- Help facilitate professional development and hiring of a diverse pool of our engineering students. (p. 7)

Industry engagement with the MEP office and students include:

- Hosting student orientation visits;
- Giving annual presentations and conducting mock interviews in our minority student focused course: E145 – Academic and Professional Preparation of Engineers II;
- Participating in periodic information and career development sessions with student chapters of AISES, NSBE, and SHPE;
- Hosting engineering student events at national conferences
- Sponsoring individual students for internships, co-operative education, undergraduate research; and

- Co-authoring papers that document unique and interesting industry/university collaborations. (p. 7)

With the purpose and nature of industry and engagement in mind, the authors indicate that there are some benefits and some challenges in these partnerships. Networking and sharing recruitment strategies are identified among the main benefits. In addition, the ability to have close and consistent contact with the MEP and college administration and priority access to students through student organizations and to freshman are also major partnering incentives. With respect to student recruitment, there are several challenges. Federal requirements to hire more minority engineers, significant reduction in engineering sought degrees, a limited pool of diverse engineering candidates, and dwindling funds to support growth and development of multicultural engineers are some of the main challenges. Lastly, the authors share several challenges associated with sustaining an effective national advisory board. From the MEP perspective, significant programming demands has adversely affected work/life balance for staff and in some cases stifled progress. In addition, changes or loss in staff has negatively impacted coordination and have even led to the termination of some advisory board activities. Like MEPs, industry also identified personnel changes as a challenge. Scheduling and workload were also identified as major barriers to participating in advisory board meetings and events especially when these elements impacted influential champions who were in positions to make important decisions. (Mitchell et al., 2007)

A third example of industry and MEP collaboration involves Arizona State University (ASU) and the Tempe Chamber of Commerce. This duo joined forces to establish a summer internship experience within the ASU's two-week residential summer bridge program for incoming minority freshman. Arizona State's MEP director envisioned an opportunity to provide summer bridge participants with a real hands-on learning experience prior to even taking

freshman courses. To help achieve this goal, they approached the Tempe Chamber of Commerce with this proposal. The Chamber immediately bought into the idea and the concept was developed and implemented. The project involved the development of a web-based version of the Chamber's newsletter. Assigned teams were judged based on documentation, web design, and oral presentation (Adair, Reyes, Anderson-Rowland, & McNeill, 2001).

During the course of the summer bridge program, students were divided into teams, held consultation meetings with members of the Tempe Chamber of Commerce, took relevant coursework to aid them with their task, and participated in routine follow-up with their client to ensure requested details were captured. Student teams made formal presentations to the Tempe Chamber of Commerce, ASU faculty and staff, community members, and family and friends. The formal presentations also included a poster session where judges were able to give direct student feedback. Arizona State's MEP and the Tempe Chamber of Commerce both indicate that this partnerships produced win-win results. The Chamber increased the reach of its newsletter more than 500% with the new web-based version. They also received immediate feedback from the students, which provided insight for the types of members they hope to capture in the future. The students gained real world experience that provided instant feedback, a supportive network throughout their college matriculation, and confidence. Lastly, ASU's MEP was able to significantly enhance an element of the summer bridge program that matched the goals of recruitment, retention, and placement with their counterparts in the Student Affairs Office and the College of Engineering as a whole (Adair et al., 2001).

Through these examples, we learn that industry engagement can occur through general MEP programming, employment, advisory boards, and summer bridge initiatives. Literature indicates several other functions of MEPs that could should implications of industry

involvement. While these examples provide a glimpse into the world of MEP and industry partnering, further research can enhance these findings to show a larger scope of these engagement activities.

Conceptual Framework: Relationship Marketing Theory

According to Liew et al. (2012), successful university-industry collaborations involve a loyal champion that is devoted to the sustainability and longevity of the relationship at all times. The success of the relationship heavily relies on strategic planning, communication, and goal setting. In regards to university-industry engagement, literature on relationship marketing theory lends key components that are indicative of promising strategies. Hunt, Arnett, and Madhavaram (2006), indicated that relationship marketing is prominent today due to “the trend for firms in advanced economics to be services oriented, adopt information technologies, be global in nature, be niche-oriented, and be information-oriented” (p. 74). These concepts, especially the notion of globalization, is a common theme between academe and industry.

Zinkhan (2002) stated, “Relationship Marketing (RM) can be defined as an approach to establish, maintain, and enhance long-term associations with customers and other stakeholders” (p. 83). Hunt et al. (2006) quoted additional authors that define relationship marketing as the following:

1. Attracting, maintaining, and – in multiservice organizations – enhancing customer relationships (Berry, 1983, p. 25)
2. Relationship marketing concerns attracting, developing, and retaining customer relationships (Berry and Parasuramen, 1991).
3. Relationship marketing (RM) is marketing seen as relationships, networks, and interaction (Gummesson, 1994, p. 2)
4. Relationship marketing is to identify and establish, maintain, and enhance relationships with customers and other stakeholders, at a profit, so that the objectives of all parties involved are met; and that this is done by a mutual exchange and fulfillment of promises (Gronroos, 1996, p. 11).
5. The understanding, explanation, and management of the ongoing collaborative business relationship between suppliers and customers (Sheth, 1994).

6. Attempts to involve and integrate customers, suppliers, and other infrastructural partners into a firm's developmental and marketing activities (Sheth and Parvatiyar, 1995). (p. 73)

In Zinkhan's (2002) definition of relationship marketing, the word "long-term" stands out. Relationship marketing strategy suggests that investing in long-term customer/consumer engagement is more beneficial than pursuing a sequence of one-time exchanges. Establishing long-term relationships requires the seller to form a bond with the customer. In the case of university-industry engagement, either party could be the buyer or seller depending on the end goal. So why enter these types of relationships? Who is the seller and who is the customer? Who benefits from these relationships? What are the checks and balances? Regardless of who occupies which role, the mantra 'customer is king' reigns supreme (Zinkhan, 2002).

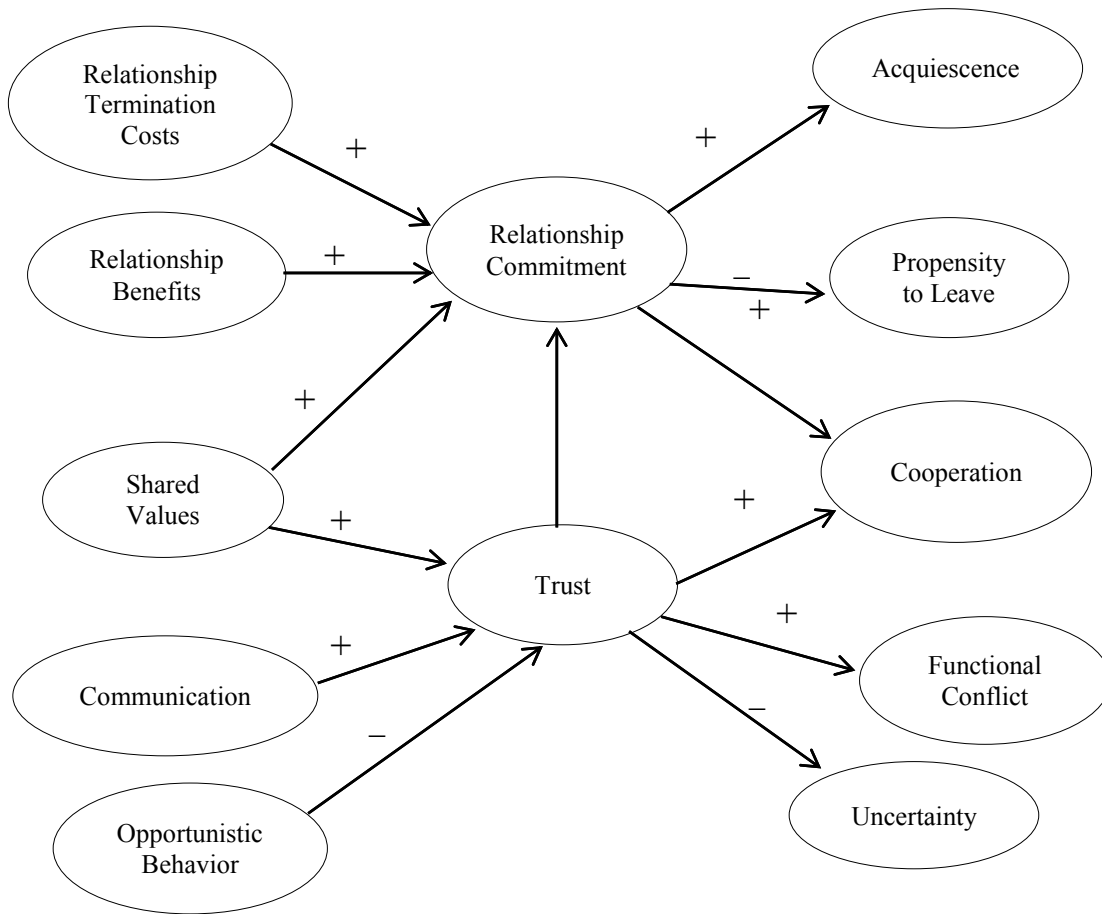
The literature points out several motives for seeking relational interactions. Hunt et al. (2006) indicated "that consumers must perceive that the benefits of engaging in relational exchange with particular firms exceed the costs incurred" (p. 75). Industry enters these types of relationships to enhance their opportunity for competition. Participating in these types of exchanges allows them to customize services and products to a particular audience, acquire or develop complementary and/or idiosyncratic resources with other industry partners, or add value to their corporate identity when associated with a particular group or organization (Zinkhan, 2006). Simply stated, people want to know what's their return on investment. Will the time, energy, and resources put into this relationship yield valuable results and meet or exceed expectations? If the answer is yes, some of the benefits include:

1. the belief that a particular partner can be trusted to reliably, competently, and non-opportunistically provide quality market offerings;
2. the partnering firm shares values with the consumer;
3. the customer experiences decreases in search costs;
4. the customer perceives that the risk associated with the market offering is lessened;
5. the exchange is consistent with moral obligation; and

6. the exchange allows for customization that results in better satisfying the customer's needs, wants, tastes, and preferences. (Hunt et al., 2006, p. 76)

If the answer is no, the likelihood of such a relationship will not exist.

The literature also reveals another form of relationship marketing theory that widely appeals to this study, the commitment-trust theory of relationship marketing (Morgan & Hunt, 1994). In Morgan and Hunt's (1994) theory, commitment and trust serve as the foundation of the relationship with ten emerging tenets that can either positively or negatively impact the relationship. These tenets include: relationship termination costs, relationship benefits, shared values, communication, opportunistic behavior, acquiescence, propensity to leave, cooperation, functional conflict, and uncertainty (Morgan & Hunt; see Figure 2.1).



(Morgan & Hunt, 1994, p. 22)

Figure 2.1 *The KMV Model of Relationship Marketing (Key Mediating Variable).*

Morgan and Hunt (1994) explained, “relationship commitment is central to relationship marketing” (p. 23). Relationships are built on commitment and commitment is built upon trust. The authors explain that trust exist “when one party has confidence in an exchange partner’s reliability and integrity” (1994, p. 23). When trust and commitment exist in a relationship a sense of loyalty is established that promotes the longevity of the partnership. However, such

loyalty does not always come naturally. According to Morgan and Hunt (1994), there are several factors to consider. They divide them into precursors of relationship commitment and trust and outcomes of relationship commitment and trust.

According to Morgan and Hunt (1994):

(1) relationship termination costs and relationship benefits directly influence commitment, (2) shared values directly influence both commitment and trust, and (3) communication and opportunistic behavior directly influence trust (and through trust, indirectly influence commitment). (p. 24)

These precursors help frame the nature of the relationship in its infancy. It sifts through the basics. Why is this partnership needed? What does each party hope to gain? What are the potential losses? By having these conversations early and continuously, the chances of a mature, producing relationship are high.

Relationship termination costs refers to “all expected losses from termination and result from the perceived lack of comparable potential alternative partners, relationship dissolution expenses, and/or substantial switching costs” (Morgan & Hunt, 1994, p. 24). Simply put, one partner questions if the relationship is worth terminating because the cost/loss associated with termination are too high, therefore they decide to stay and commit to the relationship. Alternatively, the other partner may sense separation in the relationship and fear termination, motivating them to become more committed. In some instances, termination is unavoidable and can be unhealthy for those involved if the relationship remains stagnant. Yet, in other situations, costs and fear of loss can encourage commitment and reignite passion.

Relationship benefits are essential to the livelihood any partnership. Partners strive to produce win-win outcomes for all involved. According to Morgan and Hunt (1994), competition also drives partnerships. Strategically selecting partners can also be a competitive advantage. When the benefits are high so is the level of commitment. Such high stakes necessitate trust

within the relationship to accomplish identified goals. Morgan and Hunt (1994) explain that partners who produce quality benefits within the relationship are considered highly valuable, and will in turn receive a tremendous level of commitment from their counterparts.

Shared values can be viewed as the relationship's blueprint. According to the literature, shared values directly impact commitment and trust within a relationship (Morgan & Hunt, 1994). What do both parties have in common? What do they believe? What do they want from each other? Morgan and Hunt (1994) posit, "shared values... is the extent to which partners have beliefs in common about what behaviors, goals, and policies are important or unimportant, appropriate or inappropriate, and right or wrong" (p. 25). While values differ among organizational cultures, when shared amongst partners, they incite a mutual sense of commitment.

In addition to shared values, communication plays an essential role in building trust and commitment. Communication, as mentioned before, is vital to any relationship. In the commitment-trust theory of relationship marketing, it is considered to be a major precursor of trust (Morgan & Hunt, 1994). Communication, both formal and informal, fosters trust within the relationship. Communication must be timely, specific, thorough, and reliable. Consistent communication, embodying these traits, generates a higher level of trust.

The last precursor of relationship commitment and trust is opportunistic behavior. Opportunistic behavior is described as self-seeking and deceit-oriented (Morgan & Hunt, 1994). Morgan and Hunt (1994) explained, "when a party believes that a partner engages in opportunistic behavior, such perceptions will lead to decreased trust...and that such behavior results in decreased relationship commitment because partners believe they can no longer trust

their partners” (p. 25). For the sake of the relationship, such behavior cannot be tolerated and can ultimately lead to permanent damage.

Morgan and Hunt (1994) claimed that in addition to the precursors of relationship commitment and trust, there are also five additional outcomes. “First, acquiescence and propensity to leave directly flow from relationship commitment. Second, functional conflict and uncertainty are the direct results of trust. Third, and most importantly, “cooperation arises directly from both relationship commitment and trust” (Morgan & Hunt, 1994, p. 25). These outcomes, cooperation in particular, are considered to be the prescription for relationship marketing success.

Acquiescence is defined as, “the degree to which a partner accepts or adheres to another’s specific requests or policies” (Morgan & Hunt, 1994, p. 25). Propensity to leave is described as, “the perceived likelihood that a partner will terminate the relationship in the (reasonably) near future” (Morgan & Hunt, 1994, p. 26). It is believed that a party’s commitment to the relationship positively impacts acquiescence, while trust only impacts acquiescence through relationship commitment. In other words, each partner positively responds and honors the requests of the other partner when they are equally committed to the relationship and trust each other. In reference to propensity to leave, according to Morgan and Hunt (1994), when both parties are committed to the relationship, the likelihood of leaving decreases, concluding that fostering commitment within the relationship leads to stability.

The third desired outcome of relationship commitment and trust is cooperation. Cooperation is essential to ensure that all the moving parts of the partnership function cohesively. Morgan and Hunt (1994), noted that the only outcome directly impacted by relationship commitment and trust is cooperation. Partners must work together to achieve

desired goals. Some might argue that cooperation and acquiescence are one in the same, but they are very different. Cooperation is considered to be proactive, while acquiescence is considered to be reactive. For example, “Passively agreeing to advertise a partner’s product is acquiescence; proactively suggesting better advertisements is cooperation” (p. 26). With this in mind, cooperation can be thought of as active participation in a relationship.

Functional conflict is mentioned as the fourth outcome (Morgan and Hunt, 1994). In any relationship, conflicts are bound to arise. However, it is what surfaces from those conflicts that determines if a relationship is severed or if they emerge anew. In some cases, functional conflict is considered healthy and can increase productivity when trust is present. According to Morgan and Hunt (1994), “Past cooperation and communication...result in increased functionality of conflict as a result of increasing trust” (p. 26).

Finally, decision-making uncertainty is the last outcome of relationship commitment and trust. “Uncertainty in decision making refers to the extent to which a partner (1) has enough information to make key decisions, (2) can predict the consequences of those decisions and (3) has confidence in those decisions” (Morgan & Hunt, 1994, p. 26). Morgan and Hunt (1994) suggested that when one party has difficulty making decisions, established trust allows them to confidently defer difficult decision making to the other party. Relationships grounded in trust showcase that the parties involved believe in their partner’s strengths and consider them to be reliable.

Implementing relationship marketing theory in university-industry engagement can create a competitive advantage for both parties (Zinkhan, 2002). However, the foundation of this relationship rests on the people involved. People are the glue that keeps the relationship thriving. People support those that share common backgrounds, interests, goals, and values similar to

them. While seemingly very personal, this concept, is magnified on a business platform. This level of engagement can be advantageous to both parties who understand the value in setting long-term goals and are committed to achieving them. Commitment and trust are essential elements that serve as the foundation and contributing factor of a partnership's success (Morgan & Hunt, 1994). In contrast, partnerships can also pose daunting challenges. Lack of desire and accessibility, combined with insufficient of time, resources, and structure all contribute to the demise of partnerships. Partnerships are essentially about relationships. This echoes the popular expression, "It's not always what you know; it's who you know." When meaningful relationships exist, "who you know," provides access; "what you know," fosters stability; and when combined, opportunities ascend and flourish.

Summary

Chapter 2 reviewed the literature pertaining to the following: a historical overview of university and industry engagement; financial implications of university and industry engagement; types of university and industry engagement; benefits to university and industry engagement; barriers to university and industry engagement; minorities in engineering; multicultural student services; multicultural engineering programs; multicultural engineering programs and industry engagement; and relationship marketing theory. Chapter 3 details the study's methods in efforts to address the research question: What is the nature of industry engagement within university multicultural engineering programs? This chapter will detail the study's design, site and participant selection, and interview protocols.

Chapter 3 - Methodology

Study Design Overview

The method of inquiry employed for this exploratory study largely involves the use of qualitative techniques. “The main purpose of qualitative research—whatever kind – is to provide an in-depth description and understanding of human experience” (Lichtman, 2006, p.8).

According to Bogdan and Biklen (1982), “Qualitative researchers are concerned with making sure they capture perspectives accurately” (p. 30). Attention is given to detail and the process can therefore be time intensive. However, the goal is not necessarily about quick findings, it is about meaningful results. Creswell (2009) indicated that qualitative approaches “bring(s) personal value into the study...create(s) an agenda for change or reform and collaborates with the participants” (p. 17). The proposed study highlights a practitioner-based group that serves as a change agent for minority students in science, technology, engineering, and mathematics (STEM). This group of multicultural engineering programs heavily relies on industry collaboration for support and program enhancements. Opting for a qualitative method of inquiry uniquely captured the rich details that characterize this group. It is also appropriate given the lack of research about this group (Creswell, 2013).

The qualitative approach most resembles case study. The literature defines a case study in a number of ways. Case studies are “intensive analyses and descriptions of a single unit or system bounded by space and time” (Hancock & Algozzine, 2006, pp. 9, 11). Creswell (2006) described it as “a bounded system, which can be defined in terms of time and place; over time and through detailed, in-depth data collection; involving multiple sources of information that are rich in context” (p. 73). Creswell (2009) also indicated “case studies are a strategy of inquiry in which the researcher explores in depth a program, event, activity, process, or one or more

individuals” (p. 13). Yin (1984) explained, “a case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used” (p. 23). According to Robert Stake (as cited in Thomas, 2011):

Case study is not a methodological choice but a choice of what is to be studied... By whatever methods we choose to study the case. We could study it analytically or holistically, entirely by repeated measures or hermeneutically, organically or culturally, and by mixed methods – but we concentrate, at least for the time being, on the case. (p. 9)

The purpose of this case was to study the nature of industry engagement within university multicultural engineering programs (MEPs). This case was bounded within the population of current institutional members of the National Association of Multicultural Engineering Program Advocates (NAMEPA). Since the literature on MEPs is limited, this exploratory study informs the literature about MEPs in general and provides insights on the types of relationships they share with industry. The study’s theoretical framework derives from the Commitment–Trust KMV Model of Relationship Marketing (Morgan & Hunt, 1994). This framework indicates that trust and commitment from all parties involved must coexist to yield thriving and effective relationships. Through this study, the researcher attempted to reveal how trust and commitment contribute to the relationship between industry and university multicultural engineering programs.

According to Yin (1989), “case studies may be based on six different sources of evidence: documentation, archival records, interviews, direct observations, participant-observations, and physical artifacts” (p. 84). In efforts to investigate the nature of university – industry engagement in multicultural engineering programs (MEP), the researcher found it beneficial to utilize several sources of data common to case study methodology to showcase the meaningful facets that can lend information to the field and inform the literature. The sources of

data for this proposed study included interviews and questionnaires. The researcher used interviews and questionnaires as primary sources of data and collected related online documents to assist with participant profiles found in Chapter 4. Selected MEPs were asked during the interviews to provide any relevant information highlighting the history of the program, organizational structure, and programming components. Interviews were used to gain insight on industry engagement in the MEP. Questionnaires served as a primary source of data collection from industry representatives nominated by MEP program directors or designees.

Guiding Research Question and Sub-Questions

Guiding Research Question

What is the nature of industry engagement within university multicultural engineering programs?

Sub-Questions

1. How do industry and university multicultural engineering programs develop trust in their relationships?
2. How do industry and university multicultural engineering programs establish commitment in their relationships?

Site Selection

The sites and participants at each site for this study were selected using a criterion-based sampling technique. According to Creswell (2009), “The idea behind qualitative research is to purposefully select participants or sites (or documents or visual material) that will best help the researcher understand the problem and the research question” (p. 178). The sites included current institutions that hold institutional membership in the National Association of Multicultural Engineering Program Advocates (NAMEPA). NAMEPA is an organization of major institutions with a multicultural, diversity, or minority serving engineering program with a

primary goal of increasing multicultural engineering graduates in the STEM fields. This organization is divided into five regions (A, B, C, D, and E) and has a membership of approximately 75 public and private institutions. Each region is organized as follows:

Region A: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and Washington, DC.

Region B: Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia

Region C: Illinois, Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, Ohio and Wisconsin

Region D: Arizona, Colorado, Kansas, Nebraska, North Dakota, Oklahoma, Puerto Rico, South Dakota, and Texas

Region E: Alaska, California, Hawaii, Idaho, Montana, Nevada, Oregon, Utah, Washington and Wyoming

These institutions include some of the most prestigious and largest engineering programs in the nation (e.g., Harvard, Princeton, Cornell, MIT, New Jersey Institute of Technology, Georgia Tech, Purdue University, The Ohio State University, The University of Texas, Louisiana State University, and Kansas State University).

To obtain sites most knowledgeable about industry engagement with university MEPs, the researcher solicited nominations for institutional participants from the current and two immediate past NAMEPA presidents. The nominators were invited through an email invitation and courtesy follow up phone calls. Nominators were asked to identify five (5) institutions, one per region, whose MEP programs exhibit meaningful and successful industry relationships. The nominators were instructed to use the following criteria for institutional nomination:

- Current or past NAMEPA institutional member
- Institution has a formal program dedicated to multicultural engineering programming
- Reputation for strong industry partnerships within multicultural engineering programming

Institutions with formal programs were selected to explore a structured programmatic approach to industry engagement verses non-structured individual efforts.

Once the nominations were submitted, the researcher had a pool of 14 unique institutional nominations. Six of the fourteen institutions received multiple nominations. The researcher selected five institutions, one per region, from the list of 14 to participate in the study. An initial group of five institutions were contacted to determine willingness to participate. The nominated institution from Region E was not able to participate. Since there was not another institution nominated from Region E, the researcher combined all regional nominations and contacted the next institution in alphabetical order resulting in another selection from Region D.

The researcher coordinated an electronic communication to the nominated institutions' multicultural engineering program directors or designees explaining the purpose of this study, what it would lend to the field, and how their participation would not only enhance the literature on multicultural engineering programs, but also add to the understanding of the partnering relationships between the university and industry. This communication also addressed tentative interview timelines, potential follow-up requests, and a request for supporting documents that highlight industry engagement.

Participant Selection

Once the sites were determined, the researcher interviewed the program director or other designee. The goal of these interviews was to identify all types of efforts in university-industry engagement in engineering multicultural programming. The interviews were focused on the elements of programming that have been utilized in establishing industry partnerships and the nature of these relationships (see Appendix A for the interview guide).

In addition, each interview participant from the five institutions was asked to identify an industry champion to participate in a brief questionnaire related to their involvement with the institution's multicultural engineering program. The program director or designee was requested to obtain the cooperation of the industry partner in efforts to establish rapport with the researcher. A total of five industry partners, one per institution was secured.

The researcher coordinated an electronic communication to industry representatives indicating that they have been identified as an industry partner by the stated university. This communication explained the purpose of the study and how their participation would lend to the literature on industry engagement within multicultural engineering programs. It also emphasized response deadlines and the potential for follow-up requests. This questionnaire was used to learn how industry partners perceive their relationships and impact with university multicultural engineering programs and why such engagement matters. The industry questionnaires were distributed via email (see Appendix B for industry questionnaire)

Data Sources and Collection of Related Information

Interviews were conducted via telephone. Each interview was scheduled for at least one hour. The longest interview was one hour and thirty-three minutes and the shortest interview was twenty-nine minutes. The researcher asked for brief demographic information during the

interview to capture for profile information. The researcher utilized open-ended interview questions to guide the interview process. The industry questionnaire consisted of open-ended questions to collect data on the industry's perception of the relationship with their partner university. The questionnaire was delivered via email and collected within a predetermined timeframe via email. Lastly, the researcher requested MEP directors or designees and industry representatives to supply related documents to help better understand the case. The researcher was referred to each participant's website to obtain requested information.

Analysis

The researcher utilized strategies identified by Creswell (2013) to analyze collected data. Creswell (2013) pointed out the following analytic strategies:

Sketching ideas, taking notes, summarizing field notes, working with words, identifying codes, reducing codes to themes, counting frequency of codes, relating categories, relating categories to analytic framework in literature, creating a point of view, and displaying the data. (p. 181)

Since the researcher was not conducting on site observations, field notes were not part of the analysis process. However, a researcher's journal was maintained to record pertinent information and reflections regarding the design and conduct of the study. After each interview, a transcript was produced as soon as possible by a hired transcriber. A confidentiality form and agreement for preparation of the transcripts was used for transcribing services. The researcher developed a coding system based on the theoretical framework and those concepts emerging from the data. The researcher created categories to code interview and questionnaire responses to determine patterns under each coding category. The patterns were then analyzed to determine overarching themes that reflect connection between or across coding categories to address the research questions (Creswell, 2013, pp. 181, 183, 190-191).

Protection of Human Subjects

To protect the research participants involved in the study, the researcher submitted a formal research proposal to the Kansas State University Institutional Review Board for feedback and approval. While fundamental characteristics of each of the sites are important to the interpretation of this research, they will be reported in general terms and the identities of all individual respondents will remain confidential, protected by using pseudonyms (Creswell, 2009). The researcher has stored all recorded interviews, completed questionnaires, and transcripts electronically stored on a password-protected computer. As required by the IRB, materials will be kept for three years.

Validation of the Study

According to Creswell (2013), validation is a strength of qualitative research that refers to the “accuracy of the findings” stated by the researcher and study participants (p. 249). In qualitative research, validation highlights a process versus terms such as verification that implies quantitative techniques. With respect to validation, Creswell (2013) noted several options to consider. He suggested that at least two of the eight strategies he summarizes (prolonged engagement and persistent observation, triangulation, peer review or debriefing, negative case analysis, clarifying researcher bias, member checking, rich, thick description, and external audits) be used in any study.

The researcher utilized rich, thick descriptions and clarified researcher bias to validate the study. Creswell (2013) stated, “Rich, thick description allows readers to make decisions regarding transferability because the writer describes in detail the participants or setting under study” (p. 252). Rich descriptions were used to transport readers to the study’s setting and further understand how reported behaviors have been enacted and the perceptions of how they

contributed to the pipeline for diverse STEM talent. The goal of researcher bias clarification is to inform the reader of the researcher's role, position, and any bias that could potentially impact the study. Creswell (2013) refers to this as reflexivity. Reflexivity ensures that the researcher positions themselves strategically in the body of work and is aware of the, "biases, values, and experiences that he or she brings to a qualitative study" (p. 216). Therefore, the researcher revealed her background, role in the research, and assumptions about the topic of the study in a self-reflection section in this chapter.

The researcher used coder consensus, also known as intercoder agreement, to review transcripts and coding schemes. The researcher partnered with another doctoral student familiar with qualitative analysis to serve as the secondary coder. This student had completed formal qualitative coursework and was concurrently applying coding techniques to another investigation. This secondary coder was also knowledgeable about relationship marketing theory, which assisted with the verification of the researcher's codes. Finally, an informal journal of all the steps in the research process was maintained throughout the study. It served as a source of information documenting the decisions and processes considered and used at each stage of the investigation.

Background and Role of the Researcher

The researcher has been a professional and student member of NAMEPA, the proposed study group, since 2009. She has served on regional and national committees, the national executive board, Region D chair, and co-chaired the national conference in 2012 and 2013. At Kansas State University, she has served as a graduate teaching assistant for the multicultural engineering program from 2007-2008. In addition, from 2008 to 2011 she also served as the assistant director of career and employment services for the college of engineering and from

2011-2012, as the first-generation scholars program coordinator in the college of engineering working directly with the multicultural engineering program.

Through her affiliation and experience, she has developed a great rapport and sense of trust with many MEP directors, staff, and assistant deans of diversity and inclusion and industry representatives across the country. She believes that her reputation and involvement with the organization has demonstrated her commitment and passion about the success of multicultural engineering students, especially since she does not come from an engineering educational background. Because of her involvement with the organization, professional experience, and the overall interest in the topic from NAMEPA members, she expected institutions to be willing to participate in the study and that participants would provide honest, thoughtful and thorough responses. In addition, her professional insight through both MEP and industry lenses likely aid in probing for further in depth information that might otherwise have been omitted. She believes the participants knew her motives were genuine and that this research would inform the field and engineering-related industries of best practices in multicultural engagement. To minimize the researcher's influence on the findings the following validation strategies were employed: rich, thick descriptions, researcher bias clarification, and coder consensus.

Summary

In summary, Chapter 3 highlighted the methods used and outlined the study's design. The researcher employed qualitative techniques most commonly used in case studies to address the research question: What is the nature of industry engagement within university multicultural engineering programs? The main sources of data were derived through interviewing and questionnaires with documents and the researcher's journal used to assist with interpretation and detailed descriptions. Chapter 4 provides site case descriptions of each participant. Chapter 5

discusses the analysis of collected data utilizing codes emanating from the Commitment-Trust
KMV Model of Relationship Marketing and emergent topics from the data.

Chapter 4 - Case Descriptions

Introduction

This study involved five university multicultural engineering program participants and five industry representatives for a total of 10 participants. A committee of NAMEPA executive officers, including the current and two immediate past national presidents, nominated university multicultural engineering program participants. The nominators were asked to use the following criteria for institutional nomination:

- Current or past NAMEPA institutional member
- Institution has a formal program dedicated to multicultural engineering programming
- Reputation for strong industry partnerships within multicultural engineering programming

In addition, each university participant was asked to identify an industry champion to participate in the study. The only criterion given for the selection of the industry champion was the stipulation the researcher wanted the nominated MEP participant to select an industry representative they consider to be an advocate for their program.

The purpose of this chapter is to provide a general profile of each university site and their respective industry partner. Individual participants are not named to protect their anonymity. Since NAMEPA is organizationally divided into regions, the researcher refers to the specific region for each site but not the exact state. Below are the regional breakdowns:

Region A: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and Washington, DC.

Region B: Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia

Region C: Illinois, Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, Ohio and Wisconsin

Region D: Arizona, Colorado, Kansas, Nebraska, North Dakota, Oklahoma, Puerto Rico, South Dakota, and Texas

Region E: Alaska, California, Hawaii, Idaho, Montana, Nevada, Oregon, Utah, Washington and Wyoming

University 1

University 1 is located in Region A (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and Washington, DC). This institution is a public, polytechnic, major research university. It has a total enrollment of 10,646 students. The College of Engineering at this institution is considered to be one of the oldest and largest professional engineering schools in the United States. The undergraduate enrollment in the College of Engineering is over 2,500 with a graduate enrollment of over 1,100.

Undergraduate degree programs include: biomedical engineering, chemical engineering, civil engineering, computer engineering, electrical engineering, engineering science (including accelerated pre-med program), engineering technology, industrial engineering, and mechanical engineering. Graduate degree programs include: biomedical engineering, chemical engineering, civil engineering, computer engineering, electrical engineering, electrical engineering online, engineering management, engineering science, environmental engineering, industrial engineering, internet engineering, manufacturing systems engineering, mechanical engineering,

occupational safety and health engineering, pharmaceutical engineering, power and energy systems, telecommunications, and transportation. Doctoral degree programs include: biomedical engineering, chemical engineering, civil engineering, computer engineering, electrical engineering, environmental engineering, environmental science, industrial engineering, mechanical engineering, transportation.

The multicultural engineering program at this institution was established in 1968 and later renamed in 1975 to encompass a broader mission. The mission of this program

is to provide educational opportunities and improve educational outcomes for populations traditionally underrepresented in mathematics, the natural sciences, engineering, computer and information science, business, architecture, engineering technology, and in the professions related to these fields. (University 1)

Programmatically, this office focuses on academic assistance, summer programs/summer bridge, mentoring, and professional development and career preparation. They also have a focus in undergraduate research opportunities. They work closely with corporate partners representing the manufacturing, pharmaceutical, information technology and finance industries to assist in these efforts. This particular MEP also has an advisory board that assists in identifying additional industry members to engage. They also have significant support from their alumni who contribute time and resources to the overall goals of this program.

Organizationally, this office has a staff of nine full-time employees. The director also established a shared salary model that pays a salary percentage of about 40 other vital university staff members outside of MEP to assist in the program's overall efforts. Some of these positions include personnel from admissions, financial aid and the registrar's office. This program has a unique funding structure. It is a state funded program for students who are academically and financially challenged and who are greatly underrepresented in science and technology fields. However, industry funding still supports additional programmatic needs of this unit.

Industry 1

Industry 1 is known as an international leader in the integration of financial services. They advise, originate, trade, manage and distribute capital for governments, institutions and individuals. This company employs over 45,000 employees across the globe. Industry 1 showcases a keen sense of diversity. According to the chairman,

diversity is an opportunity – for clients, employees and Firm. By valuing diverse perspectives, we can better serve our clients while we help employees achieve their professional objectives. A corporate culture that is open and inclusive is fundamental to our role as a global leader constantly striving for excellence in all that we do.
(Industry 1)

This company has demonstrated a dedicated stance to the development of diverse employees. Within the last five years, they launched a program targeting junior multicultural talent that hones in on: careers, commercial thinking, relationships, and communication skills. Other diversity programs include Leadership Engagement and Development (LEAD), a six month program for African American and Hispanic vice presidents and executives directors; and the Multicultural Leadership Summit for diverse financial advisors. This company also places special emphasis on global community outreach. Through their foundation, they support efforts educations and health and wellness amongst many others.

In relation to this study, Industry 1 indicated they partner with University 1 to promote and recruit students for internship and full-time opportunities, engage with MEP student organizations, and facilitate funding for scholarships. As an alumnus of the program, they also mentor students and provide program feedback to University 1.

University 2

University 2 is located in Region B (Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia).

University 2 is a public research institution with a student population of over 36,000 students. At this university, the College of Engineering is considered to be one of the first five institutions in the nation to offer engineering courses. The College of Engineering's total student enrollment is over 5,000 with 4,771 undergraduates and 334 graduate students. The college has 120 faculty members.

Undergraduate degree programs include: aerospace engineering, architectural engineering, chemical engineering, civil engineering, computer science, construction engineering, electrical engineering with a computer engineering option, environmental engineering, mechanical engineering, and metallurgical engineering. Graduate degree programs include: aerospace engineering, chemical engineering, civil engineering, computer science, electrical engineering, engineering science and mechanics, environmental engineering, mechanical engineering, and metallurgical engineering. Doctoral degree programs include: aerospace engineering and mechanics, chemical engineering, civil engineering, computer science, electrical engineering, mechanical engineering, and metallurgical engineering.

The multicultural engineering program at University 2 was established in 1987. It was originally funded through a joint grant from the Alfred P. Sloan Foundation and the National Action Council for Minorities in Engineering (NACME). This program is also a founding member institution of the Southeastern Consortium for Minorities in Engineering. The multicultural engineering program at University 2 has three main goals.

Goal 1: Increase the number of academically qualified students from underrepresented populations to apply, are accepted and enroll in University 2's College of Engineering.

Goal 2: Enhance and develop comprehensive support services that ensure graduation success.

Goal 3: Promote a diverse community that encourages and provides a successful path for fulfilling a career in engineering or computer science. (University 2)

The MEP at University 2 offers several services to help meet these goals. Some of these services include: pre-college K-12 initiatives, summer programs, academic, financial aid, personal counseling, graduate school support, and employment referrals. Structurally, this MEP is housed under Engineering Student Services. Engineering Student Services hosts several other programs including the Academic Advising Center and the Freshman Engineering Program.

In prior years, University 2 had a separate industry advisory board. Due to a shift in focus, the MEP board was dissolved and one board for the entire College of Engineering was created. The MEP director is a member of this board and advocates for program initiatives. This MEP partners with a wide variety of corporate partners from the oil and gas, energy, information technology and consumer goods industries.

Industry 2

Industry 2 is a global specialty chemical company. It has over 14,000 employees worldwide. This company provides services for customers in over 100 countries. This company is globally recognized for their efforts in environmental stewardship. With respect to diversity and inclusion, Industry 2 states, “We create an inclusive global culture where everyone can do their best work. We seek out different points of view and engage in conversations to enrich our ability to generate fresh ideas.” Industry 2 describes diversity as an essential element of their business. At Industry 2,

diversity is about more than just our differences. It’s the mix of differences and similarities in the workplace. Diversity at Industry 2 is about building relationships that capitalize on differences and similarities for a corporate culture that optimizes the capability of all employees. (Industry 2)

This company is very dedicated to educational and community outreach. They have a full-time staff that operates a K-12 program that develops curriculum and educational STEM initiatives for eight school systems. Internationally, they have also forged an educational

partnership in Europe. Industry 2 also values university relationships and has established cutting edge partnerships that demonstrate a commitment to safety, sustainability, and innovation. To assist with their community efforts, this company established Community Action Panels (CAPs) in geographic locations where they have manufacturing sites. They are also very involved in community efforts that focus on: military support, disaster relief, recycling, and nature preservation.

In this study, Industry 2 indicated they engage with University 2 to seek potential hires for internships, co-ops, and full-time opportunities. They also provide financial support and scholarship funding. In addition, they make routine campus visits, support MEP student organizations, and host student events at their corporate facilities.

University 3

University 3 is located in Region C (Illinois, Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, Ohio, and Wisconsin). This university is a public, research, land-grant institution. It boasts a student population of over 50,000. The College of Engineering is one of the oldest and largest colleges on the university's campus. There are nearly 6,000 students enrolled in the College of Engineering, 4,954 undergraduates and 791 graduate students.

Undergraduate degrees are offered in: applied engineering sciences, biosystems engineering, chemical engineering, civil engineering, computer engineering, computer science, electrical engineering, environmental engineering, materials science and engineering, and mechanical engineering. Graduate degrees are offered in the following: biosystems engineering, civil engineering, environmental engineering, chemical engineering, materials science and engineering, computer science, mechanical engineering, engineering mechanics, and electrical engineering.

University 3 established a multicultural engineering program in 1968. This program came at a pivotal point in the college's history when the Dean of Engineering realized there was a lack of minority representation within the college. The MEP at University 3 is committed to:

Increasing the recruitment and retention of a diverse set of students;
Encouraging a greater understanding of national and international diversity to meet the needs of a multicultural and global society; and Improving the climate for underrepresented students. (University 3)

This program has several programmatic components to achieve these goals including: tutoring, advising, undergraduate research experience, residential summer bridge programs, and pre-college outreach. It has a staff of six and is classified under the College of Engineering's Diversity Program Office.

University 3's MEP has established strong relationships with industry. Some of their partners represent the following industries: automotive, automotive suppliers, aerospace, and computer science. While they do not currently have an industry advisory board, there is serious interest in starting one within the next year.

Industry 3

Industry 3 is one of the nation's largest combination utility companies, servicing over six million state residents. This company has over 7,500 employees. According to their guiding principles, they make a conscious effort to foster a team environment that respects diversity.

We use interactions as an opportunity to build relationships. We promote openness and teamwork, and support change. We see the big picture and balance. We respect and value individual backgrounds, contributions and perspectives. We give our personal best to the team. (Industry 3)

In regards to diversity hires, Industry 3 indicates,

Our commitment to diversity encompasses four areas: talent management, supplier diversity, community outreach and recognition. We're focused on hiring and retaining the top professionals in the industry. (Industry 3)

Structurally, Industry 3 has established employee resource groups to address diversity concerns, support employees, and build professional skills. These employee resource groups include: Minority Advisory Panel (MAP), Women's Advisory Panel (WAP), Women's Engineering Network (WEN), and Hispanic Outreach Team (HOT). Industry 3 is also an active community advocate. Through their foundation, they support non-profit organizations in five focal areas: social welfare, community and civic development, education, state growth and environmental enhancement, and culture and the arts. In addition, this company is an active supporter of United Way and PeopleCare organizations.

In respect to this study, Industry 3 indicated they are both an overall partner of University 3 MEP and the College of Engineering. They actively participate in MEP campus events, recruitment efforts, and annual summer programs. Throughout their relationship with the MEP, they have made a significant financial investment through program and scholarship support.

University 4

University 4 is located in Region D (Arizona, Colorado, Kansas, Nebraska, North Dakota, Oklahoma, Puerto Rico, South Dakota, and Texas). This university is a public, teaching and research institution with a primary focus on engineering and applied science. This institution has a smaller population of 5,673 undergraduate and graduate students combined. University 4 is globally recognized for their highly selective admissions process and science and engineering focus. This university does not have just one separate College of Engineering; instead it has three colleges including: the College of Applied Science and Engineering (CASE), College of Engineering and Computational Sciences (CECS), and College of Earth Resource Science and Engineering (CERSE).

Undergraduate degrees are offered in: civil engineering, environmental engineering, electrical engineering, computer science, mechanical engineering, geological engineering, mining engineering, petroleum engineering, chemical and biological engineering, metallurgical and materials engineering, geophysical engineering, and engineering physics. Graduate degrees are offered in: chemical engineering, civil and environmental engineering, electrical engineering, hydrology, materials science, mechanical engineering, metallurgical and materials engineering, nuclear engineering, underground construction and tunneling, mining and earth systems engineering, petroleum engineering, geological engineering, geophysical engineering, and engineering and technology management.

The multicultural engineering program at this institution was founded in 1989. This program's mission is to "provide support that contributes to the recruitment, retention, graduation, and professional development of historically underrepresented students, staff, and faculty" (University 3). With a staff of two, this MEP hosts a variety of programs and activities with an emphasis in professional and leadership development, K-12 outreach, residential summer pre-college programs and residential summer bridge programs. The specialized academic rigor of this institution attracts a wide variety of corporate interest. Some of these industries include: energy and environment, infrastructure, aerospace, and biosciences. Currently, this MEP does not have an industrial advisory board but would like to reestablish one in the near future.

Industry 4

Industry 4 is a premier engineer-procure-construct company. They are a worldwide leader in consulting, design, design-build, operations, and program management. This company has more than 26,000 employees on six continents. They partner with clients in energy, water,

environment and infrastructure. Industry 4's company philosophy indicates valuing diversity as a main component. They state,

We are committed to sustainability; to protecting and preserving our planet's natural resources and to inspiring and educating a diverse and inclusive future workforce that will help solve the environmental and engineering challenges of tomorrow. (Industry 4)

This company holds diversity in high regard,

Diversity leads to stronger teams, higher-quality client work, better end products, and more insightful decision-making. Diversity supports the firm's growth objective and is key to our short-term growth and long-term survival. Diversity will help Industry 4 remain a strong competitor and even increase our competitive edge in core markets and industries throughout the world. We set open and transparent examples firm-wide through our networking, hiring, and promotion practices. (Industry 4)

Internally, this company has developed employee networks to foster diverse interaction and collaboration. Mentioned networks include: Hispanic Employee Network Group, Women's Network, and Gay, Lesbian, Bisexual and Transgender and Allies.

In the community, this company is known for supporting organizations that have an emphasis on environmental concerns. Some of these organizations include: the American Water Works Association, Neutral Gator, and Earth Force. They also have a passion for educational outreach and partner with universities, K-12 schools, local chambers of commerce, and other educational groups to promote and educate students about STEM and STEM career opportunities.

In this study, Industry 4 indicated that they participate in MEP campus events, career fairs and are involved with the MEP student organizations. They also mention that they sponsor different MEP initiatives and actively recruit students for employment opportunities.

University 5

University 5 also derives from Region D due to the unavailability of a Region E institution. Again, Region D includes: Arizona, Colorado, Kansas, Nebraska, North Dakota,

Oklahoma, South Dakota, Texas and Puerto Rico. This institution is a public, research institution with a population of over 24,000 students. This institution is considered one of America's first land grant universities. The College of Engineering has nearly 4,000 undergraduate and graduate students.

Undergraduate degrees are offered in: architectural engineering, biological systems engineering, chemical engineering, civil engineering, computer engineering, computer science, construction science and management, electrical engineering, industrial engineering, information systems, and mechanical engineering. Graduate programs are available in: architectural engineering, biological and agricultural engineering, chemical engineering, civil engineering, computer science, electrical engineering, engineering management, industrial engineering, mechanical engineering, nuclear engineering, operations research, and software engineering. Additional doctoral degrees are offered in: biological and agricultural engineering, chemical engineering, civil engineering, computer science, electrical engineering, industrial engineering, mechanical engineering, and nuclear engineering.

The multicultural engineering program at this institution was established in 1977

to increase the pool of interested and qualified students from historically under-represented groups pursuing engineering degrees and to provide a foundational support system and programs that encourage students to find solutions to technical and social challenges. (University 5)

With a staff of seven, University 5's MEP coordinates various student services and events. This program manages a variety of scholarship programs; assists in the facilitation of tutoring placement and math cluster course enrollment; partners with two additional university colleges to host a residential summer bridge program. In addition, this MEP organizes additional outreach and professional development activities and provides academic advising.

University 5 does have an advisory board and has partners from the oil and gas, energy, aviation, manufacturing, construction, and consumer goods industries. This advisory board meets twice a year prior to the all-university and engineering career fairs.

Industry 5

Industry 5 is considered an international leader in the oil and gas industry. This company has nearly 75,000 employees globally. Their geographical reach includes: North America, South America, Europe, Middle East, North Africa, Sub-Saharan Africa, and Asia Pacific.

Organizationally, they have a commitment to a competent and diverse workforce. One of their guiding principles states:

The exceptional quality of our workforce provides a valuable competitive edge. To build on this advantage, we will strive to hire and retain the most qualified people available and to maximize their opportunities for success through training and development. We are committed to maintaining a safe work environment enriched by diversity and characterized by open communication, trust, and fair treatment. (Industry 5)

This company also has corporate affinity groups for employees that focus on diverse groups. These groups include the Black Employee Success Team (BEST); Global Organization for the Advancement of Latinos (GOAL); Asian Connection for Excellence (ACE); People for Respect, Inclusion and Diversity of Employees (PRIDE); Women's Interest Network (WIN); and the Veteran Advocacy and Support Team. "These groups facilitate professional development programs, sponsor educational and community service programs to raise cultural awareness, and actively mentor new employees" (Industry 5).

Industry 5 is also a big proponent of community engagement, diversity, and educational initiatives. They have numerous programs that focus on STEM awareness and involvement. In the past fourteen years, they have donated over \$973 million to educational programs globally. In addition, they have partnered with other STEM focused organizations to provide unique

programming and support including but not limited to: the Hispanic Heritage Foundation, National Society of Black Engineers, Society of Women Engineers, Society of Hispanic Professional Engineers and the National Action Council for Minorities in Engineering. In relation to multicultural engineering programs, Industry 5 partnered with the National Association of Black Engineers to establish an award that highlights U.S. universities in their efforts to recruit, retain, and graduate underrepresented students in engineering.

In this study, Industry 5 indicated that they are alumni of the program at University 5. They emphasize the importance of hiring diverse employees. This participant also indicates that through their role with University 5's MEP, they provide financial support, recruit students for internships and full-time positions, attend the university's career fairs, and participate in campus workshops.

Summary

This chapter provided case descriptions of each university and industry participant. Through these narratives, the reader is able to gain some insight on the characteristics of each site participant. Chapters 5 and 6 give further detail on the findings and conclusions of this study.

Chapter 5 - Data Analysis

Introduction

This chapter presents an analysis of the data collected related to the following:

Guiding Research Question

What is the nature of industry engagement within university multicultural engineering programs?

Sub-Questions

1. How do industry and university multicultural engineering programs develop trust in their relationships?
2. How do industry and university multicultural engineering programs establish commitment in their relationships?

This chapter will first identify the procedures used for analyzing the data. Tables and narrative descriptions are used to explain identified patterns and emergent themes. The Commitment-Trust KMV Model of Relationship Marketing was used to theoretically analyze reported data. Patterns are then presented in narrative and table form along with a summary of these patterns. Finally emergent themes formulated from the patterns are reported in both narrative and table form.

Data Analysis Procedures

The data for this study are from interviews and questionnaires. Information from interviews along with university and industry websites was used to construct profile information for each site. An informal journal was used during analysis to document decisions and processes considered and used at each stage of the investigation. The following provides a detailed description of the analysis process.

Documents and Artifacts

The researcher used collected documents from the MEP and Industry participants' respective websites to contribute to profile information produced in Chapter 4. Information collected from websites was found in the following sections: university profile, university college of engineering and MEP history, industry profile, industry diversity, and industry corporate responsibility. Pertinent information presented in transcripts and questionnaires were also used in participant profiles.

Interviews and Questionnaires

The study included five university MEP interviews. The goal was to have one university per region. Unfortunately, one region was unable to participate. Therefore, as described in Chapter 3, the researcher contacted the next nominated university from an alphabetically ordered list. Prior to each interview and the electronic delivery of the questionnaire, the researcher scheduled brief telephone calls with each participant to make personal introductions, discuss the details of the study, and give participants an opportunity to ask questions. All interviews were conducted via telephone and captured on an audio recorder. Audio files were then transferred to a password-protected computer. All interviews were transcribed by a hired transcription company and reviewed for accuracy prior to coding. In addition to the interviews, each university participant nominated an industry champion to participate in an industry open-ended questionnaire. There were a total of five industry participants. Each questionnaire was reviewed and placed in a transcript format prior to coding.

The study's theoretical framework served as the data's managing agent for both the university interviews and industry questionnaires. Collected data were coded and analyzed for patterns. Lastly, patterns were further reviewed to identify emergent themes.

In the initial step of analysis, the researcher thoroughly reviewed each transcript and questionnaire. During this process, the researcher performed open coding to become familiar with data. Next, the researcher organized the data into individual charts created in Microsoft Word based on the main codes derived from 10 elements presented in the Commitment-Trust KMV Model of Relationship Marketing. An additional emergent code brought the total number of main codes to 11. Passages, phrases, and sentences were highlighted from the transcripts and copied and pasted into respective charts.

Table 5.1

Summary of Main Codes

| | Definition of Code | Example of Data |
|---|--|---|
| Theoretically-driven Codes (Morgan and Hunt, 1994) | | |
| Relationship Termination Costs | <p>Theoretical Definition: All expected losses from termination and result from the perceived lack of comparable potential alternative partners, relationship dissolution expenses, and/or substantial switching costs</p> <p>Working Definition: The harms from terminating or ending the relationship</p> | <p>“You've been on there for eight years, but you're generating not a dime and none of the kids are coming in there. Then we're we don't need your advice anymore.” (U1-L27)</p> |
| Relationship Benefits | <p>Theoretical Definition: Win-win outcomes for both partners, high benefits yield high commitment</p> <p>Working Definition: Individual or mutual assets, gains, betterments, profits, perks, financial assistance, sponsorship</p> | <p>“I'm producing students that are going to go to you because you're giving me some money and I'm talking about you to that student so the student is only thinking about going to (partnering company).” (U1-L8)</p> |
| Shared Values | <p>Theoretical Definition: The extent to which partners have beliefs in common about what behaviors, goals, and policies are important or unimportant, appropriate or inappropriate, and right or wrong</p> <p>Working Definition: Shared ideals and beliefs (purpose of the partnership, commitment to ideals, common mission</p> | <p>“They want to get the best students available. They're going to work hard at doing that. We're going to work equally as hard at making sure that we're exposing our students to opportunities and providing them with information on good companies.” (U4-L95)</p> |

Table 5.1 (continued)

| | Definition of Code | Example of Data |
|------------------------|---|--|
| Communication | <p>Theoretical Definition: Essential role in building trust – both formal and informal; must be timely, specific, thorough, reliable, and consistent</p> <p>Working Definition: Creating a sense of understanding through meetings, in person interaction, conversation, electronic communication, documentation, social media and print materials (i.e. brochures, reports, video)</p> | <p>“It’s helpful when we’re either approaching a company or if there is a company that is approaching us and wanted to get involved with supporting MEP, to be able to meet face-to-face with their recruiters, with their representatives.” (U4-L85)</p> |
| Opportunistic Behavior | <p>Theoretical Definition: Self seeking and deceit-oriented behavior; leads to decreased trust</p> <p>Working Definition: Occurs when one partner expects maximum benefit for minimum contribution</p> | <p>“I mentioned the issue of just wanting to come in and cherry-pick and get the best and brightest students without having some of that time and energy there.” (U3-L74)</p> |
| Acquiescence | <p>Theoretical Definition: The degree to which a partner accepts or adheres to another’s specific requests or policies</p> <p>Working Definition: The reluctant acceptance of something without protest. (Compliance, Obedience, Submission)</p> | <p>“Then we have companies that just like to cut a check.” (U3-L11)</p> |
| Propensity to Leave | <p>Theoretical Definition: The perceived likelihood that a partner will terminate the relationship in the (reasonably near future)</p> <p>Working Definition: Controllable and uncontrollable circumstances that can lead to termination</p> | <p>“I imagine that’s really the biggest challenge there, is that you can have somebody who really believes in everything you do and they’re a champion for you within the company, but if they retire or they move on to another job, the next person may not be as passionate about it.” (U3-L77)</p> |

Table 5.1 (continued)

| | Definition of Code | Example of Data |
|---------------------|---|--|
| Cooperation | <p>Theoretical Definition: Both partners work together to achieve desired goals; Active participation</p> <p>Working Definition: Unity, Alliance, Reciprocity, Responsive, Teamwork, Helpful, Combined Effort, Give and Take, Provide Support and Assistance, Facilitate Meaningful Connections</p> | <p>“And they support organizations, too, that we also advise, like NSBE or SHPE. We would help them in terms of different projects that they may have as well.” (U2-L17)</p> |
| Functional Conflict | <p>Theoretical Definition: Conflict that is considered healthy and can increase productivity</p> <p>Working Definition: Struggle or disagreements between partners that can lead to positive outcomes</p> | <p>“The Dean in one way didn’t want to have a conflict with its fundraising and fundraising for the MEP itself. He saw that as somewhat of a conflict and so he ... but he also made sure that I was at the table when they did meet and to have the opportunity to engage from there.” (U2-L21)</p> |
| Uncertainty | <p>Theoretical Definition: The extent to which a partner has enough information to make key decisions; can predict the consequences of those decisions; has confidence in those decisions; when one party has difficulty making decisions, established trust allows them to confidently defer difficult decision making to the other party</p> <p>Working Definition: Deferring decision making to partner who has more knowledge and understanding</p> | <p>No Example, Data Not Found</p> |

Table 5.1 (continued)

| | Definition of Code | Example of Data |
|--|---|---|
| Emergent Codes (not addressed by the theory) | | |
| Barriers | <p>Theoretical Definition: Differences that can ignite vigor in the relationship, but can equally provoke chaos.</p> <p>Working Definition: Issues or events that can negatively impact the relationship.</p> | <p>“I guess the other is keeping up with the changes on their end. For instance, knowing who the talent coordinator is, knowing who their main campus contacts are and how they’ve changed.” (U5-L92)</p> |

NOTE: All descriptive information regarding the history, structure, organization, or formation of the program or the industry partnership will be used for profile information. This information is coded as: Profile. U = University Perspective and I = Industry Perspective.

Where applicable, Sub-Codes were used to further examine data. Sub Sub-Codes were only used when there was sufficient data in the Sub-Codes to warrant an additional level of coding to identify patterns. However, Sub-Sub Codes, when used did not always yield patterns. Patterns were established only if they held credible and meaningful information and if at least three out of five participants from either the university or industry participants referenced the same point. There are a total of twenty-four patterns and three themes that emerged from the analysis.

Throughout the analysis process, the researcher often referred back to the transcripts to ensure the essence of the meaning was captured. Notes were consistently made and referenced to corroborate categorized data and reorganize when needed. During the analysis phase, the researcher was mindful to code the majority of the data. All captured data are itemized in the following charts. The small portion of un-coded data either did not pertain to the study or was used for profile information located in Chapter 4.

To achieve reliability, the researcher used coder consensus (Creswell, 2013). A peer researcher familiar with the coding process and relationship marketing theory coded 100% of one interview transcript. After initial review, the peer coder and researcher reached 40% consensus. After further discussion and clarification of coding definitions and examples, the peer coder and researcher achieved 100% consensus.

Relationship Termination Cost

Relationship termination cost is defined as “all expected losses from termination and result from the perceived lack of comparable potential alternative partners, relationship dissolution expenses, and/or substantial switching costs” (Morgan & Hunt, 1994, p. 24). While there was not enough information to yield a pattern from this element, participants mentioned unproductive advisory board members and unsatisfactory MEP results as causes of relationship termination. For example, University 1 indicated that they sever ties with industry advisory board members if said member is no longer contributing to the board. University 2 indicates that they use to receive funding from a particular corporation that was a significant portion of their budget. At the time, the MEP wasn't performing to the company's standards and they decided to pull their funding.

Table 5.2

Relationship Termination

Main Code #1: RELATIONSHIP TERMINATION

Theoretical Definition:
 All expected losses from termination and result from the perceived lack of comparable potential alternative partners, relationship dissolution expenses, and/or substantial switching costs

Working Definition:
 The harms from terminating or ending the relationship

| Sub-Codes | *U | **I | Patterns |
|-------------------------------------|----|-----|----------|
| 1A | | | |
| Unproductive Advisory Board Members | 1 | | |
| 1B | | | |
| Unsatisfactory MEP Results | 2 | | |

Legend

*U = University Perspective
 **I = Industry Perspective
 *** = Sub Sub-Codes

Note: Sub Sub-Codes are only used when there are sufficient data in the sub-codes to warrant an additional level of coding to identify patterns. However, Sub Sub-Codes, when used, do not always yield patterns. Patterns were established only if they held credible and meaningful information and if at least three out of five participants from either the university or industry participants referenced the same point.

Relationship Benefits

Relationship benefits are defined as win-win outcomes for both partners; high benefits yield high commitment (Morgan & Hunt, 1994). There are several patterns identified from this element. All MEPs and Industry participants report that employment opportunities for students are a benefit of their partnership. MEPs and Industry both indicate that internships and full-time employment opportunities for students are the primary employment related relationship benefits. All MEPs and majority of Industry report funding as a relationship benefit. MEPs report that funding received Industry supports general MEP programming, student organizations, summer programs/summer bridge, and K-12 Outreach. Industry representatives indicate funding for general MEP programs and scholarship funding as notable relationship benefits. In the area of professional development most MEPs indicate that they benefit from the professional development activities provided by industry. Industry branding is another area that stood out as a benefit. Some MEPs indicate that industry branding opportunities are benefits of their partnerships. Industry branding is identified as advertising of industry involvement through programming, print, and other mediums. Lastly, MEPs and Industry report several positive remarks regarding the partnership that are considered relationship benefits. Some Industry participants indicate that longevity is an important relationship benefit while some MEPs reveal that win-win outcomes are important relationship benefits.

Table 5.3

Relationship Benefits

| Main Code #2: RELATIONSHIP BENEFITS | | | | | | | |
|--|-----------|-----------|------------------------|-----------|-----------|-----------|--|
| Theoretical Definition: Win-win outcomes for both partners, high benefits yield high commitment | | | | | | | |
| Working Definition: Individual or mutual assets, gains, betterments, profits, perks, financial assistance, sponsorship. | | | | | | | |
| Sub-Codes | *U | **I | ***Sub | Sub-Codes | *U | **I | Patterns |
| 2A | | | | 2A.1 | | | 2A: MEPs and Industry report student employment opportunities as a benefit of their partnerships. |
| Employment Opportunities | 1,2,3,4,5 | 1,2,3,4,5 | Internships | | 2,3,5 | 1,2,3 | |
| | | | Co-Ops | | 2,3 | 2 | |
| | | | Full-Time | | 1,3,4,5 | 1,2,3,4,5 | 2A.1: MEPs and Industry mostly report internships and full-time positions as major employment opportunities as relationship benefits. |
| 2B | | | | 2B.1 | | | 2B: MEPs and Industry both report funding MEPs receive from Industry is a relationship benefit. |
| Funding | 1,2,3,4,5 | 2,3,4,5 | MEP General Programs | | 1,2,3,4,5 | 2,3,4,5 | |
| | | | Scholarships | | 2 | 1,2,3 | |
| | | | Student Organizations | | 2,3,4,5 | | |
| | | | Summer Programs/Bridge | | 2,3,4,5 | | |
| | | | K-12 Outreach | | 3,4,5 | | 2B.1: MEPs report funding for general MEP programming, student organizations, summer programs/summer bridge, and K-12 Outreach as relationship benefits. Industry identify funding for general MEP programs and scholarships as relationship benefits. |

Table 5.3 (continued)

| Sub-Codes | *U | **I | ***Sub Sub-Codes | *U | **I | Patterns |
|--|-----------|---------|--|--------------------------------------|--|---|
| 2C Professional Development | 2,3,4,5 | 3,4 | 2C.1 MEP General Programs Student Organizations Summer Programs/Bridge | 4,5 2,3 4 | 4 3 | 2C: Most MEPs identify professional development provided by Industry as a relationship benefit for the program. |
| 2D Industry Branding | 1,2,3 | 2,3 | | | | 2D: Some MEPs indicate that industry branding opportunities are benefits in their partnerships. |
| 2E Positive Remarks Regarding Partnership | 1,2,3,4,5 | 1,3,4,5 | 2E.1 Continuity/Longevity Win-Win Cohesiveness Positive Impact w/Students Positive Relationship w/MEP Program Success Strong Reputation/Credence Strong Alumni Relationship | 1,2 1,3,5 4 1,5 | 1,4,5 4 1 3,4 2 1,5 | 2E: MEPs and Industry report additional positive remarks regarding the partnership as relationship benefits. 2E.1: Some Industry participants indicate that longevity is an important relationship benefit while some MEPs reveal that win-win outcomes are important relationship benefits. |
| 2F Other | 1,4 | | 2F.1 Enhanced Experience Executive on Loan | 1 4 | | |

161

Legend

- *U = University Perspective
- **I = Industry Perspective
- *** = Sub Sub-Codes

Note: Sub Sub-Codes are only used when there are sufficient data in the sub-codes to warrant an additional level of coding to identify patterns. However, Sub Sub-Codes, when used, do not always yield patterns. Patterns were established only if they held credible and meaningful information and if at least three out of five participants from either the university or industry participants referenced the same point.

Shared Values

The shared values element yielded three main patterns. Shared values are defined as, “the extent to which partners have beliefs in common about what behaviors, goals, and policies are important or unimportant, appropriate or inappropriate, and right or wrong” (Morgan & Hunt, 1994, p. 25). MEPs reported student development as a shared value of their relationships with Industry. MEPs and most Industry participants report employment opportunities for underrepresented students as a major shared value. In addition, MEPs report that having belief/trust in their Industry partners is an important shared value.

Table 5.4

Shared Values

Main Code #3: SHARED VALUES

Theoretical Definition:
 The extent to which partners have beliefs in common about what behaviors, goals, and policies are important or unimportant, appropriate or inappropriate, and right or wrong

Working Definition:
 Shared ideals and beliefs (purpose of the partnership, commitment to ideals, common mission)

| Sub-Codes | *U | **I | Patterns |
|--|-----------|---------|---|
| 3A Student Development | 1,2,4,5 | 3,5 | 3A: MEPs report student development as shared value of their relationships with Industry. |
| 3B Academic Excellence | 1,3 | | |
| 3C Employment for Underrepresented Students | 1,2,3,4,5 | 1,2,3,5 | 3C: MEPs and most Industry report employment opportunities for diverse/underrepresented students as a major shared value. |
| 3D Commitment to Diversity | 2,5 | 4 | |
| 3E Belief/Trust | 1,2,3,5 | | 3E: MEPs report that having belief/trust in their Industry partners is an important shared value. |

Legend

*U = University Perspective
 **I = Industry Perspective
 *** = Sub Sub-Codes

Note: Sub Sub-Codes are only used when there are sufficient data in the sub-codes to warrant an additional level of coding to identify patterns. However, Sub Sub-Codes, when used, do not always yield patterns. Patterns were established only if they held credible and meaningful information and if at least three out of five participants from either the university or industry participants referenced the same point.

Communication

Morgan and Hunt (1994) defined communication as an essential in building trust-both formal and informal; must be timely, specific, thorough, reliable, and consistent. MEPs indicated that they primarily communicate with Industry about partnership goals, employment opportunities and funding. Most MEPs and some Industry participants both indicate that they communicate about general information pertaining to their relationship. Both MEPs and Industry a variety of ways they actually communicate with each other. MEPs report that they primarily communicate with Industry through the print (brochures and reports), electronic (email, social media, MEP website), professional conferences, MEP meetings, and campus events. While other methods were mentioned, Industry indicate that they mostly communicate with MEPs through campus events. Lastly, MEPs report that the director is the primary person that communicates with Industry partners.

Table 5.5

Communication

| Main Code #4: COMMUNICATION | | | | | | | |
|--|-----------|---------|----------------------------|-----------|-----------|-------|--|
| Theoretical Definition: | | | | | | | |
| Essential role in building trust –both formal and informal; must be timely, specific, thorough, reliable, and consistent | | | | | | | |
| Working Definition: | | | | | | | |
| Creating a sense of understanding between partners through meetings, in person interaction, conversation, electronic communication, documentation, social media and print materials (i.e. brochures, reports, video) | | | | | | | |
| Sub-Codes | *U | **I | ***Sub | Sub-Codes | *U | **I | Patterns |
| 4A | | | | 4A.1 | | | |
| Topic of Communication | 1,2,3,4,5 | 1,3,4,5 | Partnership Goals | | 1,2,3,4,5 | 3 | 4A.1: MEPs indicate that they primarily communicate about partnership goals, employment opportunities, and funding. Both MEPs and Industry indicate that they communicate about general information. |
| | | | Employment Opportunities | | 1,2,3,4,5 | 1,5 | |
| | | | General Information | | 1,3,4,5 | 1,3,4 | |
| | | | Industry Personnel Changes | | 1,5 | 1 | |
| | | | Funding | | 1,3,4,5 | | |
| | | | MEP Program Statistics | | 3,4 | | |
| 4B | | | | 4B.1 | | | |
| Method of Communication | 1,2,3,4,5 | 2,3,4,5 | Print | | 1,2,3,4,5 | | 4B.1: MEPs report that they primarily communicate with Industry through the following methods: print, electronic mediums, professionals conferences, MEP meetings, and campus events. Industry indicates that they mostly communicate with MEPs through campus events. |
| | | | Electronic | | 1,2,3 | 5 | |
| | | | Professional Conferences | | 2,3,5 | | |
| | | | MEP Meetings | | 1,2,3,4,5 | 4 | |
| | | | Industry Site Visits | | 1,3 | | |
| | | | Telephone | | 3 | 3,4 | |
| | | | Campus Events | | 3,4,5 | 2,4,5 | |

95

Table 5.5 (continued)

| Sub-Codes | *U | **I | ***Sub Sub-Codes | *U | **I | Patterns |
|-----------------------------|-----------|---|---|------------------------------|-----|--|
| 4C | | | 4C.1 | | | |
| Source of Communication | 1,2,3,4,5 | 2 | MEP Director MEP Staff Students Foundation/Development | 1,2,3,4,5 1 4,5 3,5 | 2 | 4C.1: MEPs report that the director is the primary person in communication with Industry partners. |
| Legend | | Note: Sub Sub-Codes are only used when there are sufficient data in the sub-codes to warrant an additional level of coding to identify patterns. However, Sub Sub-Codes, when used, do not always yield patterns. Patterns were established only if they held credible and meaningful information and if at least three out of five participants from either the university or industry participants referenced the same point. | | | | |
| *U = University Perspective | | | | | | |
| **I = Industry Perspective | | | | | | |
| *** = Sub Sub-Codes | | | | | | |

Opportunistic Behavior

Opportunistic behavior is defined as self-seeking and deceit-oriented behavior leading to decreased trust (Morgan & Hunt, 1994). This element was not as prevalent in the collected data. Some MEPs indicate that they experience industry opportunistic behavior through student recruitment for employment opportunities. For example, University 2 mentions,

I've seen companies that I've never had a relationship with or my NSBE or SHPE chapters, they've never seen these organizations at the career fair, but then they come in and they say, "I want your 3.5 GPAs. I got a job for them," but they don't know them. They don't know what they're all about, what their company is all about, and we're not as comfortable sharing that kind of information with those type of companies.

Table 5.6

Opportunistic Behavior

Main Code #5: OPPORTUNISTIC BEHAVIOR
 Theoretical Definition:
 Self seeking and deceit-oriented behavior; leads to decreased trust

Working Definition:
 Occurs when one partner expects maximum benefit for minimum contribution

| Sub-Codes | *U | **I | Patterns |
|---------------------------|-------|-----|---|
| 5A Student Recruitment | 1,2,3 | | 5A: Some MEPs report that Industry show opportunistic behavior in the area of student recruitment for employment opportunities. |

Legend
 *U = University Perspective
 **I = Industry Perspective
 *** = Sub Sub-Codes

Note: Sub Sub-Codes are only used when there are sufficient data in the sub-codes to warrant an additional level of coding to identify patterns. However, Sub Sub-Codes, when used, do not always yield patterns. Patterns were established only if they held credible and meaningful information and if at least three out of five participants from either the university or industry participants referenced the same point.

Acquiescence

Acquiescence is described as, “the degree to which a partner accepts or adheres to another’s specific requests or policies” (Morgan & Hunt, 1994, p. 25). There were not enough data to yield any patterns for this element, however a couple of examples were presented. University 3 said shared that they have some industry partners who are not active participators but only provide financial support. In addition, the same university indicated that they have had requests to submit reports in a format that is very specific to that company.

Table 5.7

Acquiescence

Main Code #6: ACQUIESCENCE
 Theoretical Definition:
 The degree to which a partner accepts or adheres to another’s specific requests or policies

Working Definition:
 The reluctant acceptance of something without protest. (Compliance, Obedience, Submission)

| Sub-Codes | *U | **I | Patterns |
|-------------------------------------|----|-----|----------|
| 6A Requested Reporting Structure | 3 | | |
| 6B Financial Support Only | 3 | | |

Legend
 *U = University Perspective
 **I = Industry Perspective
 *** = Sub Sub-Codes

Note: Sub Sub-Codes are only used when there are sufficient data in the sub-codes to warrant an additional level of coding to identify patterns. However, Sub Sub-Codes, when used, do not always yield patterns. Patterns were established only if they held credible and meaningful information and if at least three out of five participants from either the university or industry participants referenced the same point.

Propensity to Leave

“The perceived likelihood that a partner will terminate the relationship in the (reasonably) near future” is defined as propensity to leave (Morgan & Hunt, 1994, p.26). This element yielded two patterns. First, MEPs report that negative economic impact is an indicator of why certain industry relationships change or terminate. Secondly, MEPs report that Industry personnel changes make it hard in some cases to sustain industry relationships.

Table 5.8

Propensity to Leave

Main Code #7: PROPENSITY TO LEAVE
 Theoretical Definition:
 The perceived likelihood that a partner will terminate the relationship in the (reasonably) near future

Working Definition:
 Controllable and uncontrollable circumstances that can lead to termination

| Sub-Codes | *U | **I | Patterns |
|---------------------------------------|-------|-----|--|
| 7A Negative Economic Impact | 2,3,4 | | 7A: MEPs report that negative economic impact is an indicator of why certain Industry relationships change or terminate. |
| 7B Personnel Changes | 1,2,3 | | 7B: MEPs report that Industry personnel changes make it hard in some cases to sustain industry relationships. |
| 7C Geographic Location of Industry | 1 | | |

Legend
 *U = University Perspective
 **I = Industry Perspective
 *** = Sub Sub-Codes

Note: Sub Sub-Codes are only used when there are sufficient data in the sub-codes to warrant an additional level of coding to identify patterns. However, Sub Sub-Codes, when used, do not always yield patterns. Patterns were established only if they held credible and meaningful information and if at least three out of five participants from either the university or industry participants referenced the same point.

Cooperation

Cooperation is defined as both partners working together to achieve desired goals; active participation (Morgan & Hunt, 1994). Both MEPs and Industry report that they are aware of the role Industry plays in MEPs. MEPs report they play a central role in working with Industry through academic development, employment opportunities, professional development and commitment. In addition, MEPs report having meaningful relationships with university and college administration, career services, and the foundation/development team to assist them in engaging with Industry. Universities express that Industries engage MEPs primarily through professional development activities including: presentations and workshops, K-12 outreach, industry tours, employment opportunities and student organization activities. Industry express that they primarily engage in professional development activities through MEP student organizations. Industry 3 states, “I believe our company enjoys a reputation of “showing up” when asked to participate and through our partnership.”

Table 5.9

Cooperation

| Main Code #8: COOPERATION | | | | | | |
|--|-----------|-----|--|-----------|-----|--|
| Theoretical Definition: | | | | | | |
| Both partners work together to achieve desired goals; Active participation | | | | | | |
| Working Definition: | | | | | | |
| Unity, Alliance, Reciprocity, Responsive, Teamwork, Helpful, Combined Effort, Give and Take, Provide Support and Assistance, Facilitate Meaningful Connections | | | | | | |
| Sub-Codes | *U | **I | ***Sub Sub-Codes | *U | **I | Patterns |
| 8A | | | 8A.1 MEP Role with Industry | | | 8A: MEPs are very aware role of their role with Industry. |
| MEP | 1,2,3,4,5 | 5 | Academic Development | 1,2,3,4 | 5 | |
| Role | | | Employment Opportunities | 1,2,4,5 | 5 | |
| | | | Commitment | 1,4,5 | | |
| | | | Professional Development | 1,3,4,5 | 5 | 8A.1: MEPs report they play a central role in working with Industry through academic development, employment opportunities, professional development, and commitment. |
| | | | 8A.2 MEP and Larger University | | | |
| | | | College of Engineering (COE) Faculty | 1 | | |
| | | | Administration (COE and Larger University) | 1,2,3,4,5 | | |
| | | | Career Services/Career Center | 2,4,5 | | |
| | | | Foundation/Development | 1,2,3,4,5 | | 8A.2: MEPs report having meaningful relationships with university and college administration, career services, and the foundation/development team to assist them in engaging with Industry. |
| | | | Other | 1,5 | | |

Table 5.9 (continued)

| Sub-Codes | *U | **I | ***Sub Sub-Codes | *U | **I | Patterns |
|---------------|-----------|-----------|---|-----------|---------|--|
| 8B | | | 8B.1 Professional Development | | | 8B: Both MEPs and Industry are very aware of the role Industry plays in MEPs. 8B.1: Universities express that Industry engage MEPs primarily through professional development activities including: presentations and workshops, K-12 outreach, industry tours, employment opportunities and student organization activities. Industry express that they primarily participate in professional development activities through their interaction with MEP student organizations. |
| Industry Role | 1,2,3,4,5 | 1,2,3,4,5 | Employment Opportunities | 1,2,3,5 | 1, 2 | |
| | | | Presentations/Workshops | 1,2,3,4,5 | 5 | |
| | | | Student Organizations | 1,2,3,4,5 | 1, 2, 4 | |
| | | | Mentoring | 1,2 | | |
| | | | K-12 Outreach | 1,2,3,4,5 | | |
| | | | Industry Tours | 1,2,3,4,5 | 2 | |
| | | | Summer Programs/Summer Bridge | 3,4,5 | | |
| | | | 8B.2 Industry Advisory Board | | | |
| | | | Goal Setting/Advice | 1,5 | | |
| | | | Research | 1 | | |
| | | | Curriculum Input | 1 | | |
| | | | Employment | 1,5 | | |
| | | | Funding | 1,5 | | |
| | | | 8B.3 Industry Role with Larger University | | | |
| | | | COE Departments | 1,5 | | |
| | | | Admissions | 1 | | |
| | | | Senior Design Projects/Capstone | 2,3 | | |
| | | | Career Services/Career Center | 4 | | |
| | | | Other Larger University Partnerships | 5 | | |
| | | | 8B.4 – Industry Role with MEP (General) | | | |
| | | | Commitment | 2 | 3,4 | |
| | | | General Support | | 3 | |

Table 5.9 (continued)

| Sub-Codes | *U | **I | ***Sub Sub-Codes | *U | **I | Patterns |
|-----------------------------|-----|-----|---|-----|-----|----------|
| 8C | | | 8C.1 | | | |
| Alumni | 1,5 | 3 | Mentoring | 1 | | |
| | | | University Wide Advisory Boards | 1,5 | | |
| | | | MEP Advisory Board | 1,5 | | |
| | | | General Support | 5 | 3 | |
| | | | Employment | 5 | | |
| Legend | | | Note: Sub Sub-Codes are only used when there are sufficient data in the sub-codes to warrant an additional level of coding to identify patterns. However, Sub Sub-Codes, when used, do not always yield patterns. Patterns were established only if they held credible and meaningful information and if at least three out of five participants from either the university or industry participants referenced the same point. | | | |
| *U = University Perspective | | | | | | |
| **I = Industry Perspective | | | | | | |
| *** = Sub Sub-Codes | | | | | | |

Functional Conflict

According to Morgan and Hunt (1994), conflict that is considered healthy and can increase productivity is considered functional conflict. The study did not reveal any significant data for this element but revealed two examples. University 2 mentions scholarship funding and a shift from an MEP advisory board to a college-wide advisory board as examples of functional conflict. University 2 states,

The Dean in one way didn't want to have a conflict with its fundraising and fundraising for the MEP itself. He saw that as somewhat of a conflict and so he ... but he also made sure that I was at the table when they did meet and to have the opportunity to engage from there.

Table 5.10

Functional Conflict

Main Code #9: FUNCTIONAL CONFLICT

Theoretical Definition:

Conflict that is considered healthy and can increase productivity

Working Definition:

Struggle or disagreements between partners that can lead to positive outcomes.

| Sub-Codes | *U | **I | Patterns |
|-----------------------------|----|-----|----------|
| 9A | | | |
| Scholarship Funding | 2 | | |
| 9B | | | |
| College-Wide Advisory Board | 2 | | |

Legend

*U = University Perspective

**I = Industry Perspective

*** = Sub Sub-Codes

Note: Sub Sub-Codes are only used when there are sufficient data in the sub-codes to warrant an additional level of coding to identify patterns. However, Sub Sub-Codes, when used, do not always yield patterns. Patterns were established only if they held credible and meaningful information and if at least three out of five participants from either the university or industry participants referenced the same point.

Uncertainty

Uncertainty is described as, “the extent to which a partner (1) has enough information to make key decisions, (2) can predict the consequences of those decisions and (3) has confidence in those decisions” (Morgan & Hunt, 1994, p. 26). When one party has difficulty making decisions, established trust allows them to confidently defer difficult decision making to the other party. Collected data did not produce any evidence of the uncertainty element.

Table 5.11

Uncertainty

Main Code #10: UNCERTAINTY
 Theoretical Definition:
 The extent to which a partner has enough information to make key decisions; can predict the consequences of those decisions; has confidence in those decisions; when one party has difficulty making decisions, established trust allows them to confidently defer difficult decision making to the other party

Working Definition:
 Deferring decision making to partner who has more knowledge and understanding

| Sub-Codes | *U | **I | Patterns |
|----------------------|----|-----|----------|
| None (no data found) | | | |

Legend

*U = University Perspective
 **I = Industry Perspective
 *** = Sub Sub-Codes

Note: Sub Sub-Codes are only used when there are sufficient data in the sub-codes to warrant an additional level of coding to identify patterns. However, Sub Sub-Codes, when used, do not always yield patterns. Patterns were established only if they held credible and meaningful information and if at least three out of five participants from either the university or industry participants referenced the same point.

Barriers

The final element, barriers, was an emergent main code not derived from the theory. Barriers or challenges within these relationships can stifle progress and productivity. Barriers were identified and generally viewed differently for the both MEP and Industry. While there was not enough information to produce any specific patterns, several examples were given in the following chart.

Table 5.12

Barriers

| Main Code #11(Emergent...not derived from the theory): BARRIERS | | | | | | |
|---|---|------------|--|-----------|------------|---|
| Working Definition: Issues or events that can negatively impact the relationship. | | | | | | |
| <i>Sub-Code</i> | <i>*U</i> | <i>**I</i> | <i>***Sub Sub-Code</i> | <i>*U</i> | <i>**I</i> | <i>Patterns</i> |
| 11A | | | 11A.1 MEP Barriers | | | |
| MEP and Industry Barriers | 1,2,3,4,5 | 2,3,5 | Understanding of Diversity | 2 | | 11A: All MEPs and some Industry participants indicate several barriers in their relationships. |
| | | | Understanding of Relationship Building | 1 | | |
| | | | Understanding of Student Development | 3 | | 11A2: Barriers were generally viewed differently for the partners. |
| | | | Industry Personnel Changes | 3,5 | | |
| | | | Maintaining Communication | 4 | | |
| | | | Industry Reporting | 5 | | |
| | | | Industry's Sense of Urgency | 1 | | |
| | | | GPA Requirements | 2 | | |
| | | | 11.A.2 Industry Barriers | | | |
| | | | Limited Internship Availability | | 2 | |
| | | | Geographic Location | | 2,5 | |
| | | | GPA Requirements | | 5 | |
| | | | Timing (MEP Requests/Campus Visits) | | 3 | |
| Legend | Note: Sub Sub-Codes are only used when there are sufficient data in the sub-codes to warrant an additional level of coding to identify patterns. However, Sub Sub-Codes, when used, do not always yield patterns. Patterns were established only if they held credible and meaningful information and if at least three out of five participants from either the university or industry participants referenced the same point. | | | | | |
| *U = University Perspective | | | | | | |
| **I = Industry Perspective | | | | | | |
| *** = Sub Sub-Codes | | | | | | |

Summary of Patterns across The Commitment-Trust KMV Model of Relationship

Marketing

A summary of the twenty-four patterns found across the Commitment –Trust KMV Model of Relationship Marketing can be found below.

Table 5.13

Summary of Patterns across The Commitment-Trust KMV Model of Relationship Marketing

Relationship Benefits (2)

2A: MEPs and Industry report student employment opportunities as a benefit of their partnerships.

2A.1: MEPs and Industry mostly report internships and full-time positions as major employment opportunities as relationship benefits.

2B: MEPs and Industry both report funding MEPs receive from Industry is a relationship benefit.

2B.1: MEPs report funding for general MEP programming, student organizations, summer programs/summer bridge, and K-12 Outreach as relationship benefits. Industry identify funding for general MEP programs and scholarships as relationship benefits.

2C: Most MEPs identify professional development provided by Industry as a relationship benefit for the program.

2D: Some MEPs indicate that Industry branding opportunities are benefits in their partnerships.

2E: MEPs and Industry report additional positive remarks regarding the partnership as relationship benefits.

2E.1: Some Industry participants indicate that longevity is an important relationship benefit while some MEPs reveal that win-win outcomes are important relationship benefits.

Shared Values (3)

3A: MEPs report student development as shared value of their relationships with Industry.

3C: MEPs and most Industry report employment opportunities for diverse/underrepresented students as a major shared value.

3E: MEPs report that having belief/trust in their Industry partners is an important shared value.

Table 5.13 (continued)

Communication (4)

4A.1: MEPs indicate that they primarily communicate about partnership goals, employment opportunities, and funding. Both MEPs and Industry indicate that they communicate about general information.

4B.1: MEPs report that they primarily communicate with Industry through the following methods: print, electronic mediums, professional conferences, MEP meetings, and campus events. Industry indicates that they mostly communicate with MEPs through campus events.

4C.1: MEPs report that the director is the primary person in communication with Industry partners.

Opportunistic Behavior (5)

5A: Some MEPs report that Industry show opportunistic behavior in the area of student recruitment for employment opportunities.

Propensity to Leave (7)

7A: MEPs report that negative economic impact is an indicator of why certain Industry relationships change or terminate.

7B: MEPs report that Industry personnel changes make it hard in some cases to sustain Industry relationships.

Cooperation (8)

8A: MEPs are very aware role of their role with Industry.

8A.1: MEPs report they play a central role in working with Industry through academic development, employment opportunities, professional development, and commitment.

8A.2: MEPs report having meaningful relationships with university and college administration, career services, and the foundation/development team to assist them in engaging with Industry.

8B: Both MEPs and Industry are very aware of the role Industry plays in MEPs.

8B.1: Universities express that Industry engage MEPs primarily through professional development activities including: presentations and workshops, K-12 outreach, industry tours, employment opportunities and student organization activities. Industry express that they primarily participate in professional development activities through their interaction with MEP student organizations.

Barriers (11)

11A: All MEPs and some Industry participants indicate several barriers in their relationships.

11A2: Barriers were generally viewed differently for the partners.

Themes Derived from the Commitment-Trust KMV Model of Relationship Marketing

After reviewing interview transcripts and questionnaire results through the Commitment-Trust KMV Model of Relationship Marketing theoretical framework, twenty-four patterns emerged. To complete the analysis phase, the patterns were examined to identify emergent themes. There were three themes that emerged from the data. Patterns that presented similar information three times or more were selected as a theme.

Table 5.14

Themes Derived from The Commitment-Trust KMV Model of Relationship Marketing

1. Partnering engenders employment opportunities for underrepresented students.
 2. Partnering promotes a well-developed talent pipeline.
 3. Partnering fosters increased funding.
-

Theme 1: Partnering engenders employment opportunities for underrepresented students.

Both MEPs and Industry indicate an important component of their relationship is to enhance employment opportunities for underrepresented students. These opportunities include internships and full time employment. Theme 1 was supported by patterns 2A, 2A.1, 3C, 4A.1, 8A.1, 8A.2, and 8B.1. These patterns revealed that employment opportunities for underrepresented students were identified as focal points of relationship benefits, shared values, communication, and cooperation.

Theme 2: Partnering promotes a well-developed talent pipeline.

MEPs and Industry emphasize that professional development activities are very significant in their relationship. Some of these activities include workshops, presentations, career fairs, and industry tours. Industry also assists MEP student organizations with professional

development events as well. Theme 2 was supported by patterns 2C, 3A, 8A.1, 8A.2, and 8B.1. These patterns revealed that developmental activities were focal points of relationship benefits, shared values, and cooperation.

Theme 3: Partnering fosters increased funding.

Funding is overwhelmingly reported as a main component of MEP and Industry relationships. Industry funding helps support MEP general programming, scholarships, student organizations events, student travel, and summer programs/summer bridge. In some cases without this funding, MEPs and their students would not be able to participate in activities that expose them to career related opportunities and promote academic success. Theme 3 was supported by patterns 2B, 2B.1, 4A.1, and 8A.2. The focal points of these patterns stemmed from relationship benefits, communication, and cooperation.

Table 5.15

Themes and Supporting Patterns

| Theme Across Patterns | Description of Theme | Patterns Supporting Development of Theme |
|--|--|---|
| Partnering engenders employment opportunities for underrepresented students. | Both MEPs and Industry indicate an important component of their relationship is to enhance employment opportunities for underrepresented students. These opportunities include internships and full time employment. | <p>2A: MEPs and Industry report student employment opportunities as a benefit of their partnerships.</p> <p>2A.1: MEPs and Industry mostly report internships and full-time positions as major employment opportunities as relationship benefits.</p> <p>3C: MEPs and most Industry report employment opportunities for diverse/underrepresented students as a major shared value.</p> <p>4A.1: MEPs indicate that they primarily communicate about partnership goals, employment opportunities, and funding. Both MEPs and Industry indicate that they communicate about general information.</p> <p>8A.1: MEPs report they play a central role in working with Industry through academic development, employment opportunities, professional development, and commitment.</p> <p>8A.2: MEPs report having meaningful relationships with university and college administration, career services, and the foundation/development team to assist them in engaging with Industry.</p> <p>8B.1: Universities express that Industry engage MEPs primarily through professional development activities including: presentations and workshops, K-12 outreach, industry tours, employment opportunities and student organization activities. Industry express that they primarily participate in professional development activities through their interaction with MEP student organizations.</p> |

Table 5.15 (continued)

| Theme Across Patterns | Description of Theme | Patterns Supporting Development of Theme |
|---|---|--|
| Partnering promotes a well-developed talent pipeline. | MEPs and Industry emphasize that professional and student development activities are very significant in their relationship. Some of these activities include workshops, presentations, career fairs, and industry tours. Industry also assists MEP student organizations with professional development activities as well. | <p>2C: Most MEPs identify professional development provided by Industry as a relationship benefit for the program.</p> <p>3A: MEPs report student development as shared value of their relationships with Industry.</p> <p>8A.1: MEPs report they play a central role in working with Industry through academic development, employment opportunities, professional development, and commitment.</p> <p>8A.2: MEPs report having meaningful relationships with university and college administration, career services, and the foundation/development team to assist them in engaging with Industry.</p> <p>8B.1: Universities express that Industry engage MEPs primarily through professional development activities including: presentations and workshops, K-12 outreach, industry tours, employment opportunities and student organization activities. Industry express that they primarily participate in professional development activities through their interaction with MEP student organizations.</p> |

Table 5.15 (continued)

| Theme Across Patterns | Description of Theme | Patterns Supporting Development of Theme |
|------------------------------|--|--|
| Partnering fosters funding | Funding is overwhelmingly reported as a main component of MEP and Industry relationships. Industry funding helps support MEP general programming, scholarships, student organizations events, student travel, and summer programs/summer bridge. | <p>2B: MEPs and Industry both report funding MEPs receive from Industry is a relationship benefit.</p> <p>2B.1: MEPs report funding for general MEP programming, student organizations, summer programs/summer bridge, and K-12 Outreach as relationship benefits. Industry identify funding for general MEP programs and scholarships as relationship benefits.</p> <p>4A.1: MEPs indicate that they primarily communicate about partnership goals, employment opportunities, and funding. Both MEPs and Industry indicate that they communicate about general information.</p> <p>8A.2: MEPs report having meaningful relationships with university and college administration, career services, and the foundation/development team to assist them in engaging with Industry.</p> |

Summary

Chapter 5 described the data analysis procedures, patterns associated with the Commitment-Trust KMV Model of Relationship Marketing, and the themes derived from pattern examination. Chapter 6 will discuss the conclusions of this study. It will also answer the guiding research question and sub-questions, reiterate the significance of the study, reveal any implications for practice and suggest recommendations for future research.

Chapter 6 - Conclusions

Introduction

This research examined the nature of industry engagement within university multicultural engineering programs. It also examined the role of commitment and trust in these relationships. Based on the findings, three themes emerged that addressed the fundamental research questions. This chapter includes a discussion of the research questions as well as the significance of the study, implications for practice, and recommendations for future study.

Discussion of Guiding Research Question

What is the nature of industry engagement within university multicultural engineering programs?

The present study found that industry engagement within university multicultural engineering programs manifests in a variety of ways. A prior investigation of minority engineering programs by Morrison and Williams (1993) reported findings that highlighted a few areas of industry involvement within professional and personal development, employment, and private funding. While Morrison and Williams' (1993) research did not solely focus on industry engagement, the present study affirmed some of their findings; it seems clear that industry does in fact, primarily engage multicultural engineering programs through funding, professional development and employment opportunities. These surfaced as the study's three main themes.

In the realm of professional development, the present findings indicated that industry engages MEPs through general programming initiatives, student organizations, summer programs and summer bridge, presentations and workshops, K-12 Outreach, and industry tours. Some mention was given to mentoring as well. Industry's involvement in professional development activities allows students to interact with potential employers and learn first hand

about corporate culture and opportunities. In addition, industry members gain access to students as early as their pre-college experiences to introduce students to their respective brands and to impart advice on how to be both a productive student and a potential employee. Industry 5 states, “I feel that we get a “first” look at potential candidates that could be a great fit.” In addition, MEPs reported being very grateful for industry’s involvement in professional development activity. University 4 states,

The fact that they’re willing to support us by coming to campus and doing new presentations on professional development, fundraising, leadership, interviewing skills, resume writing skills, things like that. That part of it, it’s huge and so helpful for our students.

Industry funding echoes support for general programming initiatives, student organizations, summer programs and summer bridge, K-12 Outreach, industry tours and scholarships. Such financial support helps MEPs provide programming and events to engage students and introduce them to opportunities that they otherwise might have to forgo. All MEPs indicated that funding tremendously helped their student organizations. The main MEP student organizations mentioned are the American Indian Science and Engineering Society (AISES), National Society of Black Engineers (NSBE), and the Society of Hispanic Professional Engineers (SHPE). Through these organizations, industry sponsors local campus meetings, conference travel and lodging, and outreach events or activities. University 5 mentions,

Another way is that at the national and regional conferences, have our students connect with the companies that have funded our students to be able to be part of ... to go to the conference, so they meet with them at career fairs at the national conferences or regional conferences.

University 3 adds,

We have some companies that are tried and true partners. They participate by way of financial support; they participate by way of sweat equity. They’re on campus several times a year; they’re engaging our students; they’re connecting with the registered student organizations. They’re here. That takes up time and money.

The literature shows that universities as a whole benefit greatly from additional fiscal resources provided by industry partners (Thelin, 2004). This study indicates the same to be true at the departmental level with MEPs.

Lastly, all MEP and industry participants indicated that employment opportunities were a main component of their engagement. Internships, co-ops, and full-time positions constituted the most commonly identified employment opportunities. Internships often serve as an effective segue to full time employment. They are typically the first introduction a student has to direct corporate climate and career expectations. Co-ops are extended internships where students stay for a least a semester. While co-ops were not commonly used among all the study's participants, institutions that have students take part in them find that students benefit tremendously from their extended time with employers. Full time employment for students of diverse backgrounds is one of the ultimate goals for MEPs and their respective industry partners. MEPs and Industry participants almost unanimously stated that employment opportunities for students of underrepresented backgrounds was one of their main shared values.

Discussion of Sub-Question 1

How do industry and university multicultural engineering programs develop trust in their relationships?

According to the Commitment-Trust KMV Model of Relationship Marketing, there are six elements that effect trust. These elements include: shared values, communication, opportunistic behavior, cooperation, functional conflict, and uncertainty (Morgan & Hunt, 1994). The present investigation suggests how these elements contribute to trust within MEP and Industry relationships.

There were three main patterns that derived from shared values. Most MEPs specifically identified that having trust in their industry partners is an important shared value. MEPs also reported student development as a shared value of their relationships with industry. Employment opportunities for underrepresented students were deemed an important shared value by the majority of both MEP and Industry participants. Because of this shared value, MEPs trust industry to engage and recruit students with this goal in mind. Industry trusts MEPs to serve as the talent pipeline for students of diverse backgrounds and expect them to provide the foundation of student development and facilitate opportunities for meaningful industry engagement.

The next element largely impacting trust is communication. Communication is essential in any relationship and can be the reason for strained or even severed ties when done ineffectively. MEP directors are reported as the main communicators with industry representatives. Industry representatives have to trust that the person they are connecting with in MEP is a consistent and reliable source. In addition, there has to be an understanding of the best methods of communication and what topics are most relevant to the relationship.

Opportunistic behavior is the third element impacting trust. As Morgan and Hunt (1994) pointed out, opportunistic behavior is viewed as self-seeking and deceit oriented behavior. Such actions lead to decreased trust. The relationships in this study reveal limited evidence of opportunistic behavior. However, when present, it is generated by industry members who may not have longstanding relationships with the MEP and expect to receive preferential treatment. Such actions result in marred reputations and a failed desire to build fruitful relationships.

The fourth element is cooperation. Cooperation in these relationships is a direct result of trust. MEPs and Industry both declare that because of trust they can work closely together to achieve joint goals. Both MEPs and Industry indicate that they have a clear understanding of

their respective roles. In addition, MEPs mention that they even employ other university units such as career services, foundation and development, and department and university administration to assist in their engagement efforts with industry. University 5 mentions, “Well, it’s best to have campus partners to work with, whether that partner is your foundation, which is awesome ... it’s fantastic to have them as a partner.” Because of trust, these partners are able to join forces on professional development activities, student organizations support, industry tours, K-12 outreach, and summer programs/summer bridge.

The next element effecting trust is functional conflict. Functional conflict is described as healthy conflict that can increase productivity (Morgan & Hunt, 1994). While positive when present in relationships, this study showed limited examples of functional conflict. Lastly, uncertainty is identified as a negative contributor to trust. Uncertainty is defined as the extent to which a partner has enough information to make key decisions; can predict the consequences of those decisions; and has confidence in those decisions. The findings from this study did not report any evidence of uncertainty amongst these MEP and Industry relationships.

Discussion of Sub-Question 2

How do industry and university multicultural engineering programs establish commitment in their relationships?

Similar to trust, the Commitment-Trust KMV Model of Relationship Marketing also features six elements that effect commitment including: relationship termination costs, relationship benefits, acquiescence, propensity to leave, shared values and cooperation (Morgan & Hunt, 1994). It is not surprising that trust, along with all of its designated elements, directly impact commitment. Established trust leads to relationship commitment.

The first element impacting relationship commitment is relationship termination costs. Relationship termination cost is identified as all expected losses from termination and result from the perceived lack of comparable potential alternative partners. In some cases this can have a positive impact on the relationship because one partner realizes the potential risk of ending the relationship. However, this study showed that in certain cases terminating the relationship is unavoidable when there is no beneficial gain for one of the partners involved. Examples of this were provided from both an MEP and Industry participant.

The next element is relationship benefits. Relationship benefits can be considered a driving force for any partnership. Naturally, engaged participants are interested in how their participation benefits them. Morgan and Hunt (1994) refer to this as win-win outcomes, high benefits yield high commitment. The present research highlighted several key areas of relationship benefits, including: employment opportunities, funding, professional development and industry branding. Due to the trust established between the participating MEP and Industry partners, there are high levels of commitment to the relationship. MEPs and Industry work together to ensure that students are aware of and qualify for potential employment opportunities.

Industry funding supports MEP programming, K-12 outreach, summer programs, and student organizations. Industry and MEPs also collaborate to provide effective professional development for students through multiple programming avenues. In addition, MEPs are committed to industry branding efforts. They often facilitate and participate in opportunities that allow students to network with industry members in various capacities such as: campus visits, industry tours, career fairs, and professional conferences. Lastly, MEPs and Industry identified numerous positive attributes deemed as relationships benefits that contribute to their level of commitment. While several were mentioned, most industry partners acknowledged that

continuity was a major relationship benefit. Some MEPs also mentioned continuity as a relationship benefit, but most indicated that win-win outcomes is a primary relationship benefit. All of these benefits ultimately contribute to the level of commitment shown in MEP and Industry engagement.

The third and fourth elements are acquiescence and propensity to leave. Acquiescence refers to the degree to which partner accepts or adheres to another's specific requests or policies (Morgan & Hunt, 1994). This study did not yield enough information to produce any significant findings in the area of acquiescence. However, when present, acquiescence, is noted to have a positive impact on relationship commitment. Propensity to leave is described as the perceived likelihood that a partner will terminate the relationship in the reasonably near future (Morgan & Hunt, 1994). Propensity to leave has a negative impact on relationship commitment. According to MEPs, the two main factors contributing to propensity to leave were negative economic impact and personnel changes, both deriving from Industry.

The final elements of shared values and cooperation directly impact both trust and commitment. As stated earlier, one of the main shared values in these relationships is the employment of underrepresented students in engineering. This objective ignites MEPs and Industry to demonstrate cooperation to prove their commitment. They cooperate through programming, outreach, summer programs/summer bridge, student organization support and ultimately developing and hiring students for internships, co-ops, and providing full-time positions. In addition, the findings indicate MEPs and Industry are committed to cooperation because they have a clear understanding of each other's role and trust that each partner will consciously fulfill predetermined expectations to achieve joint goals.

Significance of the Study

Multicultural engineering programs were created and designed over forty years ago to support the recruitment, retention, and graduation of underrepresented students in engineering (Landis, 1988). Today, these programs still exist and are focused on the same mission. Not only is it a mission of academic institutions, industry has made it a priority as well. According to Minerick, Toghiani, and Dawson (2011),

Developing a diverse engineering workforce is of utmost importance for the future of the engineering profession. Companies striving to stay in business for generations push the envelope of technology, this is where innovation and new perspectives are crucial. (p. 1)

Diversity in the corporate sector is no longer just about equal opportunity; it is now a critical necessity for an evolving society. “The increase in globalization demands more interaction with people from diverse cultures, religions, and backgrounds than ever before” (Sadiku & Obiomon, 2007, p. 5). The present research intended to describe the significant activities and varied approaches surrounding how industry engages with university multicultural engineering programs to supply and sustain the pipeline of diverse engineering talent.

This investigation also contributes to the conversation of university and industry partnering as a whole, as well as at the departmental level. The findings provide a range of engagement activities to the overall literature available on multicultural engineering programs and contribute to the knowledge base of multicultural engineering programs and industry relationships. These examples, as discussed in Chapter 5, represent professional development activities, employment opportunities, and funding initiatives. The study also affirmed the industry related findings of the important Morrison and Williams’ (1993) study, that indeed MEPs do engage Industry through professional development activities and employment opportunities for students. It also affirms that private funding from Industry may be crucial to

the fiscal sustainability of meaningful programs that contribute to the recruitment and matriculation of minority engineering students.

Through this study, additional examples MEP and Industry engagement were noted in a broader context, contributing new insights and information to the literature. These examples may well help shape future studies focused in depth about a particular form of industry engagement found within university multicultural engineering programs. One of the strengths of this study was that it looked in depth at five unique and respected multicultural engineering programs and their respective industry champions. This allows readers to compare, contrast, and consider the parallels and distinctions among strong university multicultural engineering programs and industry participants.

Implications for Practice

The results from this study can potentially impact the practice of university multicultural engineering programs and industry alike. Multicultural engineering programs will find a variety of ways they can engage with industry and garner ideas for potential partnerships. Other programs can affirm whether or not their current practices are consistent with the important features presented for successful partnerships in this study. Industry members who are not currently engaged with multicultural engineering programs can learn about the benefits of these relationships and assess if this route is viable for their organization. Existing industry partners can identify additional areas to engage with multicultural engineering programs or evaluate if their current strategies align with the study's findings.

The three main themes from this study indicate that partnering engenders employment opportunities for students of diverse backgrounds; promotes a well-developed talent pipeline; and fosters increased funding. From these themes, industry and MEPs can focus their efforts and

develop strategic partnerships to lead to desired outcomes. The present investigation provides several specific target areas within these themes to explore. The findings produced insight on the programming components of MEPs including: general programming, K-12 outreach, summer programs/summer bridge, and professional development activities. It also captured the existence of MEP student organizations and how they serve an integral role within the program's structure. Either party could further investigate how these examples could contribute to or enhance their efforts in recruiting, retaining, and employing underrepresented engineering students.

Multicultural engineering programs and existing industry partners recognize that diversity is essential in the STEM workforce. It is no longer "a feel good proposition. It is good business" (Sadiku & Obiomon, 2007, p. 5). Today's global economy is no longer farfetched and impenetrable. The ongoing evolution of technology and 21st century globalization has condensed a once grandiose notion into a single global reality. Industry leaders and MEPs appear to have recognized that in order to stay relevant and competitive in a diverse global economy they must turn to each other and form meaningful relationships that groom and cultivate the engineers that will sustain and advance our society.

Frequently academic institutions and industry enter partnerships for some agreed mutual benefit. These partnerships are grounded in a sense of shared values, mutual respect, trust and commitment. This study examined such relationships through the Commitment-Trust KMV Model of Relationship Marketing (Morgan & Hunt, 1994). Through the lenses of this theory, findings indicate that industry and MEPs would not experience the level of cooperation and variety of relationship benefits if trust and commitment were not established. MEPs and Industry can review the information presented in this study through this theoretical framework

and formulate meaningful relationships, grounded in commitment and trust that can produce mutually beneficial, positive results.

Implications for Personal Practice

The researcher was drawn to this study because of her personal professional experience working with industry and university multicultural engineering programs through multiple university roles. Nationally, she has co-chaired two major conferences for the National Association of Multicultural Engineering Program Advocates an organization that serves as the platform for the mission of MEPs nationwide. She pursued this topic because of the passion she has for multicultural engineering programs, her dedication towards her former MEP students and the respect and admiration she has for fellow MEP colleagues.

Seeing a need for additional research regarding university multicultural engineering programs, the researcher intended to contribute to the conversation of diversity in STEM. She also sought to shed light on the existence and importance of MEPs and industry relationships with hope that future research will follow. Qualitative research allows a researcher to immerse themselves into cases that are being examined. Through this process, the researcher gained a deeper understanding of and appreciation for the field. She intends to use her own career as a platform to promote, create, enhance, and report notable occurrences within university multicultural engineering programs and industry partnerships.

Recommendations for Future Studies

Recommendation 1

This study utilized the Commitment-Trust KMV Model of Relationship Marketing (Morgan & Hunt, 1994). The researcher did not ask specific questions from each element purposefully. She wanted to capture what would emerge from the study. It would be beneficial to

conduct a similar case study asking questions that directly relate to each and all elements presented in the framework.

Recommendation 2

Due to time and financial limitations, the researcher did not interview industry participants. Industry participants completed an open-ended questionnaire. While the answers were clear and concise, phone or in person interviews might well have captured additional information that could have strengthen some of the areas of involvement mentioned by MEPs.

Recommendation 3

A future study on the structure and function of MEP advisory boards would be beneficial. Only two of the university participants indicated having industry advisory boards. Those that did not indicated the desire to have one. It would be informative to examine if the MEPs with advisory boards experience any difference in the level of industry engagement verses MEPs that do not have advisory boards.

Recommendation 4

This study noted the existence and importance of MEP student organizations including: the American Indian Science and Engineering Society (AISES), National Society of Black Engineers (NSBE), and the Society of Hispanic Professional Engineers (SHPE). A future study of industry engagement within student chapters of these organizations and how they affect MEPs could be impactful.

Recommendation 5

There were a few mentions of MEPs working with alumni industry members. A study on MEPs and alumni industry partners would provide further insight of the level of commitment and trust within such partnerships.

Recommendation 6

This study gave a broad overview of the different areas in which industry engage with university multicultural engineering programs. Future studies examining either one of these areas in depth might yield insights into the nature and design of such partnership activities.

Recommendation 7

This study focused exclusively on MEP-Industry engagements identified as having a ‘strong reputation’. Perhaps an investigation of MEP-Industry partnerships that failed to flourish would expand an understanding of the dynamics of such endeavors.

Summary

The demand for more diverse engineers in the workforce is apparent more now than ever (Chubin et al., 2005). We live in a global society that is rapidly demanding a talent pool that mirrors the melting pot of cultures that define our nation. Diversity not just in color, but in mindset as well. For engineers, it is better to,

think of diversity as an asset, an enabler that makes teams more creative, solutions more feasible, products more usable, and citizens more knowledgeable. Diversity arguably makes any profession, but especially science and engineering, more competent. (Chubin et al., 2005, p. 74)

This study examined the nature of a relationship that plays a big role in supplying diverse talent into the engineering pipeline. An analysis of the nature of industry engagement within university multicultural engineering programs provided by the participants of this study reported a range of engagement activities. In addition, this study indicated how commitment and trust play an important, perhaps crucial, role in these relationships.

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Appendix A - Interview Questions for Director or Designee of the University MEP

Industry-University Engagement in Multicultural Engineering Programs: An Exploratory Study

Directions:

This is an open-ended interview. There are no wrong answers to the questions. Please provide detailed responses. This interview will be about an hour in length, but could be longer depending on details shared. The purpose of this interview is seek information to understand your program's relationship with industry.

1. Please share some background information about your MEP program?

2. Tell me the history of the partnering with industry in the MEP.

Probing Questions

- a. Variations in partners
 - b. Changes over time
 - c. Desires for decreasing or increasing number of partners
-
3. How does your MEP engage industry through the following?
 - a. Internships/Co-ops
 - b. Advisory Boards
 - c. Summer Programs/Summer Bridge
 - d. Curriculum Development
 - e. Problem/Project Based Learning Projects
 - f. Design Projects or Competitions
 - g. Mentoring Program
 - h. Site Visits/Industry Tours

11. Please describe the benefits to having a relationship with industry.

12. Please describe the challenges associated with having a relationship with industry.

13. What would you want (me to know) to share with other MEPs about engaging industry what we have not discussed?

14. May I call back for clarification of responses if needed?

Appendix B - Industry Partner Questionnaire

Industry-University Engagement in Multicultural Engineering Programs: An Exploratory Study

Directions: This is an open-ended questionnaire. There are no wrong answers to the questions listed below. The purpose of this study is seeking to understand the nature of industry engagement within university multicultural engineering programs. **Please provide detailed responses including specific examples verses general comments.** This questionnaire may take a minimum of one hour to complete. Feel free to use multiple pages for your responses and examples. Please complete this questionnaire in a word document and submit electronically via email to Jacqueline M. Gatson, Educational Leadership, Doctoral Candidate, Kansas State University, at jcooper3@ksu.edu. Questionnaire submission is due **INSERT DATE**.

1. How do you describe your corporation's engagement with **UNIVERSITY 1's** multicultural engineering program?
2. In what ways does your corporation partner with **UNIVERSITY 1's** multicultural engineering program? Please give specific examples and details.
3. Why is this relationship important?
4. How do you develop trust in your relationship with **UNIVERSITY 1's** multicultural engineering program?

5. How do you establish commitment in your relationship with **UNIVERSITY 1's** multicultural engineering program?

6. Please describe the benefits to having a relationship with **UNIVERSITY 1's** multicultural engineering program. What are some specific examples and what were the outcomes?

7. Please describe the barriers to having a relationship with **UNIVERSITY 1's** multicultural engineering program. What are some specific examples and what were the outcomes?

8. What else would you like to share?

9. May I call you for clarification of responses if needed? If so, please provide your contact information.

Appendix C - Invitation Letter to Nominators

DATE

Dear **NAMEPA NOMINATOR**,

My name is Jacqueline M. Gatson, a doctoral student in the Educational Leadership program at Kansas State University. I am also a member of NAMEPA and have served the organization in numerous capacities including: Region D Chair (2012-2014), National Conference Co-Chair (2012 and 2013), National Conference Proceedings Committee Co-Chair (2010) and National Conference Membership Committee Member (2011). As an active member of NAMEPA, I have a deep appreciation and realize the importance of the work being done to recruit, retain, and graduate underrepresented students in engineering. Because of my commitment, I have decided to use my dissertation as a platform to investigate industry engagement within NAMEPA, multicultural engineering programs.

I selected NAMEPA because this organization's history represents an elite group of institutions with a demonstrated commitment to the advancement of multicultural students in science, technology, engineering, and mathematics. I believe the field and industry could benefit greatly from the insight NAMEPA institutions can provide.

I am writing to request your participation as a nominator for my dissertation investigation. The research question is: How is industry engagement within university multicultural engineering programs established? As a nominator, you will be tasked with nominating one institution per region that meets all of the following criteria:

- Current or past NAMEPA institutional member
- Institution has a formal program dedicated to multicultural engineering programming
- Reputation for strong industry partnerships within multicultural engineering programming

There should be a total of five institutions nominated. There will be a total of fifteen (15)

institutions nominated from all nominators. The researcher will then select five institutions, one per region, if possible, to participate in the study. Institutions that are nominated more than once will be contacted first and the rest in alphabetical order per region, until five institutions have agreed to participate. If you agree to participate as a nominator, please respond with your confirmation or declination no later than **INSERT DATE**. All institutional nominations are requested no later than **INSERT DATE** via email.

As a past president of NAMEPA, you have a broad scope regarding the status of multicultural engineering programs nationwide. You are also aware of the benefits and barriers MEPs face when working with industry. The goal of this study is to shed some light on how MEPs interact with industry and industry's perceptions regarding this engagement. By participating as a nominator, you not only highlight the work of multicultural engineering programs nationwide, you highlight the work being done by institutions who are or have been members of NAMEPA.

Should you have any questions or concerns regarding this study, please feel free to contact me via the information provided below. Thank you in advance for your time and consideration.

Best regards,

Jacqueline M. Gatson
Doctoral Candidate
Educational Leadership
Kansas State University
jcooper3@ksu.edu
785-230-5844

Appendix D - Invitation Letter

to Director or Designee of the University MEP

DATE

Dear **UNIVERSITY 1 PARTICIPANT**,

My name is Jacqueline M. Gatson, a doctoral student in the Educational Leadership program at Kansas State University. I am also a member of NAMEPA and have served the organization in numerous capacities including: Region D Chair (2012-2014), National Conference Co-Chair (2012 and 2013), National Conference Committee Co-Chair (2010), and National Conference Committee Member (2011). Being an active member of NAMEPA, I have a deep appreciation and realize the importance of the work being done to recruit, retain, and graduate underrepresented minorities in engineering. Because of my commitment, I have decided to use my dissertation as a platform to investigate industry engagement within NAMEPA, multicultural engineering programs.

I selected NAMEPA because this organization's history represents an elite group of institutions with a demonstrated commitment to the advancement of multicultural students in science, technology, engineering, and mathematics. I believe the field and industry could benefit greatly from the insight NAMEPA institutions can provide.

I am writing to request your participation as an institutional member for my dissertation investigation. Your institution was nominated as an ideal candidate by a panel of current and former NAMEPA executive officers. The research question for this study is: What is the nature of industry engagement in university multicultural engineering programs? As a participant you will be requested to participate in an interview related to the study's research question. This interview should be no longer than an hour. If an additional interview is needed, I will contact you to schedule another time. In addition, you will be requested to nominate and contact an industry representative who you feel champions the efforts of your multicultural engineering

program and would be willing to complete a brief questionnaire regarding their experience.

If you agree to participate in the study, please respond with your confirmation or declination at your earliest convenience. If possible, I would like to schedule our interview on or before **INSERT DATE**. Any additional interviews will be requested as needed per your availability.

As a MEP advocate, you have intimate knowledge regarding the status of your multicultural engineering program. You are also aware of the benefits and barriers your program faces when working with industry. The goal of this study is to shed some light on how MEPs interact with industry and industry's perceptions regarding this engagement. By participating, you not only highlight the work of multicultural engineering programs nationwide, you highlight the work being done by institutions who are members of NAMEPA.

Should you have any questions or concerns regarding this study, please feel free to contact me via the information provided below. Thank you in advance for your time and consideration.

Best regards,

Jacqueline M. Gatson
Doctoral Candidate
Educational Leadership
Kansas State University
jcooper3@ksu.edu
785-230-5844

Appendix E - Industry Letter to Industry Partner

DATE

Dear **INDUSTRY 1 PARTICIPANT**,

My name is Jacqueline M. Gatson, a doctoral student in the Educational Leadership program at Kansas State University. I am also a member of the National Association of Multicultural Engineering Program Advocates (NAMEPA) and have served the organization in numerous capacities including: Region D Chair (2012-2014), National Conference Co-Chair (2012 and 2013), National Conference Committee Co-Chair (2010), and National Conference Committee Member (2011). Being an active member of NAMEPA, I have a deep appreciation and realize the importance of the work being done to recruit, retain, and graduate underrepresented minorities in engineering. Because of my commitment, I have decided to use my dissertation as a platform to investigate industry engagement within NAMEPA, multicultural engineering programs.

I selected NAMEPA because this organization's history represents an elite group of institutions with a demonstrated commitment to the advancement of multicultural students in science, technology, engineering, and mathematics. I believe the field and industry could benefit greatly from the insight NAMEPA institutions and their industry partners can provide.

I am writing to request your participation as an industry partner for my dissertation investigation. **NAME OF UNIVERSITY 1 REPRESENTATIVE, TITLE, AT UNIVERSITY 1**, nominated your corporation as an ideal candidate. This program is an institutional member of NAMEPA.

The research question for this study is: What is the nature of industry engagement in university multicultural engineering programs? As a participant you will be requested to respond in detail to an electronic questionnaire regarding your experience with the multicultural engineering

program at **UNIVERSITY 1**.

If you agree to participate in the study, please respond with your confirmation or declination no later than **INSERT DATE**. The questionnaire will be delivered electronically via email and due via email on or before **INSERT DATE**. Any additional information or clarification will be requested as needed per your availability.

As a MEP advocate, you have intimate knowledge regarding the status of your corporation's involvement with the multicultural engineering program at **UNIVERSITY 1**. You are also aware of the benefits and barriers your corporation faces when working with this MEP program. The goal of this study is to shed some light on how MEPs interact with industry and industry's perceptions regarding this engagement. By participating, you not only highlight the work of NAMEPA multicultural engineering programs nationwide, you highlight the work being done by industry that support NAMEPA institutions.

Lastly, if you agree to participate, I would like to arrange a time to speak with you regarding the details of the study. This conversation should last no longer than 30 minutes. At your convenience, please provide a list of dates and times that work with your schedule. Thank you in advance for your time and cooperation! I look forward to working with you!

Should you have any questions or concerns regarding this study, please feel free to contact me via the information provided below.

Best regards,

Jacqueline M. Gatson
Doctoral Candidate
Educational Leadership
Kansas State University
jcooper3@ksu.edu
785-230-5844

Appendix F - Informed Consent Form

PROJECT TITLE:

Industry – University Engagement in Multicultural Engineering Programs

APPROVAL DATE OF PROJECT:

EXPIRATION DATE OF PROJECT:

PRINCIPAL INVESTIGATOR:

- Dr. Michael Holen, College of Education, Kansas State University

CO-INVESTIGATOR(S):

- Jacqueline M. Gatson, Doctoral Candidate, College of Education, Kansas State University

CONTACT NAME AND PHONE FOR ANY PROBLEMS/QUESTIONS:

- Dr. Michael Holen, mholen@ksu.edu, 785-532-3650

IRB CHAIR CONTACT/PHONE INFORMATION:

- Rick Scheidt, Chair, Committee on Research Involving Human Subjects, 203 Fairchild Hall, Kansas State University, Manhattan, KS 66506, (785) 532-3224.
- Jerry Jaax, Associate Vice President for Research Compliance and University Veterinarian, 203 Fairchild Hall, Kansas State University, Manhattan, KS 66506, (785) 532-3224.

PURPOSE OF THE RESEARCH:

The purpose of this study is to explore the nature of industry engagement within university multicultural engineering programs (MEP). Many multicultural engineering programs emulate a practitioner-based model that focuses on program planning, implementation, and best practices that aid in the recruitment, retention and graduation of underrepresented students. Historically these students have been identified as African American, Hispanic, and Native American. Today, while many programs have continued to serve this traditional demographic, other

programs have expanded to be inclusive of all diverse populations including international students. Such efforts demand strategic and meaningful partnerships with academe and industry to sustain a promising pipeline of diverse talent. Since industry engagement and support are two main tenants in an MEP operation, research in this area would inform MEPs and industry of how universities and industry can partner to achieve their goals.

PROCEDURES OR METHODS TO BE USED:

The study will be an exploratory, qualitative investigation. The proposed participants in this study would include five institutions that hold or have held institutional membership in the National Association of Multicultural Engineering Program Advocates (NAMEPA) and five industry partners. Once the sites are determined, directors or designees of the multicultural engineering programs will be contacted for an interview. Interviews will be conducted via telephone or in person if possible. Institutions willing to participate will identify industry partners to participate in an electronic questionnaire. There will be a total of five directors or designees and one industry partner from each institution for a total of ten participants.

LENGTH OF STUDY:

Interviews will be scheduled for one hour. Additional interviews will be scheduled per the participant's availability if needed. Industry questionnaires will be distributed electronically through email and should take no longer than one hour to complete.

RISKS OR DISCOMFORTS ANTICIPATED:

None

BENEFITS ANTICIPATED:

The goal of this research is to contribute to the literature about multicultural engineering programs in general and explain the nature of industry engagement within university multicultural engineering programs. Results are intended to assist participants and other university- industry partnerships improve their programs.

EXTENT OF CONFIDENTIALITY:

Any identifying characteristics of the site and/or participant will be kept confidential. Aliases or pseudonyms will be used to protect confidentiality. The researcher will keep all recorded interviews, completed questionnaires, and transcripts electronically stored on a password-protected computer or memory card that will be kept in separate locations. All related documents will be scanned and stored electronically as well. As required by the IRB, materials will be kept for three years.

TERMS OF PARTICIPATION:

I understand this project is research, and that my participation is completely voluntary. I also understand that if I decide to participate in this study, I may withdraw my consent at any time, and stop participating at any time without explanation, penalty, or loss of benefits, or academic standing to which I may otherwise be entitled.

I verify that my signature below indicates that I have read and understand this consent form, and willingly agree to participate in this study under the terms described, and that my signature acknowledges that I have received a signed and dated copy of this consent form.

Participant Name: _____

(Please Print)

Participant Signature: _____

Date: _____

Witness to Signature: _____

Date: _____