ENTREPRENEURIAL PROPENSITY: THE CONSTRAINING AND ENABLING FACTORS OF INSTITUTIONAL ENVIRONMENTS ON WOMEN FACULTY IN ENGINEERING

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A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

Geography–Doctor of Philosophy

2019

ABSTRACT

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Research on women entrepreneurs over the last 40 years has centered on comparative studies between men and women related to sociodemographic, perceptual, and contextual factors. An emerging area for research is studying contextual factors such as corporations, households, family businesses, and universities. Using an institutional theory framing, this study explored the constraining and enabling factors institutions have on the entrepreneurial propensity of women faculty at Michigan State University and the University of Michigan. Given the gaps in the women's entrepreneurship knowledge base, the following research question was asked: how do university policy, support measures, and reward systems constrain or enable the entrepreneurial activity of white women faculty in engineering? A qualitative case study approach was used to collect and analyze the data. Interviews were the primary data source and documents were the secondary data source. Pattern matching was used to analyze the data. Findings show that university promotion methods and the number of faculty job responsibilities were constraining factors. The factor that was enabling to white women engineering faculty at both universities, was the ability to act as a change agent who shapes new institutional environments.

This dissertation is dedicated to Margareth Casimir, Georges J. Casimir, Liliane Pimentel, Lola Colbert, and my siblings
Thank you for your encouragement and support
L'union fait la force

ACKNOWLEDGEMENTS

A spider's web is weaved through patience and with precision. Each thread fortified by the next, creates a layering of strong interconnected circles. The spider's web is a metaphor for my academic journey from home to doctorate. My journey was fortified by the countless individuals who provided encouragement, guidance, and love.

Thank you to my parents, Margareth and Georges Casimir. You instilled in me the values of family, education, determination, collaboration, leadership, and resilience. These characteristics proved useful during my academic journey. Thank you to my grandparents, Liliane and Edwidge Pimentel. You demonstrated what it means to provide upward mobility for your family and community. Thank you to my aunt Lola. You always provided a listening ear and a voice of reason. Thank you to my siblings, Nathalie, Kervin, Stephanie, Patrice, and DeeDee. This PhD journey was not easy for me and you never left my side. You supported me the entire way. Thank you to my family for going through every emotion with me as I completed this PhD. You provided advice, a shoulder to cry on, laughs, and encouragement. Georgie, Korey, Jalen, Ruby, Grant, Preston, Nadia, Dean, Michel family, Jean-Francois family, and Moore family.

Thank you to my friends new and old who were always available for phone calls, lunch dates, craft nights, walks, vacations, and many other adventures that allowed me to step away from the books.

Thank you to my committee. Dr. Elizabeth Mack, for teaching me how to write and conduct research. Dr. Joe Darden, for encouraging me to reach for ambition and the art of collaboration. Dr. Igor Vojnovic, for teaching me the importance of letting my voice shine through my writing. Dr. Steve Gold, for encouraging me to think critically about my findings.

Dr. Logan Williams, for teaching me how to do good qualitative research and introducing me to academic entrepreneurship.

Thank you to the academic institutions that provided the foundation for my education. Saint Agnes, Sacred Heart Academy, Spelman College, the Women's Research and Resource Center at Spelman College, the University of Miami, the Center for Suburban Studies at Hofstra University, Arizona State University, Michigan State University, and the Department of Geography, Environment, and Spatial Sciences at Michigan State University.

Thank you to those who are not mentioned by name but hold a special place in my heart.

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CHAPTER 1

INTRODUCTION

Entrepreneurial activity, a phenomenon of interest to researchers, is a driver of economic development (Malecki, 1994) and growth (Carree & Thurik, 2003). The noneconomic and economic outcomes (Jennings & Brush, 2013) of entrepreneurship in nations, regions, and local communities highlight the importance of studying entrepreneurial activity at scales ranging from the firm to household to the individual (Steyaert & Katz, 2004). While the supply of entrepreneurs is variable at different scales and places (Baumol, 1990); policy measures impact not only the institutional environment (Baumol, 1990; North, 1990) but also entrepreneurial activity and behavior (Minniti, 2008). Entrepreneurial activity and behavior are influenced by investment, tax, and entrepreneurial policy enacted at the national to local levels (Von Bargen, Freedman, & Pages, 2003). For example, over the last four decades, the United States' innovation policy enacted at the national level and implemented at the local level has encouraged entrepreneurial activity between universities and industries.

Following the passing of the 1980 University and Small Business Patent Procedures Act (Bayh-Dole Act), research developed in university labs were transferred to industry for commercial and practical use (Shane, 2004) and an emerging research stream focused on the concept of academic entrepreneurship developed. Academic entrepreneurship studies focus on researchers within a university context who transfer knowledge to industry partners via new firms, products, services, or processes (Shane, 2004) and how federal policies as well as the creation of entrepreneurial universities (Etzkowitz, 2004; Guerrero & Urbano, 2012), foster new venture activity.

As noted by scholars, the idea of who is an entrepreneur, what constitutes entrepreneurship, and where entrepreneurship takes place is evolving (Jennings & Brush, 2013; Steyaert & Katz, 2004). One evolving definition is that of the academic entrepreneur, a researcher who engages in commercializing their research (Shane, 2004). Commercial activity is produced by researchers and includes a range of activities; for example, consulting, publications, patents, spinoffs, and entrepreneurial teaching methods (Guerrero & Urbano, 2012; Lam, 2011; Perkmann et al., 2013). However, as pointed out by Tartari and Salter (2015), regardless of sex, not many faculty members reach the point of a spinoff; thus, entrepreneurial activity should expand to include various activities in university and industry partnerships. This activity is more inclusive of people from underrepresented groups and illustrates their propensity to engage in innovation outside of spinoff activity (Tartari & Salter, 2015). For this study, an academic entrepreneur is defined as an individual within the university system (faculty, staff, student) that engages in university-industry collaboration, which includes commercialization and engagement (see Table 1). Mainly, an area of interest deals with the faculty themselves, since they are the initial drivers of the university innovation (Shane, 2004) and innovators create new goods, services, or processes that shift the market (Carree & Thurik, 2003; Shane & Venkataraman, 2000).

Table 1.

Types of Academic Entrepreneurship

Academic Entrepreneurship	Examples
Commercialization	Spinouts
	Consultancy
	Patents
	Copyrights
	Trademarks
	Licensing
Engagement	Advisory Board
	Contract or joint research agreements
	Training of company employees
	Participating in exhibitions
	Providing informal advice to non-academics

Source: Abreu & Grinevich, 2017; O'Shea, Allen, Chevalier, & Roche, 2004; Perkmann et al., 2013; Tartari & Salter, 2015

Engaging in academic entrepreneurship is an entrepreneurial journey bolstered by policy measures aimed at assisting researchers in reaching their goals and the university's collective goal of industry engagement. Despite national and university policy measures encouraging technology transfer, the propensity to engage in academic entrepreneurship is uneven between researchers (Thursby & Thursby, 2005). Although women at universities are more likely to produce intellectual property (patents, trademarks, copyright) in comparison to women at an industry or individual level (Sugimoto, Chaoqun, West, & Lariviere, 2015), there still is an attainment gap in entrepreneurial activity between men and women at a university level (Abreu & Grinevich, 2017; Tartari & Salter, 2015; Thurbsy & Thurbsy, 2005, Whittington & Smith-Doer, 2005; Whittington & Smith-Doer, 2008). While previous studies attribute the attainment gap between men and women to prior experience (Abreu & Grinevich, 2017; Allen, Link, & Rosenbaum, 2007), organizational model (Whittington & Smith-Doer, 2008), presence of women in a discipline (Tartari & Salter, 2015), and gendered social networks (Crowe &

Goldberger, 2009; Ding, Murray, & Stuart, 2013), there is room to explore how institutional environments impact the entrepreneurial activity of women researchers.

Background

In 1976, the first article that focused solely on women entrepreneurs was published and was primarily a descriptive summary of the characteristics of women entrepreneurs (Schwartz, 1976). The next series of publications did not emerge until the 1980s (Jennings & Brush, 2013). The subarea of women's entrepreneurship took form with publications stemming from the feminist, gender, and occupations research (Jennings & Brush, 2013). Over time, research on women's entrepreneurial propensity was broadly grouped into sociodemographic, perceptual, and contextual factors (Langowitz & Minniti, 2007).

Sociodemographic factors that play a role in the propensity for women to engage in entrepreneurial activity typically fall under the categories of age, income, work status, education, and finances (Langowtiz & Minniti, 2007). The women entrepreneur regardless of the industry type tends to share similar characteristics; 26-40 years of age (Schwartz, 1976), college educated (Hisrich & Brush, 1984; Schwartz, 1976), unmarried or divorced (Schwartz, 1976), having little to no industry experience (Brush, 1992). Those who are educated are more likely to have business administration as a major, come from an educated family, and more likely to marry an educated man (Hisrich & Brush, 1984). Women can start their business by borrowing capital, and this financial support can help women develop and strengthen their businesses, but it is not an easy task (Buttner & Rosen, 1989). Though loan officers do not legally discriminate based on gender, they do perceive women entrepreneurs to be less entrepreneurial (Buttner & Rosen, 1989). This perception is problematic because women entrepreneurs struggle to receive financing from institutions and need to use a range of loan sources, often internal sources – credit cards and

personal loans (Anna, Chandler, Jansen, & Mero, 2000; Buttner & Rosen, 1989). Financial planning, training, and support are not the only challenges women entrepreneurs face; they also lack business knowledge, managerial experience, and education (Hisrich & Brush, 1984; Schwartz, 1976).

Perceptual factors that play a role in the propensity for women to engage in entrepreneurial activity typically fall under opportunity recognition, risk tolerance, and confidence of skills (Langowitz & Minniti, 2007). Research suggests that women are less likely to pursue opportunities because they have unfavorable views of their abilities and the entrepreneurial environment (Langowitz & Minniti, 2007; Malach-Pines & Schwartz, 2008). Women also juggle complex relationships between familial obligations, community connections, and business operations (Brush, 1992). Context also mediates the rationale for women starting businesses. Women entrepreneurs are motivated to start businesses as a response to previous employment, out of necessity or opportunity, because of the social or physical environment, or to reach defined goals (Global Entrepreneurship Monitor (GEM), 2017). These motivational behaviors vary between income, class, country economic status, and race. Women from developed countries tend to form businesses for opportunistic reasons (Brush & Cooper, 2012; GEM, 2017), whereas women from the developing countries form businesses out of necessity, with an added desire to contribute to household income (Brush & Cooper, 2012). Prior research also highlights that women have negative perceptions of their capabilities and the entrepreneurial environment, which negatively influences their entrepreneurial propensity (Langowitz & Minniti, 2007; Malach-Pines & Schwartz, 2008). These perceived constraints include financial barriers to entrepreneurship, which may underlie some of the noted financial constraints that women entrepreneurs face.

Contextual factors that play a role in the propensity for women to engage in entrepreneurial activity typically fall under informal and formal networks, role models, and family responsibilities. The level of human and social capital of entrepreneurs, as well as the social networks they access, are all critical to obtaining the necessary information about available entrepreneurial opportunities. The composition of women's social networks impacts the information they receive about entrepreneurial opportunities. Comparative work on men and women entrepreneurs finds that men possess higher levels of human and social capital than women, which explains why they discover more business opportunities (Gonzalez-Alvarez & Solis-Rodriguez, 2011).

Understanding the contextual factors that play a role in the propensity for women to engage in entrepreneurial activity is expanding to include the institutional setting, particularly how informal and formal institutions constrain or enable activity (Giménez & Calabrò, 2017). Welter and Smallbone (2011) found that informal institutions such as social norms impact women's entrepreneurial behavior and opportunity recognition. For example, the portrayal of entrepreneurship as a masculine endeavor hinders women's decision to enter entrepreneurship because of the lack of women representation in the media (Achtenhagen & Welter, 2011). Social norms also hinder entrepreneurship for women. For example, social norms such as domestic responsibilities (Estrin & Mickiewicz, 2011), entering traditional female industries such as retail (Anna et al., 2000), or following the norms of their religion or ideology (Ahl & Nelson, 2010; Welter & Smallbone, 2008). Formal institutions such as rules and regulations (Giménez & Calabrò, 2017; North, 1990; Welter, 2011), political rule (Giménez & Calabrò, 2017), and education (Giménez & Calabrò, 2017) can also impact women's entrepreneurial behavior and opportunity recognition (Welter, 2011). Regulations in some societies can have discriminatory

practices that hinder women's desire to become entrepreneurs (Estrin & Mickiewicz, 2011) or in some cases, entrepreneurial policies have gendered discourse (Ahl & Nelson, 2015) which are subtle in the ways they constrain women entrepreneurs.

Research on women entrepreneurs over the last 40 years has centered on comparative studies between men and women related to sociodemographic, perceptual, and contextual factors. An emerging area for research is studying the contextual factors. Contexts that are underexplored are corporations, households, family businesses, and universities (Jennings & Brush, 2013). Thus, this dissertation study intends on researching constraining and enabling factors institutions have on the entrepreneurial propensity of women faculty in a university setting.

Objective and Research Question

Given the gaps in the women entrepreneurship knowledge base, **the objective** of this dissertation is to understand how institutional environments play a role in the propensity to engage in entrepreneurial activity. To address the objective of this dissertation, the following **research question** is asked: how do university policy, support measures, and reward systems constrain or enable the entrepreneurial activity of white women faculty in engineering?

Propositions

Faculty are hired to teach or conduct research and those that wish to engage in entrepreneurial activity, typically need expertise that is found within support measures. Within an entrepreneurial university –a university that values entrepreneurship– programs are developed to support researchers who wish to engage in entrepreneurial activity (Guerrero & Urbano, 2012; O'Shea, Allen, Chevalier, & Roche, 2005), which include the technology transfer office and training programs (Guerrero & Urbano, 2012). Proactive measures to support entrepreneurship

increase engagement and universities that provide direct support to women in STEM have increased entrepreneurial activity (Tartari & Salter, 2015). Thus, there is room to understand how universities provide the support that can increase participation, which in turn results in increased entrepreneurial activity that can transfer into the economy.

Proposition one. White women engineering faculty's entrepreneurial activity is positively influenced by university support programs supporting diversity and inclusion in science, technology, engineering, and mathematics (STEM).

Researchers are motivated to engage in entrepreneurial activities because of rewards, reputation, finances, or intrinsic satisfaction (Lam, 2011). To encourage involvement in entrepreneurial activity, universities create financial incentives (salary, royalties, equity) (Goldfarb & Henrekson, 2003), which do not always increase activity (Goldfarb & Henrekson, 2003) because faculty are promoted based on research or teaching (Lam, 2011). At a university level, technology transfer policies encourage entrepreneurship, rewarding such engagement through financial incentives. However, interactions at a department level are more influential to the entrepreneurial activity of faculty (Bercovitz & Feldman, 2008; Rasmussen, Mosey, & Wright, 2014), suggesting that tenure and promotion policies might constrain or enable engagement. When department policy on tenure and promotion do not align with the university policy, it serves as a barrier in disclosing intellectual property (Wright, 2014). The presence of a tenure and promotion policy that rewards entrepreneurship is important in studying women researchers because of the existing perception of career interference (Alonso-Galicia, Fernandez-Perez, Rodriguez-Ariza, & Fuentes-Fuestes, 2015; Ding, Murray, & Stuart, 2006).

Proposition two. White women engineering faculty's entrepreneurial activity is negatively influenced by reward systems that do not include entrepreneurial activities in tenure and promotion policies.

Since entrepreneurship is gendered (Ahl, 2006; Brush, De Bruin, & Welter, 2009; Jennings & Brush, 2013), researchers call for a gender-aware approach (Brush et al., 2009). Entrepreneurship research that takes a gender-aware lens acknowledges that unpaid work that occurs in the household is important to include in analyses on entrepreneurs (Ahl, 2006; Brush et al., 2009). One suggestion is to consider family orientation as domestic work, family responsibilities, or care work (Brush et al., 2009) in framing entrepreneurial activity. While much of the literature on women academic entrepreneurship focuses on disparities between women and men researchers (Whittington, 2011), there is a growing interest in looking at the role domestic responsibilities play in propensity (Tartari & Salter, 2015; Whittington, 2011), particularly comparing women without children to women with children (Whittington, 2011).

Some research suggests that family responsibilities can reduce engagement in faculty, particularly, women (Tartari & Salter, 2015), however, this study used age as a proxy to determine the presence of children and did not have this information directly. In studies that did have motherhood information, it was found that the perceived and actual time that is dedicated to care work responsibilities supersedes patenting involvement, particularly since it is not a career advancement incentive in promotion policy (Whittington, 2011). Additionally, this perceived and actual time that is dedicated to care work responsibilities plays a role in colleagues presenting patenting opportunities to women researchers with children (Whittington, 2011). However, regardless of motherhood status, when women researchers participate in patenting activities, they are more likely to continue participating, and their patents are cited as frequently as men

indicating that it is not a quality of research issue that plays a role in disparities (Whittington, 2011). Research on disparities in the workplace do not commonly focus on women researchers involved in technology transfer; thus, there is room to understand more about how child and care work responsibilities factor in academic entrepreneurship. Furthermore, there is room to understand how family orientation to policies can enable or constrain the entrepreneurial activity of women researchers.

> **Proposition three.** White women engineering faculty's entrepreneurial activity is positively influenced by university policies that provide support for childcare and household responsibilities.

The Case Studies

This study takes place in Michigan, which is located within the Midwestern region of the United States. Michigan is in the rustbelt, a region known for its industrial and automobile industries. Since 2007, the Michigan University Research Corridor has existed to create innovation for Michigan and the Great Lakes region (University Research Corridor, n.d.). This focus on innovation in this rustbelt state provides a context for studying university-industry engagement. Focusing on two research one universities, the constraining and enabling role institutional environments have on the entrepreneurial propensity of white women faculty in engineering at Michigan State University and the University of Michigan is explored.

Findings

While studying the entrepreneurial university and its outcomes at a macro-scale is valuable, it is important to also look at the micro-scale processes occurring in institutional settings (Bruton, Ahlstrom, & Li, 2010), which challenges the traditional notions of what constitutes the spaces and places of economic activity (Blake & Hanson, 2005; Hanson, 2009;

Steyaert & Katz, 2004). This study looks at the "everydayness" of entrepreneurship (Steyaert & Katz, 2004) as well as highlights the importance of understanding activity that occurs in the workplace. The study contributes and extends the literature on academic women entrepreneurs by taking a qualitative approach and using an institutional theory framing to analyze policies topically. The findings show that the factor that is constraining to white women engineering faculty at both universities is organizational structure. How the university rewards promotion and the number of job responsibilities faculty have are constraining factors. The factor that is enabling to white women engineering faculty at both universities is institutional change. The actions faculty take to create change within the institutional environment enables faculty as change agents.

Michigan State University white women faculty were not positively influenced by programs supporting diversity and inclusion in STEM because of a lack of programming. Whereas at the University of Michigan, white women engineering faculty were positivity influenced by programs supporting diversity and inclusion in STEM. Reward systems negatively influenced Michigan State University and the University of Michigan white women engineering faculty. Michigan State University, white women engineering faculty, were negatively influenced by policies that provided support for childcare and household responsibilities. University of Michigan white women engineering faculty were positively influenced by policies that provided support for childcare and household responsibilities, particularly travel reimbursements, daycare, and modified duty.

The structure of this dissertation is as follows: Chapter two provides an overview of the literature on entrepreneurial universities, institutional environments, and women academic entrepreneurs. Chapter three provides details on the data and methodological approaches taken to

answer the research question and propositions. Chapter four provides an overview of coding and theme development, illustrative quotes, and the answers to the research question and hypotheses. The fifth and final chapter concludes with limitations, further research directions, policy implications, and policy recommendations.

CHAPTER 2

LITERATURE REVIEW

There is growing body of research focusing on the challenges and opportunities that women entrepreneurs face in society, highlighting that women play an essential role in economic development (Brush, Carter, Gatewood, Greene, & Hart, 2006; Brush & Cooper, 2012; GEM, 2017; Jennings & Brush, 2013). Women entrepreneurs are one of the fastest growing demographics in business startups (GEM, 2017); however, they are also the most likely to exit businesses in comparison to men (Fairlie & Robb, 2009; Robb & Watson, 2012). This uneven activity is not limited to entrepreneurs within startups, but also entrepreneurial activities that occur within organizations, such as universities (Abreu & Grinevich, 2017; McMillan, 2009; Murray & Graham, 2007; Tartari & Salter, 2015). These disparities have prompted researchers to explore the various contexts that women entrepreneurs operate within and how these contexts hinder or facilitate their entrepreneurial activity (Abreu & Grinevich, 2014; Ding et al., 2013; Lindholm-Dahlstrand & Politis, 2013; Whittington & Smith-Doerr, 2008). Previous research has explored disparities women researchers face within academic disciplines (Abreu & Grinevich, 2014), social networks (Ding et al., 2013), university incubators (Lindholm-Dahlstrand & Politis, 2013), and organizational settings (Whittington & Smith-Doerr, 2008). Examining disparities and context from an institutional environment and policy perspective is an area that needs further exploration in the women academic entrepreneurship literature stream. Previous research has focused primarily on the differences between men and women's spin-off activity, disclosure rates, and patenting productivity. Studying disparities between women and within institutional environments differs from previous research because it looks beyond the attainment gap.

Institutional theory, as a theoretical framework is useful in exploring how formal or informal institutions influence the entrepreneurial behavior or activity of individuals.

This chapter explores the literature on academic entrepreneurship using institutional theory to frame the findings and highlight the gaps in the literature. The first section introduces the concepts of institutional theory. The second section explores how concepts of institutional theory lend itself to research on entrepreneurship. The third section examines the role institutional environments play in academic entrepreneurship and describes why the influence of policy on women researcher's entrepreneurial activity is a gap in the knowledge base. The fourth section narrows the focus to women researchers and factors that hinder or facilitate their entrepreneurial propensity. The fifth and final section of the chapter synthesizes the literature to form a conceptual framework that can inform future research on institutional environments and the role it plays on women researcher's entrepreneurial propensity.

Institutional Theory

Institutional theory refers to principles that guide the behavior of individuals, organizations, and societies. These principles are considered rules (North, 1990), assumptions (Meyer & Rowan, 1977), or acceptable or nonacceptable actions (DiMaggio & Powell, 1991; Meyer & Rowan, 1977) that can become standard behavior (Zucker, 1987). Institutional theory is useful for understanding the process of how norms and rules are created across varying temporal and spatial contexts (Scott, 2005) and how they can influence the behavior of individuals and organizations across micro-macro scales (Scott, 2008). Institutions can enable or constrain economic development behavior (North, 1991; Scott, 2005) and actions implicitly or explicitly (DiMaggio & Powell, 1991).

The rules and norms that form the basis of the institutional theory are categorized into regulative, normative, and cognitive (Scott, 2008). The regulative category of institutional theory refers to behavior that is guided by the government, regulations, and laws (DiMaggio & Powell, 1983; North, 1990; Scott, 2008). For example, the legal structure of a country or state can facilitate the ease of starting a business (Aldrich & Fiol, 1994; Bruton et al., 2010). In Stenholm, Acs, & Wuebker's (2013) global country-level analysis of 63 countries, it was found that entrepreneurial activity was most encouraged by the regulative category compared to the normative and cognitive categories. However, in terms of high growth firms, knowledge spillovers and capital were the best predictors of new entrepreneurial activity (Stenholm et al., 2013). The normative category refers to behavior that is guided by values and norms (Scott, 2008) that are considered acceptable within a society or profession (Bruton et al., 2010). Individuals within industries and organizations behave in accordance with what is expected and how things are normally done (Stenholm et al., 2013)**.** These cultural norms of a society can influence the desire to become an entrepreneur. In an analysis of German newspaper media representations of women entrepreneurs, it was found that while the country's portrayal of women entrepreneurs was positively changing over time, there still were improvements that could be made in how these images transmitted to the population at large (Achtenhagen & Welter, 2011; Stenholm et al., 2013).

The cognitive category refers to behavior that is based on shared culture and beliefs (Scott, 2008). For example, the focus on the cognitive aspect of institutional theory determined that a strategy to create new industries at an institutional level is to encourage knowledge development through education (Aldrich & Fiol, 1994). The cognitive aspect of institutional theory was also one of three variables used in a study of 63 countries across the globe (Stenholm

et al., 2013). Stenholm et al. (2013) studied non-entrepreneurs who perceived they had the skill and knowledge to start a business and who knew people that started a business. Cognition as an institutional category is apparent in the perception of skills needed to start a new business, the ease of business entry, and the availability of resources (Busenitz, Gomez, & Spencer, 2000).

Institutional Environment and Entrepreneurship

Bruton and colleagues (2010) reviewed nine entrepreneurship journals and 44 articles on institutions and their impact on entrepreneurship. Following this review, institutions were categorized into three main streams; institutional setting, legitimacy, and institutional entrepreneurship (Bruton et al., 2010). Institutional setting refers to the environmental structures that help with business entry, legitimacy refers to a business being deemed acceptable and conforming to values, while institutional entrepreneurship refers to an entrepreneur's ability to develop or change institutions (Bruton et al., 2010). For this dissertation study, institutional setting is the stream that frames the research questions, hypotheses, conceptual framework, and findings.

Reviews on entrepreneurship and institutional settings focus on how variations across regions (Welter, Brush, & De Bruin, 2014) and the types of institutional settings (Welter et al., 2014) influence entrepreneurial opportunities (Hwang & Powell, 2005). The types of institutional settings that emerge across regions are mainly economic, political, and cultural (Welter & Smallbone, 2011) and these institutional settings impact the rate of startup activity (Hwang & Powell, 2005). Institutional settings create an environment where entrepreneurs need to overcome barriers or conform to barriers, to have their business created or thrive (Aldrich & Fiol, 1994). The impact of institutional settings is apparent in how regulations (Stenholm et al., 2013) interact with new and existing organizations (Aldrich & Fiol, 1994). For example,

governments can create supportive or non-supportive environments through policy (Bruton et al., 2010), these policies can encourage individuals to start a business or if there is too much red tape (Aldrich & Fiol, 1994), then individuals are discouraged from the process (Bruton et al., 2010). These rules and regulations do not impact all entrepreneurs the same.

While scholars identified that institutions can constrain or enable organizations (Aldrich, 1990) and individuals (Bruton et al., 2010; Waldinger, Aldrich, & Ward, 1990), others have contributed to institutional theory by conceptualizing how individuals and organizations can change how institutions operate (Battilana, 2006; DiMaggio, 1988; Welter et al., 2014). Institutional theory's foundations assume that individuals and organizations are comfortable in their institutional settings (Zucker, 1987), which perpetuate the existence of institutions (DiMaggio, 1988). Institutional theory's theoretical gap is the assumption that individuals and organizations do not have an agency or interest in creating new institutions (DiMaggio, 1988). This limitation led to the conceptual development that people and organizations can evoke change as institutional entrepreneurs – people and organizations that have enough resources to push forward interests (DiMaggio, 1988). Since the introduction of institutional entrepreneurship, a model of the process of institutional entrepreneurship has developed, which provides insight into how individuals and organizations change institutions (Battilana, 2009). In a review of the institutional literature, DiMaggio (1988) questioned how change occurred within formal and informal institutions and developed the definition for an institutional entrepreneur as someone who sees opportunities to create change. Prior to this articulation of the institutional entrepreneur, Meyer and Rowan (1977), in their review of the literature, identified reasons why norms and rules might need change. Findings suggested that organizations often have gaps between what is practiced in the workplace and the policies and programs that are in place

(Meyer & Rowan, 1977). These organizational structure gaps create conflict in the need for an organization to be efficient and adhere to policies and programs (Meyer & Rowan, 1977). These conflicts provide room for change to occur within institutions (Battilana, 2006; Welter et al., 2014).

Battilana's (2006) review of the literature resulted in a model that considered how social position could explain how institutional change occurs. Individuals from underrepresented groups or lower status may not have the resources or decision-making power to create change; however, if they have status within their organization, they can create change whether they are aware they are creating change (Battilana, 2006). Battilana (2006), in the model, identifies the three positions that a person can have within an organization: informal, formal, and duration in position. For example, an individual might not have a highly ranked formal position within an organization, but in their informal interactions with individuals within an organization they have status. Additionally, positions in organizations are fluid and can change over time; a person may be in a position for a long time and have more status because of that. These roles in organizations and networks can increase the likelihood they will act as an institutional entrepreneur (Battilana, 2006). A literature review on how institutions change identified the importance of considering the institutional environment in which a person operates (Welter & Smallbone, 2011). Differentiating between institutional environments is important because not all individuals respond the same to constraints (Welter & Smallbone, 2011). Welter et al. (2014), in their review of 83 articles from 11 journals, identified that organizations and individuals can act as change agents based on emotions and social status. Welter et al. (2014) argue that because the change can be intentional or unintentional, that the word institutional entrepreneurship is not the appropriate word to use and that institutional change agent is the appropriate word choice.

Institutional Environment and Academic Entrepreneurship

Several factors contribute to the promotion of academic entrepreneurship within a university. In a review of 173 articles from 28 journals, Rothaermel, Agung, & Jiang, (2007), found that academic entrepreneurship research is separated into four research themes: new firm creation, the productivity of the technology transfer office, regional networks, and development of the entrepreneurial university. For this dissertation study, the focus is on the entrepreneurial university, which according to Rothaermel and colleagues (2007) includes incentive systems, role and identity, faculty, university status, culture, and experience.

Patent protections have existed within the United States since the 18th century (Sandberg et al., 2014), however it was not until the 1980s that a formal policy was enacted with respect to intellectual property rights within universities (Rasmussen, Moen, & Gulbransen, 2006; Sandberg et al., 2014) leading to research on academic entrepreneurship. Previously, the university researcher's intellectual property rights that were developed with federal dollars were owned by the federal government (Rasmussen et al., 2006). With the passage of the Bayh Dole Act, intellectual property rights were given to the university instead of the researcher (Goldfarb & Henrekson, 2003).

The passage of this legislation incentivized universities (Rothaermel et al., 2007) to create technology transfer offices (Goldfarb & Henrekson, 2003; Walter, Ihl, Mauer, & Brettel, 2013) and pass policies on how income could transfer to the university, researcher, and departments (Rasmussen et al., 2006). The passage of the Bayh Dole Act in 1980 encouraged the development of the entrepreneurial university (Guerrero & Urbano, 2012; Walter et al., 2013), which are universities that in addition to teaching, research, and service, include economic development of regions as part of their mission (Guerrero & Urbano, 2012). The university prior

to the Bayh Dole Act was not fully committed to the technology transfer process, however science policy at the federal level created incentives for universities to engage with industry partners at a higher rate (Walter et al., 2013; Sandberg et al., 2014) and benefit from licensing profits (Sandberg et al., 2014) and technology transfer office expertise (Goldfarb & Henrekson, 2003).

The entrepreneurial university model has its proponents, but also has its critics, who bring up main arguments against the entrepreneurial university. While the Bayh-Dole Act can be credited for getting university discoveries to the public, one of the major critiques of the Act is that it has changed universities from a place of knowledge (Berman, 2012) to a place that can be profitable. Another critique of the entrepreneurial university is that the focus on quantitative measures and revenue brought in by the universities created the development of research such as the Association of University Technology Managers (AUTM) reports (Etzkowitz, 2016). This focus on revenue focused metrics do not consider the social dimensions of the university and overlooks issues of diversity in the university (Etkowitz, 2016). The limitations of the metrics make it difficult to measures the true public value of the entrepreneurial university in society. The entrepreneurial university operating within a neo-liberal ideology is another critique because it encourages a corporate culture within a space that is for educating people (Giroux, 2002). The commodification of the university and the labeling of the university as a firm instead of a place where education is accessible is another critique that individuals have of the entrepreneurial university (Connell, 2013). The university within this model is no longer responding to the demands of creating a culture of education but responds as a firm to the uncertainties of the market (Connell, 2013; Giroux, 2002).

The university model traditionally consists of teaching, research, and service (Guerrero & Urbano, 2012). However, with the advent of the commercialization focus, universities combine the new entrepreneurial driven goals with the traditional missions (Walter et al., 2013), leading to a misalignment of values (Lam, 2011) and policies (Renault, 2006). At an organizational level, universities are embracing the participation of faculty in technology transfer by creating research parks, incubators, technology transfer offices, and research centers that encourage the disclosure of inventions. This cultural (Rothaermel et al., 2007) change at universities encourages researchers to become involved in the commercialization process, which generates income. For example, it was found that universities that have royalty distribution policies generate patenting activity (Lam, 2011), resulting in startups (Di Gregorio & Shane, 2003) and increased licensing (Lach & Shankerman, 2008) and royalty (Friedman & Silberman, 2003) income.

The development of the entrepreneurial university is a result of universities transforming their institutional logics in reaction to government policy. Analyzing 200 survey responses from 50 Spanish public universities, it was found that factors that play a role in the entrepreneurial university can be separated into environmental and internal factors (Guerrero & Urbano, 2012). Within the university context, there are informal and formal environmental factors and resources and capabilities that contribute to the development of an entrepreneurial university (Guerrero & Urban, 2012). Formal environmental factors within a university context fall under four areas, policies (e.g., royalties and ownership) (Rothaermel et al., 2007), entrepreneurial organization and governance structures (e.g., mission statement and organizational model) (Guerrero & Urbano, 2012), entrepreneurship education (e.g., business training) (Guerrero & Urbano, 2012), and support measures for entrepreneurship (e.g., technology transfer offices or programs) (Guerrero & Urbano, 2012). A case study using secondary AUTM data of 10 American

university entrepreneurial environments (Schultz, 2014) identified the policies that are implemented within a university to encourage entrepreneurship. These policies include the development of a royalty distribution, conflict of interest, and tenure and promotion policies in addition to the presence of business training and business competitions (Schultz, 2014).

Informal environmental factors within a university context fall under three areas, culture (e.g., university community attitude towards entrepreneurship) (Guerrero & Urbano, 2012; Rothaermel et al., 2007), entrepreneurial teaching methodologies (e.g., presence of course offerings in entrepreneurship) (Guerrero & Urbano, 2012; Schultz, 2014), and role models (e.g., presence of individuals participating in entrepreneurial activity) and reward systems (e.g., policies rewarding innovative activity) (Guerrero & Urbano, 2012). Schools with business training and funding available to students through business competitions tend to have more startups (Schultz, 2014) and departments that have policies encouraging mentors and role models tend to have more spinoff success (Rasmussen et al., 2014) indicating that informal environmental factors are also important to academic entrepreneurship. The formal and informal environmental factors at a university were developed off the foundations of institutional theory (Guerrero & Urbano, 2012), and these factors can be used to study academic entrepreneurship. Environmental factors contribute to the development of the entrepreneurial university, highlighting the importance of understanding institutional environments and those that operate within those settings. Factors that are important to the development of entrepreneurial universities are attitudes towards entrepreneurship, presence of entrepreneurship education, role models, and reward systems (Guerrero & Urbano, 2012).

Institutional Environment and Women Academic Entrepreneurs

The research on women researchers engaging in commercial activity is primarily situated within entrepreneurial activity factors, followed by perceptual factors, and finally by contextual factors. Entrepreneurial activity factors are factors relating to attainment gaps, networks, patent involvement, experience, and collaboration. Women researcher's entrepreneurial activity increases with collaboration with industry (Meng, 2016) as found in an analysis of 1,283 surveys of American research one university professor's patent involvement. In an exploration of 151 American research universities, it was found that women researcher's entrepreneurial activity increases with collaboration with research center affiliations (Gaughan & Corley, 2010). In researching spinout activities, 40 interviews were conducted at 20 UK universities and it was found that entrepreneurial activity increased when working with teams of the same sex or mixed sex (Rosa & Dawson, 2006). These collaboration efforts are important to increase participation, because women tend to have fewer industry ties (Crowe & Goldberger, 2009), benefit from having experience in commercialization (Abreu & Grinevich, 2017; Allen et al., 2007), and benefit from having a presence of women in their discipline (Tartari & Salter, 2015). This is evident in surveys of 1,782 professors in 52 American universities engaging in consulting (Crowe & Goldberger, 2009), 22,556 faculty in the United Kingdom engaging in spinout activity (Abreu & Grinevich, 2017), 1,335 professors in the United States engaging in patent activity (Allen et al., 2007), and 2,194 faculty in the United Kingdom engaging in consulting and other engagement efforts (Tartari & Salter, 2015). Though there are disparities between men and women researchers, a survey of 23,839 faculty in the United States found there is another gap between women with children and women without; women with children receiving fewer invitations to participate in patenting (Whittington, 2011).

Perceptual factors are factors relating to perceptions, risk tolerance, confidence, alertness, attitude, and motivations (Langowtiz & Minniti, 2007). Women researchers tend to have a negative perception of (Alonso-Galicia et al., 2015; Murray & Graham, 2007) or no interest (Abreu & Grinevich, 2017) in commercialization because they consider their career trajectory when making decisions to engage with commercial activity (Ding et al., 2006). This decision is at times based on a risk aversion because of wanting to align behaviors with university reward structures (Howe et al., 2014) as explored in a focus group of six faculty at the Ohio State University. Contextual factors (Langowtiz & Minniti, 2007) are factors relating to spatial, historical-temporal, and institutional contexts (Welter et al., 2014). A survey of patent involvement of 3000 faculty in the United States found that organizational models can influence disparities between men and women (Whittington & Smith-Doerr, 2008) because organizations that formally support women in science tend to have increased engagement rates (Tartari & Salter, 2015).

While research on women academic entrepreneurs have focused on sociodemographic and perceptual factors to frame the propensity to engage, there is room to understand the role of contextual factors, specifically workplace policies on women researchers. The literature on women academic entrepreneurs have identified a host of factors that play a constraining or enabling role in the gender gap in propensity to commercialize (Ding et al., 2013; Goel, Goktepe-Hulten, & Ram, 2015; Murray & Graham, 2007; Tartari & Salter, 2015). For example, Howe et al. (2014) and Ding et al. (2006) found that informal factors like the reward structure of the university constrain women and risk aversion and behavior are adopted. While Tartari & Salter (2015) found that lack of formal commitment to supporting women faculty is a constraining factor that falls under the formal environmental category. Availability of

entrepreneurial training (Howe et al., 2014) and faculty ranking (Murray & Graham, 2007) are indicators of environmental factors that enable entrepreneurial activity.

The nature of entrepreneurship is gendered (Ahl, 2006; Jennings & Brush, 2013), and this holds true for academic entrepreneurship (Faltholm, Abrahamsson, & Kallhammer, 2010). Though the number of women with advanced science and technology degrees has increased (Fox, 1995), women scientists do not have the same propensity to commercialize their work in comparison to men (Colyvas, Snellman, Bercovitz, & Feldman, 2012; Murray & Graham, 2007; Whittington & Smith-Doerr, 2005) and they do not report (Colyvas et al., 2012) or commercialize (Whittington & Smith-Doer, 2005) their ideas as often as men despite having the same quality of work (Whittington & Smith-Doerr, 2005) and publication patterns (Thursby & Thursby, 2005). The differences in propensity are related to less prior business experience (Abreu & Grinevich, 2017), prior patent record (Goel et al., 2015), leadership roles (Goel et al., 2015), gender stratification (Murray & Graham, 2007), gendered discourse (Faltholm et al., 2010), and resources (Colyvas et al., 2012; Rosa & Dawson, 2006; Stephan & El-Ganainy, 2007).

Support measures. Support measures are systems that are in place to assist faculty, students, and university personnel (Guerrero & Urbano, 2012) through the various stages of academic entrepreneurship (Wood, 2011). These support measures range from the technology transfer office (Guerrero & Urbano, 2012; Markman, Phan, Balkin, & Gianiodis, 2005) to entrepreneurship education (Guerrero, Cunningham, & Organ, 2014; Guerrero & Urbano, 2012) to business plan services (Rasmussen et al., 2006) to university seed funds (O'Shea et al., 2005; Guerrero et al., 2014). Interviews with 128 technology transfer directors highlight that the transfer office's role in the university is to educate faculty on commercialization options, provide

legal support on intellectual property, and connect industry with university intellectual property (Markman et al., 2005). Entrepreneurship education is the presence of entrepreneurship training opportunities and entrepreneurship course availability within the university (Guerrero & Urbano, 2012; Guerrero et al., 2014; Rasmussen et al., 2006). Studies of European universities and reviews of the literature find that business plan services are the availability of experts who provide advice on business plans (Rasmussen et al., 2006) and additionally provide the opportunities for business plan competitions (Hayter, Nelson, Zayed, & O'Connor, 2018). Access to financial resources is a key determinant in business startup success and survival (Brush et al., 2009), thus in a case study analysis of European universities, it is found that there are university seed funds which provide financial assistance at the beginning stages of the academic entrepreneurship process (Guerrero et al., 2014).

While support measures vary in the purpose in which they serve the individuals, they are important factors in the development of the entrepreneurial university (Guerrero & Urbano, 2012). In a review of 209 articles in 53 journals, it was found that support measures for individuals allow for the development of an entrepreneurial infrastructure or ecosystem within the university (Hayter et al., 2018). The effectiveness and development of these support measures for individuals are impacted by various factors. For example, access to resources that the technology transfer office has (O'Shea et al., 2005) or if it has a for-profit business structure which is linked to the creation of new firms (Markman et al., 2005). While previous research has focused on the ability of technology transfer offices to produce spinoffs (O'Shea et al., 2005), access resources (O'Shea et al., 2005), and support individuals (Guerrero & Urbano, 2012), there are not as many studies on the gendered aspects of these support measures. Previous studies in Australia and the United Kingdom found that a relationship between support measures and

individuals has primarily focused on students (Russell, Atchinson, & Brooks, 2008). These studies focused on students and the effectiveness of business plan competitions (Russell et al., 2008) and entrepreneurship education (Souitaris, Zerbinati, & Al-Laham, 2007) or the general impact technology transfer has on all faculty regardless of sex (O'Shea et al., 2005). The studies on women faculty and support measures have focused on incubators (Lindholm-Dahlstrand & Politis, 2013), research centers (Gaughan & Corley, 2010), and technology transfer offices (Murray & Graham, 2007). Thus, there is room to understand how support measures that focus on assisting women researchers play a role in their propensity to engage in entrepreneurial activity.

Rewards and incentives. Incentive structures serve as a catalyst in increasing the commercialization process within universities (Rasmussen et al., 2006); thus, policies are formed that encourage startup creation (Di Gregorio & Shane, 2003). The literature on how incentive structures increase researcher participation in the commercialization process can be categorized into three levels: science and institutional policy, organizational and university models, and individual beliefs and perspectives (Renault, 2006; Walter et al., 2013). This is based on interviews with 98 professors at 12 Southern universities in the United States (Renault, 2006) and surveys of 1686 faculty at nine German universities.

The role incentive system design plays in technology transfer is a recent topic of discussion amongst scholars (Rothaermel et al., 2007; Walter et al., 2013) who provide insight into the conditions that stimulate entrepreneurial activity in universities. The incentive system and policy within the university in addition to external factors such as industry conditions and government policies play a role in entrepreneurial activity (Rothaermel et al., 2007) amongst faculty, within departments, and within technology transfer offices (Friedman & Silberman,

2003). These incentive systems are categorized as pecuniary and non-pecuniary rewards, for example in the United States and Sweden, pecuniary rewards include salary, royalties, and equity (Goldfarb & Henrekson, 2003), while non-pecuniary rewards include recognition (Lam, 2011), publication citations, and career advancement (Sandberg et al., 2014). It could be assumed that pecuniary rewards would lead to non-pecuniary rewards; however, in an academic setting, entrepreneurial activity does not necessarily translate into career advancement policies (Sandberg et al., 2014).

Since the early 20th century, tenure policies have existed at universities as a mechanism to protect academic speech, with many schools considering publications as an indicator of career advancement (Renault, 2006; Sandberg et al., 2014). While most tenure and promotion policies at universities do not reward intellectual property, there are a growing number of universities in the United States that are recognizing innovation as a career advancement activity (Sandberg et al., 2014). These universities that serve as an example of providing clear language in tenure and promotion policies are Virginia Polytechnic Institute and State University, Texas A&M University, and the University of Arizona (Sandberg et al., 2014). As universities begin to consider recognizing innovation as a career advancement policy, it is to be seen if entrepreneurial activity increases. While previous research on incentive system design can be categorized within the levels of science and institutional policy, organizational and university models, and individual beliefs and perspectives (Renault, 2006; Walter et al., 2013), there is room for more examination into the researcher's propensity for entrepreneurial activity; particularly that of women. The literature on incentive systems focuses mainly on federal policy's incentivizing universities, royalties incentivizing researchers, and reputation incentivizing researchers. There still is room to investigate further other policies that are more

relevant to the experiences of women given that policies are gendered through discourse and application (Ahl & Nelson, 2015).

Family orientation. Despite the growing number of studies on women and academic entrepreneurship (Abreu & Grinevich, 2017; Meng, 2016; Goel et al., 2015; Tartari & Salter, 2015; Sugimoto et al., 2015) that study the gender gap in patenting in various disciplines, there still is a need to understand how policy impacts the propensity to engage in entrepreneurial activity within a university context; particularly how family friendly workplace policies impact women. Previous studies in the United States and Norway have shown that marriage, motherhood, and presence of children play a role in the publication productivity of women (Cole & Zuckerman, 1987; Fox, 2005; Kyvik, 1990). Other studies indicate that increased publication productivity is not linked to being married, with findings showing that married women publish as frequently as single women (Cole & Zuckerman, 1987). Presence of children is a factor that needs to be considered when considering the publication productivity of women because the availability of childcare (Kyvik, 1990) and age of the children (Kyvik, 1990) are important indicators for women's publication productivity. For example, women who have children under the age of ten are less productive than men and women who have children over the age of ten (Kyvik, 1990). This finding conflicts with other studies that have found that women with preschool aged children are more productive than those without children (Fox, 2005). The explanation for this finding could be the availability of childcare and professional ranking, which is found to be critical to women's productivity (Kyvik, 1990).

The presence of children influences publication productivity for women faculty, and it is also influential to the tenure process (Probert, 2005). Women faculty are less likely to gain tenure because of the presence of children or are more likely to leave the profession because of

the constraints in the tenure review process (Finkel, Olswang, & She, 1994; Finkel & Olswang, 1996; Probert, 2005). These reasons indicate a need for policies that are sensitive to the added layer of complexity to a women's role as a faculty member. Some studies have looked at how family-friendly workplace policies in social work have helped women faculty (Gerten, 2011), and it has been found that the policies have different impacts on those who are mothers while on the tenure-track (Gerten, 2011). For example, at universities, policies tend to focus on adoption, childbirth, or illness (Fox, 2005; Mayer & Tikka, 2008), while these policies are intended to help women faculty, it was found that women do not take advantage of policies because of a perception that it hinders career advancement (Gerten, 2011). These policies are in place to benefit women and provide them with assistance, but they do not necessarily indicate representation for more women in higher education (Mayer & Tikka, 2008) or that it will improve work environments (Fox, 2005).

Family policies are important from a national standpoint because they are a legal requirement (Gerten, 2011; Mayer & Tikka, 2008) and from an organizational standpoint, they are essential to the careers of women (Fox, 2005; Mayer & Tikka, 2008). These policies, while enacted to benefit women faculty and women with children, they have unintended consequences, such as being perceived as career hinderances (Gerten, 2011). The growing body of literature on academic entrepreneurship and the experiences of women faculty has not yet touched on how family policies may or may not impact the propensity to engage in entrepreneurial activity within a university context and this is a gap in the literature.

Academic entrepreneurship is an activity conducted in addition to research, teaching, and service, and women perceive it as a time-intensive activity that might slow down career advancement (Murray & Graham, 2007). Understanding family friendly workplace policies that

consider care work, childcare, and other domestic responsibilities might highlight if these policies can alleviate some of the time pressures that women face when considering academic entrepreneurship. Further research is needed to understand how policies, such as family-oriented policies may hinder or facilitate entrepreneurial propensity.

The Significant Contributions of This Study: Conceptual Model of Policy Impacts on White Women in Two University Environments

As evidenced in this literature review, there are some areas for contribution in researching academic entrepreneurship. In the general research stream on academic entrepreneurship, most research is conducted on startups, spinouts, or patents and the focus needs to be expanded to consider the engagement that occurs mostly by people from underrepresented groups (Tartari & Salter, 2015). This dissertation study considers commercialization and engagement as academic entrepreneurship, which is not done in previous studies on women researchers which focus on either only commercialization (Whittington & Smith-Doerr, 2005) or engagement (Tartari & Salter, 2015). There is also room for exploration about contextual factors and their influence on entrepreneurial propensity. The literature also does not examine how formal environmental factors such as university and department policies can affect the propensity of women researchers to engage in academic entrepreneurship. Specifically, there is more room to understand the constraining and enabling factors such as support measures, reward incentives, and family orientation on the propensity to engage in entrepreneurial activity.

Conceptual model development is a useful tool for understanding processes that occur within a system. When considering how to understand the relationship between the university policy, faculty, and entrepreneurial activity, some concepts that are important to consider are gender, motivation, and entrepreneurship processes. To understand the constraining and enabling factors, studies on entrepreneurial universities (Guerrero & Urbano, 2012), motivation (Lam,

2011), academic entrepreneurship processes (Wood, 2011), and gender (et al., 2009; Jennings & Brush, 2013; Tartari & Salter, 2015) were synthesized to conceptualize environmental factors that constrain or enable the entrepreneurial activity of white women engineering faculty (see Figure 1).

This model was developed based on insights from the literature and serves to guide the reasoning behind hypotheses development, data collection, data analysis, and data interpretation. The conceptual model is comprised of four segments; policy, value orientation, entrepreneurial activity, and entrepreneurial processes. I categorize policy and value orientation as two enabling and constraining factors that faculty may face while engaging in entrepreneurial activity processes.

The conceptual model includes a value orientation (norms) continuum (Lam, 2011) in considering that universities and departments may differ in perceptions of the university as a place for learning (traditional), a place for innovation (entrepreneurial), or a combination of both (hybrid). Using mission statements as a guide, in this dissertation study, I categorize the two universities and their respective engineering departments along the continuum. In this dissertation study, the combination of policy and values orientation is categorized as an institutional environment.

Overall, at a university and department level, it is hypothesized that rewards and incentives, support measures, and family orientation will constrain or enable the entrepreneurial activity of white women engineering faculty. The conceptual model assists in differentiating the entrepreneurial activity process and institutional environment of different places within the university and between universities. For example, the rewards and incentives policy at the university level may impact entrepreneurial activities differently than these same policies at the

department level. The conceptual model currently serves to guide hypothesis development, sampling, interview protocol, and coding procedure. The conceptual model also assists in interpreting the data and indicating in the findings the constraining and enabling forces.

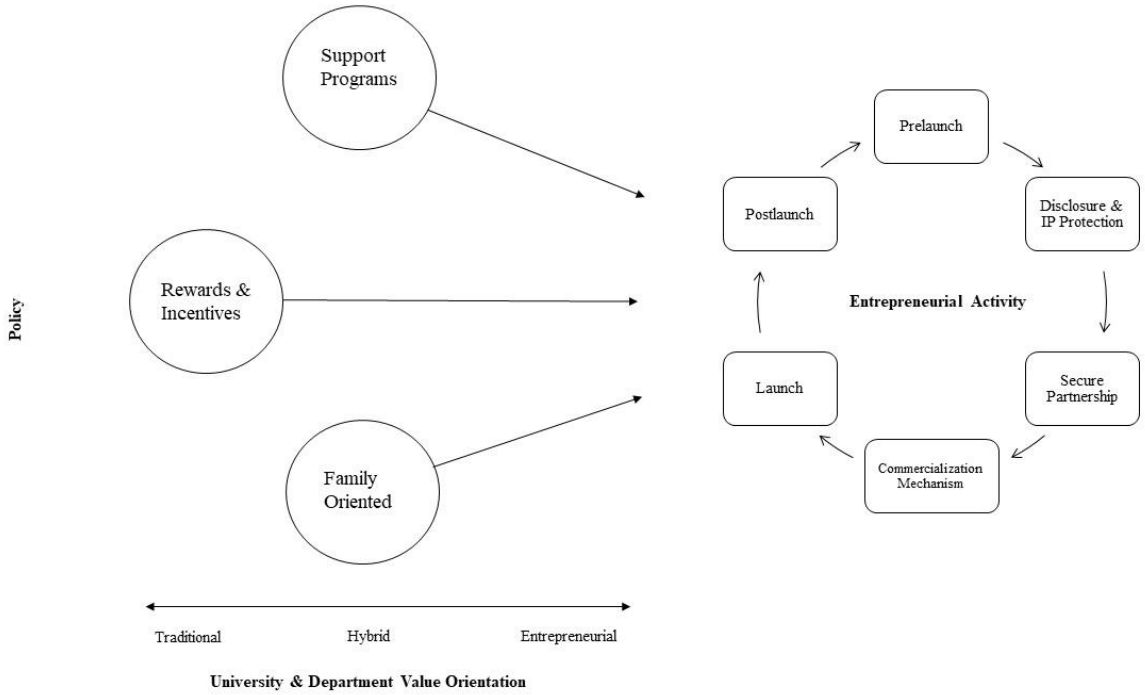

Figure 1. Conceptual Model of Policy Impacts on Entrepreneurial Activity Processes

In this study, entrepreneurial activity is defined broadly to encompass the various academic engagements that occur within the university (Tartari & Salter, 2015). The reasoning for framing entrepreneurial activity as an outcome (trademark, patent, copyright, advisory board) that occurs as a process (Wood, 2011), is because it allows for understanding policy impacts across each stage. The process of academic entrepreneurship, developed by Wood (2011) illustrates the journey innovation takes from the lab to industry; however, it does not incorporate the postlaunch (Jennings & Brush, 2013) stage, which is also a part of the entrepreneurial

process. Thus, in the conceptual model, the entrepreneurial process includes prelaunch, launch, and post-launch (Jennings & Brush, 2013), as well as the traditional commercialization stage (Wood, 2011).

In the university setting the entrepreneurial process occurs across many stages (Wood, 2011). First starting in the research lab, where the innovation is created (Wood, 2011), followed by a series of steps to report the intellectual property to the technology transfer office, which then determines if the intellectual property will undergo intellectual property protection (Wood, 2011). Once the intellectual property protection and market viability are established, the technology transfer office proceeds to search and secure industry partnership (Wood, 2011). When an interested partner is found, the technology transfer office determines the commercialization mechanism. This method determines if the intellectual property will be licensed or spun out. After the type of commercialization mechanism is determined, there is the launch or commercialization stage when the intellectual property is transferred to industry (Wood, 2011). In this dissertation study, the combination of entrepreneurial activity and the entrepreneurial process is categorized as an entrepreneurial activity process occurring within the university context.

For this dissertation study, I focus on university and department policy (rewards, incentives, and support measures) because their presence profoundly impacts engagement (Guerreo & Urbano, 2012; Tartari & Salter, 2015). Acknowledging that entrepreneurship is gendered (Ahl, 2006; Brush et al., 2009; Jennings & Brush, 2013), I include family orientation of policy because domestic and care work are important indicators to include when studying women entrepreneurs (Ahl, 2006; Brush et al., 2009; Jennings & Brush, 2013), including academic entrepreneurs (Whittington, 2011). While the conceptual model in this study was

developed with the white women faculty sample in mind; it is anticipated that this model could apply to non-white women faculty as well.

CHAPTER 3

DATA AND METHODOLOGY

A qualitative research design was developed to answer the research question of this study. The methodological orientation that underpins this project is a case study approach, which was determined based on transformative and pragmatic perspectives. The case study takes place in Michigan at two research one universities, with a focus on white women engineers and their propensity to engage in entrepreneurial activity. I was the sole researcher in this study as a Ph.D. candidate who has several years of experience engaging in qualitative research.

The participants for this study were purposively chosen. The participants in this study did not have prior connection to me, and the relationship was established via email inquiry. The sample consisted of six white assistant to full professor faculty in engineering at Michigan State University and 13 white assistant to full professor faculty at the University of Michigan. All but one of the interviews was conducted via audio or video conferencing. University, college, and department documents were collected to support the information gathered during the interviews. These documents, ranging from mission and diversity statements to technology policy to promotion policy, positioned the institutional setting of both universities. I was the sole researcher to code and analyze the data. From the interview codes, categories and themes were identified which provided information for data findings. The research framework, sampling selection, and analysis all connect back to the research question and propositions.

This chapter provides information on the methodological approaches used in this study. The first section provides background literature on the research framework and how it lends itself to the research. The second section describes the geographic context for the study. The third section provides background literature on sampling and how it lends itself to the participant

and document sampling, as well as power dynamics. The fourth and final section provides background information on qualitative data analysis and how it lends itself to the approach to data analysis, coding, memos, and interpretation.

Research Framework

My paradigm falls under the transformative and pragmatic perspectives, which suggests that the researcher use perspectives, methodologies, or methods that best answer the research question (Creswell, 2013). For this study, a qualitative research framework is adopted, which is based on a consistent decision-making process between the elements of epistemology, methodology, and method of the project (Carter & Little, 2007). Epistemology justifies the methodology used and the methods deployed (Carter & Little, 2007). I employed a constructivist epistemology, which considers the subjectivity of perspectives and recognizes that the researcher and the participants work together (Baxter & Jack, 2008; Creswell, 2013; Denzin & Lincoln, 2013). Based on this constructivist epistemology, I used a case study methodology approach to collect data because it is useful in describing phenomena in its context (Baxter & Jack, 2008; Creswell, 2013). A qualitative approach to research indicates the researcher's desire to study a phenomenon in its natural setting (Creswell, 2014; Marshall & Rossman, 2006).

When conducting a case study research project, there are several things to consider in the design (Baxter & Jack, 2008; Yin, 2002). Things that need to be considered in the design are choosing the case and unit of analysis, defining the case and identifying a single or multiple cases, deciding to base the case on theory, creating a conceptual framework, ensuring trustworthiness and reliability, and deciding on the data sources, analysis, and reporting (Baxter & Jack, 2008). When deciding on the methodology to use, it is useful to identify case study as the appropriate approach if several things are considered (Yin, 2002), such as what type of

question is asked, if the phenomena is influenced by context, and if the context and phenomenon do not have clear boundaries (Yin, 2002; Baxter & Jack, 2008). When a case study is determined as the appropriate methodology, the unit of analysis – which is the case – is chosen based on the research question (Yin, 2002).

Though the case can be individuals, events, geographic areas, processes, or groups, it is crucial to define it using previous literature (Yin, 2002). While defining the case is essential, it is of equal importance to place boundaries on the case such that it does not become too broad (Yin, 2002; Stake, 1995; Baxter & Jack, 2008). There are various ways in placing boundaries on the case, which can stand alone or be combined (Baxter & Jack, 2008). These boundaries are based on time, place, activity, definition, and context (Yin, 2002; Baxter & Jack, 2008). Determining the type of case study is based on the purpose of the research study. A case study can be explanatory, exploratory, descriptive in addition to a single, holistic, or multiple case study (Yin, 2002). A single case study looks at a single case of individuals or groups in the same situation, a holistic study looks at a single case that is embedded in context and sub-contexts, and a multiple case study looks at multiple cases in different contexts (Yin, 2012).

Researchers conducting qualitative or quantitative research seek to answer research questions based on phenomena. In quantitative research, hypothesis testing (Auerbach & Silverstein, 2003) is used based on independent and dependent variable development where the hypothesis is tested through quantitative methods to be true or false (Auerbach & Silverstein, 2003). In qualitative research, hypothesis generation (Auerbach & Silverstein, 2003) is used to develop theories of a topic after the data collection and analysis occurs (Auerbach & Silverstein, 2003). Researchers use the interview, document, observation, and other data points to guide the development of the hypotheses at the end of the study; this is rooted in the grounded theory

tradition (Glaser & Strauss, 1967). Case study research is considered a qualitative approach but is influenced by the hypothesis testing of quantitative methods (Baxter & Jack, 2008). Yin (2002), in the development of case study research, described propositions as a guide that limits the research based on previous literature, theories, and empirical data. The propositions are used to answer the research question while using qualitative data and testing prior to data collection. For this dissertation study, the term proposition is used following in the tradition of previous case study researchers (Yin, 2002).

Propositions, like boundaries, are important for making sure the project scope does not become too broad by providing focus (Baxter & Jack, 2008; Yin, 2002). Propositions are based on literature and theories (Yin, 2002). Propositions allow for project feasibility (Baxter & Jack, 2008) by assisting with deciding on what to study and examine (Yin, 2002) because it will eventually be used to guide the methods, discussion, and conceptual framework (Baxter & Jack, 2008). The conceptual frameworks in a case study are based on propositions (Yin, 2002), used as a foundation in the research, which helps interpret the data (Miles & Huberman, 1994). The purpose of the conceptual framework in a case study is to reflect inclusion or exclusion in the study, determine relationships between the concepts, and to tie all the concepts into one model (Miles & Huberman, 1994). The conceptual framework at the start of the research has a general construction, but as the research develops, the relationship between the elements are developed into a final conceptual framework that includes the information from data analysis (Baxter & Jack, 2008).

The propositions help the researcher develop the framework which is linked to the data which helps with interpreting the data (Yin, 2002). The logic of reasoning in a case study approach begins with a deductive approach, but can still use inductive and abductive reasoning

by using critical reflexivity, which is the process of critically assessing the research at all stages (Baxter & Jack, 2008). Case study research uses multiple sources of data in the collection process, which includes interviews, archival information, documents, artifacts, and observations (Yin, 2002). When analyzing the multiple data sources, they are looked at collectively instead of individually, and databases are created to organize the data (Yin, 2002). Yin (2002) describes five main types of analysis that can be used, and each can be used depending on the type of case. These types of analysis are time-series, logic models, cross-case, pattern matching, linking to propositions, and explanation building (Yin, 2002).

The case study methodology is grounded in looking at phenomena within a context providing a well-described illustration (Yin, 2002; Stake, 1995). Yin (2002), highlights the importance of grounding and refining the research question so that the remainder of the study decisions are made appropriately. This dissertation's aim and questions are guided by the decision-making process in case study research design. The methodological process of this dissertation study is based on the insights from the literature on case study approaches (Baxter & Jack, 2008; Miles & Huberman, 1994; Yin, 2002; Yin, 2012). The unit of analysis or case for this dissertation study are white women engineering faculty. The type of design for this dissertation case study is a multiple case design (Yin, 2012). This dissertation study which uses institutional theory as a foundation, is a multiple case design because while the faculty are the unit of analysis, two universities are being studied within the institutional environment context.

The boundary placed in this dissertation case study is that it focuses on the institutional environment of two universities located in Michigan. The dissertation case study also places boundaries on data collected, which focuses on interviews of white women engineers and documents on policy. The three propositions were developed to ensure that the project was

focused on the institutional environment at the two universities. Based on the three propositions and previous literature, an initial conceptual framework was developed to serve as a foundation for the research and assist in interpreting the data. This conceptual framework focused on three policy types, the entrepreneurial orientation of the universities, and the academic entrepreneurship stages. The propositions and codes were developed first using a deductive approach, which uses previous literature and theory. However, inductive reasoning was also used to determine codes that were not predetermined by the literature.

Setting

This dissertation study takes place in Michigan, which is located within the Midwestern region of the United States. This dissertation study takes place in Michigan, which is located within the Midwestern region of the United States. Two universities are being studied within the institutional environment context. The creative capital perspective popularized by Florida (2004) argues that growth is dependent on four main conditions: technology, talent, tolerance, and good quality of place. Michigan is in the rustbelt, a region known for its industrial and automobile industries. When examining Michigan's conditions for growth based on these four main conditions for creative capital, it is useful to consider the historical context of discrimination and how this aspect of tolerance could possibly play a role in the reason why Michigan has not yet reached the creative capital status of other large states in the United States. Research measuring residential segregation using an index of dissimilarity indicates that there is unevenness in the spatial distribution of white and non-white residents within metro areas in Michigan (Darden, 2003). Though Florida (2004), primarily focused on the presence of gays and bohemians as an indicator for tolerance, it is important to consider in a region like Michigan where there is a black majority city, that race could also serve as an indicator for tolerance. Historically, Michigan has

been a place where policy has led to education inequity, residential segregation, and discriminatory mortgage lending (Darden, 2003). When considering the economic growth of Michigan based on entrepreneurship, it is useful to situate the region within the perspective of creative capital, particularly tolerance.

Compared to 25 large states in the United States (Kauffman Index, 2017), Michigan is not highly ranked. The Kauffman Index measures growth entrepreneurship, startup activity, and main street entrepreneurship amongst 25 large states in the United States. Growth entrepreneurship is measured by a change in employment. In 2016, Michigan was ranked last and in 2017, Michigan was ranked 25 (Kauffman Index, 2017). Startup activity is measured by new monthly venture creation. In 2016, Michigan was ranked 11, and in 2017, Michigan was ranked 15 (Kauffman Index, 2017). Main street entrepreneurship is measured by the number of small business owners who own a business as their main source of income. In 2015, Michigan ranked 11, and in 2016, Michigan ranked 13 (Kauffman Index, 2017). Overall, the Kauffman Index (2017) indicates that Michigan, compared to other large states, is either last or in the middle of rankings. Additionally, Michigan over the last couple of years has not experienced much growth other than in main street entrepreneurship.

The Michigan University Research Corridor, created in 2007, is a research cluster that includes Michigan State University, the University of Michigan, and Wayne State University. These three research universities collaborated to create innovation for Michigan and the Great Lakes region (University Research Corridor, n.d.). The goal of the University Research Corridor is to make an economic impact across the region and the world (University Research Corridor, n.d.). The basis of this collaboration is to create employment and startups that generate an economic impact for Michigan (University Research Corridor, n.d.). According to the 2018

annual economic impact report, the University Research Corridor contributed 18.7 billion dollars to the Michigan economy in 2017, in comparison to the 16.5 billion dollars in 2015 (University Research Corridor, 2018). The impact of the three universities is a 2.3 billion dollar spending in research and development (University Research Corridor, 2018) and in 2016 was the second largest employer in Michigan (GM was number one and Ford number two) (University Research Corridor, n.d.). Michigan is an atypical context for research about university commercialization. Many studies on women academic entrepreneurship research take place at research one universities (Gaughan & Corley, 2010; Murray & Graham, 2007; Stephan & El-Ganainy, 2007; Thursby & Thursby, 2005). Interestingly, the Michigan University Research Corridor has outperformed the research triangle, Route 128, and Silicon Valley in terms of innovation power rankings (University Research Corridor Michigan, n.d.).

In Michigan, there are thirteen public universities (Michigan Business, n.d.), of which four conduct translational research and commercialization; Michigan State University, Michigan Technological University, Wayne State University, and the University of Michigan (AUTM, 2015). The dissertation study takes places at two of the three universities in the University Research Corridor. The case study is on Michigan State University and the University of Michigan. The universities were narrowed down to two based on the number of startups, number of patents, number of licenses, and number of disclosures in 2015 (AUTM, 2015). Out of the Michigan universities surveyed, Michigan State University and the University of Michigan had the highest research expenditures, startups, patents, licenses, and disclosures (see Table 2). The two universities differ in the production of innovation, with the University of Michigan producing more licenses, patents, startups, and income than Michigan State University.

The University of Michigan technology transfer office opened in 1982, and as of 2015, had a research expenditure of $1,299,244,971, with 19 startups created in 2015, 422 disclosures, and 159 patents issued. Michigan State University's technology transfer office opened in 1992, and as of 2015, had a research expenditure of $588,248,000, with one startup created in 2015, 149 disclosures, and 40 patents issued. There is a considerable gap between the universities in nearly every category related to expenditures, patents, disclosures, and licensing; except for income received- running royalties. In 2015, Michigan State University received $7,653,058, and the University of Michigan received $7,445,410. It is not clear from the report why Michigan State does better in this category compared to the University of Michigan, but it could be because some of the intellectual property developed at Michigan State University does better in royalties received. This could be the case if certain industry partners paid more for a license of intellectual property at Michigan State University. Comparing the propensity of academics in each of these universities will help understand if there are variations present across universities or more so within universities. Both schools, through their mission statements, values, impact reports, and technology transfer offices promote using research to improve the Michigan economy and society.

Table 2.

2015 University Commercial Activity

	Michigan State University	University of Michigan	Wayne State University	Michigan Technological University
Technology Transfer Office Opened	1992	1982	1988	1988
2015 Research Expenditure	$558,248,000	$1,299,244,971	$213,878,000	$68,606,717
2013-2015 Research Expenditure	$1,600,861,000	$3,936,582,494	$656,644,000	$208,821,978
2015 Licensing Options Executed	62	164	4	11
Cumulative Active Licenses	318	387	108	31
2015 Startups	1	19	2	1
2015 Disclosures	149	422	69	30
2013-2015 Cumulative Disclosures	402	1255	199	94
2015 Patents Issues	40	159	27	2
2015 New Patent Applications	48	183	29	14
Adjusted Gross Income	$8,219,088	$77,611,359	$695,000	$255,198
2013-2015 Cumulative Adjusted Gross Income	$15,114,595	$105,732,120	$1,521,283	$553,040
2015 License Income Received	$8,579,211	$78,779,947	$695,000	$230,248
2015 License Income Received-Running Royalties	$7,653,058	$7,445,410	$109,744	$177,272

Source: 2015 AUTM U.S Licensing Activity Survey

Sampling Selection

Sampling is the selection of a population to study in a research project (Lopez & Whitehead, 2012). There are various types of methods to select participants, and what is used can play a role in the findings and outcomes of a study. Sampling falls under two main categories; non-probability, which is used in quantitative research and probability, which is used in qualitative research (Lopez & Whitehead, 2012). Within probability sampling, there are four types of sampling, which are convenience sampling, purposive sampling, snowball sampling,

and theoretical sampling (Lopez & Whitehead, 2012; Marshall, 1996; Sandelowski, 1995). In convenience sampling, participants join a study because they are accessible (Lopez & Whitehead, 2012; Marshall, 1996).

In purposive sampling, participants join a study because they are the most efficient way of answering the research question or they have knowledge of the topic (Lopez & Whitehead, 2012; Marshall, 1996; Sandelowski, 1995). In snowball sampling, a researcher starts with a few participants, and those participants recommend other individuals to the study (Lopez & Whitehead, 2012; Marshall, 1996). In theoretical sampling, the data are chosen based on theory (Lopez & Whitehead, 2012; Marshall, 1996; Sandelowski, 1995). Once the type of sampling is chosen, the researcher will determine an inclusion and exclusion criteria. Inclusion criteria are based on characteristics that need to be included in the study, and exclusion criteria are characteristics of the participants that cannot be included in the study (Lopez & Whitehead, 2012). Next in the sampling selection is arguably the most contested aspect of qualitative methods which is determining the sample size.

Marshall (1996) describes how the goal of quantitative research is to typically generalize the findings to the broader population, whereas qualitative research is focused on studying natural settings that answer the research question. In the extended case method tradition Buraway (1991), in his review on social movement research, indicates that micro events provide insights that are relevant at a macro scale, suggesting that qualitative research is generalizable. While in quantitative studies, there is consensus on what determines an adequate sample size, in qualitative studies, there is not the same consensus or formulas (Sandelowski, 1995). Some researchers suggest saturation (Glaser & Strauss, 1967), while others state it is methodologically dependent (Charmaz, 2006; Creswell, 2007; Morse, 1995; Sandelowski, 1995).

The term saturation stems from the grounded theory approach in which researchers believe sampling is complete when comparing data with previous analyses, themes and topics repeat (Glaser & Strauss, 1967; Morse, 1995). Saturation is reached not only when themes repeat each other, but when the research question is answered (Marshall, 1996; Morse, 1995). Researchers using saturation in their grounded theory have a framework which they follow based on Glaser and Strauss' (1967) work. However, some are critical of the overuse of the term saturation because researchers use it in varying ways and are not transparent with how they achieved saturation (O'Reilly & Parker, 2012). Some researchers have separated saturation into code and meaning (Hennink, Kaiser, & Marconi, 2017). Code saturation is when new code development concludes when the researchers have "heard it all" which is at nine interviews (Hennick et al., 2017). Meaning saturation is when comprehension of the data is reached when the researchers "understand it all" which is at 16 to 24 interviews (Hennink et al., 2017). Morse (1995) argues that if saturation is not met in a study, it means that the topic can be explored further.

Some studies explicitly state sample size numbers. Bertaux (1981) in his life-history sociological study, stated that 15 should be the minimum sample size, where Green and Thorogoo (2018) state that when interviewing, new information stops coming after about 20 people. Most sample sizes can range from 8 to 15 (Lopez & Whitehead, 2012). When compared to quantitative analysis, this may seem small, but can still produce detailed data and results (Lopez & Whitehead, 2012). Marshall (1996) finds that simple studies require a smaller sample and, complex questions require a larger sample size.

Some researchers determine sample size based on the type of methodology employed. For example, in a phenomenological study, six (Morse, 1995; Sandleowski, 1995) to 10

(Creswell, 2007) participants is satisfactory. In an ethnographic study, 30 to 50 interviews (Morse, 1995; Sandelowski, 1995) is satisfactory. In a case study, three to five participants are satisfactory (Creswell, 2007). In a grounded theory study, 15 to 20 (Creswell, 2007) to 25 (Charmaz, 2006), participants are satisfactory. There are those who state that adequate sample size is not based on numbers, but based on the quality of information derived from the data (O'Reilly & Parker, 2012; Sandelowski, 1995). It is the purpose of the study, the research method, and other aspects of the research design that should aid in deciding when to complete data collection (Sandelowski, 1995).

Participant sampling. For this dissertation study, using probability sampling, I chose white women engineering faculty because within the population of women engineering faculty this was a common characteristic that had enough individuals to sample from within the university contexts of interest. I use purposive sampling to focus on women engineers because it was assumed that the faculty would be knowledgeable about academic entrepreneurship, given that engineering has a reputation for innovation. The inclusion criteria are white women who are tenure track and who have engaged or not engaged in entrepreneurial activity. White women were chosen because there were not enough non-white women to choose from within each department at each university.

To pick the women faculty, I created a list of all the possible women faculty in engineering from each university. These faculty were contacted via email and phone. The email described the study and provided the Institutional Review Board (IRB) approval information. If the number of faculty was not reached during the first round of selection, a second round of random selection was conducted to gain more participants in the study. However, since I had difficulty reaching women, I contacted every white woman faculty at both schools. Since the

study objective is to understand the propensity of women researchers, I separated the faculty into those who have not engaged in entrepreneurial activity and those who have.

I went through each department and created a database of all the women faculty, their department affiliation, faculty ranking, and contact information. I had a category for race and based on appearances, I placed individuals as white, black, Asian, Indian, or other. When I interviewed each woman, I asked what her race was, and this was done to counter the bias that I had by choosing individuals based on appearances. By asking the women for their race, they were able to confirm if they were white or not; in the case of this dissertation study, all the women confirmed they were white. I chose tenure track faculty within the College of Engineering because previous studies have focused more on the life sciences (Ding et al., 2006; Ding et al., 2013; Lindholm-Dahlstrang & Politis, 2013; Murray & Graham, 2007; Whittington & Smith-Doerr 2005; Whittington & Smith-Doerr, 2008). Additionally, for both Michigan State University and the University of Michigan, the College of Engineering produced the largest number of invention disclosures, indicating a propensity to engage in commercialization within the engineering discipline.

Semi-structured interviews are the primary source of data for this dissertation research project. In this study, I use qualitative interviewing to obtain the data to answer the proposed research question and test associated propositions. Qualitative interviewing was chosen because of the opportunity to conduct research in a natural setting and the use of the researcher as an instrument (Creswell, 2014; Marshall & Rossman, 2006). The faculty were interviewed between April 2018 and September 2018 via the Zoom video conferencing platform, and one interview was conducted in person. The interview sessions lasted approximately 15 to 50 minutes for a

total of 417.5 minutes and consisted of 12 interview questions (see Appendix A) with interview responses totaling 64,572 words.

Interview sessions were recorded, transcribed, and coded for themes. I asked predetermined interview questions, and prompted the participant, with questions such as "why" and "what made you do" to gain more insight. These interview questions were not provided to participants prior to the interviews; however, they were given the research topic in the initial interview request. Following the interviews, I took notes via memos to reflect on codes, questions, themes, and other concepts related to the research (Saldaña, 2013). I had the interviews transcribed by an outside party and then imported them into Atlas.ti software for coding, analysis, and interpretation.

I specifically wanted to understand the experiences of women researchers on university campuses; thus, the sampling method is purposive (Creswell, 2014; Denzin & Lincoln, 2013; Marshall & Rossman, 2006). To determine the faculty participants, I used university human resource documents to determine the demographics of faculty and academic staff as well as to determine the number of disclosures by college (see Table 3). For this dissertation study, I focus on tenure track faculty which follows previous studies conducted on women academic entrepreneurs (Allen et al., 2007; Gaughan & Corley, 2010; Murray & Graham, 2007). At Michigan State University, there are 5,556 total faculty and staff, of which 1,988 are tenure track, and 35.7 percent of faculty in the tenure system are women faculty. At the University of Michigan, there are 8,032 total faculty and staff, of which 973 are tenure track and, 41.9 percent of faculty in the tenure system are women faculty. These numbers were calculated using the information collected from human resource documents (Michigan State University (n.d.); University of Michigan, 2017).

Table 3.

2016 Demographics at MSU and UM

Demographics	Michigan State University	University of Michigan
Total faculty & academic staff	5,556	8,032
Total women faculty and academic staff	2,540	3,534
Total faculty in tenure system	1,988	973
Total women faculty in tenure system	709	408
Disclosures by College		
Engineering	59	186
Agriculture & Natural Resources	40	
Natural Sciences	32	
Medicine	23	169
Life Sciences & the Arts		22
Other	25	51

Source: Michigan State University (2016); Michigan State University (2016); University of Michigan (2017); University of Michigan Technology Transfer Impact Report (2016)

The College of Engineering at Michigan State University has a total of 48 tenure track women faculty out of 255 total tenure track faculty (see Figure 2). The College of Engineering at the University of Michigan has a total of 99 tenure track women faculty out of 494 total tenure track faculty (see Figure 3). Within the College of Engineering at Michigan State University, 18.82 percent of tenure track faculty are women, and at the University of Michigan, 20.04 percent of tenure track faculty are women. Using these departments as a data source, I purposively sampled a total of 19 women faculty out of the possible 147 tenure track women faculty in engineering at Michigan State University (n=6) and the University of Michigan (n=13)[1]. Nineteen women faculty were chosen because previous case studies on academic

[1] The difference in sample size at both universities is a result of the number of people who responded to interview requests from each university.

entrepreneurs have studied anywhere from 10 to 49 total people (Nelson, 2014; Rasmussen & Mosey, 2011) and previous qualitative studies on women academic entrepreneurs have studied anywhere from 6 (Howe et al., 2014) to 56 people (Murray & Graham, 2007). In qualitative studies, 50 participants are considered a large sample size. It also provides maximum variation between participants (Sandelowski, 1995), which in this dissertation study is variation between those who have the propensity to engage in entrepreneurial activity and those who do not. After emailing five times and calling two times, I discovered there would be difficultly obtaining interview requests from faculty from both schools. Sampling 19 women faculty in the tenure track system would account for approximately 12.93 percent of the total sample of women in both the College of Engineering, providing an adequate sample size. However, despite the difficulty in reaching faculty members, the response rate of white faculty members was 22.22 percent at Michigan State University and 18.31 percent at the University of Michigan (see Table 4); these numbers reflected the percentage of tenure track women faculty at both schools. Additionally, as I went through the coding and analysis process, I reached code and meaning saturation (Hennink et al., 2017).

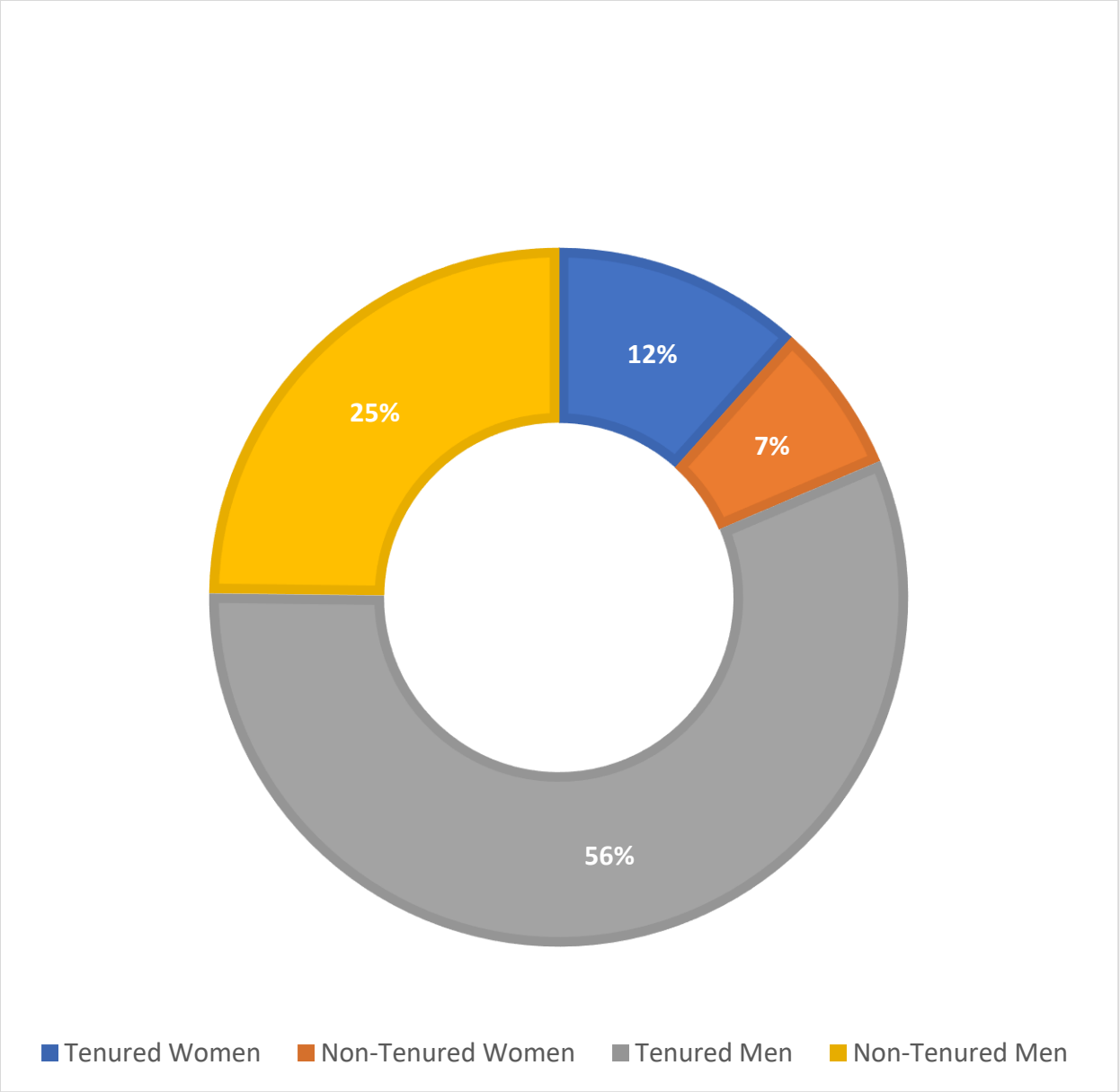

Figure 2. 2017 MSU College of Engineering Department Demographics

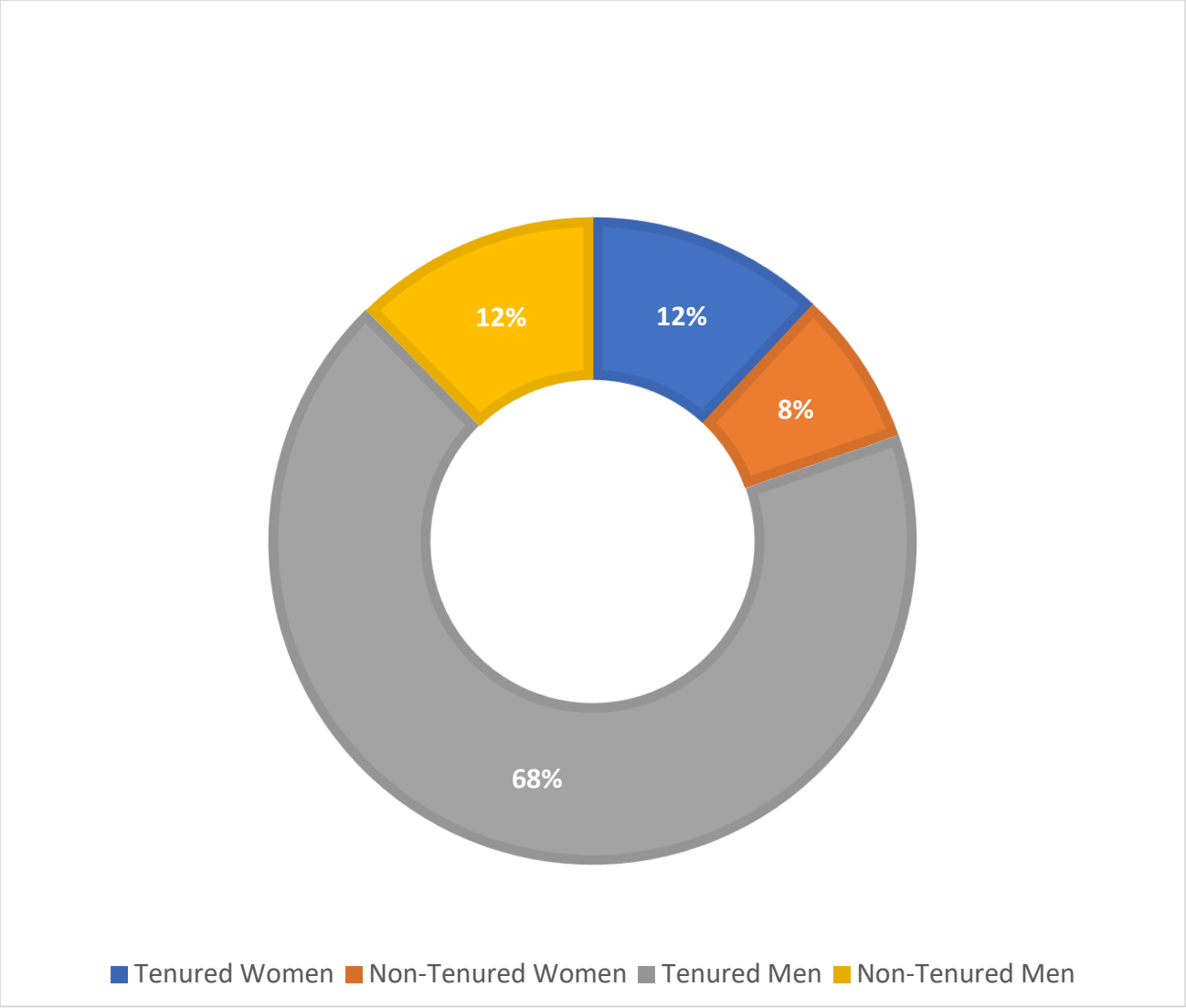

Figure 3. 2017 UM College of Engineering Department Demographics

Table 4.

Sampling Selection at MSU and UM

	Michigan State University	University of Michigan
Total number of engineering departments	8	12
Engineering departments interviewed	4	6
Number of women faculty	48	99
White	27	71
Black	2	6
Asian	16	18
Other	3	4
Response (white faculty) - Yes	6	13
Response (white faculty) - No	9	9
Response (white faculty) - No answer	12	29
Response Rate (white faculty)	22.22%	18.31%

Document sampling. I collected documents as the secondary data collection for this dissertation research project. These documents served as complementary sources to the interviews and provided additional context to the research topic (see Table 5). The documents that I collected for this dissertation study can be found on the human resources, diversity and inclusion, technology transfer, college, department, and university websites.

- The mission statements were collected from university[2] [3], college[4] [5], and department websites to determine the institutional environment and value orientation.

[2] MSU Mission Statement: https://president.msu.edu/actions-initiatives/msu-mission-core-values.html
[3] UM Mission Statement: https://president.umich.edu/about/mission/
[4] MSU College of Engineering: https://www.egr.msu.edu/engineerings-commitment
[5] UM College of Engineering: http://strategicvision.engin.umich.edu/?_ga=2.23716538.1461880761.1523042364-1852067489.1516378859

- I collected support measure information from the university[6] [7] websites on technology and entrepreneurship.
- The tenure and promotion policy of the participant's university[8] [9] and college[10] were collected from faculty handbooks to examine if academic entrepreneurship is rewarded.
- The technology transfer policy of the participant's university was collected to determine the royalty incentives.
- Diversity and inclusion documents were collected from the university[11] [12] to determine the presence of family-oriented policies. Additionally, I collected family orientation information from university and college faculty handbooks.

By examining documents from the university, college, and department level, it provides a comprehensive outlook on the institutional environment. The document sample for both universities was faculty handbooks (university and college), mission statements (university, college, department), diversity and inclusion policies (university and college), and intellectual property policies (technology transfer office). The number of documents sampled was chosen by examining both the University of Michigan and Michigan State University websites.

[6] MSU Technologies: https://technologies.msu.edu/
[7] UM Technology Transfer: https://techtransfer.umich.edu/
[8] MSU Faculty Handbook: https://hr.msu.edu/policies-procedures/faculty-academic-staff/faculty-handbook/index.html
[9] UM Faculty Handbook: https://www.provost.umich.edu/faculty/handbook/
[10] MSU Faculty Handbook: https://www.egr.msu.edu/sites/default/files/content/engineering_faculty_handbook_15may16.pdf
[11] UM Diversity Plan: https://www.egr.msu.edu/sites/default/files/content/engineering_faculty_handbook_15may16.pdf
[12] MSU Diversity Plan: https://www.egr.msu.edu/dpo/

At Michigan State University, 35 total documents were collected from the university, college, and department websites. I collected eight university level documents on conflict, patents, copyright, and royalties these documents were useful in understanding more about what aspects of technology transfer were valued. I collected seven university and college level documents on diversity as it related to discrimination, family leave, parenting, and a general diversity statement; these documents helped in determining policies related to family. I collected eight university, college, and department level documents related to the organization of the university; these documents on mission, value, and organizational charts helped in determining the value orientation. I collected five university and college level documents on tenure and promotion policies; these helped in determining how rewards and incentives are handled. I collected seven university-level documents related to support programs; these documents included work-life balance, mentoring, and other programs available to aid faculty; this helped in understanding what support systems are available to the university.

At the University of Michigan, 30 total documents were collected from the university, college, and department websites. I collected six university and college level documents on conflict, patents, copyright, and royalties. These documents were useful in understanding more about what aspects of technology transfer were valued. I collected five university and college level documents on diversity as it related to discrimination, family leave, parenting, and a general diversity statement; these documents helped in determining policies related to family. I collected seven university, college, and department level documents related to the organization of the university; these documents on mission, value, and organizational charts helped in determining the value orientation. I collected seven university and college level documents on tenure and promotion policies, these helped in determining how rewards and incentives are

handled. I collected five university-level documents related to support programs; these documents included work-life balance, mentoring, and other programs available to aid faculty. This helped to understand what support systems are available at the university for faculty.

Table 5.

Sampling Selection at MSU and UM

	Michigan State University	University of Michigan
University documents on conflict, patents, copyright, and royalties	8	6
University and college documents on diversity	7	5
University, college, department documents on organizational chart, mission, values	8	7
University and college documents on tenure and promotion	5	7
University documents on support programs	7	5
	35	30

Critical reflexivity. When conducting qualitative research, issues may arise due to the experiences and relationships that develop throughout a study (Dowling, 2000). The researcher, the participants, and society are linked, and this is considered while conducting the research. This consideration is done by using critical reflexivity, which is being mindful of formal ethical issues and power relations during the project from design to interpretation (Dowling, 2000). Prior to conducting research, it is important to follow the ethical guidelines of the university and use memos to continually analyze and reflect on the research process (Dowling, 2000).

Typically, in research studies, the researcher is in a position of power and studying those from disadvantaged situations (Becker & Aiello, 2013; Forsythe, 1999). However, there are times when the researcher will not be in a position of power, and this can vary depending on the

context. The researcher can be an insider, outsider, or a mixture of both, and this holds true for the participants (Dowling, 2000). England (1994) developed three main types of power relationships, reciprocal, asymmetrical, and potentially exploitative. Reciprocal relationships are when the researcher and the participants have similar social positions and both benefits or cnot benefit from participating a study (England, 1994). An asymmetrical relationship is when the participants are in a position of influence (England, 1994). A potentially exploitative relationship is when the researcher is in a position of greater power (England, 1994).

When using critical reflexivity, it is useful to be aware of power and ethical relationships and to reflect during the research process (Dowling, 2000). Throughout the research process, the researcher can reflect on problems that may arise during interactions with participants and be mindful not to reinforce social stereotypes during writing (Dowling, 2000). When in situations when the researcher is not in a position of power, it is useful to make decisions ahead of time on how to respond to varying circumstances (Becker & Aiello, 2013). This decision is useful because participant interview responses can result in critiques of organizations and thus potentially have impacts on careers (Forsythe, 1999). Undheim (2003) suggests that when in an asymmetrical relationship with the participants, it is an option for the researcher to use the information to improve the situation.

In this dissertation study, I would be viewed as operating in an asymmetrical relationship with the participants. The participants were white, tenure-tracked faculty at a research one university and in a higher socioeconomic bracket. As a graduate student, I am operating in a situation where race and status intersected. However, it is important to note that within the research parameter of studying the institutional environment of an organization, both myself and participants were operating within a system where we both were not necessarily in positions of

power or insiders. For example, myself and the participants are women navigating subtle or unsubtle biases in the workplace. Additionally, the participants and I were both discussing the workplace, potentially critiquing the place that employs both of us.

Informing the participants that information would be kept anonymous helped encourage them to speak on their experiences within the university. In terms of my status as a graduate student studying tenure track faculty and scientists, there were moments during my interview data collection when the participants wanted to know how my interview questions were trying to answer my research question or in some cases saying that they would give an answer that was relevant to my dissertation topic. This is an example of the interviews operating within an asymmetrical relationship context. For some participants, there was a desire to help me as a graduate student with my study and the natural curiosity that stemmed from their position as research scientists.

Gaining access tends to be another issue when studying those in elite standings. When access is granted, however, using various interview techniques is helping for gaining information (Undheim, 2003). I was able to use access to other researchers to gain insight into the entrepreneurial propensity of white women engineers. I used personal access to gain information that guided the decision-making on policy recommendations and future research suggestions (see Chapter 5).

Analysis and Interpretation

After data are collected, the researcher begins the process of analysis which is an iterative process (Ayres, 2008). When the data are collected, the coding process begins (Saldaña, 2013). In some cases, a code dictionary is created (Ayres, 2008; Saldaña, 2013) in which the codes are defined and used in the interviews and documents. In some research projects, there is more than

one coder, and the codes are verified and agreed upon between the coders. Additionally, data are analyzed using induction, abduction, or deductive reasoning (Reichertz, 2014). These three types of reasoning are not concepts, methods, or tools, but a way to connect and generate ideas (Reichertz, 2014).

Induction is a type of reasoning that looks at facts and information to arrive at statements and theories (Reichertz, 2014). For example, when analyzing interviews, the researcher does not consider previous literature or theory, the insights are derived from looking at the data, then interpreting these insights into findings and theories. Abduction is a type of reasoning that leads to new knowledge and theories (Reichertz, 2014). For example, when analyzing data, a researcher may discover something that has not been discussed in previous literature; this often is when new frameworks and theories are developed. Deduction is reasoning that starts from known features, or a familiar theory and literature. For example, when analyzing the data, the researcher already has theories or previous literature on hand to use to code the data. The three reasonings work together to develop propositions and predict findings based on the existing theory (Reichertz, 2014). For this dissertation study, deductive reasoning was used to develop the code dictionary. I used previous findings on academic entrepreneurship and women entrepreneurship to develop a codebook prior to analyzing the data. While reading the interviews and documents, I used the codebook to code, but I also came up with new codes using inductive reasoning.

Following the coding of the data, the researcher can use various methods for analyzing the information. Thematic analysis and pattern analysis are common methods for analyzing the data (Ayres, 2008). Typically, the analysis occurs in three stages (Saldaña, 2013). First, based on the coding dictionary, the codes are applied to the data, then the categories of patterns are

determined based on the number of codes. Finally, the patterns are reduced to major and minor themes that occurred throughout the dataset (Saldaña, 2013). Following the coding is when I determined the patterns across participants and universities. Using the conceptual model of this dissertation study, I tied the themes to the model and determined if they affirmed or refuted the research question and propositions. The conceptual model guided the interpretation of the patterns found and determined the relationship between value orientation, policies, and entrepreneurial activity.

Document and interview cross tabulation. Cross-tabulation is a feature in the Atlas.ti software that allows for exploratory frequency counting of each code used in the documents. For this dissertation study, this feature was used to count frequencies in the university policy documents and the interview transcriptions. It should be noted that this is a frequency count of how many times the code was used in the data; these are not word counts of what participants or documents stated. For example, the code diversity could appear in documents 15 times, but 10 of those times could be with three participants, three of those times with one participant, and two of those times with one participant. This does not mean that diversity was stated 15 times by participants. This tool is useful for highlighting insights that aid in the development of themes. The codes for the interviews and documents for both universities were the same and totaled 66 codes, of which only 56 were used.

In the Michigan State interviews, certain codes had the highest frequency of use, from 13 to 29 for codes ranging from institutional change agent to support measures (see Table 6). The codes that were used in every interview were support measures, reward systems, time, and culture.

Table 6.

MSU Interview Codes with Highest Frequency

Code Name	Code Frequency
Support measures	29
Diversity	26
Reward systems	20
Time	19
Culture	16
Attitudes toward entrepreneurship	16
Care work	14
Institutional change	13

In the Michigan State documents, 23 of the 56 codes were used in analysis, totaling 146 uses of the code in the university documents. Within the documents certain codes had the highest frequency use, from 8 to 18 for codes ranging from ownership to care work (see Table 7).

Table 7.

MSU Document Frequency

Code Name	Code Frequency
Care work	18
Reward Systems	16
Diversity	16
Culture	15
Support measure	14
Royalty sharing	11
Ownership	8

In the University of Michigan, interviews, certain codes had the highest frequency of use, from 19 to 78 for codes ranging from finance to support measures (see Table 8). The codes that were used in every interview were support measures, time, and care work.

Table 8.

UM Interview Code Frequency

Code Name	Code Frequency
Support measures	78
Time	53
Care work	44
Propensity	33
Administration	32
Culture	31
Reward systems	29
Policies	21
Institutional change	19
Finance	19

In the University of Michigan documents, 20 of the 56 codes were used in analysis, totaling 97 uses of the code in the university documents. Within the documents certain codes had the highest frequency use, from 3 to 15 for codes ranging from royalty sharing to care work (see Table 9).

Table 9.

UM Document Code Frequency

Code Name	Code Frequency
Care work	15
Diversity	10
Reward systems	6
Ownership	5
Culture	4
Royalty sharing	3

Both universities had similar codes used in the interview and document analysis. In the interviews, both universities had support measures and time codes used in every interview. Both university faculty interviews had support measures as the most frequently used code in all the interviews. Additionally, in the document analysis, similar codes appeared in both university

policy documents, with care work as the code used most frequently in both university policy documents. Though the university documents and interviews shared similar code, further analysis was done on the actual quotes to determine the constraining or enabling aspects of what was said. For example, time was the code, but an interviewee could have said something that related time to work or family. Thus, it was important to read through the codes and determine the patterns that matched across documents and interviews that were relevant to the research question.

Interview data analysis. The deductive approach to coding was chosen because the raw data were summarized into themes and categories based on empirical findings and theories on academic entrepreneurship. Additionally, an iterative induction approach was chosen because it provided room for emergent themes and categories. Using Atlas.ti, I coded, categorized, and built themes. While collecting data, the coding process began (Saldaña, 2013) and it is during this precoding stage that I highlighted participant quotes that stood out (Saldaña, 2013) and noted them via memos (Saldaña, 2013). During and after each interview, quotes, and phrases that were reflective of the research questions served as preliminary codes (Saldaña, 2013). I created a codebook based on previous research (see Appendix B) that were relevant to my research questions and propositions.

The first cycle is when I assigned codes to the transcripts. For this dissertation research, attribute codes and descriptive codes were used in the first cycle (Saldaña, 2013). Attribute code is typically information about the participant that is written at the beginning of every transcript (Saldaña, 2013). In this dissertation study, information about the field site (for example city, office), academic entrepreneurship and participant characteristics (for example gender, faculty ranking, type of academic entrepreneurs), and time frame (for example date and time) were used

(Saldaña, 2013). The attribute code is useful for providing context to the interviews and useful for data management.

The primary type of coding used in this study is descriptive coding. Descriptive coding means that participant sentences or paragraphs will be reduced into a word or phrase (Saldaña, 2013) (see Appendix B). The descriptive codes can be categorized and prepared for second cycle coding. Descriptive codes are useful because they can be applied to interviews and documents (Saldaña, 2013). Within this first cycle, if codes were too broad, I broke them down into sub-codes (Saldaña, 2013). For example, if the descriptive code was "publication", I broke it down further into "publication-journal" or "publication-web". The second cycle of coding occurred after the first cycle and is when I observed patterns that were broken down into themes and categories.

Pattern coding is the second cycle of coding. I compiled all the similar codes and categories from the first cycle and created a phrase that described the pattern. To analyze the codes, I took all the codes of the same name from the transcripts and grouped them for analysis. For example, if a code was "publication" and in the data, there were 30 instances of "publication". I took all the passages with the code "publication" and put them into one file to be analyzed. To ensure the trustworthiness of the coding, I followed the recommendations of Saldaña (2013) and maintained a reflective journal, coded as interviews were transcribed, and discussed coding strategies with the research adviser and committee.

Document data analysis. Following the same data analysis techniques as the interviews, I used attribute codes to organize and categorize the documents. Additionally, I used descriptive coding to pull out information relevant to the research questions on family orientation, rewards and incentives, and tenure and promotion. I used the same codes from the interviews in the

documents to see if there were patterns. The information gathered from the documents provided evidence for the formal stance on academic entrepreneurship that the universities have and if it constrains and enables entrepreneurial activity. Additionally, the information from the documents provided background information on the university context of Michigan State University and the University of Michigan.

Reflective and analytical memos. Memos are writing tools for idea development during the research process (Lempert, 2007). They may be disjointed and random because it is often the quick thoughts of the researcher (Groenwald, 2008; Lempert, 2007). However, memos explain different processes that are occurring during the research project and serve as a place to begin developing codes, categories, and themes (Groenewald, 2008; Lempert, 2007). Memos are written during the research process and serve as a reflective and analytical way to engage with the data (Groenewald, 2008). Memos may vary in content, but Groenewald (2008), suggests that they should be dated and referenced back to the data to provide reliability, validity, and trustworthiness to the study. Memos help with recording concepts that may occur while collecting the data, transcribing the data, or coding the data. These memos help with providing validity in the research process (Groenewald, 2008). While the analysis may be viewed as occurring at one point in time, through memos, it is occurring at all stages of the research process–as the researcher writes down reflective notes after interviews and theorizes findings in analytical notes (Groenwald, 2008). These notes help with taking the data collected and creating findings that are developed into conceptual models or theoretical developments (Lempert, 2007).

The memos are a point of reference for the researcher to have contact with the data at several stages throughout the research project. These different interactions served different purposes. While interviewing the participants, I did not take notes while they were talking. I did

this to stay engaged with them, listening for anything that prompted a follow-up question and further discussion. After the interview, I wrote down any initial thoughts and anything that I thought would be interesting to the research. This, I considered as the reflective memo. During the interview process, I would go back and listen to the audiotape of the interviews and write down further thoughts in the reflective memo. At this stage, I would write down anything that I thought could serve as a code or an interesting quote.

I engaged in analytical memos after I coded each interview and document. After I coded the interview or document, I wrote down interesting themes and patterns. I eventually noticed some commonalities throughout all the interviews at both universities, and I began to use those as prompts and as placeholders for any quotes I thought were interesting. I reflected on further research questions, thoughts I had, or policy recommendations. I compared and contrasted participants and universities. This is when I started to identify the patterns from the interviews and documents. The memos were written in Microsoft OneNote and then transferred into Microsoft Word. I reviewed all the memos for developing the themes, discussion, and adjusted the conceptual framework as I went through the analysis.

Triangulation, ethics, and generalization. Triangulation is the process of using multiple data-gathering methods to increase the credibility of a study (Saldaña, 2013) by ensuring data collection confirms the propositions (Arksey & Knight, 1999). In this dissertation study, I use interviews, documents, and theory to serve as multiple points of reference. By interviewing participants and collecting documents from various scales within the university context, this assists with looking at the institutional environments from different perspectives (Arksey & Knight, 1999). The benefit of the document and interview triangulation is that it assists in

providing a complete picture of the institutional environment while providing an opportunity for a conceptual model or theory development (Arksey & Knight, 1999).

As with any research, it is the researcher's responsibility to put the participant's wellbeing before the results of the research. I took steps to ensure that ethical issues were considered by filing the dissertation study in accordance with the Institutional Review Board (IRB). I informed all participants that their name and any business identifiers would be masked unless participants stated their names could be used. I expressed research goals verbally and in writing. Participants were aware of all audio or visual devices used during the study. I used 'rich, thick description' (Creswell, 2014) to give more perspective of my themes and to ensure the results were realistic to the reader.

The results of this dissertation study not only connect back to the research question and propositions, but are also discussed in relation to other findings within the entrepreneurship literature. This could mean that the positions are rejected or confirmed (Schoefield, 2000), but it expands ongoing the discussions of institutional environments and the propensity of women faculty to engage in entrepreneurial activity.

Data management. The data in this project include interviews, documents, literature, analytic memos, and reflective memos. Interviews were conducted on the Zoom platform and then saved onto a password protected folder on an external hard drive. The documents were saved in Microsoft Word within the same folder as the interviews. The analytic memos and reflective memos were first written in Microsoft OneNote and then transferred to Microsoft Word and saved in the same folder as the interviews and documents. It is the intention to save interview recordings and transcripts in a password protected file for ten years and then archive

them. The interview transcripts were analyzed in Atlas.ti and after coding was exported into the same folder as the interviews, documents, and memos. To preserve the data, there are three copies of the data; two local and one cloud.

CHAPTER 4

RESULTS AND DISCUSSION

The interview transcripts and university documents were analyzed separately and as a collective dataset to provide insight into theme development. These themes provided insight into the propensity of white women engineering faculty to engage in academic entrepreneurship and the role institutional environments play in this engagement. This chapter provides information on the results of the methodological approaches described in chapter three. The first section provides an overview of the interview question responses and the coding strategy used to develop themes. The second section includes discussion on the characteristics of the faculty, the orientation of the universities, the theme development for the universities, and provides quotes to support the themes. The third and final section provides answers to the research question, hypotheses, and revisits the conceptual model.

University context. Institutional environment's formal and informal factors can constrain or enable growth and behavior (North, 1990). In a university context, the institutional environment is categorized by formal factors such as support measures, mission statements, governance structures, and entrepreneurial education (Guerrero & Urbano, 2012). The informal factors are categorized by role models, reward systems, and attitudes toward entrepreneurship (Guerrero & Urbano, 2012). While the internal factors are categorized by resources and capabilities, such as networks, financial resources, human resources, and status (Guerrero & Urbano, 2012). The formal, informal, and internal factors within a university context creates the institutional environment of a university that is entrepreneurial.

Based on the interview responses and the university policy documents, the overall institutional environment of Michigan State University was determined to be an entrepreneurial

university. The university's organizational model has a board of trustees, a president, and provosts which are organized in a hierarchical nature. These central administrators are followed by executive officers, academic areas, and support units (MSU, n.d.)[13]. The mission statement and presence of a technology transfer office indicate that the university has the formal factors of an entrepreneurial university.

> *As a public, research-intensive, land-grant university funded in part by the state of Michigan, our mission is to advance knowledge and transform lives by:*
>
> > *providing outstanding undergraduate, graduate, and professional education to promising, qualified students in order to prepare them to contribute fully to society as globally engaged citizen leaders*
> >
> > *conducting research of the highest caliber that seeks to answer questions and create solutions in order to expand human understanding and make a positive difference, both locally and globally*
> >
> > *advancing outreach, engagement, and economic development activities that are innovative, research-driven, and lead to a better quality of life for individuals and communities, at home and around the world* (MSU, 2008).[14]
>
> *The college is strategically expanding our faculty and adding resources to areas that will deliver more than incremental change – we are looking to accelerate the pace of discovery in finding solutions to the "grand challenges" of society.* (MSU College of Engineering, n.d).[15]
>
> *To impart the highest quality* ***instruction*** *to our undergraduate and graduate students*
> *To conduct leading-edge* ***research*** *in computer science and engineering*
> *To provide* ***leadership and*** *service to our professional communities.* (MSU Department of Computer Science and Engineering, n.d).[16] (emphasis department's)

While Lam's (2011) orientation classifications were developed for faculty views, these same insights can be applied to the university, college, and departments. Michigan State University has a hybrid value orientation because it values the traditional aspects of the university, but also

[13] Michigan State Central Administration and Academic Organization: https://msu.edu/about/thisismsu/board-admin/org-chart.php
[14] Michigan State Mission Statement: https://president.msu.edu/actions-initiatives/msu-mission-core-values.html
[15] Michigan State College of Engineering Dean's Welcome: https://www.egr.msu.edu/about/administration/deans-welcome
[16] Michigan State Department of Computer Science and Engineering About: https://www.cse.msu.edu/About/

encourages entrepreneurial activity. These values are evident in the college, departments, and technology transfer office.

The attitudes toward academic entrepreneurship appear positive at Michigan State, but it appears that the school focuses its resources on the commercialization side of academic entrepreneurship instead of the including the engagement aspect.

> *Consistent with its public service mission and with regulations governing federally-funded research, the University endeavors to foster the development of its inventions and discoveries through patenting and licensing to industry* (MSU, 2001).[17]

The university policies on innovation focus on disclosures, patents, copyright, spinouts, and licensing; favoring patenting and licensing. This does not consider that faculty are participating in academic entrepreneurship in other ways (Tartari & Salter, 2015), as indicated by the interview responses. Additionally, the college of engineering has specific policies that encourage consultancy.

Based on the interview responses and the university policy documents, the overall institutional environment of the University of Michigan was determined to be an entrepreneurial university because the mission included traditional and entrepreneurial reasons for operating. The university's organizational model has a board of regents, president, chancellors, and directors, which are organized in a hierarchical nature. These central administrators are followed by provosts and vice-presidents over several units (UM, n.d.)[18]. The mission statement and presence of a technology transfer office indicate that the university has the formal factors of an entrepreneurial university.

> *The mission of the University of Michigan is to serve the people of Michigan and the world through preeminence in creating, communicating, preserving and applying*

[17] Michigan State Policy Document: https://trustees.msu.edu/policy-manual/03-19-01.html
[18] University of Michigan Organizational Chart: https://president.umich.edu/leadership-team/organizational-chart/

> *knowledge, art, and academic values, and in developing leaders and citizens who will challenge the present and enrich the future* (UM, n.d.).[19]
>
> *Over the coming years, we will focus on three pillars of excellence – research, education and culture – pushing ourselves to be innovative, daring and forward-thinking in our service to society. Providing the foundation for these pillars will be our core values, and the people and spaces that enable our work (UM College of Engineering, n.d.).*[20]
>
> *Here in ME at UM you'll find world-class research facilities, fantastic learning spaces including classrooms, laboratories, and maker spaces, enthusiastic faculty experts, staff members who are professional partners in the research, teaching, and service enterprise, and the brightest students whose entrepreneurial spirit and desire to help society are nurtured and enabled. Ours is a proud culture of innovation in mechanical engineering education and community engagement* (University of Michigan Mechanical Engineering Department, n.d.).[21]

Based on Lam's (2011) classifications, University of Michigan has a hybrid value orientation because it values the traditional aspects of the university, but also encourages entrepreneurial activity and engagement with the broader society. These values are evident in the college, departments, and technology transfer office.

The attitudes toward academic entrepreneurship appear positive at the University of Michigan, but it appears that the school focuses its resources on the commercialization side of academic entrepreneurship instead of including the engagement aspect.

> *The University recognizes and supports technology transfer as an integral component of the University's mission. Licensing of Intellectual Property rights to parties outside the University is one significant manner in which technology transfer is accomplished and is the focus of this Policy. The objectives of technology transfer include the following: to facilitate the efficient transfer of knowledge and technology from the University to the private sector in support of the public interest; to support the discovery of new knowledge and technology; to attract resources for the support of University programs; to provide services to University Employees to facilitate their efforts to carry out the University's mission; and to promote local, state, and national economic development* (UM Technology Transfer, 2009).[22]

[19] University of Michigan Mission: https://president.umich.edu/about/mission/
[20] University of Michigan College of Engineering Vision: https://strategicvision.engin.umich.edu/
[21] University of Michigan Department of Mechanical Engineering: https://me.engin.umich.edu/about/welcome
[22] University of Michigan Technology Policy: https://spg.umich.edu/policy/303.04

> *The College of Engineering recognizes that consulting work can greatly enhance a faculty member's productivity as a teacher and scholar. Accordingly, each instructional faculty member is permitted to consult up to an average of four days per month while he or she is on a 100% University appointment, regardless of the source of funds for the appointment* (UM College of Engineering, n.d.).[23]

The university policies on innovation focus on disclosures, patents, copyright, spinouts, and licensing; favoring licensing. Additionally, the college of engineering has specific policies that encourage consultancy. This does not consider that faculty are participating in academic entrepreneurship in other ways (Tartari & Salter, 2015), as indicated by the interview responses.

Michigan State University and the University of Michigan have the same formal institutional environment in that they both follow the entrepreneurial university model (Guerrero & Urbano, 2012). Both university, college, and department mission statements indicate the support of a traditional university model (teaching, research, service) while encouraging entrepreneurship, innovation, or economic development in surrounding spaces. Both universities lean towards prioritizing commercialization in the form of licensing, this does not include other forms of engagement such as informal advice, advisory boards, or writing policy documents. The data on the AUTM report (2015) on licensing across universities in the United States indicate that licensing is a huge component of the revenue that universities gain from technology transfer, which is supported by both university technology transfer office statements on innovation.

Faculty characteristics. Nineteen interviews of white women engineering faculty were conducted at Michigan State University and the University of Michigan. A total of 15 questions were asked (see Appendix A). All the interviews started with similar questions and depending on if the faculty had engaged in academic entrepreneurship or not, that determined if they were given questions that were for the non-academic entrepreneurs or the academic entrepreneurs. The

[23] University of Michigan Consulting Policies: https://adaa.engin.umich.edu/policies/consulting/

difference in the questions were minimal. Those who had not engaged in academic entrepreneurship were asked questions about career facilitators, career challenges, and were asked about the reason for non-engagement. Those who had engaged in academic entrepreneurship were asked questions about industry facilitators, industry challenges, and asked about the reason for engagement. Besides these questions, the remaining interview questions were the same and were directed toward perception, desired changes, and support measures. The interview responses were consolidated and paraphrased to illustrate similarities (see Tables 10 through 19). In the discussion section, full quotes are provided to illustrate the themes of this research project.

A total of six white women engineering faculty were interviewed at Michigan State University. When the three faculty who had not engaged in academic entrepreneurship were asked for their non-engagement reasons, they cited time, motivation, tenure preparation, expertise, or that their research was not applicable to entrepreneurship. Those who had decided to engage in academic entrepreneurship did so because it was common practice to share knowledge with industry, a student asked to engage, or they wanted their work to influence innovation systems. When asked about personal perceptions on academic entrepreneurship, the responses centered on lack of expertise, volume of paperwork, importance to society, or feelings of discomfort. When asked about department and discipline perceptions on academic entrepreneurship, the faculty responded that it was encouraged, albeit with various thoughts on reasons. Some thought it was encouraged, but the resource availability indicated otherwise, and another thought the departments were looking for the next big thing.

When the three faculty who had not engaged in academic entrepreneurship were asked for their career challenges, they cited time, being a woman in engineering, and the lack of women on

decision-making committees. When asked what their career facilitators were, they cited supportive department, supportive spouse, and a good recruitment package. The faculty who engaged in academic entrepreneurship were asked for their industry challenges and they cited time, interference with tenure process, the climate towards women, and difficulty with contracts. When asked what the industry facilitators were, they cited opportunities to learn and seeing their students succeed. All the faculty were asked questions about desired change in the university and they overall wanted to see a reduction in paperwork, more faculty diversity, a family-friendly university, increased resources, and more incentives to engage in different types of academic entrepreneurship. The faculty who had children or elder care mentioned that they shared their duties with their spouse, but it was still a struggle to balance work and home responsibilities. Overall, the faculty wanted ways to make university-industry collaboration easier, have an increase in women academic entrepreneur role models, more training, better maternity leave, and more incentives for tenure.

Table 10.

MSU Paraphrased Responses - Career Path

	Question		
Participant ID	Career Path	Non-Engagement Reason	Engagement Reasons
ID 2	I was recruited to come here after working as a post doc.	I don't have the time, motivation, or expertise to do it.	--
ID9	I worked as a post doc and got a faculty position and was recruited to MSU.	--	It's common in engineering to share knowledge with industry.
ID14	I worked as a post doc and applied for a job at MSU.	I'm preparing for tenure and I do not think my research is applicable to academic entrepreneurship.	--
ID15	I worked as a post doc and applied for a job at MSU.	Most of my research is not applicable to academic entrepreneurship.	--
ID19	I worked in industry, had a post doc, and applied for a job at MSU.	--	My graduate student wanted to patent our work.
ID20	I applied for job at MSU after PhD.	--	To provide policy that can broadly influence innovation systems.

Table 11.

MSU Paraphrased Responses - Personal Perception

	Question		
Participant ID	Personal Perception	Department & Discipline Perception	Career Challenges
ID 2	Boring and a lot of paperwork. I don't have a business background, who is going to help me?	It is encouraged, but you don't get any benefits. If they wanted us to do it, they would have more resources.	Being a woman is difficult in my field; there are no women sitting on the committees that make big decisions.
ID9	It is something that can be useful in the long-term for the industry and policy makers.	They encourage it.	--
ID14	A lot of professors do it, but I don't know of anyone whose work turned into something. It's one more line to add to the resume.	It is encouraged, but you don't get any benefits. If they wanted us to do it, they would have more resources.	There is not enough time to fit everything into a day.
ID15	I don't know much about it.	They encourage it.	There is not enough time to fit everything into a day.
ID19	We should focus on teaching, research, and service.	Bring in money because they are waiting for the next big thing.	--
ID20	In theory, I like engaging with industry and community, but in practice, I have ethical discomfort turning publicly funded research into academic entrepreneurship.	They encourage it.	--

Table 12.

MSU Paraphrased Responses - Industry Challenges

		Question	
Participant ID	Industry Challenges	Career Facilitators	Industry Facilitators
ID 2	--	When I was recruited, they gave me a good package.	--
ID9	I am added because I check off a box, but I'm not integral to the project and it is difficult learning contracts.	--	Opportunity to learn about other's expertise and develop relationships.
ID14	--	Having a supportive department.	--
ID15	--	Having a supportive spouse who is in academia.	--
ID19	The climate towards women and the lack of support in funding and teaching.	--	Seeing my students succeed.
ID20	It takes time and expertise for something that does not help with my tenure process.	--	Opportunity to learn about other's expertise and develop relationships.

Table 13.

MSU Paraphrased Responses - Desired Changes

Participant ID	Question: Desired Changes	Question: STEM Program Assistance	Question: Care Work Responsibilities
ID 2	Hire more women in underrepresented groups. Make this a family-friendly place. Change administration and focus on research.	There are no programs that do that.	Everyday struggle to balance responsibilities.
ID9	Reduction in paperwork, especially for junior scientists it takes away from pre-tenure process.	Not involved with university STEM programs.	Share care-work responsibilities with spouse.
ID14	More resources so you can have time to spend on other pursuits.	Not sure we have any. We have lunches.	Share home responsibilities with husband, but it will get harder when we have kids.
ID15	I don't know.	They are for undergraduate or graduate students.	Everyday struggle to balance responsibilities.
ID19	Change administration and go back to the roots of education. Stop rewarding individualism and money.	There are no programs that do that. We have lunches.	Everyday struggle to balance responsibilities.
ID20	Faculty and student voice in governance. Ensure our students are safe. Incentives in place for different types of engagement.	Not sure we have any. We have lunches.	Share home responsibilities with husband, but it will get harder when we have kids.

Table 14.

MSU Paraphrased Responses - Split Time

	Question		
Participant ID	Split Time	Race	Final Comments
ID 2	65% research, 20% teaching, 15% service	White	If this is a priority of the university, they need to have more personnel helping reduce paperwork, and we need to get royalties for work.
ID9	100% research		Need funds and platforms for risk-taking endeavors. How do we create pathways to make legal aspect of university-industry collaboration easier?
ID14	60% research, 30% teaching, 10% service		Better policies for maternity leave. We need training for entrepreneurial activity.
ID15	60% research, 30% teaching, 10% service		Women who are role models for how to go through the entrepreneurial process.
ID19	45% research, 45% teaching, 10% service		I don't think so.
ID20	50% research, 40% teaching, 10% service		We need adjustments to what are the incentives for tenure and how faculty use time. We need training for entrepreneurial activity.

A total of 13 white women engineering faculty were interviewed at the University of Michigan. When the six faculty who had not engaged in academic entrepreneurship were asked for their non-engagement reasons, they cited time, disinterest, or their research was not encouraging, and their research lends itself to industry preferences. When asked about personal perceptions on academic entrepreneurship, the responses centered on positive perceptions, lack

of knowledge, time and effort, and the need to update the intellectual property system. When asked about department and discipline perceptions on academic entrepreneurship, the faculty responded that it was encouraged, albeit with some concerns. Some thought it was encouraged, but it was not highlighted in the tenure package, another thought the departments were looking for the next big thing, and one voiced concern that encouraging it made it difficult to retain faculty.

When the six faculty who had not engaged in academic entrepreneurship were asked for their career challenges, they cited parental responsibilities, balancing professional duties with preparing for tenure, and the dominance of men in industry. When asked what their career facilitators were, they cited supportive department, personal motivation, students, financial support, and modified duty policies. The faculty who engaged in academic entrepreneurship were asked for their industry challenges and they cited breakdown in team functions, understanding legal paperwork, and professional ranking in industry is lower than that of academia. When asked what the industry facilitators were, they cited working with teams, the lawyers, and being encouraged by the department. All the faculty were asked questions about desired change in the university and they overall wanted to see increased student and faculty diversity, administrative assistance, support without the automatic university partial ownership, entrepreneurial training, and flexible teaching schedules. The faculty who had child or elder care responsibilities mentioned that they shared their duties with their spouse, but it was still a struggle to balance work and home responsibilities. Specifically, it was mentioned that the commute between work and home made it difficult for childcare and additionally distance between eldercare was cited as a difficulty. Overall, the faculty wanted ways to make university-

industry collaboration easier, have entrepreneurial training, more incentives for faculty to stay in academia, and wanted more discussion on the realities of academic entrepreneurship.

The interview question responses of faculty from Michigan State University and the University of Michigan showed shared experiences and some differences between the faculty. The faculty at both universities had similar career paths, with the majority working as a post-doctoral researcher prior to gaining a tenure track position. There were faculty at both universities that worked in industry prior to entering academia or they worked at another university and were recruited as faculty. The faculty at Michigan State University overall had a heavier research load in comparison to the University of Michigan faculty. When considering the perceptions of academic entrepreneurship in their discipline, department, and amongst themselves, both faculty at the universities stated that it was encouraged, and they mostly thought that academic entrepreneurship was time intensive and required business knowledge. The faculty at both universities also had similar responses to child and elder care, they had shared duties with partners, but still felt challenges in work and home life. The changes that both faculty at the universities wanted to see were in response to the lack of diversity in the engineering field, a change in the tenure process, and a desire for entrepreneurial assistance. The biggest difference between the university faculty were their knowledge of existing STEM program assistance. The Michigan State University faculty did not know of STEM programs and the University of Michigan faculty were all able to name a policy or program by name or service. The comparison of interview responses was further analyzed by conducting coding and developing themes.

Table 15.

UM Paraphrased Responses - Career Path

Participant ID	Career Path	Question Non-Engagement Reason	Engagement Reasons
ID52	I worked as a post doc and applied for a job at UM.	Most of my research is not applicable to academic entrepreneurship.	--
ID58	I worked in industry and applied for a job at UM.	--	Lawyers said needed to disclosure work and patent it.
ID70	I worked in government and applied for a job at UM.	Not interested in the business side want to see technology go to society.	--
ID76	I applied for job at UM after PhD.	--	The type of research I do is close to industry preferences.
ID88	I worked at another university and was recruited to UM.	--	UM is innovative and encouraging.
ID93	I worked as a post doc and got a faculty position and was recruited to UM.	--	Was invited.
ID110	I worked at another university and was recruited to UM.	--	Thought it was a good idea.
ID125	I was recruited to UM after PhD.	Most of my research is not applicable to academic entrepreneurship.	--
ID126	I worked at a startup and applied for a job at UM.	--	The type of research I do is close to industry preferences.
ID130	I was recruited to UM after PhD.	Most of my research is not applicable to academic entrepreneurship.	--

Table 15 (cont'd)

ID138	I worked as a post doc and applied for a job at UM.	I don't have time.	--
ID143	I worked as a post doc and applied for a job at UM.	Most of my research is not applicable to academic entrepreneurship.	--
ID147	I worked as a post doc and applied for a job at UM.	--	Was invited.

Table 16.

UM Paraphrased Responses - Personal Perceptions

	Question		
Participant ID	Personal Perception	Department & Discipline Perception	Career Challenges
ID52	Fairly positive thing.	They encourage it.	Balancing teaching and research responsibilities with getting tenure.
ID58	Fairly positive thing.	They encourage it.	--
ID70	Important, but a long process.	They encourage it.	Finding the right personnel.
ID76	Fairly positive thing.	They encourage it.	--
ID88	A lot of time and effort.	They encourage it.	--
ID93	A lot of time and effort.	Encouraged, but doesn't look as strong on my tenure application compared to other duties.	--
ID110	Supports, but focused on teaching and mentoring.	Encouraged to find the next big thing.	--
ID125	Good, but the system is old.	They encourage it.	Balancing what I want to work on versus what I need to do for tenure.
ID126	When you have the right lawyer, it's fun. When you don't it's frustrating and time consuming.	Encouraged, but hard to retain faculty.	--
ID130	One of many ways to disseminate research and have an impact.	They encourage it.	Finding job placements for PhD students.

Table 16 (cont'd)

ID138	I don't know much about it.	They encourage it.	Hesitant to engage with industry because it is male dominated.
ID143	I don't know much about it.	They encourage it.	Taking care of my children is a huge time drain.
ID147	I don't know much about it.	They encourage it.	--

Table 17.

UM Paraphrased Responses - Industry Challenges

	Question		
Participant ID	Industry Challenges	Career Facilitators	Industry Facilitators
ID52	--	Personal motivation, students, and university infrastructure.	--
ID58	Breakdown in team timing.	--	Working with functional teams.
ID70	--	Financial support.	--
ID76	Process moves smoothly, no challenges.	--	The legal team.
ID88	Rather someone else take the lead.	--	Encouraged by department.
ID93	Understanding the paperwork that the lawyers send.	--	Colleague motivates.
ID110	Expertise and preparing materials.	--	The legal team.
ID125	--	Learning from students and modified duty for new parents.	--
ID126	The more people patent, the harder it is to secure finding from companies.	--	Going forward I'm going to release my technology to the public.
ID130	--	Personal motivation.	--

Table 17 (cont'd)

ID138	--	Personal motivation, mentors, and supportive department.	--
ID143	--	Financial support.	--
ID147	In academia, I'm senior, but in industry, I'm junior.	--	The leadership.

Table 18.

UM Paraphrased Responses - Desired Changes

		Question	
Participant ID	Desired Changes	STEM Program Assistance	Care Work Responsibilities
ID52	More diversity.	Not sure	None
ID58	Structured plan to get new hires funding and rethink the tenure process.	ADVANCE program	I have eldercare and distance is a challenge.
ID70	Streamline the university processes and more administrative assistance.	ADVANCE program	Spousal care
ID76	More diversity.	Professional development programs.	None
ID88	More time and administrative assistance.	ADVANCE program	I have children and juggle the process.
ID93	More guidance and transparency in the process.	Generous leave policy.	I have children and juggle the process.
ID110	Entrepreneurial training.	ADVANCE program	I don't take certain opportunities because of child and eldercare.
ID125	The university give support without automatically gaining partial stake.	Professional development and lunches.	I have a child and the modified duty and reimbursement policy was helpful.

Table 18 (cont'd)

ID126	Streamline the university processes.	Professional development and lunches.	I have children and juggle the process.
ID130	Diversify the field of engineering.	Professional development and lunches.	I have children and the commute challenging. Eldercare.
ID138	More flexible teaching schedules.	ADVANCE Program	None
ID143	Ways to support women and younger faculty.	ADVANCE Program	I have children and travel and childcare is challenging.
ID147	Leader that promotes fairness, transparency, and listens to ideas, and doesn't play favorites.	ADVANCE Program	I have children and traveling without childcare is challenging.

Table 19.

UM Paraphrased Responses - Split Time

Participant ID	Split Time	Question Race	Final Comments
ID52	60% research, 30% research; 10% service	White	I don't think so.
ID58	40% research, 40% teaching; 20% service		Discussion on the patent life cycle and the time it takes.
ID70	40% research, 40% teaching; 20% service		Other people seem to have issues with the process, so it seems not worth it.
ID76	60% research, 30% teaching, 10% service		I'm busy and focused on getting grants and writing publications.
ID88	55% research, 35% teaching, 10% service		The university creates metrics for everything, and it discourages innovation for the sake of innovating.
ID93	60% research, 30% teaching, 10% service		Improve the tenure, promotion, and merit reviews. Entrepreneurial training.

Table 19 (cont'd)

ID110	45% research, 35% teaching, 20% service	Sabbaticals policies are supportive of entrepreneurial activities.
ID125	60% research, 30% teaching, 10% service	More support in alleviating faculty duties if want to pursue industry engagement.
ID126	80% research, 20% teaching	If the university doesn't allow the faculty to engage with university, they will leave.
ID130	40% research, 40% teaching, 20% service	I don't think so.
ID138	55% research, 30% teaching, 15% service	I don't think industry people are trained to interact with academics.
ID143	60% research, 30% teaching, 10% service	I don't know enough about it, but it seems like I would need legal assistance.
ID147	40% research, 30% teaching, 30% service	Provide opportunity for people to talking about entrepreneurship and if it is helpful.

At Michigan State University, six white women faculty who were of assistant and professor ranking were interviewed to gain understanding of the propensity to engage in entrepreneurial activity. Though all the faculty were in the College of Engineering, their characteristics varied (see Table 20). Value orientation represents the views individuals have on the role entrepreneurship plays in a university (Lam, 2011). Faculty operate on a continuum, which ranges from pure traditional to entrepreneurial (Lam, 2011). Faculty who are pure traditional believe academia and industry should be separate and innovation pursued only in academic spaces (Lam, 2011). Faculty who are pragmatic traditional believe academia and industry are separate but understand that industry and academia should partner to bring innovations to society (Lam, 2011). Faculty who are hybrid believe academia and industry collaboration is important for advancement, but understand the need for boundaries (Lam, 2011).

Faculty who are entrepreneurial believe academia and industry collaboration is fundamental for knowledge advancement (Lam, 2011).

> *I don't see the role of the university in entrepreneurship. To tell you the truth, I actually oppose the entrepreneurial minor. I don't think that's the role of the university, but it is what it is . . . We should be focusing on teaching, research, and service* (MSU ID19, 2018).

> *I'm kind of two minds. So, on one side, I'm very interested in a university that is locally embedded; that is internationally engaged; that is not cloistered; where we're not sitting in the ivory tower completely disassociated with society [and] with the market. And at land grant universities, we actually have a long tradition of cooperating with industry; and with building academic programs and research that help to serve industry. And I think that there are a lot of really good things with this land grant model; and the extension services; and integration into the community. So, I like that in practice; or I like that in theory, I guess. But then in practice, I have a lot of sort of moral and ethical discomfort with the idea of turning my research – especially if it's publicly-funded – into something that is focused on making me money . . . To me, it's part of this trend toward the neo-liberal university; and it is part of, really, a loss of some of our fundamental values – or what I think SHOULD be our fundamental values in the university that are focused on education and on societal benefit* (MSU ID20, 2018).

> *I think that we'd like all scientists to be, you know, entrepreneurial in a way; looking for new things, and bringing new ideas, and going after grants that precipitate really new and brand new ideas. I think the link to the business world in some ways, or a link to whether you could, you know, copyright or patent something that would bring benefit back to the university, right?* (MSU ID9, 2018).

While these responses affirm the research on value orientation on the role of the university in innovation (Lam, 2011), they indicate differences exist within the same college. These responses highlight the differences faculty have in their attitudes toward the entrepreneurial university model at Michigan State University. There are faculty who believe in the traditional university model of teaching, research, and service (Guerrero & Urbano, 2012) and faculty who align with the cultural changes (Rothaermel et al., 2007) of the university model. At Michigan State University, intellectual property disclosures are mandated. This is a policy that conflicts with the attitudes and perceptions that some faculty have about innovation's role in a university.

Of the faculty interviewed, their experiences with academic entrepreneurship ranged from not engaging in academic entrepreneurship to filing a patent, doing policy writing, consulting, or sitting on an advisory board. Five of the faculty after their graduate degrees went on to do postdoctoral work, whereas one went straight into a faculty position. Two of the faculty were recruited to Michigan State University after their postdoctoral work. Of the faculty interviewed, only one did not have any care work responsibilities, while the others had either child or elder care responsibilities. Faculty when hired undergo orientation, thus it is assumed that some awareness of a policy would exist. Given that the institutional environment is of interest in this study to provide contextual information, all the faculty were asked about policies at Michigan State University and they did not have policy awareness; meaning they were unable to specifically name or reference a policy.

Table 20.

MSU Faculty Characteristics

Characteristic Percentages				
Orientation	16.7% Pure Traditional	66.7% Pragmatic Traditional	16.7% Hybrid	
Type of Academic Entrepreneurship	33.3% None	33.3% Patent	33.3% Advisory board; Consultancy	
Industry Experience	66.7% None	16.7% Government	16.7% Industry	
Path to Faculty	83.3% Post Doc	16.7% Straight to Faculty		
Academic Rank	50% Assistant Professor	50% Professor		
Care Work Responsibilities	16.7% None	16.7% Eldercare	33.3% Childcare	33.3% Child and Elder care
Policy Awareness	100% None			
Recruited	33.3% Yes	66.7% No		

At the University of Michigan, 13 white women faculty who were of assistant, associate, and professor ranking were interviewed to gain understanding of the propensity to engage in entrepreneurial activity. Though all the faculty were in the College of Engineering, their characteristics varied (see Table 21). The faculty interviewed in this study were all pragmatic traditional in their perspectives on the role of the university in innovation.

> *So, we had great support at the University of Michigan for copyrighting, patenting [and] trademarking. Like I said, we've got an entire center that's organized for that. So, I was very well supported for patenting; but on the other side, since I'm in an academic institution, that's . . . That's not my primary goal. My primary goals are educational, mentoring [and] providing research. I'm more of a fundamental. . . more on the upstream side. So, from my perspective, patenting, copyright and trademark are almost accidental. It's . . . They're not intentional. It's like we come across something and we, you know . . . Maybe we work on a new device or something and arbitrarily we say, "Hey, that really worked well. That might be something that would be useful to a larger community." And so, then we would go ahead and apply for a patent, and that's kind of most of where that comes from. Like, most of the patents and the patent applications I've worked with have been because we had to prove something for our own research, and we thought it would be potentially something worth sharing* (UM ID110, 2018).

> *To me, I haven't come to a point in my career where I feel like I've had the idea that makes me think the sacrifice to all the other parts of my job are worth it to go push it. That's how I perceive it. It would seem . . . To me, it seems time consuming. And I'm sure it's quite fulfilling if you believe in the idea. For so . . . For me so far, I haven't been, like, so invested in the ideas that have come out that I felt like diving into it like that. I'm much more motivated by answering, like, fundamental questions about things that we observe in engineering than about technology transfer right now* (UM ID93, 2018).

While these responses affirm the research on value orientation on the role of the university in innovation (Lam, 2011), they indicate similarities can exist within the same college. These responses highlight similarities that faculty have on the role universities place in innovation. While these faculty at the University of Michigan may not necessarily want to engage in academic entrepreneurship because of the time it takes, they do not see it as something that a person should not engage in; thus, showing the pragmatism.

Of the faculty interviewed, their experiences with academic entrepreneurship ranged from not engaging in academic entrepreneurship to filing a patent, signing a contract agreement, collaborating on a spinout, consulting, or sitting on an advisory board. Eight of the faculty after their graduate degrees went on to do postdoctoral work, whereas five worked in industry before entering academia. Six of the faculty were recruited to the University of Michigan. Of the faculty interviewed, only three did not have any care work responsibilities, while the others had either child, spousal, or elder care responsibilities. Given that the institutional environment is of interest in this study to provide contextual information, all the faculty were asked about policies at the University of Michigan and nine were able to specifically name or reference a policy, indicating a high policy awareness.

Table 21.

UM Faculty Characteristics

	Characteristic Percentage				
Orientation		100% Pragmatic	Traditional		
Type of Academic Entrepreneurship	38.5% None	15.4% Patent	46.1% Patent, Disclosure, Consulting, Advisory Board, Spinout Collab, Contract Agreement		
Industry Experience	61.5% None	7.7% Government	23.1% Industry	7.7% Family Business	
Path to Faculty	61.5% Post Doc	38.5% Industry			
Academic Rank	53.8% Assistant Professor	15.4% Associate Professor	30.8% Professor		
Care Work Responsibilities	23.1% None	7.7% Eldercare	46.2% Childcare	15.4% Child and Elder Care	7.7% Spousal Care
Policy Awareness	69.2% Yes	30.8% No			
Recruited	46.2% Yes	53.8% No			

The characteristics between the faculty at Michigan State and the University of Michigan did not vary too much. The main difference was in the perceptions that the faculty had in the role a university should play in innovation. Those at Michigan State University varied in their perspective and those at the University of Michigan had the same perspective. Those at the University of Michigan could have a pragmatic view of academic entrepreneurship because of the combined culture of the university, college, and department. Previous research found that psychological factors like attitudes and perceptions play a role in entrepreneurial intentions to pursue academic entrepreneurship (Goethner, Obschonka, Silbereisen & Canter, 2012). This research assumes that intellectual property disclosure is voluntary. At both Michigan State University and the University of Michigan, the policy is mandatory disclosure, thus indicating that there are other factors to consider when researching entrepreneurial intentions and propensity.

None of the faculty interviewed had spinoffs and this was expected, since most faculty do not make it to the spinoff stage (Tartari & Salter, 2015). Tartari and Salter (2015) call for the use of the term academic engagement because it includes the various ways researchers collaborate with industry. In this study, academic entrepreneurship included commercialization and engagement activity. Faculty at both universities had engaged in similar types of academic entrepreneurship and the findings affirm Tartari and Salter's (2015) claim that women and other underrepresented groups participate in policy, consulting, and advisory boards more than spinoff activity.

Discussion

After the codes were compiled, a pattern analysis was completed to identify common categories among the codes which could be developed into themes (see Tables 22 and 23). Michigan State University and the University of Michigan had the same codes which were pattern matched into five categories: characteristics, assistance, institutional environment, motivation, and change. Characteristics were all the codes that provided information on the faculty ranking, career path, race, and split time. Fifteen codes were patterned matched to develop the category assistance. Assistance refers to circumstances that served as support for the faculty member. Twenty-seven codes were pattern matched to develop the category institutional environment. Institutional environment refers to factors that indicate the university value orientation, royalty shares, promotion, and reward systems. Eight codes were pattern matched to develop the category motivation. Motivation refers to the factors that indicate a faculty members propensity to engage in academic entrepreneurship. Eleven codes were pattern matched to develop the category change. Change refers to the actions faculty members engaged in to create new institutional environments or circumstances. The categories assistance, institutional environment, motivation, and change were further distilled into themes which provided an overarching meaning to the factors that constrain or enable the entrepreneurial activity of white women faculty in engineering.

Michigan State University and the University of Michigan shared the same three themes. However, whether the theme was a barrier or pathway differed between the universities. At Michigan State University, the assistance category became the theme of barriers to resources, where at the University of Michigan this was a pathway to resources. At Michigan State University and the University of Michigan, the institutional environment category became the

theme of barriers to organizational structure. At Michigan State University and the University of Michigan, the categories of change and motivation became the theme of pathways to institutional change. The term barrier was used to indicate constraining factors because some faculty at both schools used the word and it seemed appropriate to use it to represent constraint. The term pathway was used to indicate enabling factors, because a faculty used the word and it seemed appropriate to use it to represent enabling. The term resource was used because several faculty members used the word to describe factors or circumstances that were helpful or unhelpful to them as it related to finances, administrative assistance, family, and entrepreneurial training. The term organizational structure (Meyer & Rowan, 1977) was used to describe employee and employer responsibilities, duties, and requirements, not to be confused with organizational model (Whittington, 2011) which is related to the hierarchy of job positions in an organization. The term institutional change was used because it describes how institutions can change intentionally or unintentionally (Welter & Smallbone, 2011).

Table 22.

MSU Theme Development

Code	Category	Theme
academic experience academic rank split time gender race	Characteristics	
administration care work finance entrepreneurial education training entrepreneurial experience interaction with outside learning network provides mentoring receives mentoring role models no entrepreneurial activity industry experience role of students commercialization consultancy commercialization copyright commercialization disclosure commercialization licensing commercialization patent commercialization spinout commercialization trademark engagement policy engagement advisory board engagement contract agreement	Assistance Institutional Environment	Barriers to Resources Barriers to Organizational Structure

Table 22 (cont'd)

engagement providing advice engagement student supervision engagement training employees pure traditional pragmatic traditional hybrid entrepreneurial ownership culture governance structure time reward systems policies royalty sharing support measures commercialization consultancy commercialization copyright commercialization disclosure commercialization licensing commercialization patent commercialization spinout commercialization trademark engagement policy engagement advisory board engagement contract agreement engagement providing advice engagement student supervision engagement training employees pure traditional pragmatic traditional	Institutional Environment	Barriers to Organizational Structure

Table 22 (cont'd)

hybrid entrepreneurial ownership culture governance structure time reward systems policies royalty sharing support measures desire for independence desire for wealth desire to bring ideas to practice satisfaction propensity drive no drive distance diversity institutional entrepreneur attitudes toward entrepreneurship balance negative perception financial rewards students teams recognition space career status	Motivation Change	Pathways to Institutional Change

Table 23.

UM Theme Development

Code	Category	Theme
academic experience academic rank split time gender race	Characteristics	
administration care work finance entrepreneurial education training entrepreneurial experience interaction with outside learning network provides mentoring receives mentoring role models no entrepreneurial activity industry experience role of students commercialization consultancy commercialization copyright commercialization disclosure commercialization licensing commercialization patent commercialization spinout commercialization trademark engagement policy	Assistance	Pathways to Resources
	Institutional Environment	Barriers to Organizational Structure

Table 23 (cont'd)

engagement advisory board		
engagement contract agreement		
engagement providing advice		
engagement student supervision		
engagement training employees		
pure traditional		
pragmatic traditional		
hybrid		
entrepreneurial		
ownership		
culture		
governance structure		
time		
reward systems		
policies		
royalty sharing		
support measures		
desire for independence		
desire for wealth		
desire to bring ideas to practice		
satisfaction	Motivation	
propensity		
drive		
no drive		
distance		
diversity		
institutional entrepreneur		Pathways to Institutional Change
attitudes toward entrepreneurship		
balance		
negative perception		
financial rewards	Change	
students		
teams		
recognition		
space		
career status		

Michigan State University theme one – barriers to resources. The university uses the technology transfer office and other strategies to increase the innovative performance of the university to provide value to society. In doing so, the university uses researcher's intellectual property to gain a competitive advantage and increase innovation revenue. While the entrepreneurial university is a trend that many universities are taking (Guerrero & Urbano, 2012), not all have succeeded to the level of success of Stanford and MIT (Shane, 2004). From the perspective of the faculty, resources are lacking, and this becomes a barrier in engaging with academic entrepreneurship.

> *Almost everything comes down to just not enough funding. So, for instance, if there was more funding for . . . If there's funding for, like, startup companies, that would . . . that would help encourage people to start doing something entrepreneurial. Or even if there was more funding to fund teaching assistants in classes, then you would have more time to spend on other pursuits. So, it really just comes down to resources* (MSU ID14, 2018).

The need for resources was apparent in the responses from the faculty. The need for resources was tied to time. The availability of funding allocated towards teaching assistants or other aspects of the job could free up time for the faculty to work on starting a business. This tension between resources and entrepreneurial activity is apparent in the resources given.

The allocation of financial resources across various units in the university is needed for faculty to have the ability to possibly free up time to work on entrepreneurial ideas. These resources are not limited to teaching assistants, but also a need for administrative assistance and entrepreneurial training. When a faculty discloses intellectual property, they begin a multi-step process (Wood, 2011), that may or may not end up in a completed project. They are given paperwork, contracts, and other documents to go through the process and this is frustrating to faculty who do not have the training or time to go through these processes. Thus, the lack of

administrative assistance and entrepreneurial training within the university becomes a resource barrier.

> *It's a lot of paperwork; a lot of paperwork. . . I don't have an MBA; and I don't know how to do these things. Like, who is going to help me do that?* (MSU ID2, 2018).

> *You know, learning about the language in the contracts… If they want you to sign a certain contract and how you develop those contracts; and if you are developing contracts with your university, that can still be very frustrating because it's legalese, right? The lawyers have to review it. And so, as a scientist, you don't know what it all means and blah, blah, blah, blah, blah. And even know, there's changes all the time…. That's not the type of work I do.* (MSU ID9, 2018).

The administrative and business details are not what faculty are trained to do so this added task becomes a constraint to those who have not engaged in academic entrepreneurship and becomes a hinderance to those who have engaged in academic entrepreneurship. The barriers that the faculty faced were not limited to administrative reasons, childcare was also a resource that was desired.

Availability of childcare services on campus is a resource barrier to faculty who have children. This becomes a resource barrier because the faculty do not have places to bring their children while they are working. When asked about childcare programs on campus, a faculty stated that their child was on a year-long waiting list for a Michigan State affiliated daycare, while others could not cite resources that could help with them childcare.

> *Nothing. Nothing. Nope* (MSU ID2, 2018).

> *This has been a big disappointment and a struggle on an everyday . . . every day, right? Because I have little kids. They have to go to daycare if I need to do the work, and where are they going to go?" "Why don't we have something like that? That's a huge university. There's huge land here. Like, they could build something if it was a priority, but it's not. So, anything . . . I feel that everything women-related [and] diversity is just not a priority here* (MSU ID2, 2018).

While the faculty have a perception that resources are not available on campus, this is something that others identified as an issue that is systemic to the family policies on a federal level in the United States.

> *No, I don't think the U.S. has very good programs for women in general compared to my European colleagues. And I think we should have more daycare space for students and faculty that have kids; daycare on campus. We should have more daycares. We should be able . . . We can't accommodate everybody that needs daycare on this campus at MSU. . . And so, the programs are there. I don't think they're sufficient* (MSU ID9, 2018).

> *They don't do so great on the – oh, what's the word – basically support for your sort of work/life balance issues. So, there isn't a . . . The university doesn't have any special policy on how much time you can take off for maternity leave. It's just the standard, like, federal requirement* (MSU ID14, 2018).

Throughout various interviews it was stated that Michigan State does not have family friendly policies and is not a family friendly place, however, there are policies in place that are in accordance to the United States federal policy.

> *The Family and Medical Leave Act (FMLA) of 1993 requires that eligible employees be allowed to take unpaid leave, or paid leave if earned, for a period of up to twelve work weeks in any twelve month period (defined by MSU as the fiscal year, i.e., July 1 through June 30) for the following reasons: incapacity due to pregnancy, prenatal medical care or child birth; to care for the employee's child after birth, or placement for adoption or foster care; to care for the employee's spouse, son or daughter, or parent, who has a serious health condition; or for a serious health condition that makes the employee unable to perform the employee's job* (MSU, 2018).

> *Faculty and academic staff who are appointed on at least a 50 percent basis for nine months or more are immediately eligible for parental leave in accordance with this policy. . . Faculty and academic staff are eligible to receive up to six (6) weeks of paid parental leave in connection with the birth of a child. Faculty and academic staff who adopt a child younger than age six and/or not attending school full-time are eligible to receive up to six (6) weeks of paid parental leave. Additional unpaid leave may be available for the birth of a child or the placement of a child for adoption or foster care in accordance with the Family and Medical Leave Policy and/or the policy regarding Leaves of Absence Without Pay for faculty and academic staff* (MSU, 2017).

> *Upon request, tenure system and Health Programs faculty members who have a new child (or new children) in the home under the age of 6 and not attending school full-time may be granted a period of modified duties for up to one semester without a reduction in effort and salary. . . The period of modified duties is not a leave of absence. Faculty members with modified duties status will generally be relieved of teaching but will be*

> *expected to be fully employed by fulfilling their other professional responsibilities that can be scheduled around the child's needs at a higher percentage of effort (e.g. preparation of research proposals, papers, and course materials; supervision of graduate student research; and academic service)* (MSU, 2011).

Research on motherhood focuses on demographic issues such as marriage and child status as reasons for decreased or increased publications (Cole & Zuckerman, 1987; Fox, 2005; Whittington, 2011) or academic entrepreneurship (Tartari & Salter, Whittington, 2011). The responses of the interviews suggest that care work responsibilities are an additional responsibility that is prioritized over academic entrepreneurship. These responses add to the literature by showing that university sponsored family policy could alleviate some of the burdens on faculty who are considering academic entrepreneurship. While resources were a major theme that was mentioned through the interviews, another factor that came up in discussions was related to the organizational structure of the university and its faculty.

Michigan State University theme two – barriers to organizational structure. While faculty are instrumental to the function of the university, by providing teaching and research services, at a fundamental level they are employees at Michigan State. As employees they must adhere to standards of quality that are deemed appropriate by Michigan State, the employer.

> *Bolder by Design, is MSU's strategic planning initiative that will position the university as the nation's leading land-grant research institution. Based upon our core values of quality, inclusiveness, and connectivity, the University is dedicated to educating tomorrow's leaders and scholars through our undergraduate, graduate, graduate-professional and lifelong education programs. Through its faculty, MSU will create knowledge and find new and innovative ways to extend its applications, to serve Michigan, the nation, and the international community. The faculty must infuse cutting edge scholarship into the full range of our teaching programs. At MSU, faculty are expected to be both active scholars and student-focused educators, demonstrating substantial scholarship and ability to promote learning through our on-campus and off-campus education and research programs. The essence of scholarship is the thoughtful discovery, transmission, and application of knowledge, including creative activities, that is based in the ideas and methods of recognized disciplines, professions, and interdisciplinary fields. What qualifies an activity as scholarship is that it be deeply informed by the most recent knowledge in the field, that the knowledge is skillfully*

> *interpreted and deployed, and that the activity is carried out with intelligent openness to new information, debate, and criticism* (Michigan State University, 2017).

The university faculty handbook's description of appointment, reappointment, and tenure begins with stating the mission of the university and the standards that faculty are held to. This description serves as the structure for the job description of faculty that are hired. This description includes the duties, responsibilities, and experiences that are valued in a faculty that is employed by Michigan State. It is this organizational structure that is at odds with the faculty that were interviewed. Workplace policies and programs often state one thing, but what is practiced is different (Meyer & Rowan, 1977). In the faculty handbook description of policy and how it aligns with the mission are stated, but in practice it is more difficult for faculty to handle multiple identities and responsibilities.

There are views that the business model of a university is using intellectual property to make up for financial losses and in the end the faculty are impacted.

> *It brings in money, bring in money. That's all they really care about. "We don't care about quality of research. We don't care about whether you really do a decent job . . . you know, a good job teaching. We don't care about anything. Just keep bringing in the money because we need money to survive* (MSU ID20, 2018).

> *I think it's also seen as favorable because were making, you know . . . To patent your research; to commercialize your research, you're making money for the University; and there is a whole lot of focus in engineering departments on making money for the university. So, you know, bringing in indirect costs; or a Vice President for Research will emphasize, "It's all about the dollars", right?* (MSU ID20, 2018).

Since Michigan State has ownership over most intellectual property, there is a royalty distribution system in place (see Table 24). In this distribution system, the university at a certain point makes more money than the faculty after a certain dollar amount. It is a financial benefit for the university and the academic unit to have faculty engage in academic entrepreneurship, particularly if it is successful. Though Michigan State has a distribution system set up in

comparison to other universities it underperforms (Schulz, 2014). This leads to the question if it is worth the trouble to continue a program that underperforms and conflicts with the responsibilities of a professor.

Table 24.

MSU Distribution of Net Licensing Proceeds

Net Licensing Proceeds on a Particular University Invention	Inventor (s)	Major Administrative Unit	University
First $5,000	100%	0	0
Next $100,000	33.33%	33.33%	33.33%
Next $400,000	30%	30%	40%
Next $500,000	20%	20%	60%
Additional Net Licensing Proceeds over $1,005,000	15%	15%	70%

Source: Michigan State University Patent Policy (2017)

The overall view is that the job description has too many duties for one individual: teaching, service, research, and innovation.

> *When faculty are spending time on their company, I don't think there is sufficient management of that. It takes away from their primary job, which is teaching, research and service.* (MSU ID19, 2018).

> *They have to make this office bigger. Because, like, when I go to do something – just like a simple agreement between a company and my lab – the amount of paperwork that they gave me to fill, I was just like, "Oh, I'm just not going to do that work because it's . . ." You just see the paperwork and you're like, "I'm not getting paid to do that, so why?* (MSU ID2, 2018).

The faculty are responsible for teaching, research, service and the added task of innovation seems to stray from what the faculty were hired to do. For some there are conflicting messages, particularly with what is stated in tenure policies and what is encouraged.

> *I would say it's encouraged… I feel like it they really want us to do that, then they will have more resources for us to do it, right? They'll have more personnel to help us to it, but they don't. so maybe it's not encouraged. Maybe they just want us to do our research now that I think of it* (MSU ID2, 2018).

> *You know, there is not an effort to make it transparent whether or not this is something that the university sees as beneficial; and where it falls under our job description and our identity. So yeah . . . And maybe it doesn't even . . . Maybe they wouldn't even let me count it for any of those percentages. It doesn't fit with me* (MSU ID20, 2018).

> *So, there are lots of different factors. One is that, in your first couple of years – really first five years – as an assistant professor, you are basically judged to get tenure on how much you published; and how many graduate students you get through their PhD; and how much federal funding you bring in. So, I would argue that during your first two or three years, there is essentially no opportunity to. You would have to somehow fit it in on top of teaching and all those other requirements* (MSU ID14, 2018).

These statements align with Meyer and Rowan's (1977) research on organizational structures. The handbook may have policies on entrepreneurial activity, but they are not clear or put into practice during the tenure process; the faculty are not rewarded for this activity.

Not many faculty members receive training in their graduate programs on how to engage with industry or become an entrepreneur; most are trained as a scholar. Faculty are encouraged to engage in entrepreneurial activities but have not received prior training in the area.

> *My training really was focused on, "Here is how to be a scholar", even at a place that saw the value of training people in other ways. But it's just when you have, you know, the people who are training you . . . some of them had never left the Academy or had a job outside of the Academy, so they are not necessarily well-equipped to train you for the private sector or even government or nonprofit* (MSU ID20, 2018).

Faculty are trained in the graduate or post-doctoral positions to mentor researchers, conduct research, and in some cases teaching, but they are not given training on business knowledge. Michigan State University policy on tenure is defaulted to the college and department.

> *Each department, school, and comparable unit is required to have procedures and criteria that are clearly formulated and relevant to evaluating the performance of faculty members* (MSU, 2017).

The departments at Michigan State University, default to the college of engineering tenure policies which count the following in the tenure and promotion review: teaching and education, research and other aspects of scholarship, public service, and institutional service (Michigan State University College of Engineering, 2018). Participating in exhibitions, securing patents, copyrights, and trademarks fall under research and other aspects of scholarship, where consulting and managing resources to conduct technology transfer falls under public service (Michigan State University College of Engineering, 2018). Categorizing consulting and technology transfer as a public service indicates that this activity is not of importance to promotion since research and teaching categories typically carry more significance in promotion. The faculty evaluation system that the college uses, has a point system, but the handbook does not disclose how many points each item is weighted. It states that teaching and education, research and other aspects of scholarship, public service, and institutional service are all considered for promotion (Michigan State University College of Engineering, 2018). It is not clear if spinouts are considered in promotion and it is not clear if an individual did not publish any papers, but patented multiple inventions if that would have more weight than publications or teaching.

Michigan State University theme three – pathways to institutional change. Resources and organizational structures are barriers that have led to an opportunity for the engineering faculty. The barriers to white women engineering faculty's advancement are at times apparent and other times subtle.

> *If it's not openly hostile, it's at least subtly hostile* (MSU ID19, 2018).

> *Automatic assumption that, if you're a woman, you're not an engineer. You're not engineering faculty. You're not part of the Old Boys' Club, you know? . . . You know, they go play basketball, you're not included. They go out for lunch, you're not included. You're pretty much isol*ated (MSU ID19, 2018).

> *I deal with sexism on a daily basis; and it seems like there would be multiple layers of, like . . . There is sexism in academia in general. There is sexism in STEM. [Chuckles] Then there is sexism in entrepreneurship. I could imagine, then, that that would get overwhelming* (MSU ID20, 2018).

While the faculty interviewed have experienced discrimination based on sex, they persist in creating change within their discipline and university. The faculty employ various methods to creating change. Welter et al. (2014) in their research suggest that institutional change and institutional change agent be used to describe those who change institutions because institutional entrepreneurship implies that these changes are intentional. Institutional change allows for the flexibility in intentionality; some people change institutions unintentionally (Welter et al., 2014). The findings suggest that the faculty were acting as change agents, some deliberately were making change and others did it unintentionally.

In the case of Michigan State University, some of the women acted as institutional change agents, who sought to create change in their discipline. While some were thinking of how to make the innovation process streamlined and create pathways, most were thinking about the discipline.

> *How do we create those pathways so they're easier – especially the legal . . . the legal piece?* (MSU ID9, 2018).

> *One thing that is kind of missing is there is not . . . Like, I know a lot of men that have started . . . that have startup, but I don't know any woman in the college. So maybe just an example . . . Like, a role model is always helpful* (MSU ID15, 2018).

The institutional environment may be an important factor in the propensity of women to engage in entrepreneurial activity, however, the number of barriers present make the action more daunting. It appears that before considering the institutional environment, the women must break barriers. These barriers are embedded within various scales from federal to state to university to college to department policy. Women as a response to these barriers act as institutional change

agents who are creating pathways to change by creating new institutions. In other words, the barriers to entrepreneurial activity are clouded by the barriers that exist in the workplace for women. The women are more concerned with reaching parity in an unbalanced discipline and this is their focus and where most of their attention is directed. They are trying to break barriers in their field. There is no time to think about academic entrepreneurship. They are trying to create a STEM pipeline, add STEM programs, make change in the tenure process, bring diversity to committees, change the type of tasks given to women, and bring awareness to wage disparities.

> *So, like, I do a lot of things to encourage women to go into engineering, for example. But that's pretty much what there is. There isn't too much for faculty* (MSU ID15, 2018).

> *I know that there are NO programs that do that. Because now in engineering, I actually put a program that we're going to start actually on Monday, and it's for women leadership. I also wrote a grant for women leadership in engineering, and I know there haven't been anything in place* (MSU ID2, 2018).

> *And so, you know, we had to argue that, in policy, for tenure and other things, that these were very valuable activities. . . Because I remember being on the committee and saying, "Hey, no way. This is very valuable and we're going to recognize this as important," you know? . . . I convinced them. I did. I had to have the argument, you know, formulated. [referring to a junior faculty who participated in engagement]* (MSU ID9, 2018).

> *In fact, you know, the other thing that I see is that women faculty get . . . tend to get loaded with responsibilities that hinder their promotion. They get . . . They tend to get . . . I'll call it kind of "housekeeping" or . . . you know? . . . First of all, if you put a junior faculty member in there, they have no clout. What can they say? Second of all, you've now derailed their promotion, because now they're spending time doing X; but it's not disciplinary research that's going to get them promoted. This faculty member ultimately did get promoted, but it was a major fight; and I've seen it over and over and over again* (MSU ID19, 2018).

> *I have complained about it recently, because it's still happening. And, like I said, what I was told was, "They just didn't negotiate as well." It shouldn't be . . . I mean I don't understand why . . . Maybe I'm just naïve. In my mind, there should be equity* (MSU ID19, 2018).

It should be mentioned that the National Science Foundation has a grant program called ADVANCE, which has invested over 270 million dollars since 2011 to support women in STEM (National Science Foundation, n.d.). Michigan State University had a $3.98 million grant in 2008 for a Michigan State ADVANCE initiative called Advancing Diversity through the Alignment of Policies and Practices and it focused on faculty performance, mentoring, leadership, amongst other things. The program "formally ended in 2014" (MSU ADVANCE, n.d.) and the initiatives were integrated into different units on campus. The University of Michigan has an ADVANCE initiative created in 2002 and focuses on "recruitment, retention, climate, and leadership development" (University of Michigan, n.d.).

The faculty acting as institutional change agents is an indicator that the faculty have an entrepreneurial spirit, but that energy is directed toward improving the discipline. They use their knowledge to change what they have training in, which is teaching, research, and service. They do not put these energies into entrepreneurship.

University of Michigan theme one – pathways to resources. In the case of Michigan State University there were gaps in resource availability. However, in the case of the University of Michigan, the resource availability, distribution, and support are pathways for faculty. The technology transfer office provides support via the lawyers and technology transfer liaisons and these support staff alleviate burden on faculty.

> *Getting a good lawyer through the university has helped me understand IP [intellectual property]* (UM ID76, 2018).

> *We definitely needed the . . . We needed a lawyer; and particularly for us, we needed a liaison for the lawyer. So, you know, we don't reach out directly to the patent attorney's office. We have the Entrepreneur's Center for that. And so, they were really instrumental in taking the administrative burden off of our backs. So, all we do is focus on the technical content of the application* (UM ID110, 2018).

As previously mentioned, Michigan State University in 2014 ended the ADVANCE program. At the University of Michigan, the ADVANCE program has been in existence since 2002 and continues to this day. Many of the faculty mentioned the program by name and offered examples of how it was helpful in their development as faculty. They saw this program as a place where advice is received, or information and training given.

> *If I got into a situation where I don't think I could make it home, I probably . . . Let me put it to you this way. I would at least feel comfortable going to ADVANCE, or someone in my department, or somebody at the University of Michigan and say, "Is there any way that you can help me?" And so, I don't know if it exists specifically for my situation, but I believe that there are definitely some fail safe mechanisms for that, or childcare, or some of those types of things* (UM ID58, 2018).

> *We have ADVANCE, and so we've gone . . . I've gone to, like, their workshops and their meet and greets and things like that. Some are more useful than others. I think it's all a great networking opportunity, so that's always positive. And so, I've tried to seek it out as much as possible* (UM ID70, 2018).

> *We have a really strong . . . We have an NSF ADVANCE Program here on campus which started almost 20 years ago. Yeah, so 15 or 20 years ago. They've been great about . . . They'll do workshops on things* (UM ID110, 2018).

> *There's a lot, actually. I mean so at Michigan, we have an ADVANCE office. I'm sure you're familiar with the ADVANCE Program." "our provost funds it and they do lots of programming for women faculty and provide a lot of resources. And that's been very helpful for me at Michigan in terms of building a community of other female faculty.* (UM ID147, 2018).

A research study of the ADVANCE program at the University of Michigan (Meyerson & Tompkins, 2007) used institutional theory as a framework and found that those who pushed for the ADVANCE program at the university acted as institutional change agents. These women faculty were not academic entrepreneurs but acted as institutional change agents for gender equity at the University of Michigan (Meyerson & Tompkins, 2007). This suggests that the women faculty at the University of Michigan have a culture of pushing for change and decided

that the ADVANCE program was important for the advancement of women at the university (Meyerson & Tompkins, 2007).

At Michigan State University, faculty mentioned how they did not feel the university was a family friendly place. However, at the University of Michigan, the faculty were knowledgeable of policies in place to help with family responsibilities.

> *After childbirth, you get two semesters of Modified Duty which means two semesters where you don't have to teach, which is a great help* (UM ID143, 2018).

> *One thing I appreciate about Michigan is their policies on leave. . . they gave me a full year of teaching release; and that allowed me to kind of, you know, keep my research moving as I'm going up for tenure. I really appreciated that. So, the leave policy; and they also give males . . . new fathers a teaching release, too; and that helps the mothers because that lets them come back to work* (UM ID93, 2018).

> *They definitely have leave opportunities. So, we have a Modified Duties Program which says whether or not you take . . . caring for the elderly or for children; if you're adopting; or whether or not you have maternity leave, it doesn't matter. They are very supportive of that sort of a time* (UM ID110, 2018).

> *I just had a baby; so, our policy for modified duty has definitely facilitated my research in some sense more than it would have been if I didn't have that policy. And then there are other policies that I am learning about. So, there is, like, a childcare reimbursement. So, I went out of town for a conference and I had a babysitter, and I can get that reimbursed from the College of Engineering* (UM ID125, 2018).

> *I guess the way my university is most supportive for working women is through opportunities around daycare* (UM ID130, 2018).

The University of Michigan faculty through financial support or daycare spaces on campus feel supported to pursue activities such as attending conferences. This resource availability alleviates some of the pressures of the job description.

At the University of Michigan, faculty find that the availability of other faculty is a resource for information and support, and this facilitates their activities in the university

> *So many of the things I have been aware through emails that are communicated by the College of Engineering. Then I would think that, if you have a specific question, then you could go to the HR staff in the department, or your department chair, or senior faculty*

> *who has been around since [for]ever. So essentially within your department community, definitely there will be people who would know more than you and they will . . . Even if they don't know the answer, they will know how to direct you to the correct point of . . . to the right point of contact* (UM ID52, 2018).

> *We have a lot of good senior faculty here* (UM ID147, 2018).

Tartari and Salter (2015) in their study found that the presence of women in the discipline was not a major contributor to academic engagement. However, the results of this study suggest that the availability of other women at the University of Michigan serves as a resource.

Resources at the University of Michigan in its varying forms is an enabling factor for the women faculty in engineering. These resources allow them to operate within a supportive culture that encourages them to focus on their research. While these resources are a pathway for the faculty, the organizational structure problems at Michigan State University also impact the University of Michigan faculty.

University of Michigan theme two – barriers to organizational structure. The university faculty handbook's description of tenure principles begins with stating the mission of the university and the standards that faculty are held to. This description serves as the structure for the job description of faculty that are hired. This description includes the duties, responsibilities, and experiences that are valued in a faculty that are employed by the University of Michigan. It is this description that is at odds with the faculty that were interviewed.

> *The University of Michigan believes that tenure is an essential part of the guarantee of academic freedom that is necessary for University-based intellectual life to flourish. The grant of indeterminate tenure to faculty members represents an enormous investment of University—and societal—resources, and those who receive this investment do so only after rigorous review which establishes that their scholarship, research, teaching, and service meet the highest standards and are congruent with the needs of the University* (UM, n.d.).[24]

[24] University of Michigan Faculty Handbook: http://provost.umich.edu/faculty/handbook/6/6.A.html

The organizational structure of the university promotions entrepreneurial activity, but in practice, the tenure policy mentions scholarship, research, teaching, and service as factors for tenure. This policy does not mention innovation, though it is encouraged. This disconnect between what is said, what is implied, and what is done (Meyers & Rowan, 1977), creates a tension in the identities and responsibilities of the faculty.

The faculty desire more insight into what is required of them to function in their role as a faculty member.

> *I think it would be more transparent about expectations in this area. And value; I think that would be . . . I think universities tend to be as opaque as possible just so that there aren't goalposts that you're trying to reach so that if you do reach those goal posts, they don't feel stuck. And so, I think universities . . . This whole area is very opaque to me. I don't really know where this fits on their priorities for an assistant professor, for an associate professor, for a full professor. You know, how much should you pull back on your scholarly work to do this? What would a good model be? And so that . . . I think more guidance, I think, for . . . overall. I mean that's true for every part of my job. Again, they tend to be opaque because they don't want to tell you what to do. But in the end, I don't think we're as efficient as we could be; [as] productive* (UM ID 93, 2018).

Throughout the interviews, it is apparent that there is a conflict between the traditional duties of a professor and the desired entrepreneurial university model. The faculty are unsure how to proceed and there are not clear guidelines.

Like Michigan State University, the faculty have concerns over metrics and promotion policies. There is confusion over what counts towards promotion and where efforts should be directed.

> *I don't know that it's policies, but maybe it is. It's just I feel like the university is requiring more and more of us that we assess everything we do and create metrics out of our work – and in a way that discourages us to just innovate for the beauty of it* (UM ID 88, 2018).

> *So, when it comes to promotion and tenure, I'm going through it right now. You know, what really seems to drive it is the quality of your publications; the amount of grant money you received; your teaching evaluations. And they put . . . You know, they put spots on my promotion and tenure CV for this activity, but I definitely don't get the sense*

> *that, you know, if I had really strong . . . like, a lot of patents but very few papers, I would guess based on my feedback that it wouldn't be looked as highly as having strong papers with a little bit of patent work. That's my perception. . . And I'm finding through this process that there is a difference between what people say and what actually happens as of promotion and tenure. "Wait a second! That's not what I heard* (UM ID93, 2018).

> *And for us, every section of the tenure package has to be completed even if you say, "This isn't applicable. I didn't do this." So, there's a section for patent and patent applications. There's other intellectual products. So, we have sections that . . . I will say nothing in that – " Not Applicable", or "Nothing" or "None", that's fine. There's no penalty for not having that. Conversely, if you were to put a tenure package or a promotion package together and that's the only section that had substance, you wouldn't get tenure. It has to be in addition to or in balance with. It's not enough to [be a] really good IP person. You can't just generate lots and lots of patents. It's just . . . You know, not at our institution* (UM ID 110, 2018).

The promotion and rewards system in these universities is broken and there needs to be a reconfiguration to match what is occurring in practice. The promotion policy, as indicated by the faculty, does not provide metrics and thus the faculty are not inclined to pursue entrepreneurial activities because it is not measurable and not weighted the same as their publication productivity.

Similarly, with Michigan State University, the University of Michigan is operating under the same higher education business model that has been struggling for ways to bring in revenue. The faculty bring up the desire for faculty to innovate is based on financial need.

> *And I think face value is that it's important; and I think the universities realize that the funding . . . with the funding situation right now at the federal level, that they have to diversify; and technology transfer and patenting seems more and more important. This is just my perception. And so, I think on face value, they really value it; and they* (UM ID93, 2018).

> *You know, the university likes having their faculty start companies or bring . . . you know, have patents that bring money for the university and so on; but the real challenge is just that it is a lot of work – and especially a lot of work if you're also going to be a faculty member at the same time* (UM ID125, 2018).

Since the University of Michigan has ownership over most intellectual property, there is a revenue distribution system in place (see Table 25). In this distribution system, the university at a

certain point makes more money than the faculty after a certain dollar amount, but it is a small percentage. It is a financial benefit for the university, college, the academic unit to have faculty engage in academic entrepreneurship, particularly if it is successful. In comparison to Michigan State University, the revenue distribution is favorable for faculty.

Table 25.

UM Revenue Distribution

Division of Revenue	Inventor(s)	College	Department	University
Up to $200,000	50%	18%	17%	15%
$200,000 to $2,000,000	30%	25%	20%	25%
Over $2,000,000	30%	35%	0%	35%

Source: University of Michigan Patent Policy (2009)

In the AUTM report (2015) on licensing, the University of Michigan is a university that has good performance in terms of revenue in comparison to most universities. Additionally, the revenue distribution is more equally dispersed between inventor, college, department, and university.

Faculty training during graduate school is primarily focused on how to be a quality scholar and there is not much focus on industry or technology transfer. This is something that the faculty bring up in their discussions about the process and how they are hired for other reasons.

> *…they don't teach us anything about business in our PhDs* (UM ID58, 2018).

> *And I don't know if it's policy, but training . . . We're trained on how to be good researchers. We're not trained on how to be entrepreneurs and inventors. And so, you know, that comes all the way back down to the required classes that you take as a graduate student and the activities that you do as a grad student. So, I guess just the structure around how we're trained; and then what we're . . . what we're judged on for our jobs* (UM ID93, 2018).

Like Michigan State faculty, these faculty do not know how to become entrepreneurs. They did not learn management, business, or technology transfer knowledge while graduate students. This

seems to be an issue that begins with the graduate education training. In a field like engineering where collaboration with industry is frequent, this is a gap in educational training.

University of Michigan theme three – pathways to institutional change. The need for diversity in undergraduate and graduate education is a persistent theme between both universities and it underscores the importance of creating change in other areas of higher education before tackling innovation. The University of Michigan faculty discuss the gaps in diversity.

> *So, like, in engineering, we've been working really hard to get gender, and diverse communities, and underrepresented groups in engineering, and we flatlined. So, we have a lot of programs that were very productive in terms of increasing participation among women and minorities, and then it's kind of . . . It just hit a wall, and the wall is really low. It's like 25% at the undergraduate level and then it scales down to, like, 10% at the program level. And we have not been able to break that. You know, we have not been able to break through. And I have a joint appointment at [department]. [Department] is worse than mechanical, and it's the industry. A lot of it is that's a really, really homogenous industry* (UMID110, 2018).

> *I think it would be something around diversity. We have a really low . . . a very homogeneous population of students in our undergraduate population – and especially in [department]. It's mostly White males. So I would try to do something to better support students that don't traditionally study [field], whether it's underrepresented minority populations in engineering or women; just find ways to really better support them and create an environment which is more inclusive of a really diverse student body so that we can diversify the field generally* (UMID 130, 2018).

This desire to increase the STEM pipeline helps improve the diversity in faculty hiring (Fox, 1995). These faculty not only are concerned about diversity, but they are thinking of ways to change the outlook of the field in a variety of ways. Some are wanting to engage with the local schools, others are looking for entrepreneurial students to engage them in technology transfer, while others are using topics in the classroom to spark interest in innovation and help with job placement.

> *I'm thinking very hard about how to support female faculty and just younger faculty at Michigan* (UM ID143, 2018).

> *It's definitely a very strong feeling I have, and I . . . So, I participate in activities with the students, and I do a lot of things nationally that are related to Women in Engineering.*

> *And I've been involved in environmental justice issues and so forth that also have gender elements. And I'm getting my satisfaction there* (UM ID88, 2018).
>
> *Maybe finding places for my students. I just do work that is a little outside of the realm of what traditional engineering faculty do; and finding ways for the students that are working with me to have good job placements when they graduate is, you know, really an important part of my work generally* (UM ID130, 2018).
>
> *I have definitely kept an eye out for students who have kind of an innovation flair* (UM ID88, 2018).
>
> *So I would try to – and I hope to have the chance to do it more effectively as I also become more senior – reach out to local schools and the local communities in order to make them aware of the aerospace engineering program; and why it is very important and very cool for more women to get into aerospace engineering. So, I will be happy to contribute to that effort, and hopefully to see more female students in my classrooms* (UM ID52, 2018).
>
> *I happen to enjoy teaching, so . . . And I also had the opportunity to teach a class. I really wanted to be invested in the undergraduate teaching, so that's my class per year. But then I do additional teaching because I had the opportunity to actually teach on something that is unusual to find in a university and is my wheelhouse of expertise, which is how do you take a [widget or device through FDA approval* (UM ID58, 2018).

At the University of Michigan, like at Michigan State, the faculty are acting as institutional change agents via outreach and teaching in hopes that this will diversify the field.

Revisiting the research design. This dissertation case study focused on the experiences of women faculty in engineering. The purpose was to understand how the institutional environment can play a role in the propensity to engage in entrepreneurial activity. To examine this, women from the College of Engineering at Michigan State University and the University of Michigan were interviewed. University policy documents were used to supplement and provide context to the interview responses. These two data items were able to provide context to the research objective. On the surface, it may appear that Michigan State University and the University of Michigan differ in culture, but the overarching institutional norms of higher education permeates both organizations. The women faculty are employed in different cities in the same state, but experience many of the same problems. I answer the research question

looking at the women faculty at both universities as one group and then I answer the propositions by separating the faculty into their respective universities.

Research questions. The objective of this study was to understand how the formal and informal environmental factors of an entrepreneurial university constrain or enable the entrepreneurial activity of white women faculty in engineering. Specifically, examining the role diversity programs, family policy, and reward systems play in propensity. The research question for this study sought to answer what factors constrain or enable the entrepreneurial activity of white women faculty in engineering? The factor that is most constraining to entrepreneurial activity is organizational structure (Meyer & Rowan, 1977), which is the allocation of responsibilities and duties of a faculty. The structure of the university system in how it classifies jobs and rewards promotion is a factor that constrains white women faculty in engineering. The factor that is most enabling to entrepreneurial activity is institutional change agents, which is the action faculty take to create change with the institutional environment. The act of institutional change is a factor that enables women faculty in engineering.

Propositions. Proposition one is women faculty's entrepreneurial activity is positively influenced by university sponsored programs supporting diversity and inclusion in science, technology, and engineering, and mathematics (STEM). Based on the analysis at Michigan State University women faculty were not positively influenced by programs supporting diversity and inclusion in STEM because of a lack of programming. Based on the analysis at the University of Michigan, women faculty were positively influenced by programs supporting diversity and inclusion in STEM, particularly the ADVANCE initiative.

Proposition two is women faculty's entrepreneurial activity is negatively influenced by department reward systems that do not include entrepreneurial activities in tenure and promotion

policies. Based on the analysis at Michigan State University and the University of Michigan faculty were negatively influenced by the reward systems. Though there was the presence of language of academic entrepreneurship in tenure policies, its importance was not clear. This ambiguity constrains faculty because they do not perceive the effort to engage in entrepreneurial activity worth it in the advancement of their careers.

Proposition three is women faculty's entrepreneurial activity is positively influenced by university policies that provide support for childcare and household responsibilities. Based on the analysis at Michigan State University, women faculty were not positively influenced by policies that provided support for childcare and household responsibilities particularly the lack of daycare services. Based on the analysis at the University of Michigan, women faculty were positively influenced by policies that provided support for childcare and household responsibilities, particularly travel reimbursements, daycare, and modified duty.

Conceptual model of policy impacts on academic entrepreneurial activity. A conceptual model was developed to frame the study (see Figure 4). The conceptual model identified that the university operates on the value orientation continuum (Lam, 2011); traditional to hybrid to entrepreneurial. Michigan State University and the University of Michigan were both operating as hybrid universities because they value the traditional model of teaching, research, and service in addition to economic development. Within this entrepreneurial university and institutional environment, there are policies that play a role in entrepreneurial activity. For this dissertation study, support measures, reward and incentives, and family orientation were identified as policies that constrain or enable entrepreneurial activity. The entrepreneurial activity was identified as the prelaunch to postlaunch stages of the process. After finding the results of this study, the conceptual model is revisited.

The majority of faculty at both universities were in a prelaunch phase; these were the faculty who had not engaged in academic entrepreneurship. The findings of this study suggest that at this stage of entrepreneurial activity, support measures, rewards and incentives, and family orientation all play a role. It is at the prelaunch stage where a faculty is at the decision-making stage and considering or not considering entering academic entrepreneurship. The majority of faculty who had engaged in entrepreneurial activity at both universities had only reached the disclosure and intellectual property protection phases of entrepreneurial activity. At this stage of entrepreneurial activity, support measures, rewards and incentives, and family orientation all play a role at this stage. The conceptual model is modified to reflect the findings that faculty operate as institutional change agents. This change agent behavior is influenced by the institutional environment and in return can influence entrepreneurial activity. The institutional change created during all the stages of entrepreneurial activity can encourage movement from prelaunch to launch phase. This is particularly so if policy changes are made to facilitate and ease the barrier of entry.

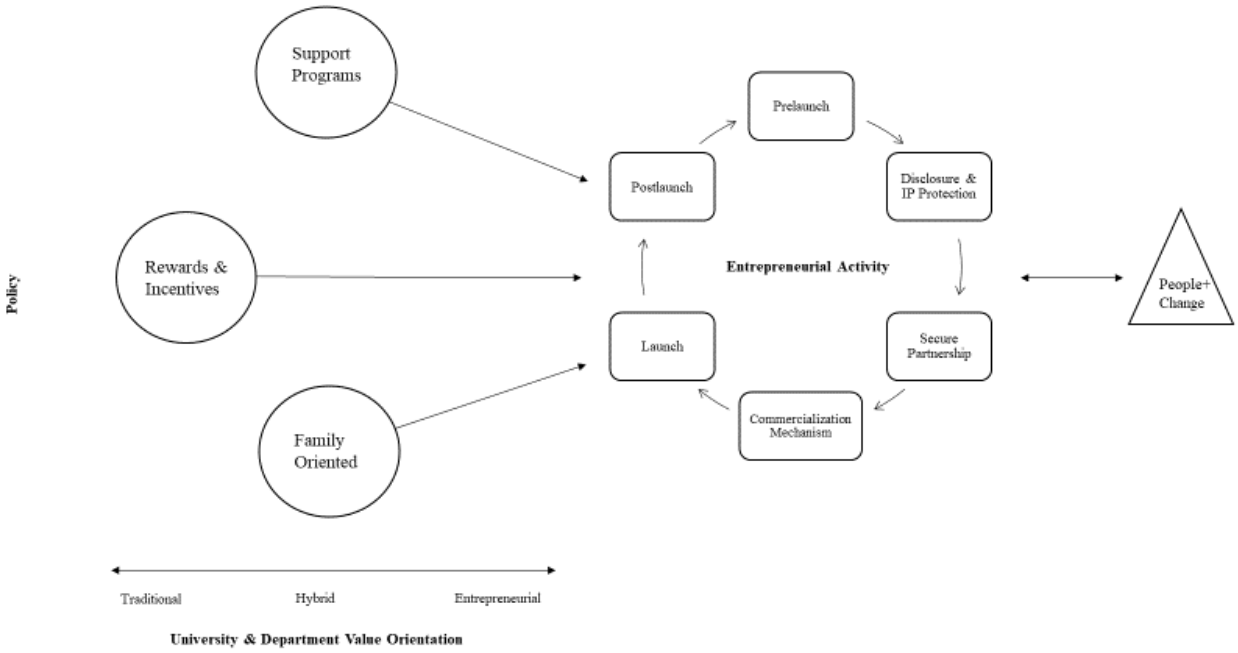

Figure 4. Conceptual Model of Policy Impacts on Entrepreneurial Activity Processes

In comparing the institutional environments, Michigan State University is a more constraining environment because of the lack of resources and the organizational structures in comparison to the University of Michigan. Both universities share the barrier of organizational structures. Institutional change at the normative and cognitive levels is slow in comparison to regulatory. Changing a policy at a university or modeling a university as entrepreneurial is a regulatory change that on the surface promotes change, but underneath the surface are the social norms and behaviors that have guided the thinking of faculty and higher education for centuries.

The desire for universities to become entrepreneurial does not begin and end at the mission statement, but must be included not only in undergraduate education but graduate education. The social norms of engaging in entrepreneurial activity begins in training prior to becoming a faculty member and continues into the metrics of the rewards systems. While Michigan State University is a more constraining environment for white women engineers, both universities have challenges that are pushing the faculty to become institutional change agents.

The embeddedness of both universities supersedes the entrepreneurial university model. The university is embedded into the federal policies, the norms of higher education, and the norms of the discipline. Gender equity is an issue that faculty are more interested in creating change than participating in entrepreneurship.

CHAPTER 5

CONCLUSION

The previous chapters of this study provide background literature on the topic of women academic entrepreneurs, the entrepreneurial university, and institutional environments. The following chapter concludes the research on institutional environment and white women engineering faculty. The first section discusses the limitations of the study, the second section provides future research suggestions, the third section discusses policy implications, and finally, the fourth section concludes the study.

Traditionally, the university functions as a place where teaching, research, and service occur. However, with the passage of federal legislation in the United States, such as the Bayh Dole Act, the university model adjusted to include entrepreneurship, innovation, and economic growth as part of its mission. Researchers at the university are encouraged to engage with industry. This engagement benefits the university through revenue received and the world at large who benefits from the innovations. With the passage of legislation that encouraged the entrepreneurial university model, empirical research followed the benefits and critiques of this model. This field of inquiry is called university-industry collaboration, commercialization, academic engagement, or academic entrepreneurship. For this dissertation study, the term academic entrepreneurship refers to the commercialization and engagement aspects of the phenomenon.

The study of academic entrepreneurship has recently extended to include discussions on gender (Fox, 2005; Whittington & Smith-Doerr, 2005; Tartari & Salter, 2015; Meng, 2016). This research primarily focused on gender differences between men and women and their entrepreneurial activity. This focus on the attainment gap concludes that there are differences

between men and women entrepreneurial activity but does not investigate further differences between women or how context impacts women. The objective of this dissertation project is to understand how the formal and informal environmental factors of an entrepreneurial university constrain or enable the entrepreneurial activity of white women faculty in engineering. Specifically examining the role diversity programs, family policy, and reward systems play in propensity. Using institutional theory as a framework to guide the development of the research design allows for exploring gaps in the literature, contributing topically and theoretically to the literature.

The qualitative case study approach allows for an in-depth investigation of 19 white women engineers at Michigan State University, and the University of Michigan. The coding and analysis of interviews, and documents allow for a pattern matching analysis. This analysis of the data allows for the development of three main themes that address the research question. At Michigan State University these themes are barriers to resources, barriers to organizational structure, and pathways to institutional change. At the University of Michigan, these themes are pathways to resources, barriers to organizational structure and pathways to institutional change. The idea of resources refers to the availability of funding, training, administrative help, and other forms of support. The idea of organizational structure refers to the job descriptions, duties, and activities that are expected of faculty. The idea of institutional change refers to the unintentional or intentional ways faculty take steps to make changes that improve their experiences. The most constraining aspect of entrepreneurial propensity are the university responsibilities, duties, and promotion of faculty. The most enabling aspect for entrepreneurial propensity is the institutional change that faculty create by fighting for gender equity in the discipline.

Topically, this dissertation study extends the existing literature on women researchers who engage in academic entrepreneurship in three ways. First, previous literature has focused on socio-demographic factors, such as age and experience (Allen et al., 2007; Ding et al., 2006) and perceptual factors (Alonso-Galicia et al., 2015; Murray & Graham, 2007; Stephan & El-Ganainy, 2007) to explain disparities in commercialization rates. Contextual factors are examined less frequently, and this study contributes by studying context. Previous studies on contextual factors focus on organizational hierarchy (Whittington & Smith-Doerr, 2008) as an explanation for women researcher's propensity to engage in entrepreneurial activity. However, this dissertation study finds that organizational structures such as the job description play a role. Second, previous research has found that most research on academic entrepreneurship focuses on spinout activity even though most academic researchers do not reach the spinout stage (Tartari & Salter, 2015). Given this underexplored aspect, this study considers other forms of academic engagement, such as consulting, advisory boards, and writing policy briefs. Fourth, previous research focuses on entrepreneurial activity as static, even though entrepreneurial activity is a process (Jennings & Brush, 2013) that within the university context occurs as a multi-step process (Wood, 2011). Thus, this dissertation study fills a gap in the literature by exploring how the institutional environment affects entrepreneurial activity at various stages. The findings of this dissertation study indicate that policy impacts faculty at the pre-launch stage before they have intellectual property disclosure and that policy also impacts those who go through the disclosure process.

Theoretically, previous studies that looked at the gender gap in academic entrepreneurship turn to theories of human capital (Allen et al., 2007; Gaughan & Corley, 2010; Polkowska, 2013; Rosa & Dawson, 2006), supply and demand perspectives (Ding, Murray, & Stuart, 2013; Murray & Graham, 2007; Stephan & El-Ganainy, 2007; Whittington & Smith-

Doerr, 2008), and social capital theory (Meng, 2016) to explain the differences between men and women researchers. However, theoretically, institutional theory is used rarely to explain the propensity of academic women entrepreneurs. Institutional theory is an appropriate theory to use in looking at university institutional environments because it explains the constraining and enabling factors on entrepreneurial activity. This dissertation study uses institutional theory to explain the propensity of women researchers engaging in entrepreneurial activity because the gendered nature of institutions illustrates the relationships between policy, social norms, and participation (Ahl & Nelson, 2010; Ahl & Nelson, 2015). Formal and informal institutions constrain or enable entrepreneurial activity (Bruton et al., 2010) and given the increasing importance of universities to the economy (Shane, 2004; Urbano & Guerreo, 2013); it is a continued area of interest to researchers and policymakers.

Limitations

This dissertation study has seven main limitations; however, these limitations are not expected to diminish the findings. The first limitation is that the dissertation study takes place at two universities in the Midwest that have successful technology transfer offices, thus not considering universities with technology transfer offices that have smaller budgets, less incoming revenue, and innovation output. Studying only the Midwest does not include other regions that have entrepreneurial universities. This is limiting the findings of institutional environments because it does not extend to other universities.

The second limitation is that only white women engineering faculty are interviewed, thus limiting the findings to the experiences of white women in an entrepreneurial university. The broader literature on women entrepreneurs indicates that Black and Latino women are the fastest growing demographics in entrepreneurship. These studies consider that structural barriers may

constrain or enable non-white women. By studying only white women, non-white women are rendered invisible, and they might have unique experiences tied to their race or ethnicity that may not be an issue that the white women engineers experienced.

The third limitation is that the dissertation study considers only engineering faculty and does not include other science or humanities discipline, thus limiting the broader reach of engagement that occurs in the university. The humanities discipline is well suited to engage in entrepreneurial activity via copyrights, informal advice, or sitting on advisory boards. There contributions to the entrepreneurial university should be included because their barriers and pathways may or may not be different.

The fourth limitation is that the dissertation study only considers the normative and regulative aspects of institutional theory and does not include the cognitive category in development of the conceptual framework and research question. Institutional theory proports that the regulative, normative, and cognitive aspects work together and to not include this aspect in the dissertation study dismisses the cognitive aspects that might play a role in the results.

The fifth limitation is that university stakeholders, department chairs, or college deans were not interviewed. The results of this dissertation study stem from the perceptions and attitudes of the white women engineering faculty. Gaining insight from other stakeholders might have provided more richness to the interviews and documents. Additionally, it could have provided more insight into the organizational structure of the university.

The sixth limitation is that the findings groups all the women faculty together and did not analyze the findings based on type of commercialization, faculty ranking, or engagement or non-engagement. The focus was to understand the constraining and enabling factors on the propensity

to engage but analyzing the data from different units of analyses could have been fruitful, however the size of the sample may have to increase.

The seventh limitation is that the dissertation study places institutional change as a pathway. This does not consider the perspective that the act of creating change is another task added on to the workload of women. Placing the onus of changing systems of oppression and discrimination on women.

Further Research

Though the dissertation study has limitations, there is room for future research to explore this topic further. There are five areas for future research. The first area for future research is to consider this research topic from a different perspective. This research was conducted from an institutional/cultural approach to economic geography that emphasizes the importance of place and culture. There is room to explore academic entrepreneurship and women researchers from the lens of space. Based on participant comments, some areas for exploration are distance of technology transfer office and other innovation spaces from the faculty office, distance of the home from work, and the presence of family-oriented spaces on campus. Geographers are well-placed to study spatial topics such as distance and commute (Lee, Vojnovic, & Grady, 2017) and other topics related to the spatial composition of the region.

The second area for future research is to consider a perspective on academic entrepreneurship that is inclusive of other groups that are not in the majority. Some areas for exploration: consider other disciplines, such as the humanities or social sciences that also collaborate with industry and include the experiences of women of color whose experiences are different than white women based on the inclusion of race as a variable.

The third area for future research is to consider an institutional change agent or institutional entrepreneurship perspective. Some areas for exploration: clarifying identity and definitions of what is an academic entrepreneur. Understanding if it is appropriate to call women faculty academic entrepreneurs, institutional entrepreneurs, or institutional change agents. There is room for understanding how the entrepreneurial university can modify the organizational structure to align with all the varying missions of innovation, inclusion, and diversity.

The fourth area for future research is to consider the process orientation of academic entrepreneurship. Some areas for exploration: studying women faculty at each stage of their entrepreneurial activity, understanding how policies influences behavior at each stage, and considering the faculty ranking at each stage of the process.

The fifth area for future research is exploring regional differences. Some areas for exploration: including more Midwestern universities, comparing regional differences at universities, and considering the local and state innovation policy role in university development.

Policy Implications and Recommendations

At Michigan State University and the University of Michigan, there is room for policy improvements. The first area for improvement is to consider the faculty hiring model and employment description. Currently faculty are hired and promoted based primarily on their research, teaching, and service. Industry recruits faculty to startups, thus university administration could consider recruiting faculty from industry and hiring them as 100 percent research or innovation. The success of a model of hiring for research, teaching, service, and innovation would mean that the employment description for faculty would have to clearly outline what is considered research, teaching, service, and innovation. In addition to this clear employment description, it should also include how these areas are measured. Building this

model of a new hiring process, a new promotion description would be needed that clearly identified how each area (research, teaching, service, and innovation) is measured and defined. An index of faculty merit could be developed that included quantitative and qualitative activities. Such a change in faculty hiring and promotion practices would challenge the deep social norms of academia yet could create institutional change that results in theory and practice alignment.

The second area for improvement is applying a gender aware framework (Brush et al., 2009) to policy. The common theme between the barriers and pathways of the faculty is gender related issues. In this study, the focus was primarily on family related responsibilities, but issues of sexism, pay discrimination, lack of women faculty and students, and other gender related issues were discussed during interviews. Diversity and inclusion are areas that organizations nationwide are implementing to improve the workplace, but there is still a disconnect between the programs created and the perceptions and experiences of the faculty. The university could benefit from focus group or smaller scale studies in various departments to understand how to better serve women on university campuses. Taking a gender aware lens to policy might be a more inclusive perspective of policy development. For example, a recent PNAS study (Yang, Chacula, & Uzzi, 2019) found that high achieving women are more likely to succeed when surrounded by a community of women. This suggests that groups for women, mentoring, and role models are important. In the case of wanting increased faculty involvement in entrepreneurship, universities should consider the importance of having spaces for women faculty to convene or having mentorship programs in place to encourage other women faculty to engage in innovation.

The third area for improvement is expanding entrepreneurship training. While the university is in place to serve students, the faculty should also be served. For example, many of

the faculty in the study mentioned they did not receive entrepreneurship training in graduate school or as a faculty. Changing the norms of the university will take time, but administrators could consider including transferable skill training for graduate students. Examples of this could be courses on communication, management, policy, and innovation or an internship/practicum partnership with industry. This practice would allow a broader training to graduate students that will benefit whether they end up in academia or not. Another strategy for university administrators is to open undergraduate entrepreneurship education courses or workshops to graduate students, postdocs, faculty, and staff. This encourages all individuals within the university ecosystem have access to training resources. Additionally, following the practices of MBA programs, PhD programs could benefit from a requirement of previous work experience.

The fourth area for improvement is increasing the availability and allocations of resources. Increasing resources in the form of administrative assistance or childcare services would alleviate some of the barriers faculty face while considering or participating in entrepreneurial activity. Policymakers and university officials want to have technology transfer benefit the local and regional economy (Tartari & Salter, 2015), those policies are put in place to encourage faculty. This dissertation study provides insight into how different policies impact entrepreneurial activity at different stages of the process. This suggests that policies need to be crafted and developed with context in mind. For example, a blanket policy that encompasses universities in the same region may not be effective because each university has different cultures at the college and department level. Thus, it is important to craft policy that takes into consideration the place and the people who are being affected.

Concluding Remarks

The objective of this dissertation study was to understand how aspects of an institutional environment enables or constraints the entrepreneurial activity of white women researchers in a university context. This dissertation study used previous literature and qualitative methodologies to explore themes related to barriers and pathways to engaging in entrepreneurial activity. After considering the universities, the white women researchers, and their responses to the institutional environments, a more complex response to the research question applied to white women at both universities. The institutional environment may be an important factor in the propensity of white women to engage in entrepreneurial activity, however, the number of barriers present make the action daunting. The findings suggest that white women faculty must break barriers. These barriers are embedded within various scales from federal to state to university to college to department policy. White women as a response to barriers, create pathways to change by attempting to create new institutions. The barriers to entrepreneurial activity are clouded by the barriers that exist in the workplace for white women. There is concern with reaching parity in an unbalanced engineering discipline and this is a focus of the faculty; they are trying to break barriers in their discipline.

The entrepreneurial propensity of white women engineering faculty is constrained by resources and organizational structure. This constraint unintentionally and intentionally leads to the emergence of faculty becoming institutional change agents. However, the byproduct of this institutional change agent behavior is the desire to create change in the broader engineering discipline and the treatment of women in the workplace. While entrepreneurship might be important to the university and the broader local economic development, without addressing gender inequities within the workplace, achieving the goal of becoming a successful

entrepreneurial university will not occur. Faculty first need to have equity as employees and then perhaps the added responsibility of entrepreneurship can be considered.

APPENDICES

Appendix A.
Interview Questions

Those who do not engage in entrepreneurial activity

- What kind of research do you do here at [name of university]?
- Academic entrepreneurs are researchers who transfer research to industry. Have you ever engaged in entrepreneurial activity? For example, patent, copyright, trademark, consulting, speaking engagements, etc?
- Why don't you engage in entrepreneurial activity?
- How do you perceive patenting, copyrighting, and trademarking?
- What is the informal take on academic entrepreneurship in your department and discipline?
- When it comes to your career, what might be your biggest struggle, challenge, or frustration. Can you explain why?
- When it comes to your career, what might the biggest factor in facilitating your work? Can you explain why?
- If you could make a change in the university and/or department, what would it be and why?
- How have university sponsored programs that assist women in STEM hindered or facilitated your work activities?
- Do you have any domestic, family, or care responsibilities? Can you tell me about them?
- Do these responsibilities interfere with your work?
- Are there any final comments you would like to share on policies and how they enable or constrain entrepreneurial activity?

Those who do engage in entrepreneurial activity

- What kind of research do you do here at [name of university]?
- Academic entrepreneurs are researchers who transfer research to industry. Have you ever engaged in entrepreneurial activity? For example, patent, copyright, trademark, consulting, speaking engagements, etc?
- Can you tell me about [name of entrepreneurial activity] and why you decided to engage in entrepreneurial activity?
- How do you perceive patenting, copyrighting, and trademarking?
- What is the informal take on academic entrepreneurship in your department and discipline?
- When it comes to [name of entrepreneurial activity], what might be your biggest struggle, challenge, or frustration. Can you explain why?
- When it comes to [name of entrepreneurial activity], what might the biggest factor in facilitating the process?
- If you could make a change in the university or department, what would it be and why?
- How have university sponsored programs that assist women in STEM hindered or facilitated your work activities?
- Do you have any domestic, family, or care responsibilities? Can you tell me about them?
- Do your responsibilities interfere with your work or entrepreneurial activity?
- Are there any final comments you would like to share on policies and how the enable or constrain entrepreneurial activity?

Appendix B.
Coding Dictionary

1st Cycle Codes	Definition	Example
Policies (Rothaermel et al., 2007)	Principles, rules, guidelines	No, I don't think the U.S. has very good programs . . .
Governance Structure (Guerrero & Urbano, 2012)	Mission, values, organizational model	I think the leadership in different units matters; you know, having a department Chair who is willing to listen to ideas, to promote different faculty members [and] not play favorites; you know, sort of a little bit more fairness and transparency
Support Measures (Guerrero & Urbano, 2012)	Technology transfer office, incubators, research parks, university programs	I did want to do something at MSU; and I contact, like, the Business Office and all that, but they just make it pretty much very difficult for a person like me to, you know, do that work
Entrepreneurial Education (Guerrero & Urbano, 2012)	Courses, business training	They could have some sort of programs that would specifically teach people about how to get patents; or how to start a small business
Culture (Rothaermel et al., 2007)	Customs, attitudes, social norms	People really favor it; and not necessarily just at the department level, but at the college level. That's something that we keep getting . . . being told to, "Start your own company," and, "Patent stuff" because they make money from us
Attitudes towards Entrepreneurship (Guerrero & Urbano, 2012)	Views and opinions	I mean there are ways to be an entrepreneur other than commercializing research, in my opinion. Would you agree with that?
Role Models (Guerrero & Urbano, 2012)	Individuals who other looks to for example	There is not . . . Like, I know a lot of men that have started . . . that have startup, but I don't know any woman in the college. So maybe just an example . . . Like, a role model is always helpful.
Reward Systems (Guerrero & Urbano, 2012)	Tenure, promotion, salary raise	When I think about my Form D that I have to fill out for my tenure process and my white forms – my annual evaluations in the college – there is a section for engagement like you mentioned before; but the way that we define engagement in the university tends to be really narrow and kind of problematic.
Desire to bring ideas to practice (Shane, 2004)	Takes action on ideas	I would say I have always been curious, so my internal curiosity was driving most of the things.
Desire for wealth (Lam, 2011; Shane, 2004)	Wants to have more money	

Satisfaction (Lam, 2011)	Fulfilling goals and needs	my personal motivation and getting involved with it is what have been really the largest motivating factor for me to do work in this field; and just the personal satisfaction
Financial Rewards (Lam, 2011; Owen-Smith & Powell, 2001)	Want to gain money from activities	I think getting the patents . . . So, if, like . . . If a chemical company is interested or another kind of company is interested in buying it, then . . . if we're making money from it, it will be fine
Royalty Sharing (Bercovitz & Feldman, 2008)	Fees received from university or industry for academic entrepreneurship	The University will recover all direct expenses incurred for the patenting, protection and licensing of each University Invention from its licensing proceeds before distributing the net proceeds remaining among the inventor(s), the inventor's major administrative unit, and the University according to the following schedule.
Pragmatic Traditional (Lam, 2011)	Academia and industry should be separate, but practically sees that industry and academia should partner	I do see the value in the innovation, and being . . . moving things forward; but it hasn't been my top passion, if you will
Pure Traditional (Lam, 2011)	Academia and industry should be separate, and innovation should be pursued only in academic space	I don't see the role of the university in entrepreneurship.
Hybrid (Lam, 2011)	Believes academia and industry collaboration is important for advancement, but realizes the needs for boundaries	I think the link to the business world in some ways, or a link to whether you could, you know, copyright or patent something that would bring benefit back to the university
Academic rank	Stage in career	But I'm too junior to have been asked to be on, like, writing a grant report, if that makes sense
Race	Self-identified race	Oh, my race. I'm White
Academic experience	Academic positions during career	So, I was a postdoctoral researcher for a couple of years, and then started applying for faculty positions
Entrepreneurial experience	Prior business experience	I grew up in a family business. I . . . We . . . You know, from the age I was walking, my parents were in the family business and we lived and breathed the family business.
Industry experience	Prior experience working in industry	I have not patented anything myself. So, I've worked with companies that are trying to do that, but not . . . I haven't put . . . anything on my own
Commercialization - consultancy	Has consulted with industry	I mean there are several ways I consulted. Often, I liked to . . . It was mostly with the engineering firms, so these . . . what they called the consulting engineering firms

Commercialization - disclosure	Has notified university of innovation	in terms of new technologies, I do have a project right now that is moving towards a patent disclosure; and so, we have a disclosure drafted
Commercialization - patent	Has filed for patent	So, I have applied for patents.
Engagement - advisory board	Has participated on an advisory board	join us for a workshop. Join us on an advisory board" – that kind of thing.
Engagement - student supervision	Has graduate or undergraduate students	my students. So, we . . . As a group, we have a lot of ideas.
Engagement - providing informal advice to non-academic	Has provided advice to industry	I have been engaged in working with non-profits throughout my PhD up until the present
Role of students	Students are partners in commercialization or engagement	it was actually my graduate student who really wanted to patent it.
Provides mentoring	Mentors students or faculty	What facilitates my work is motivating . . . is my . . . or my students. It's seeing my students succeed
Receives mentoring	Has received mentoring	Where I trained, I had really super good mentors. Some were men [and] some were women,

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