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Identification of Entrepreneurial Competencies in I-Corps Site Teams at the University of South Florida

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Identification of Entrepreneurial Competencies in I-Corps Site Teams at the
University of South Florida

by

Mark A. Giddarie

A dissertation submitted in partial fulfillment of the requirements for the degree of
Doctor of Business Administration
Muma College of Business
University of South Florida

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DEDICATION

This dissertation is dedicated to my wife, Maria Giddarie, RN as well as my children, Annalise and Ethan, who bring sunshine to my life daily; you are all shining beacons of light on my journey to a DBA degree. My research work is also dedicated to my late mother, Grace A. Giddarie, and Father Everald Giddarie, who are two of the most courageous people I know; they immigrated to the United States and worked tirelessly to provide me an opportunity to grow and experience a life far beyond the shores of our original home country. I am forever indebted to them. Finally, I offer this dissertation to all of the aspiring entrepreneurs who participated in this study – may the lessons from your journeys pave the way forward for others to truly embrace the tremendous opportunity we all have to chase our entrepreneurial dreams.
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ABSTRACT

The Innovators to Entrepreneurs Act was introduced by Congressman Daniel Lipinski of Illinois and several other congressional colleagues in January of 2019. This bill enables broader participation in the successful National Science Foundation Innovation Corps (I-Corps) program and provides additional training for innovators to learn how to turn their research into new products and businesses. I-Corps connects scientists and engineers within the technological, entrepreneurial, and business communities to move discoveries from the laboratory to the market.

The most successful federal program of its kind, I-Corps has trained over 1,300 teams, led to the formation of 644 startup companies and resulted in over $300 million in follow-on funding raised since 2012. The Innovators to Entrepreneurs Act of 2019 expands the eligible pool of applicants for the I-Corps program, allowing the participation of aspiring entrepreneurs who have demonstrated their merit by being awarded Small Business Innovation Research or Small Business Technology Transfer grants from a federal agency.

The objective of this research is to explore the relationship between entrepreneurial competencies and successful I-Corps site teams. With the knowledge gained in this dissertation, the researcher offers suggestions towards an improved I-Corps site team selection process.
CHAPTER ONE:
INTRODUCTION

The federal government allocates several million dollars annually in support of commercialization and technology transfer initiatives across the United States. As noted by Nag, “Technology Transfer started in 1980 when the Bayh-Dole act was created, this allowed universities and other research institutions to own the intellectual property created from federal research funding” (Nag, 2017). Determining the success and impact of these initiatives can be challenging as noted by Nag, “if you take the example of Stanford University, the most successful in technology transfer, according to many experts. Only 77 of their 10,000 technologies have ever made more than $1M cumulative. That means only 0.77% of their licensed technologies are successful” (Nag, 2017).

Whether these programs are a success or not, they are necessary mechanisms to the entrepreneur ecosystem at the university and the geographic communities in which they reside. It is important to understand that the reach of these programs extends to the creation of technologies and business that can have large economic impacts at a state, regional, or national level. Technology Transfer “begins with identifying discoveries that are protectable and marketable from a broad range of invention disclosures and shepherding those technologies into the commercial marketplace where they can improve lives and drive growth” (The impact of technology transfer, n.d.).
One agency that primarily supports the Technology Transfer process is the National Science Foundation: the “The National Science Foundation (NSF) funds research and education in most fields of science and engineering. It does this through grants and cooperative agreements to more than 2,000 colleges, universities, K-12 school systems, businesses, informal science organizations and other research organizations throughout the United States. The Foundation accounts for about one-fourth of federal support to academic institutions for basic research” (National Science Foundation, “Where Discoveries Begin”).

**Figure 1. Technology Transfer Process.**

As detailed in the National Science Foundation literature, “NSF receives approximately 40,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships.” (NSF, “About the National Science Foundation”).

Additionally, related on the NSF’s website, “The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Antarctic research stations. The Foundation also supports cooperative research between
universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level” (GPG – About the National Science Foundation).

From a historical context, “The National Science Foundation is an independent federal agency created by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense... “NSF is vital because it supports basic research and people to create knowledge that transforms the future. This type of support: 1) is a primary driver of the U.S. economy, 2) enhances the nation's security, and 3) advances knowledge to sustain global leadership. With an annual budget of $7.8 billion (FY 2018), The National Science Foundation is the funding source for approximately 27 percent of the total federal budget for basic research conducted at U.S. colleges and universities. In many fields such as mathematics, computer science and the social sciences, NSF is the major source of federal backing” (National Science Foundation, “About”).

Another subsequent challenge faced in the University Tech Transfer process is the knowledge gap of the inventors of intellectual property and their common lack of understanding of the commercialization process of technology. This common lack of understanding occurs because most university-based inventors are faculty or students with limited “real world” business or commercialization experience.

NSF addressing this forementioned challenge, “In October of 2010, Dr. Subra Suresh took the position as the 13th Director of the National Science Foundation. He remained in that position from October 2010-March 2013. During his tenure as NSF director, he emphasized the translation of basic research into commercial opportunities, collaborative research at the interface of scientific disciplines and across geographical boundaries, and the creation of favorable work environments for women scientists and engineer” (NSF, “Where Science Begins”). Dr. Suresh
had prior experience in commercialization as a result of his former position as Dean of the School of Engineering at Massachusetts Institute of Technology (MIT), a school with a strong reputation of transferring research into commercial applications.

One of Dr. Suresh’s hallmark achievements was the creation of the National Science Foundation (NSF) Innovation Corps (I-Corps) Program in 2011. The basic underlying premise for this program was to increase the economic impact of NSF supported basic research. A synopsis of this program follows; the excerpt below was taken from the original NSF Program Solicitation document that initiated the project NSF 11-560 (Exhibit 1.): “The National Science Foundation (NSF) seeks to develop and nurture a national innovation ecosystem that builds upon fundamental research to guide the output of scientific discoveries closer to the development of technologies, products and processes that benefit society. In order to jumpstart a national innovation ecosystem, NSF established the NSF Innovation Corps (NSF I-Corps)” (NSF, “Innovation”). Figure 2 illustrates where the NSF I-Corps Program integrates into the University Technology Transfer Process.

![Figure 2. Technology Transfer Process with NSF I-Corps Innovation Program.](image-url)
The purpose of the NSF I-Corps grant is to give the project team access to resources to help determine the readiness to transition technology developed by previously funded or currently funded NSF projects. The outcome of the I-Corps projects is threefold: 1) a clear go/no go decision regarding viability of products and services, 2) should the decision be to move the effort forward, a transition plan to do so, and 3) a technology demonstration for potential partners (National Science Foundation, “Innovation Corps”).

Per the program solicitation NSF 11-560 (exhibit 1), the goal of the program is as follows: “The goals of this program are to spur translation of fundamental research, to encourage collaboration between academia and industry, and to train students to understand innovation and entrepreneurship. The purpose of the NSF I-Corps program is to identify NSF-funded researchers who will receive additional support - in the form of mentoring and funding - to accelerate the translation of knowledge derived from fundamental research into emerging products and services that can attract subsequent third-party funding. The go/no go decision of the proposed effort will be made by the I-Corps team (that includes the Principal Investigator, the Entrepreneurial Lead, and the I-Corps Mentor) in consultation with the I-Corps Cognizant Program Directors” (see Figure 3 for I-Corps team composition).

**Figure 3.** I-Corp’s Project Team Structure.
The role of each I-Corps Project team member is detailed in National Science Foundation literature and Figure 4:

The **Entrepreneurial Lead (EL)** could be a Postdoctoral scholar, graduate or other student with relevant knowledge of the technology and a deep commitment to investigate the commercial landscape surrounding the innovation. In rare circumstances, with approval of a cognizant NSF I-Corps Program Officer, it also could be the PI. The Entrepreneurial Lead should also be capable and have the will to support the transition of the technology, should the I-Corps project demonstrate the potential for commercial viability.

The **I-Corps Mentor (IM)** will typically be an experienced or emerging entrepreneur with proximity to the institution and experience in transitioning technology out of Academic labs. The I-Corps Mentor must be a third-party resource and may be recommended by the proposing institution or may be a member of the NSF-supported I-Corps network which is being put together at this time. The I-Corps Mentor will be responsible for guiding the team forward and tracking progress through regular communication with the Cognizant NSF I-Corps program director.

The **Technical Lead (TL)** - Principal Investigator will be responsible for overall grant management. (Program Solicitation NSF 11560).

**Figure 4. I-Corps Team Member Role Definitions.**

The institutions that participate in the I-Corps Program have to submit proposals to the NSF to be awarded monetary grants for each participating I-Corps Team. Per the Program solicitation NSF 11560, institutions are subject to the following qualifying criteria:
“Proposals may only be submitted by the following: Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Such organizations also are referred to as academic institutions. Other Federal Agencies and Federally Funded Research and Development Centers (FFRDCs): Contact the appropriate program before preparing a proposal for submission” (NSF, “About Funding”).

Once the proposal is accepted by the NSF, grant monies are awarded to the submitting institution. Then, these funds are disseminated to each individual I-Corp team. I-Corps Teams, “participate in the seven-week I-Corps curriculum. Each I-Corps Team learns what it will take to achieve a commercial impact with their innovation. The I-Corps curriculum enables teams to systematically identify and address knowledge gaps to understand the most appropriate path forward for their technology concept. I-Corps Team awards support the team's participation in the curriculum and their customer discovery work” (GPG – About the National Science Foundation).

I-Corps Project Teams operate under two separate designations: as a site program or a regional node. The National Science Foundation website defines Site and Nodes as follows:

**I-Corps Sites**: nurture and support multiple, local teams to transition their technology concepts into the marketplace. The Sites provide infrastructure, advice, resources, networking opportunities, training and modest funding to enable groups to transition their work into the marketplace or into becoming I-Corps Team applicants. Sites are single-institution efforts to support innovation locally.

**I-Corps Nodes**: support regional needs for innovation education, infrastructure and research. The I-Corps Nodes work cooperatively to build, utilize and sustain a national innovation ecosystem that further enhances the development of technologies, products and processes that benefit society. Nodes are single- or multi-institution efforts to support innovation regionally (National Science Foundation - Where Discoveries Begin, n.d.).
Regardless of the I-Corps designation, each university institution administers I-Corps boot camp programs that are typically six weeks in length. Per the NSF program solicitation 11560, the curriculum is as follows: “The approach to develop the technology disposition will be a structured hypothesis/validation approach. The Entrepreneurial Lead will be responsible for proceeding along a content-guided path to develop, over the course of the six-weeks grant, a final technology disposition plan.”

Commitment to Pursue Online Curriculum

Each team must commit to pursuing a formal hypothesis-validation approach to identify and mitigate gaps in knowledge in the following seven areas:

- Value Proposition of the proposed product or service
- Customer/User use-case and pain point
- Demand Creation
- Channel Development
- Revenue Model
- Partnership Strategy
- Resource Requirement

The University of South Florida (USF) was identified in the NSF Innovation Corps program as an I-Corps Site program, which is geared for developing potential I-Corps Team projects and providing an entrepreneurial program for potential faculty and graduate student teams to complete together to assess their business potential. I-Corps Sites provide infrastructure, advice, resources, networking opportunities, training, and modest funding to enable groups to transition their work into the marketplace or into becoming I-Corps Team applicants.
With the support and mentorship of the Sites, the teams learn first-hand about entrepreneurship and explore the transition of their ideas, devices, processes, or other intellectual activities into the marketplace. Having the National Science Foundation, I-Corps Site program at USF, participants have a unique opportunity to learn and explore the commercial potential of their ideas. Through its unique NSF recognized Lean Launch Pad TM curriculum, the program teaches entrepreneurial skills and how to mature a research idea with commercial potential into a commercially viable prototype design (About USFRI). USF is one of the 86 national sites designated for this type of entrepreneurial training and one of only two in Florida. Participants are part of a highly sought-after national movement and join the elite groups of innovators in the National Innovation Network of I-Corps participants. If selected, participants join the select group of I-Corps Fellows at USF. What follows are statistics detailing some accomplishments of the I-Corps site program at University of South Florida:

- 115 I-Corps Site teams taught
- 27 I-Corps National teams
- Post I-Corps: 14 startup companies funded with more than $3.8 million

Under congressional challenge and mandate, the National Science Foundation is currently in position to annually justify these multimillion-dollar grant expenditures due to the historically low commercialization outcomes. The objective of this research is to evaluate the relationship of success factors of NSF I-Corps site program participants and commercialization goals.

**Motivation**

At University of South Florida, the I-Corps site program was established in 2016. The program is geared for developing potential I-Corps team projects and providing an
entrepreneurial program for potential faculty and graduate student teams to complete together to assess their business potential (University of South Florida, n.d.). To date, 76% of the 115 teams that have participated in the program have not been successful in meeting program objectives. Fourteen teams have successfully established startup companies (28%) and been able to secure $4.3 million in funding. Twenty-seven teams were able to successfully accomplish the program objectives at the university site program level; the other fourteen teams were able to reach the program objectives after participating at the I-Corp national program level. Commercialization goals for the purpose of this study is identified by the National Science Foundation program definitions, which identify successful teams as those I-Corps Teams that have been able to successfully complete site or national program and attract subsequent third-party funding (NSF, “Innovation Corps”).

Many entrepreneurs and investors seek the university setting for entrepreneur education and the sourcing of potential startup companies. There has been an emergence of entrepreneurial themed education programs globally. Depending on the academic institution, the specific entrepreneur curriculum is employed in a variety of ways. Some institutions offer standalone classes, certificate-based programs, or entire undergraduate/graduate degree programs.

In 2016, with a personal interest in entrepreneur education and investing in startups, the researcher enrolled in the Master of Science in Entrepreneurship and Applied Technology Program at the University of South Florida Muma College of Business. The first class the researcher was exposed to was “Strategic Market Assessment of New Technologies;” this class exposed students to the process of evaluating university developed intellectual property for commercialization.
At the University of South Florida, several options are offered to those interested in entrepreneurship education. One option is The USF Center for Entrepreneurship, which offers undergraduate courses and programs for all USF students (business and non-business). Whether students would like to increase their entrepreneurial business skills, pursue their business ideas, or learn ways to bring innovation and entrepreneurial leadership into existing positions and businesses, an entrepreneurship minor or concentration teaches valuable skills that will complement any degree program. A student does not need to declare a minor or concentration to take entrepreneurship courses. Also, many courses are offered online (University of South Florida, n.d.).

The Master of Science in Entrepreneurship in Applied Technologies integrates the principles for successful opportunity recognition, technology and market assessment, product commercialization, new venture formation, and new venture financing into a single interdisciplinary curriculum. The degree may be pursued alongside (dual degree) the Master of Business Administration (MBA) or the biomedical engineering, biotechnology, global sustainability, and other degree programs. A maximum of two graduate degrees may be pursued concurrently (University of South Florida, n.d.b).

Separate from USF’s business school, USF’s Office of Research and Innovation offers its own entrepreneurship related training program. The researcher’s further involvement in the entrepreneur program led to an appointment by the USF’s Office of Research and Innovation I-Corps program as a graduate assistant. This position offered the researcher the opportunity to co-teach the I-Corp curriculum in the classroom setting at USF’s Patel College of Global Sustainability under the class titling; “Social Entrepreneurship.”
NSF I-Corps is a public-private partnership program that teaches university entrepreneurs with a targeted curriculum to identify valuable product opportunities that can emerge from academic research and offers entrepreneurship training to participants (University of South Florida - USFRI., n.d.a). At the core of the six-week NSF I-Corps cohort program, or in the social entrepreneurship classroom setting, is the formation of teams of potential entrepreneurs. These newly formed teams utilize components of the Lean Startup\(^1\) methodology, which mirrors scientific method\(^2\) practices, to vet potential entrepreneurial ideas for further commercialization steps.

Having observed a number of teams go through the program as a graduate assistant, including participating in the program as an entrepreneurial team member, the researcher was convinced that there is true merit in the I-Corps program. The researcher can also attest that his knowledge has increased exponentially in evaluating startup teams and their corresponding entrepreneurial project success.

The greatest limitation that has been noted in the current I-Corps Site program at the University of South Florida is the process of initial team selection and evaluation. The researcher was able to arrive at these conclusions as a result of multiple comparative observational interviews with various I-Corps Site\(^3\) programs (University of Central Florida and Georgia Technical University).

These comparative interviews revealed that the process of team selection varied immensely compared to the USF Site program. As it correlates to industry practice, successful startup entrepreneurial teams have an integral impact on initial startup venture progress, which is

---
\(^1\) Lean Start Up- Lean startup is a methodology for developing businesses and products, which aims to shorten product development cycles and rapidly discover if a proposed business model is viable.

\(^2\) Scientific Method- The scientific method is a process for experimentation that is used to explore observations and answer questions

\(^3\) Site Program- The purpose of an I-Corps Site is to nurture and support multiple, local teams that are transitioning their ideas, devices, processes or other intellectual activities into the Marketplace.
more than likely a result of certain competencies and characteristics of the individual team members in these startup teams.

**Research Questions and Hypothesis**

**Research Question 1.** How are the NSF I-CORPS site program outcomes related to the core entrepreneurial competencies for the participant teams? The objective is to seek to identify and analyze the specific entrepreneurial competencies of participating I-Corps teams.

*H1a: Teams with greater entrepreneurial competency coverage pre-program participation have more positive outcomes.* In other words, participant teams who are more entrepreneurially competent tend to have pre-program participation with more positive outcomes.

*H1b: Teams with greater entrepreneurial competency coverage post-program participation have more positive outcomes.* In other words, participant teams who are more entrepreneurially competent post-program participation tend to have more positive outcomes.

**Research Question 2.** How are the NSF I-CORPS site program outcomes related to a change in the core entrepreneurial competencies of teams? The objective is to collect useful data to gain an understanding of the relationship between program outcomes and a change in entrepreneurial competencies of participant teams from program inception to program completion.

*H2: Teams with greater radar chart coverage (in terms of relative area) have more positive outcomes.*
CHAPTER TWO: LITERATURE BACKGROUND

Entrepreneurship pedagogy can be efficiently implemented throughout academia and the business environment by utilizing unique, innovative perspectives. The application of pedagogy should be based on methodology that has fostered a greater level of student involvement, measurable curriculum transfer, and knowledge retention. Measurements of overall effectiveness should be indicative of the establishment, growth, and sustainability of business enterprises.

Blank stated, “that I-Corps is an educational program that serves as a bridge to private capital. It teaches top scientists how to develop the many other essential components that comprise an investable business. In practice, many government agencies use the Technology Readiness Levels to measure a project’s technical maturity, and there are no standards around Business Maturity levels. The output of the NSF I-Corps class provides a proxy for a minimum level of business maturity” (Blank, 2012).

By identifying the entrepreneurial competencies in successful I-Corps teams, this dissertation research seeks to draw a parallel with a theoretical foundation on which innovation in tech entrepreneurship and technology teams are based. The theoretical basis of the dissertation seeks correlation with the Entrepreneurial Competency Theory. Blank stated that we have been imprecise in defining different roles in tech team startups. In doing so, we have failed to help founders understand what it takes to build a great founding team (Blank, n.d.).
In Mann et al.’s study of Entrepreneurial Competencies and the Performance of Small and Medium Enterprise, there was an assumption that the Entrepreneurial Competency framework was central in identifying the role of the entrepreneur in determining small and medium enterprise firm’s performance.

As described by Rasmussen, the Entrepreneurial Competency framework stated that the development of this framework evolved from studying the early stages of university spin-off development, which offers a theoretical basis to understand the heterogeneity of entrepreneurial competencies and the diversity among those who provide them (Rasmussen and Wright, 2015). Simply stated, the entrepreneurial competencies are related to three core processes necessary to develop a new venture: the need to develop a viable business opportunity (opportunity development competency), the need for championing individuals that provide meaning and energy to the entrepreneurial process (championing competency), and the need to access the resources necessary to develop the new venture (resource acquisition competency).

Using these three competencies provides an analytical framework that highlights how different actors can play different roles in the development of the venture. Below, the entrepreneurial competency framework is used to highlight the different challenges faced by new science-based ventures throughout their early development process and how the challenges can be overcome. Identifying the sources and processes behind these entrepreneurial competencies helps determine how the university can facilitate the creation and development of spin-off ventures (Rasmussen and Wright, 2015).

**Commercialization and Tech Transfer**

Tech Transfer is a growing, expanding area of processes in research university-based programs. The AUTM foundation defines Technology Transfer as: “Universities are society’s
greatest conduit for advancing medicine, technology, agriculture and public health, thereby improving quality of life globally by transforming research into innovation. This process, known as technology transfer, begins with identifying discoveries that are protectable and marketable from a broad range of invention disclosures and shepherding those technologies into the commercial marketplace where they can improve lives and drive growth” (The impact of technology transfer, 2018).

Princeton University Research describes tech transfer succinctly as a six-step process: “Universities compete for federal funding to conduct critical research, University faculty and students make groundbreaking discoveries in the lab, University technology transfer offices patent and copyright these discoveries, University technology transfer offices then help transfer the rights to use these ideas to businesses and entrepreneurs and startups. Businesses, entrepreneurs, and startups develop the ideas into products that create jobs and help improve quality of life for all Americans” (The Trustees of Princeton University).

In the publication Annals of Regional Science, Baycan and Stough (2013) related that the traditional mission of universities, including teaching and research, has gradually changed with new perspectives on the role of the university in the system of knowledge production; it has expanded to assume a “third mission,” namely commercial activities, including patenting, licensing, and company formation. In his research, Siegel et al. note that the activities of Technology Transfer Offices have important economic and policy implications since licensing agreements and university-based start-ups (spin-offs) can result in additional revenue for the university, employment opportunities for university-based researchers (especially post-docs) and graduate students, and local economic and technological spillovers through the stimulation of
additional research and development (R&D) investment and job creation (Siegel, Veugelers, & Wright, 2007).

The University of South Florida, which is a Preeminent Research University in Florida, established its Technology Transfer Office (TTO) in the early 1990s. The TTO works with researchers and students in every college to prepare new inventions for the patenting process and potential licensing opportunities. TTO's work allows for a sustained focus on transferring cutting-edge research and innovation to the commercial marketplace, generating revenue and diversifying the economy of USF Research and Innovation (About USFRI, n.d.).

USF was ranked in the Top 20 of American Universities for technology transfer by the prestigious Milken Institute. With 96 new utility patents issued in calendar year 2018, USF ranks seventh among American public universities and sixteenth among universities worldwide in generating new U.S. patents, according to the National Academy of Inventors (NAI) and Intellectual Property Owners Association (IPO). In 2019, the university had 98 license and option agreements and seven new startup companies in fiscal year 2019; it has facilitated the formation of 47 startup companies in the last five years. TTO endeavors to educate and promote innovation, the result of which is products, jobs, and technologies utilized in the public interest USFRI (University of South Florida, n.d.).

I-Corps

Tech Transfer initiatives at universities are ambitious programs that seek to assist academic personnel in possession of or in the process of creating intellectual property on a pathway to commercialization. One challenge many academics face is not having the requisite knowledge or business acumen to understand pathways to commercialization. Robinson elaborates on the for-mentioned challenge that academics face: “Even after years of study and
ex- laboratory, most inventions must clear a number of hurdles before they can be released to the open market. This encompasses refining the technology as well as building the necessary partnerships and collaborations to create an effective infrastructure for product manufacture and delivery. The ‘valley of death’ and other grim parlance used to describe the tenuous journey from discovery to com- of this process” (Robinson, 2012, p. 1132).

The National Science Foundation established the I-Corps program in 2011 to address this particular issue. In a report to a congressional committee in 2012, Blank detailed the role of the National Science Foundation, “The National Science Foundation’s funding of America’s research universities have been the critical assets that have laid the groundwork—through research and doctoral education—for the development of many of the competitive advantages that make possible the high American standard of living” (Blank, 2012).

Steve Blank, Architect and Author of the National Science Foundation Innovation Corps Curriculum, is a serial entrepreneur who took four companies public, has a net worth estimated at $2.5 billion, and is considered the dean of Silicon Valley (The 25, 2019). At the inception of the program, Blank stated, “I am a part of a National Science Foundation (NSF) project that is hoping to change this. The NSF has announced a new initiative called the Innovation Corps (I-Corps), to take the most promising research projects in US university laboratories and turn them into start-ups. The I-Corps project will train scientists for business by teaching them a process that gets them back to the roots of Silicon Valley, by embracing experimentation, learning and discovery” (2011). In the Journal of Technology Transfer, the I-Corps program was described further as, “The NSF I-Corps™ program is the first large-scale, government-funded program that brings together funding and an educational component for its principal investigators. The program catalyzes several different aspects of the entrepreneurial ecosystem, not only
influencing the translational research potential of university research but also individual faculty members and students, and overall culture” (Huang-Saad, Fay, & Sheridan, 2016, p.1473).

A year after the program launched in 2012, Blank shared the impact of the new program in a report to the Subcommittee on Research and Science Education Committee on Science, Space, and Technology in the U.S. House of Representatives. He outlined the following regarding the preliminary results of the program: “The NSF Innovation Corps is the first successful STEM education program to bridge the gap between NSF funded researchers who want to commercialize their technology and the needs of private capital. Data from the first 50 I-Corps teams confirm the effectiveness of the program. We believe the result will be new jobs and increased competitiveness of American industries. There have been two other consequences of this program. The first has been the leveraging effect as Principal Investigators take what they learned from I-Corps back to their home institutions and develop workshops and similar opportunities on their own campuses. The second has been the applicability of the program to small business innovation and job creation on “Main Street” as well as in technology startups” (Blank, 2012).

**Entrepreneurial Characteristics**

This dissertation and its focus on entrepreneurial competency were naturally guided by literature that touched on the exploration of several keyword searches. I found that entrepreneurial characteristics overlapped in the searches as a foundational element of competency development.

**Entrepreneurial Team Formation**

A core component of the I-Corp program is the I-Corp Team, “The NSF Innovation Corps (I-Corps) Teams have three primary members: the technical lead, the entrepreneurial lead,
and the I-Corps mentor. All three members of the team participate fully in the I-Corps Curriculum” (National Science Foundation, “Where Discoveries Began”). For this dissertation, I reviewed literature respective to Entrepreneurial Team Formation. It can be inferred that I-Corps teams are representative of typical entrepreneurial startup teams. How these types of teams are formed as well as their function are highly relevant in application towards the successful attainment of I-Corps program outcomes. The research supporting entrepreneurial team formation is evolving. Forbes et al. refers to entrepreneurial team formations as an evolving tapestry of human interaction, cooperation, and coordination (Forbes, Zellmer-Bruhn, & Sapienza, 2006, p.225). Vistin and Pittino (2014) also notes that one of the factors that may affect growth and success in new business ventures is the quality of the entrepreneurial-managerial group.

On the fundamental level of team formation, a project team is a small team with a shared mission, goal, and approach that exists within a fixed timeline. A proper selection of the team members for a given project will probably reduce the team development time and lead to higher performance (Baykasoglu, Dereli, & Das, 2007, p. 155). The I-Corps program is predicated on specific training involving “Project Teams” meeting respective program outcomes. In most instances, these I-Corps teams apply to the I-Corps program already fully formed and, in some instances, partially formed. Historically, when the teams apply to the program and are partially formed, they are provided assistance by I-Corps faculty in sourcing the missing Team Member/Roles. The I-Corps three-person teams are predicated on the specific roles of (TL) Technical Lead, (EL) Entrepreneurial Lead, and (IM) I-Corps Mentor.

Baykasoglu cites Castka et al. (2001), stating that the following issues should be considered when selecting team members (especially for high performance teams):
• Team member competency/compatibility/suitability
• Skills (especially technical and functional ones), processes, tools, and techniques
• Interpersonal skills, communication, personality preferences
• Value system
• Shared vision, purpose, goals, direction
• Organizational values, including openness

This dissertation seeks to draw a correlation with the first identified issue in the Castka citation around Team Member competency, specifically entrepreneurial competency.

**Entrepreneurial Competencies**

Entrepreneurial competencies and the specific literature relevant to the subject matter of this dissertation identify competencies as being built on structuration theory. Morris further relates that entrepreneurship is a process that unfolds as individuals behave within and interact with their environments. Environments provide scripts that guide individual behaviors and interactions while education serves as an important source of scripts within the individual’s environment. Individuals adopt and/or revise scripts based on feedback and evaluation of their behavioral and interactional outcomes. Where scripts are successfully employed over time, they can become the foundation for the individual’s competencies. Man et al. (2002), identifies Entrepreneurial Competencies as a higher-level characteristic encompassing personality traits, skills, and knowledge and, therefore, can be seen as the total ability of the entrepreneur to perform a job role successfully. The main advantage of using this approach is it offers a way to investigate entrepreneurial characteristics that have long-term effects and closer links to organizational performance (Man et al., 2002, p. 17).
The environment, as described in the Morris study, that I seek to draw correlation to in this dissertation is the I-Corps program environment. By nature, the program is intended to provide education (scripts) that leads to respective change to the individual participant and I-Corps teams over the six-week period at the “site” level in which the program operates. The structure of the I-Corps curriculum allows, as Morris (2013) stated previously in his general description, individuals (I-Corps Participants/Teams) an opportunity to adopt and/or revise scripts based on the feedback and evaluation of their behavioral and interactional outcomes. The I-Corps teams receive such feedback from the I-Corps Faculty weekly for the duration of the program.

The Morris Study identifies the following as entrepreneurial competencies:

- Opportunity Recognition
- Opportunity Assessment
- Risk Management/ Mitigation
- Conveying of a Compelling Vision
- Tenacity Perseverance
- Creative Problem Solving/ Imaginativeness
- Resource Leveraging
- Guerilla Skills
- Value Creation
- Maintain Focus
- Resilience
- Self-Efficacy
- Building and Using Networks
I found that the Morris study, its respective design, its identified entrepreneurial competencies, and the participant types were similar to the I-Corps Site programs and their participants.

**E-Competencies and I-Corps Teams**

In further analyzing the literature, it was important to understand how literature corresponds to the identified entrepreneurial competencies in this study and the specific I-Corps Team roles. Table 1 outlines the proposed relationship correlations from the literature.

Listed in Table 1 are the respective Entrepreneurial Competencies outlined in the Morris study and the specific I-Corps roles that correspond to an I-Corps Team: Entrepreneurial Lead (EL), Technical Lead (TL), and I-Corps Mentor (IM). In the figure, the I-Corps Team Roles are separated into individual components and color coded. The bottom half of the figure reflects the initial steps taken to identify which entrepreneurial competencies correlated to each role. This matching of roles was validated by interviewing I-Corps supervising faculty individually and gaining consensus individually regarding which entrepreneurial competencies would appear to correspond most to each specific I-Corp role.
Table 1. E-Competencies and I-Corps Teams Roles.

<table>
<thead>
<tr>
<th>ENTREPRENEURIAL COMPETENCIES &amp; I-CORP TEAM ROLES - LITERATURE REVIEW</th>
<th>I-Corp Team Role Entrepreneurial Lead (EL)</th>
</tr>
</thead>
</table>

24
Table 2. E-Competencies and I-Corps Teams Role Correlation.

<table>
<thead>
<tr>
<th>Entrepreneurial Lead (EL) E-Competency Roles</th>
<th>Technical Lead (TL) E-Competency Roles</th>
<th>I-Corp Mentor (IM) E-Competency Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opportunity Recognition Opportunity Assessment</td>
<td>Opportunity Recognition Opportunity Assessment</td>
<td>Risk Management/Mitigation Conveying a compelling vision</td>
</tr>
<tr>
<td>Opportunity Analysis</td>
<td>Opportunity Recognition Opportunity Assessment</td>
<td>Creative Problem Solving/Imaginativeness</td>
</tr>
<tr>
<td>Tenacity/Perseverance</td>
<td>Opportunity Recognition Opportunity Assessment</td>
<td>Value Creation</td>
</tr>
<tr>
<td>Creative Problem Solving/Imaginativeness</td>
<td>Opportunity Recognition Opportunity Assessment</td>
<td>Ability to Maintain Focus yet Adapt Resilience</td>
</tr>
<tr>
<td>Resource Leveraging /Bootstrapping</td>
<td>Opportunity Recognition Opportunity Assessment</td>
<td>Tenacity/Perseverance</td>
</tr>
<tr>
<td>Guerilla Actions</td>
<td>Opportunity Recognition Opportunity Assessment</td>
<td>Resilience</td>
</tr>
<tr>
<td>Value Creation</td>
<td>Opportunity Recognition Opportunity Assessment</td>
<td>Self-Efficacy</td>
</tr>
<tr>
<td>Ability to Maintain Focus yet Adapt</td>
<td>Opportunity Recognition Opportunity Assessment</td>
<td>Networking Social Skills</td>
</tr>
<tr>
<td>Resilience</td>
<td>Opportunity Recognition Opportunity Assessment</td>
<td>Value Creation</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>Opportunity Recognition Opportunity Assessment</td>
<td>Guerilla Actions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Creative Problem Solving/Imaginativeness</td>
</tr>
</tbody>
</table>
CHAPTER THREE:
METHODOLOGY

Research Design

To address the research questions listed in this dissertation, this study utilized a multi-method research approach consisting of Phenomenological methods and Elaborated Action Design research methods.

Phenomenological Approach

From a phenomenological research perspective, the plan in the study was to use primary, secondary, and tertiary sources of data to further explore the phenomenon of identifying the specific Entrepreneurial Competencies in I-Corps Site Teams at the University of South Florida. In phenomenological research, it is important to capture participants’ lived experiences around a phenomenon. Cope cited that, “It is important to realize that an entrepreneur may well interpret things differently at different times and in different contexts. An individual’s perspective on an event or experience, therefore, can change over time” (Cope, 2005, p. 170).

This study consisted of several phases. The first was a systematic investigation of relevant and existing literature. The literature reviewed explored the concepts of Technology Transfer, Commercialization, I-Corps, and the correlated fields of Entrepreneurial competencies/Entrepreneurial characteristics. The second phase of this study consisted of the survey design, institutional review board submission and approval, and three separate rounds of data collection aimed at collecting the relevant information to address the specific research
questions and hypothesis in this dissertation. The third phase of this study shifted to an Elaborated Action Design research perspective.

**Action Design Research**

This study utilized components of Design Science research, specifically Action Design Research (ADR) and Elaborated Action Design Research (EADR), to effectively analyze the relationship between the growth of Entrepreneurial Competencies in I-Corps teams at the University of South Florida. The researcher believed that Action Design research was an appropriate method as Hevner et al. (2004, p. 23) noted that “a design science contribution must articulate an important problem and build an innovative artifact that address is it.” Research by Mullarkey and Hevner (2018) further related that “ADR is used effectively in many research projects and, because of its ever-expanding applications, the ADR concepts and process model continue to grow and evolve to meet the demands of new and the challenging environments” (p. 6). In this relatively new environment of I-Corps programs, the researcher believed this study could impact and evolve, emblematic of the iterative research cycles in the ADR research process.

An example of this process is as follows. The first action design research cycle is composed of four stages (Sein et al., 2011):

- Problem Formulation
- Building, Intervention, and Evaluation
- Reflection and Learning
- Formulation of Learning

The first three stages form an iterative cycle with the research (i.e., learning) results captured and formalized in the final stage (Mullarkey & Hevner, 2018).
Elaborated Action Design Research

Finding gaps in the earlier introduced action design research cycle and noting that practitioners could better relate to an explicit and enhanced ADR Cycle, Mularkey and Hevner (2018) proposed the Elaborated Action Research Cycle (Figure 5), which reflects the beliefs that “(1) Intervention is a core concept in the ADR process and should occur with each ADR cycle (2) the activities of evaluation (E), reflection (R) and learning (L) occur in each ADR Intervention cycle” (2018, p.10).

Figure 5. Elaborated Action Research Cycle, (Mullarkey & Hevner, 2018).

In addition to the Elaborated Actions Design Cycle, an ADR Stage Process model (Figure 6) was introduced by the researchers; it includes:

- Diagnosis
- Design
- Implementation
- Evolution
Figure 6. The Four ADR Stages (ADR Process Model).

Mullarkey and Hevner (2018) believed that, “a four-stage ADR Process model with clear paths of forward progress and feedback loops as required by the emerging project. The important insight we discovered in our project and in our review of ADR projects in literature is that each of the stages supports multiple iterations of the ADR intervention cycle” (Mullarkey & Hevner, 2018, p. 8).

The previous researchers also noted that different problem environments require different entry points in the ADR Process Model (Mullarkey & Hevner, 2015). In this dissertation, the proposed entry point in the ADR process model was a Design and Development Centered approach as noted in Figure 7.

![The ADR Process Model with Dissertation Research Entry Point](image)

Figure 7. The ADR Process Model with Dissertation Research Entry Point.

This entry point is appropriate in this dissertation, as further noted by Mullarkey and Hevner (2018), since Development Centered projects require the development of an ensemble instantiated artefact (e.g., system to address research problems and demonstrate a satisfactory solution). The proposed Instantiated Artefact in this dissertation is Radar Charts.
During the Problem Formation stage of the EADR research cycle, the Entrepreneurial Competencies of I-Corps Teams (Design Element) and the Artefact (Radar Charts) were identified. The study proceeded through the ADR process model with the following Intervention, which is composed of three separate cycles of evaluation of the artefact (radar charts):

1.) Pre-Program Assessment
2.) Post Program Assessment
3.) I-Corps Faculty Post Program Assessment

As further detailed in the study, “Evaluation is ‘crucial’ to Design Science Research and requires researchers to rigorously demonstrate the utility, quality, and efficacy of a design artefact using well-executed evaluation methods” (Hevner et al., 2004, pp. 82, 85). Designed artefacts must be analyzed as to their use and performance as possible explanations for changes (and hopefully improvements) in the behavior of systems, people, and organizations (Vaishnavi & Kuechler, 2004).

This study used a Summative evaluation Method, as described by Venable (2016), where “Summative evaluations usually (but not always) occur at the end of an evaluation trajectory or strategy. Possibly more than one summative evaluation episode may be required to evaluate different artefacts or their aspects or to provide stronger evidence (e.g., of their utility in different contexts.” (p. 82).

**Theoretical Foundations**

Utilizing the example laid forth in the design of the Morris study as a model in the design of this dissertation, I determined that Pre-and Post-assessments of I-Corps Program participants were relevant in exploring the impact of the program on participants. The Morris study grounds itself in Structuration theory as a basis of competency development; Morris
explained that “a useful lens can be found in structuration theory, which concerns the reciprocal interactions between individuals and their environments” (Giddens 1984, p. 355).

Morris believed that, “Environments provide structure to individuals’ behaviors and interactions” (Morris, 2013). Additionally, Morris states, “as scripts are confirmed, they can serve as the foundation for the development of competencies, a development which generally occurs over time” (Nelson & Winter, 1982).

I-Corps participants form teams on their own, prior to program participation. In some instances, if teams are not fully formed prior to program participation, assistance from I-Corps program faculty is rendered in completing team formation deficiencies. Once accepted into the program, I-Corps teams participate in six to eight-week programs, depending on their I-Corps site location. The program exposes participant teams to multiple modes of curriculum. A portion of the curriculum is lecture-based material; the other portion is experiential hands-on outside of classroom weekly activities (Customer Discovery Interviews). Additionally, there are weekly in-class I-Corps team presentations that include respective feedback and evaluation from peers and I-Corps faculty.

The inference made in this study is that these I-Corps program activities are the scripts Morris\(^4\) cites and relates to in his study and the basis of the participants’ hypothesized entrepreneurial competency growth and development of I-Corps participant teams.

**Survey Instrument**

A survey instrument (Appendix C) was created and employed utilizing a series of 5-point Likert-type items. As explained on the website “Statistics how to,” “A Likert Scale is a type of rating scale used to measure attitudes or opinions. With this scale, respondents are asked to rate

items on a level of agreement. Additionally, five to seven items are usually used in the scale. The scale doesn’t have to state ‘agree’ or ‘disagree;’ dozens of variations are possible on themes like agreement, frequency, quality and importance” (Stephanie, 2019). I chose Likert’s scale response anchors indicative of quality (Vagias, 2006), as I believed these response anchors would most accurately assess the participants’ perceptions of their lived experiences relating to each specific entrepreneurial competency assessed. The response anchors utilized were as follows: 1- not skilled and 5-Very skilled.

A concern that presented itself was the validation of each specific entrepreneurial competency and its proposed relevance to the I-Corps program. I conducted four separate interviews with USF Supervising I-Corps Faculty to discuss this matter. The goal in these interviews was to discuss the framework of the Morris\textsuperscript{4} study and seek objective feedback and consensus on the relevance of the prescribed entrepreneurial competencies from the individuals directly involved in the supervision and employment of the I-Corps curriculum. After gaining unanimous agreement from the USF I-Corps faculty regarding my initial propositions, I further questioned faculty regarding which of the I-Corps core process would appear to relate to each specific entrepreneurial competency. Table 3 outlines the combined results of the questioning of each USF I-Corps site faculty member.

**Table 3. E-Competencies & I-Corps program correlation - I-Corps Faculty Feedback.**

<table>
<thead>
<tr>
<th>Entrepreneurial Competencies</th>
<th>SS</th>
<th>GW</th>
<th>RB</th>
<th>MM</th>
<th>I-Corps Program Processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opportunity Recognition</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Customer Discovery</td>
</tr>
<tr>
<td>Opportunity Assessment</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Customer Discovery, Customer Validation</td>
</tr>
<tr>
<td>Risk Management/Mitigation</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Hypothesis testing, Customer Discovery, Customer Validation</td>
</tr>
<tr>
<td>Conveying a Compelling Vision</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Customer Interviews, Hypothesis Testing</td>
</tr>
<tr>
<td>Tenacity/Perseverance</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Customer Discovery, Customer Interviewing</td>
</tr>
<tr>
<td>Creative Problem Solving/Imaginativeness</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Customer Discovery, Hypothesis Testing</td>
</tr>
<tr>
<td>Resource Leveraging</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Customer Discovery, Customer Validation</td>
</tr>
<tr>
<td>Guerrilla Skills</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Hypothesis Testing, Customer Discovery</td>
</tr>
<tr>
<td>Value Creation</td>
<td>X</td>
<td>n/a</td>
<td>X</td>
<td></td>
<td>Hypothesis Testing</td>
</tr>
</tbody>
</table>
Table 3 (Continued)

<table>
<thead>
<tr>
<th>Entrepreneurial Competencies</th>
<th>SS</th>
<th>GW</th>
<th>RB</th>
<th>MM</th>
<th>I-Corps Program Processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain Focus, yet Adapt</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Customer Discovery, Hypothesis Testing</td>
</tr>
<tr>
<td>Resilience</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Customer Discovery</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Customer Discovery, Customer Validation, Hypothesis Testing</td>
</tr>
<tr>
<td>Building and Using Networks</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Hypothesis Testing, Customer Discovery</td>
</tr>
</tbody>
</table>

In the table, faculty identity is reflected by their respective initials. Affirmative responses across categories per faculty are shown with (X) per category. Each line of the figure is intended to show a relationship between Entrepreneurial Competencies, Faculty agreement (X), and the specific I-Corps core program process that the faculty interviewed felt were associated. Only one of the USF I-Corps faculty indicated (n/a) Not applicable in one category, “Value Creation.” In that same category of Value Creation, the other I-Corps faculty unanimously agreed to its relevance.

**Institutional Review Board (IRB)**

A submission was made to the Institutional Review Board (IRB) at the University of South Florida. This dissertation met the definition of a social-behavioral type of human subjects’ research with no more than minimal risk and required an expedited review of USF’s IRB. Provisions such as informed consent (see Appendix B) and data access protection procedures were put in place to ensure the safety and dignity of the research participants. The informed consent explained data security measures, including their present and future uses. Explicit permission was asked from each participant for his/her willingness and consent to share video or audio recordings of the interviews. The permissions were documented on the consent forms.

Anonymity of subjects who participated was maintained during data collection, analysis, and in this study report. These provisions were approved by the IRB and granted an exempt status Approval Notice #PRO000413572 (See Appendix D).
Data Collection and Selection of Study Participants

In the Fall of 2019 at the University of South Florida, eight I-Corps teams were accepted from a pool of 18 team applications to participate in the University of South Florida's I-Corps Site Program. By program design, I-Corps teams consist of three participants per Figure 3. Furthermore, Figure 4 describes the specific roles as outlined in NSF Program Solicitation NSF18-515. Per the program description, each participant fulfills a unique role; “(TL) Technical Lead-will typically be a faculty member, senior research scientist or postdoctoral scholar with deep and direct technical expertise in the actual core technology; (EL) Entrepreneur Lead-could be a postdoctoral scholar, graduate or other student, staff member, researcher, or other personnel with relevant knowledge of the technology and a deep commitment to investigate the commercial landscape surrounding the innovation or (IM) I-Corps Mentor-will typically be an experienced entrepreneur with proximity to the institution and experience in transitioning technology out of academic labs” (Where Discoveries Begin. (n.d.). In some instances, as noted per the NSF program solicitation, teams may have an additional member in the role of co-EL, co-TL, or co-IM. Typically, teams with more than four members will not be supported.

Table 4 outlines the composition of I-Corps teams of the Fall 2019 Cohort at the University of South Florida who were accepted into the program. The Fall 2019 I-Corps program at USF was structured in six weekly increments, commencing on Monday, September 16, and continuing on the following Mondays: September 23, October 7, October 14, October 28, and concluding on November 4. The Pre-assessment survey for this I-Corp group was conducted on October 7, coinciding with the actual commencement with the lecture component of the classroom curriculum (See Appendix E).

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5 Innovation Corps- National Innovation Network Teams Program (I-Corps TM Teams)-Program Solicitation NSF18-515
Table 4. USF Fall 2019 USF I-Corps Team Participants.

<table>
<thead>
<tr>
<th>Team #</th>
<th>Technical Lead (TL)</th>
<th>Entrepreneurial Lead (EL)</th>
<th>I-Corps Mentor (IM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2</td>
<td>X</td>
<td>X</td>
<td>None</td>
</tr>
<tr>
<td>3</td>
<td>X</td>
<td>X</td>
<td>None</td>
</tr>
<tr>
<td>4</td>
<td>X + Co-TL</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>6</td>
<td>X + Co-TL</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>7</td>
<td>X</td>
<td>X</td>
<td>None</td>
</tr>
<tr>
<td>9</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>10</td>
<td>X</td>
<td>X</td>
<td>None</td>
</tr>
</tbody>
</table>

All of the teams accepted into the program, except for Team 3, were admitted with fully formed teams prior to participation. Team 3 received assistance from USF I-Corps Faculty in completing team formation, who identified an Entrepreneurial Lead (EL) to participate. No I-Corps Mentor (IM) was identified for this team. Teams 2, 3, 7 and 10 were accepted into the program without an I-Corps Mentor (IM). Teams 4 and 6 had Co-Technical Leads (Co-TL) as additional components.

Document/Data Description

Data consisted of survey responses from eight NSF I-Corps teams. Most of these teams did not have a team mentor (i.e., business mentor), so mentors were excluded in all of the descriptive analyses of this document. One of the teams had pre-program entrepreneurial competency data only. As such, complete pre- and post-data were only available for seven of the eight teams, which means that the effective sample size for all pre versus post analyses was seven, far too small to conduct virtually all inferential analyses with any reasonable sense of reliability.

While the entrepreneurial competencies were assessed for most members of every team, both before and after the site program, the outcome measures for the current study were collected only at the team level. Accordingly, only team-level analyses are included in the current report.
Additional study data also consisted of survey responses from three University of South Florida I-Corps Site Team faculty members.
CHAPTER FOUR:

THE INSTANTIATED ARTEFACT

The proposed artefact (radar charts) in this dissertation is a unique tool, which has never been utilized in any study related to the I-Corps program. In the context of a proposed innovative artifact where no existing artefact can be shown to exist, the ADR approach provides a means to make practitioner embedded knowledge explicit in the full complexity of the artifact’s intended use environment while insuring the rigor of a theoretical (versus consultative) foundation (Mullarkey & Hevner, 2015).

Radar Charts

A key and integral part of this study is the use of radar charts. These radar charts allow for the grouping and visualization of many data points. This tool is commonly used in management disciplines, ex, comparing the performance of one metric to another. In this study radar charts will be used as a novel tool to evaluate data collected in the I-Corp Teams pre/post program assessments, and post programs faculty assessments and compare it to the respective entrepreneurial competencies (design element) outlined. Since I-Corps program inception, Radar Charts has never been used to explore the proposed relationships as posed in the research questions of this study.

Radar charts provide an ability to quantify a large amount of possibly interconnected information in a visualized two-dimensional chart. According to the American Society for
Quality, “a radar chart as: A graph with multiple scales to report self-assessed knowledge or competence, often several points in time” (American Society of Quality, 2006a).

**Relative Areas**

A key component of the Radar chart visualization is the change in relative area. Throughout this document, the term relative area refers to the proportion of coverage in a given radar chart. Relative areas were constructed in the following manner. First, participants (i.e., the members of each team) were asked to rate their entrepreneurial competencies, with higher scores reflecting greater competency. Then, for each competency, individual participant scores were averaged to create team scores for each competency. Average competency scores were then entered into radar charts (one for each of the 8 teams). Then, a side-angle-side formula was used to calculate the area of each of the thirteen triangular partitions for each radar chart. Partition areas were then summed to obtain total radar chart area, which was then divided by the total possible area of given radar chart to obtain relative area.

**Team-Size-Adjusted Relative Areas**

The relative areas for each team seem to have been influenced by the size of the team. As such, team-size-adjusted relative areas were obtained by dividing a team’s area by that team’s size. This measure of relative area should provide a more accurate picture of how much area (on average) each team member is responsible for (once again, on average).

**Entrepreneurial Competencies**

Entrepreneurial Competencies were measured using a 5-point Likert Scale. A breakdown of the entrepreneurial competencies associated with each survey item is provided in the following table. The codes in Table 5. were used to make all radar charts easier to read. Each
item of the competencies survey was measured using a 5-point Likert scale, with 1 representing “Not Skilled” and 5 representing “Very skilled.

**Table 5. Entrepreneurial Competency Codes.**

<table>
<thead>
<tr>
<th>Entrepreneurial Competency</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opportunity Recognition</td>
<td>A</td>
</tr>
<tr>
<td>Opportunity Assessment</td>
<td>B</td>
</tr>
<tr>
<td>Risk Management/Mitigation</td>
<td>C</td>
</tr>
<tr>
<td>Conveying a Compelling Vision</td>
<td>D</td>
</tr>
<tr>
<td>Tenacity</td>
<td>E</td>
</tr>
<tr>
<td>Creative Problem Solving</td>
<td>F</td>
</tr>
<tr>
<td>Resource Leveraging</td>
<td>G</td>
</tr>
<tr>
<td>Guerilla Skills</td>
<td>H</td>
</tr>
<tr>
<td>Value Creation through Innovation</td>
<td>I</td>
</tr>
<tr>
<td>Ability to Focus Yet Adapt</td>
<td>J</td>
</tr>
<tr>
<td>Resilience</td>
<td>K</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>L</td>
</tr>
<tr>
<td>Building and Using Networks</td>
<td>M</td>
</tr>
</tbody>
</table>

The artefact (Radar Chart) that was created is represented by Figure 8. *Entrepreneurial Competency Radar Charts by I-CORPS Team (Pre vs. Post).* These radar charts are reflective of the 8 teams that participated in the program. The Entrepreneurial competencies as outlined in Table 5. Entrepreneurial Competency Codes are listed on the perimeter of chart. The periods of competency measurement are reflected by the red shading indicating the pre-program assessment of competencies, versus green shading representing the post entrepreneurial competency assessment of competencies. The respective points on each curve originate from the center and reflect the measured 5-1 Likert survey scores for each team assessment.
**Figure 8.** Entrepreneurial Competency Radar Charts by I-CORPS Team (Pre vs. Post).

**Figure 9.** Entrepreneurial Competency Radar Charts by I-CORPS Role (Pre vs. Post).
CHAPTER FIVE: EVALUATION 1

Data Collection # 1 Pre-Program Assessment

The first round of data collection occurred on October 7, 2019, at the University of South Florida I-Corps program meeting. I-Corps team participants were provided a copy of the “Informed Consent to Participate in Research Involving Minimal Risk, Pro #00041352” document (Appendix B). The contents and context were explained to the I-Corps team participants. The I-Corps teams were instructed to read the entire document, with an understanding that participation in this data collection process was not mandatory. Participants were given the opportunity to opt out of the proposed data collection. Upon unanimous approval of all teams to participate, I provided each I-Corps team member a copy of the survey (Appendix C), explained briefly the contents, and reviewed the instructions regarding completion. The initial survey (pre) assessment of I-Corps participants was intended to capture the lived experiences of each individual I-Corps team member. Each participant was encouraged to provide their individual perceptions towards their respective level of entrepreneurial competency per category at the start of the program (Appendix C). In phenomenological research, it is important to capture participants’ lived experiences around a phenomenon. Cope stated,” that it is important to realize that an entrepreneur may well interpret things differently at different times and in different contexts. An individual’s perspective on an event or experience, therefore, can change over time” (Cope, 2005, p. 170).
The collective results of the preprogram assessment were captured in the study artefact (radar charts) further identified in the study as: Figure 8. *Entrepreneurial Competency Radar Charts by I-CORPS Team (Pre vs. Post)* and Figure 9. *Entrepreneurial Competency Radar Charts by I-CORPS Role (Pre vs. Post).* The relative areas represented in the radar chart for each team is captured and reflected in Tables 5- Relative Areas by Team and Tables 6 – Team size Adjusted Relative Areas by Team.

**Table 6. Relative Areas by Team.**

<table>
<thead>
<tr>
<th>Team</th>
<th>Pre (%)</th>
<th>Post (%)</th>
<th>Difference (%)</th>
<th>Team Size</th>
<th>Roles Included</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22.72</td>
<td>40.02</td>
<td>17.30</td>
<td>2</td>
<td>TL EL</td>
</tr>
<tr>
<td>2</td>
<td>30.53</td>
<td>45.79</td>
<td>15.26</td>
<td>2</td>
<td>TL EL</td>
</tr>
<tr>
<td>3</td>
<td>34.74</td>
<td>33.53</td>
<td>-1.21</td>
<td>2</td>
<td>TL EL</td>
</tr>
<tr>
<td>4</td>
<td>50.16</td>
<td>53.10</td>
<td>2.94</td>
<td>3</td>
<td>TL EL COTL</td>
</tr>
<tr>
<td>6</td>
<td>46.42</td>
<td>52.35</td>
<td>5.93</td>
<td>3</td>
<td>TL EL COTL</td>
</tr>
<tr>
<td>7</td>
<td>26.08</td>
<td>32.69</td>
<td>6.61</td>
<td>2</td>
<td>TL EL</td>
</tr>
<tr>
<td>9</td>
<td>38.34</td>
<td>NA</td>
<td>NA</td>
<td>2</td>
<td>TL EL</td>
</tr>
<tr>
<td>10</td>
<td>43.63</td>
<td>48.56</td>
<td>4.93</td>
<td>2</td>
<td>TL EL</td>
</tr>
</tbody>
</table>

**Table 7. Team-Size-Adjusted Relative Areas by Team.**

<table>
<thead>
<tr>
<th>Team</th>
<th>Pre (%)</th>
<th>Post (%)</th>
<th>Difference (%)</th>
<th>Team Size</th>
<th>Roles Included</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11.36</td>
<td>20.01</td>
<td>8.65</td>
<td>2</td>
<td>TL EL</td>
</tr>
<tr>
<td>2</td>
<td>15.26</td>
<td>22.90</td>
<td>7.64</td>
<td>2</td>
<td>TL EL</td>
</tr>
<tr>
<td>3</td>
<td>17.37</td>
<td>16.77</td>
<td>-0.60</td>
<td>2</td>
<td>TL EL</td>
</tr>
<tr>
<td>4</td>
<td>16.72</td>
<td>17.70</td>
<td>0.98</td>
<td>3</td>
<td>TL EL COTL</td>
</tr>
<tr>
<td>6</td>
<td>15.47</td>
<td>17.45</td>
<td>1.98</td>
<td>3</td>
<td>TL EL COTL</td>
</tr>
<tr>
<td>7</td>
<td>13.04</td>
<td>16.35</td>
<td>3.31</td>
<td>2</td>
<td>TL EL</td>
</tr>
<tr>
<td>9</td>
<td>19.17</td>
<td>NA</td>
<td>NA</td>
<td>2</td>
<td>TL EL</td>
</tr>
<tr>
<td>10</td>
<td>21.81</td>
<td>24.28</td>
<td>2.47</td>
<td>2</td>
<td>TL EL</td>
</tr>
</tbody>
</table>

**Reflection**

In Table 6, we see the teams with the largest percentage relative’s area from largest to smallest as follows; Teams 4,6,10,9,3,2,7,1. Teams 4 and 6 both uniquely contained a second technical lead member, which is referred to as per NSF program guidelines as a Co-technical
Lead. The visualization (red shading) provided in the radar charts as shown in Figure 1. Entrepreneurial Competency Radar Charts by I-CORPS Team (Pre vs. Post), for these two teams reflected a near to fully expressed concentric circle. This fully expressed shaded circle reflect teams assessing themselves with a higher level of Entrepreneurial Competencies preprogram participation. Its noteworthy to consider from the defined I-Corp Program roles of a Technical Lead, that their backgrounds are typically as university faculty members, or experienced researchers prior to I-Corp program participation. Having two technical leads on a team would appear to support the notion that these two teams possess a stronger skillset of entrepreneurial competencies.

In comparison to the remaining six teams, the relative areas get smaller. It is noticeable that the varied visualizations remaining in the other team’s radar charts are of differing shapes and sizes, which are reflective of each teams’ individual assessments of their entrepreneurial competencies.

Learning

The radar chart as a tool is useful in this initial pre-program assessment of the participating teams. Its utilization in this study represents a first for the NSF and I-Corps program. Once completed, the visualization that the radar chart provides is helpful to the teams and participating faculty in ascertaining specifically where the strengths and weaknesses of competencies are of these participating teams. This awareness also allows participating teams, and supervising faculty a baseline measure of comparison, once the teams go through another cycle of reassessment of competencies upon program completion.
Additionally, as teams are evaluated weekly by supervising faculty, the radar charts assist in further identifying teams that maybe in need of additional coaching towards specific competencies, or towards NSF Program goals.
CHAPTER SIX:
EVALUATION 2

Data Collection # 2 Post Program Assessment

The second round of data collection occurred on November 4, 2019, at the University of South Florida I-Corps program meeting. I-Corps team participants were provided a copy of the “Informed Consent to Participate in Research Involving Minimal Risk document, Pro #00041352” (Appendix B). The contents and context were explained to the I-Corps team participants. The team participants were given the opportunity to opt out of the proposed data collection. Upon unanimous approval of all teams to participate, I provided each I-Corps team member a copy of the survey (Appendix C), explained briefly the contents, and reviewed the instructions regarding completion.

The second round of data collection consisted of the utilization of the same survey (post) assessment of I-Corps participants; again, it was intended to capture the lived experiences of each individual I-Corps team member. Each participant was encouraged to provide their individual perceptions towards their respective level of entrepreneurial competency per category; this assessment occurred at the conclusion of the program (Appendix C).

A visual comparison for each I-Corps Teams entrepreneurial competencies before and after the I-Corps program is provided in the Radar charts in Figure 5. While relative areas and team size are provided in Table 6. In Table 6, we see that Team 1 saw the largest increase in relative area (17.30%) while Team 2 saw the second largest increase (15.26%). Team 3 was the
only team to see a decrease in relative area. A quick viewing of the “Pre” and “Post” columns of Table 6 in light of the “Team Size” column reveals that there may have been a relationship between the number of team members and relative area. This potential relationship is highlighted in Figure 6, where we see that teams with three members tended to have larger relative area values (both pre and post). To account for this potential relationship between relative area and team size, team-size-adjusted relative areas are provided in addition to standard (unadjusted) relative areas where relevant. The team-size-adjusted relative area figures are provided in Table 7 below. To adjust for team size, relative areas were divided by team size. This is what is meant by the phrase “Team-Size-Adjusted” throughout this document. From Table 7, we see that Team 10 had the greatest entrepreneurial competency coverage per team member both before and after the I-Corps site program. However, the largest difference (per team member) was observed for Team 1.

In terms of entrepreneurial competency coverage by role, we see from Figure 5a that EL’s (i.e., Entrepreneurial Lead) tended to be less competent before the program compared to TL’s (Technical Lead). However, EL’s saw the greater increase among the two roles, with EL’s increasing to 48.64% coverage from 33.67% throughout the program, while TL’s only increased to 42.42% from 40.93%. In other words, the program seems to be designed to foster greater entrepreneurial competencies in Entrepreneurial Leads than Technical Leads.

Reflection

As observed in Figure 5 (Entrepreneurial Competency Radar Charts by I-CORPS Team (Pre vs. Post)), and Figure 5a (Entrepreneurial Competency Radar Charts by I-CORPS Role (Pre vs. Post)) demonstrated the effectiveness and growth of entrepreneurial competencies in key personnel in the I-Corps Teams post program versus preprogram. This dissertation was not
designed specifically to examine individual I-corps team roles, but it is noteworthy to acknowledge the collective growth effect of the I-Corps program on each of the specific entrepreneurial competencies for these key team members as demonstrated also on this figure.

It is important to note also that for teams that have not fully met program goals but do show improved coverage in the area of the radar chart, recommendations can be made by faculty to teams, to add additional team members to enhance the team’s entrepreneurial competencies. Teams 4 and 6 are examples of teams that started out with larger team sizes comparatively and larger e-competency coverage initially. Post assessment their overall change in relative area was not as large as other teams, but they both were able to maintain and grow their e-competency relative areas. Both teams 4 and 6 were recommended by faculty as meeting program objectives, and to move on to the I-Corps national program. In this data pool “size did matter”. Many I-Corps teams in this study also were lacking in a third member, the I-Corps mentor (IM). This third team member could potentially have added to the teams overall e-competencies.

France Cordova Director of National Science Foundation related in the 2019 NSF I-Corps biennial report to congress stated, “For those who have participated in the program, it has been truly transformational. After completing I-Corps, many participants have adopted an entrepreneurial mindset that makes them reassess how they teach and how their future research might positively impact society and the world as we know it “(National Science Foundation, 2019). Figure 7 provides an example of such a transformational growth. Post program 11 of the 13 entrepreneurial competencies measured showed positive change, with increasing Entrepreneurial competencies from preprogram to post program. The most growth in competencies were seen in the following entrepreneurial competencies: guerilla skills, value creation, creative problem, and self-efficacy. These improvements could be attributed to two
factors, the initial skillsets of the participants, and the lack of experience of the key participants. The Entrepreneurial Leads (EL) tend to be individuals who are less experienced student participants, versus the Technical leads (TL) who are more experienced/worldly university faculty researchers. The second factor is the I-Corp curriculum which requires weekly team engagement. Weekly teams receive I-Corps instructor team critiques and feedback, additionally teams also weekly receive lecture and instruction on the various components of the business model canvas. As stated previously this dissertation is supported by structuration theory. Morris (2013) related, “Environments provide scripts that guide individual behaviors and interactions, and education serves as an important source of scripts within the individual’s environment. Individuals adopt and/or revise scripts based on feedback and evaluation of their behavioral and interactional outcomes. Where scripts are successfully employed over time, they can become the foundation for the individual’s competencies.” It can be inferred from this research that, the environment that has been created by the National Science Foundation is the I-Corps program. The scripts that are employed refer to the curriculum, and experiential involvement of the teams who participate in the program.

Learning

Upon completion of the I-Corps program, teams and faculty ascertain the progress made throughout the program based on the guidance provided in the I-Corps curriculum towards specific outcome attainment. The radar chart in this study, and furthermore here in the post program phase of assessing entrepreneurial competencies, is valuable in comparatively showing the visualization of both baseline measurements of e-competencies and post program measurements of e-competencies. Kaczynski et al (2008) related that the innovative use of a radar chart for educational assessment is suitable, and Radar charts are graphs with multiple
scales that are used to report self-assessed knowledge and competencies. Graphic measurements can be compared over time to monitor changes or growth across the chosen factor. The I-Corps curriculum by design is set up to foster a respective amount of growth in its team participants. France A. Cordova related;” A core contribution of the NSF I-Corps program is a robust innovation ecosystem with entrepreneurially trained scientists and engineers who can evaluate market opportunity” (National Science Foundation, 2019, p.1).
CHAPTER SEVEN:
EVALUATION 3

Data Collection # 3 I-Corps Faculty Assessment

The third round of data collection occurred on October 7, 2019, at the University of South Florida I-Corps program meeting. I-Corps supervising faculty were provided a copy of the “Informed Consent to Participate in Research Involving Minimal Risk document, Pro #00041352” (Appendix B). The contents and context were explained to each faculty participant. The faculty participants were given the opportunity to opt out of the proposed data collection. Upon unanimous approval of all faculty members to participate, each USF I-Corps faculty were provided a copy of the survey (Appendix D), explained briefly the contents, and reviewed the instructions regarding completion.

The I-Corps Site program faculty are evaluating I-Corps teams based on specific training they have received by the National Science Foundation, which encompasses not only the employment of I-Corps curriculum, but also a systematic evaluation of each I-Corps Teams during program participation respective to specific NSF mandated outcomes outlined in NSF Program Solicitation NSF18- 515. The outcomes of I-Corps Teams projects will be threefold:

1) a clear go/no go decision based on an assessment of the viability of the overall business model (Go No Go)

2) substantial first-hand evidence for or against product-market fit (Product Market Fit), with a pithy definition of the customer segments and corresponding value propositions,
3) a narrative of a compelling technology demonstration for potential partners

(Compnar).

Faculty Rater recommendations were measured using five separate Likert-type items (rated 1 = “Very Poor” to 5 = “Excellent”), as well as a binary (yes/no) item. Three separate program raters (i.e., judges) provided outcome ratings by team.

The following six response measures were captured in the faculty assessment:

**Go-No-Go (GNG).** I-Corps site teams are required to demonstrate the ability to make a go- or no-go decision. Raters were asked in the survey: how would you rate this team’s ability to make a go/no-go decision?“

**Compelling Narrative for Future Partners (COMPNAR).** Throughout the I-Corps site team process teams are evaluated on the ability to communicate and present effectively. Raters were asked in a survey “How would you rate this team’s ability to effectively communicate a compelling narrative for their technology?”

**Product Market Fit (PMF).** At the conclusion of the I-Corps Program teams are evaluated on the ability to evaluate their proposed technologies potential commercial marketability. Raters were asked in a survey: “How would you rate the team’s decision-making ability for/against a product market fit for their technology?”

**Customer Discovery Interviews (CDI)**

An integral part of the I-corps curriculum requires I-corps site teams to conduct a targeted number of interviews on a weekly basis. Raters were asked how would you rate this team’s ability to effectively conduct customer interviews?

**Pivoting (PIV).** Throughout the I-Corps program process teams are evaluated on the ability to pivot, if potential technology, customer types, etc. are not fit for program objectives.
Raters were asked in a survey: “How would you rate this team’s decision-making ability around pivoting?

**Rater Recommendation.** The final outcome measure consisted of a single yes or no question, which reads “Would you recommend this team to advance to the national NSF I-Corps Program?”

It should be noted that of the six response measures captured, four of the measures were utilized specifically in the artifact evaluation. This was done purposefully as those four measures were directly related to the I-Corps program outcomes.

**Reflection**

**GNG.** As reported in Tables 6a and 6b several teams (1,2,4,6,10) have demonstrated an overall increase in relative area from baseline (pre vs. post). This would support the hypothesized idea that these teams have experienced an overall growth in their entrepreneurial competencies as a result of participation in the I-Corp program.

For the teams that have demonstrated a greater entrepreneurial competency coverage (relative area) preprogram as reported in Tables 6a, 6b, the category of “Go No Go” Faculty raters tended to rate most of these teams higher than lesser performing teams. As reported in Table 8. I-Corps Teams Faculty Assessment, this would support the notion that these teams are perceived as being more entrepreneurial competent previous to program involvement than teams that have demonstrated an increase in relative area post program as reported. in Tables 6a and 6b, in the category of “Go No Go” decisions, Faculty raters tended to rate most of these teams higher than teams with lesser relative area. This would support the hypothesized idea that these teams have achieved a greater level entrepreneurial competency coverage as a result of program involvement.
Additionally, one team (3) experienced a negative relative area growth (pre vs. post) and another team (9) data was only available for pre-program participation, as secondary team member left team prior to program completion. Figure 5. *Entrepreneurial Competency Radar Charts by I-CORPS Team (Pre vs. Post)* provides collectively a further visualization of these trends.

Regarding these specific Teams outcome attainments, Team 1 demonstrated a 17.3% increase in relative area, and additionally received high Go No Go outcome ratings comparatively to other teams, being unanimously rated 4’s (good) by all raters. Team 1 was also recommended by all raters to advance to the national NSF I-Corps Program. In comparison Team 6 had a relative area increase in of 5.93% and received outcome ratings of excellent (5) to good (3) from all three raters. Raters also recommended this team to move on to the larger scale national NSF I-Corps program. Team 4 had a relative area increase in entrepreneurial competencies at 2.94% and received outcome ratings of good from all three raters and also was recommended to move on to the national NSF I-Corps program. Notable, and a possible influence on performance in teams 4 and 6, was the presence of a fourth team member a 3rd technical lead. This 3rd technical lead was referred to as a Co-Technical lead (COTL). Teams 7 & Team10 had respective relatives area increases of 6.61% and 4.93%. For Team 7 raters provided positive (GNG) outcome ratings from fair (3) to Excellent (5). For Team10 raters provided positive (GNG) outcome ratings from good (4) to Excellent (5).

**COMPNAR.** Each I-Corps Teams is evaluated and judged on their respective ability to provide a compelling narrative of their potential business idea throughout the program. The very first program meeting requires each team to present a “Compelling Narrative for Future
Partners” (COMPNAR) in the form of a pitch presentation to the raters in program and other team participants.

As reflected in the results in Tables 5 and 6, several teams have demonstrated growth in Entrepreneurial Competencies measured in relative areas from baseline (pre) to post program. Regarding these specific Teams, Team 1 which demonstrated a 17.3 % increase in relative area, received high COMPNAR outcome ratings comparatively to other teams, being rated 5 (excellent) and 3’s (fair)by all raters. Team 1 was also recommended by all raters to advance to the national NSF I-Corps Program. In comparison Team 6 had a relative area increase in Entrepreneurial competencies at 5.93% and received the highest COMPNAR outcome ratings of excellent from all three raters and was recommended to move on to the national program. Team 4 had a relative area increase in Entrepreneurial competencies at 2.94% and received outcome ratings of fair (3) from two raters and one rater rated excellent (5). All 3 raters recommended Team 4 move on to the national NSF I-Corps program. Notable and a possible influence on performance in teams 4 and 6, was the presence of a fourth team member a 3rd technical lead. This 3rd technical lead was referred to as a Co-Technical lead (COTL).

Teams 7 & Team10 had respective relatives area increases of 6.61% and 4.93%. For Team 7 raters provided negative (COMPNAR) outcome ratings from fair (3) to poor (2). For Team 10 raters provided (COMPNAR) outcome ratings of (3) Fair to (4) Good. It is important to recognize here that the teams that have achieved positive outcomes measure ratings in Product market fit category have demonstrated a level of Entrepreneurial Competency growth from preprogram participation to post program participation. Teams 1(17.3%), Team 6 (5.93%) ,10 (4.93%), and Team 4 (2.94). Two outliers in this analysis were teams 2(15.26%) and teams 3(-1.21%). Irrespective of having the 2nd largest growth difference seen in Entrepreneurial
competencies in teams, Team 2 received (Fair) to very poor (1) ratings in this category by raters. Team 3 (-1.21%) received fair (3) to poor (2) ratings in this category. For a team to receive low ratings at program conclusion would require such team having not demonstrated a specific competence in this area. Overall, it can still be stated that the teams that did have successful outcomes in this category also did see growth in their measured (relative area) entrepreneurial competencies.

**PMF.** It is important for participating I-Corps Teams to be able to demonstrate an ability to communicate Product Market Fit from program commencement to conclusion. As teams are being evaluated by raters the I-Corps curriculum helps to further develop this ability in the team participants. Initially raters are more openminded to participating team’s overall competence level in this area. Some I-Corps Site teams present initially with a compelling idea which has, already had some level of further due diligence attached to it. By design the program examines multiple parameters as the goal is to teach a process that brings the idea closer to a commercially viable product.

As reflected in the results in Tables 6a and 6b, several teams have demonstrated growth in Entrepreneurial Competencies measured in relative areas from baseline (pre) to post program. Regarding these specific Teams, Team 1 which demonstrated a 17.3% increase in relative area, received high Product Market Fit outcome ratings comparatively to other teams, being rated 4’s (good) and 5’s (excellent) by all raters. Team 1 was also recommended by all raters to advance to the national NSF I-Corps Program. In comparison Team 6 had a relative area increase in Entrepreneurial competencies at 5.93% and received outcome ratings of excellent to good from all three raters and was recommended to move on to the national program. Team 4 had a relative area increase in Entrepreneurial competencies at 2.94% and received outcome ratings of good (4)
from two raters and one rater rated poor (2). Irrespective of the negative rating by that rater 2 of the 3 raters recommended Team 4 move on to the national NSF I-Corps program. Notable and a possible influence on performance in teams 4 and 6, was the presence of a fourth team member a 3rd technical lead. This 3rd technical lead was referred to as a Co-Technical lead (COTL). Teams 7 & Team10 had respective relatives area increases of 6.61% and 4.93%. For Team 7 raters provided negative (PMF) outcome ratings from fair (3) to Very poor (1). For Team10 raters provided unanimous (PMF) outcome ratings of (3) Fair. It is important to recognize here that the teams that have achieved positive outcomes measure ratings in Product market fit category have demonstrated a level of Entrepreneurial Competency growth from preprogram participation to post program participation. Teams 1(17.3%), Team 6 (5.93%) ,10 (4.93%), and Team 4 (2.94). Two outliers in this analysis were teams 2(15.26%) and teams 3(-1.21%). Team 2 received poor (2) to very poor (1) ratings in this category by raters. Irrespective of having the 2nd largest growth difference seen in Entrepreneurial competencies in teams, for a team to receive low ratings at program conclusion would require such team having not demonstrated a specific competence in this area. Overall it can still be stated that the teams that did have successful outcomes in this category also did see growth in their measured (relative area) entrepreneurial competencies.

Table 8. I-Corps Teams Faculty Assessment.

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Learning

**CDI.** Considerable variation in CDI ratings by rater was observed. In other words, the raters tended to rate the same teams quite differently. Rater B appeared to be the most critical, while Rater C was the least critical. Rater A tended to have ratings that were in between those of the other raters. Rater C was the only rater to exhibit a stochastically increasing pattern (i.e., one that tends to increase but does not always increase), with Raters A and B exhibiting little-to-no pattern between CDI and relative area (both pre and post). This is an indication that Rater C tended to rate those teams with greater coverage in their respective radar chart higher in customer discovery interview quality. There appears to exist virtually no relationship between relative area difference and CDI for any of the three raters. In terms of team-size-adjusted relative areas, Raters C and A displayed a stochastically increasing relationship between adjusted relative area and CDI rating. Overall, no relationship was observed between relative areas and CDI ratings for Rater B, indicating that this rater seems to place little importance on entrepreneurial competency coverage (or change in coverage) when evaluating a team’s CDI quality.

Table 9 provides a breakdown of the number of interviews each team conducted during the course of the program. Team 4 conducted the most interviews overall, as well as the most interviews per member of their team. Team 3 conducted the least interviews overall, as well as the least per team member. This lack of interviews could help to explain the fact that Team 3 was the only team to lose entrepreneurial competency coverage during the program. The average number of interviews conducted across all eight teams was 33.5, while the median number of interviews was 27.
**Table 9. Interview Counts by Team.**

<table>
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<th>Team</th>
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<tr>
<td>10</td>
<td>22</td>
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</table>

**PIV.** It was observed that no relationship appears to exist between entrepreneurial competency coverage (pre, post.) This would appear to indicate that a team’s total average entrepreneurial competency coverage does not seem to influence that team’s ability to pivot. It is worth noting here that some teams do not pivot at all, while others pivot several times during the program. Since we do not know how many times each team pivoted (because the data was not collected), the number of pivots is not controlled for here.

**Faculty Rater Recommendation.** Since entrepreneurial competency coverage may be related to whether a rater recommends a team for the national program, we address this possible relationship here. From Figure 10. Relative Areas by Recommendation Decision by Raters, we see that Raters A and C might base their decision to recommend a team for the national program on pre-program entrepreneurial competencies. However, Rater B’s decision to recommend does not seem to be influenced by their pre-program abilities. From the first row and second column of this plot, it appears that Raters A and C also base their decision to recommend a team on that team’s post-program competencies. Once again, Rater B does not seem to have been influenced by post-program competencies. Rater B seems to focus more on a team’s entrepreneurial growth throughout the program when choosing to recommend a team for the national program. Rater A and C do not appear to base their recommendations on changes in competencies.
In terms of team-size-adjusted results, Rater B seems to recommend teams with lower average competencies per team member. Adjusted pre-program areas do not seem to influence recommendations from either Raters A or C. As was the case for the unadjusted difference in relative areas, we see that Rater B made recommendations based on growth in competencies per team member, once again suggesting that Rater B focuses more on a team’s change in competencies when choosing whether or not to recommend that team for the national program.

Figure 10. Relative Areas by Recommendation Decision by Rater.
CHAPTER EIGHT:

DISCUSSION

Utilizing a phenomenological approach and Action Design Research methods to conduct the research of this study was key, Cope cited that, “It is important to realize that an entrepreneur may well interpret things differently at different times and in different contexts. An individual’s perspective on an event or experience, therefore, can change over time” (Cope, 2005, p.170). The interaction and evaluation of I-Corps Teams begins and continues from the initial application to program completion. Morris related again that, “entrepreneurship is a process that unfolds as individuals behave within and interact with their environments. Environments provide scripts that guide individual behaviors and interactions. Education serves as an important source of scripts within the individual’s environment. Individuals adopt and/or revise scripts based on feedback and evaluation of their behavioral and interactional outcomes. Where scripts are successfully employed over time, they can become the foundation for the individual’s competencies” (Morris, 2013, p. 355).

The research questions that guided this study sought to examine and test the relationship between entrepreneurial competencies and outcomes regarding “How does the NSF I Corps site program outcomes relate to the core entrepreneurial competencies of the participant teams. Additionally, the study sought to examine the relationship between the program outcomes and a change or improvement in their entrepreneurial competencies.
The radar chart has shown its value and usefulness in this study. The radar chart in Figure 5. *Entrepreneurial Competency Radar Charts by I-CORPS Team (Pre vs. Post)* correlated visually to the changes noted in Table 6. *Relative Areas by Team* and Table 7. *Team-Size-Adjusted Relative Areas by Team*. As the relative areas differed per team, and as some changes were more pronounced as in team 1, 2 and 4. It can be inferred that again by participation in the I-Corps program that entrepreneurial competencies were changed and impacted positively. These better teams did the best job using the program to build out their competencies over the 10 or 12 weeks of the program. As they increased the relative area under the curve in any way shape or form, these teams seem to be evaluated as having been more effective in meeting program outcomes by the instructors, versus teams that did not increase their skill sets and relative area under the curve.

**Compelling Narrative for Future Partners (COMPNAR)**

Results in this study reflect that there may be an indication that a team need not be entrepreneurially savvy in order to present a compelling narrative to future partners. Of further interest is the fact that this lack of a relationship was observed for all three raters.

Typically, the Entrepreneurial teams that approach the I-Corps site programs, are in an early exploration phase of their potential business idea. As related in NSF program solicitation 18-515, “The purpose of the I-Corps Teams program is to identify NSF-funded researchers who will receive additional support in the form of entrepreneurial education, mentoring and funding to accelerate the translation of knowledge derived from fundamental research into emerging products and services that can attract subsequent third-party funding”. In some cases, Entrepreneurial Teams that are further along the continuum of business development still participate in the I-Corps program. Those teams are in a unique position typically to provide
compelling narratives to future partners. Tampa based investor Dr. Joe Hodges outlined in a recent discussion three things which he sought after when focusing on early-stage entrepreneurial companies that he invests in; “1.) Are teams clear about their business idea, more importantly the problem they are attempting to solve, 2.) They know how to scale this idea, and 3.) They know how to leverage the necessary resources around them to scale their business. In essence the companies that Dr. Hodges invest in are able to offer him as a future partner/investor a compelling narrative.

**Pivoting (PIV)**

This variable indicates that a team’s total average entrepreneurial competency coverage does not seem to influence that team’s ability to pivot. It is worth noting here that some teams do not pivot at all, while others pivot several times during the program. Since we do not know how many times each team pivoted (because the data was not collected), the number of pivots is not controlled for here.

**Number of Interviews**

There is an argument for curvilinearity in the relationship between pre-program relative areas and number of interviews could be made. However, we felt that this relationship is too noisy to tell for sure. There appears to be no relationship between the number of interviews and the difference in relative areas.

This lack of relationship indicates that, once we account for a team’s size, we no longer see a relationship between the relative areas and the number of interviews. It can be said here that this indicates that team size may be a stronger predictor of number of interviews than entrepreneurial competency coverage.
Rater Recommendation

From the first row and second column of the measured plot, it appears that Raters A and C also base their decision to recommend a team on that team’s post-program competencies. Once again, Rater B does not seem to have been influenced by post-program competencies. Rater B seems to focus more on a team’s entrepreneurial growth throughout the program when choosing to recommend a team for the national program. Rater A and C do not appear to base their recommendations on changes in competencies.
Academic Contribution

Considering the background research conducted for this study, there were no studies that have previously been conducted that explored the relationship between the I-Corps program and Entrepreneurial Competencies. Additionally, this study contributes to the body of knowledge surrounding the I-Corps program by extending further into areas where research methods such as Action Design Research and Elaborated Action Design research have never been utilized. It is my hope that the current thinking around the I-Corps program can reach outside of the commercialization dialogue, and towards the deeper and intrinsic benefit of building/selecting better I-Corps Teams, and Entrepreneurial competency development.

I-Corps teams are emblematic of startup teams Blank, stated I-Corps is an educational program that is a bridge to private capital (Blank, 2012). Startup teams go through a process of evolution along the entrepreneurial continuum from project inception. I-Corps teams go through a similar process of entrepreneurial development from project inception. Morris relates that; entrepreneurship is a process that unfolds as individuals behave within and interact with their environments (Morris, 2013, p. 354). As outlined in this study, participants in these programs are exposed to a specific multi-modal curriculum that is specifically designed to teach participants a specific and purposeful process. This process and its curriculum are considered scripts. Morris stated that Structuration theory is a basis of competency development, Morris related and cited that, “a useful lens can be found in structuration theory, which concerns the reciprocal
interactions between individuals and their environments. Environments provide structure to
individuals’ behaviors and interactions” (Morris, 2013, p. 355). Additionally, Morris cites; “As
scripts are confirmed, they can serve as the foundation for the development of competencies, a
development which generally occurs over time” (Morris, 2013, p. 355).

**Practical Contribution**

This study not only adds to the current body of knowledge in academia, it also adds to the
body of knowledge in practical business applications. The results of this study have given the
sponsors of this program the National Science Foundation positive feedback towards the
effectiveness of the I-Corp program. There currently is no study that has taken such an approach
to utilize Action Design research methods to research I-Corps teams, Entrepreneurial
competencies and Radar Charts.

Wójcik-Augustyniak (2020) related in Entrepreneurship and Sustainability that; “At
present the use of radar (web) charts is gaining interest in various areas of management theory
and practice, including organization strategic management. The areas in which radar charts are
successfully applied are sustainable development management, university management, product
management, and human resource management” (p. 2149).

Another practical contribution is the further application of these research methods to the
private sector, specifically towards private investors, and venture capital firms who regularly
examine startup companies for investment purposes. In a recent conversation with Tampa Bay
investor/entrepreneur Dr. Joe Hodges related that he utilizes a set of competencies that he has
created to evaluate early-stage companies before he chooses to invest in them. He further related
that these early-stage companies are clear about their ideas and how to scale them to
commercialization. He continued to relate that as the teams grow and evolve their respective
businesses, he constantly evaluates the team’s competencies. He ended the conversation by stating that it would be helpful to have a tool such as the Radar Chart in which he could personalize, input, and monitor respective competencies. Essentially, the ability to personalize for an end user, and the visualization that radar charts provide is the key indicator to the user, as it is able to quantify a large amount of possibly interconnected information. The American Society for Quality defines a radar chart as: “A graph with multiple scales to report self-assessed knowledge or competence, often several points in time” (American Society of Quality, 2006a).

**Implication for Government Policy**

The I-Corps program and its program sponsor the National Science Foundation, a government agency has had a tremendous impact on entrepreneurism in academia. Since its 2011 inception, NSF I-Corps has trained 1,315 I-Corps teams with a total of 3,745 people. Following I-Corps training, I-Corps teams have raised $301 million in funding to support startup development and created 644 startups with potential societal impact (National Science Foundation, 2019).

The National Science Foundations I-Corps teams have to date demonstrated that at a baseline level, the motivation behind the program's creation and its subsequent implementation has been successful in meeting the outcomes of the program. The program outcomes of I-Corps Teams projects are threefold: 1) a clear “go”/”no-go” decision based on an assessment of the viability of the overall business model; 2) substantial first-hand evidence for or against product-market fit, with a clear definition of the customer segments and corresponding value propositions; and 3) a narrative of a compelling technology demonstration for potential partners” (National Science Foundation, 2019).
This study has demonstrated an ability to integrate into current I-Corps programs and offer I-Corp administrators’ immediate value by providing them an analysis tool which could be standardized for use by all programs nationwide. NSF currently outside of the site and regional hub I-Corps programs have expanded the I-Corps programs into several other governmental initiatives;” NSF collaborated with the National Institutes of Health (I-Corps at NIH) in 2014 and the Department of Energy (Energy I-Corps) in 2015. NSFI-Corps has also collaborated with eight U.S. federal government agencies, one state government and one foreign country to provide access to the NSF I-Corps training more broadly” (National Science Foundation, 2019).

Multiple I-corps sites were interviewed as background research for this study, it was clear to ascertain that even though there was a consensus towards meeting the mandated program outcomes, the execution between sites was vastly different. The incorporation of the study methods (radar charts, relative area of teams) could be a way to further introduce a level of analysis and standardization, that could generate multiple layers of useful program data, useful not only at the local site level but in compilation at the national level.

Implementation of the methods used in this study, would not be difficult. Radar charts are analysis tools commonly available in the management and business disciplines. Various software platforms, such as Excel, allow the user the hands-on ability to generate radar charts and calculate the respective relative areas of the team being examined.

Introduction of this method as a new process by the National Science Foundation I-corps program to its teams would not disrupt the ability of these current programs' independence in administering the core I-Corps program. The incorporation of the methodology of this study could offer an expanded awareness of team potential, and increased team performance throughout the program. Considering that each I-Corp site programs at the outset of each cohort
class, is attempting to identify and build better teams, the artifact (radar charts) in this study and the design element (Entrepreneurial Competencies) could be incorporated into the screening process of potential teams early in application process. Thus, offering site administrators the choice of inclusion or exclusion of teams from the program early in the process.

Limitations

Considering the sample size in this study, there were a limited number of complete teams available for examination at the time of the pre- and post-assessments data collection. Most I-Corps Teams in this study did not have a I-Corps team mentor (IM). “As in business, the NSF I-Corps training program supports a team-based approach. NSF I-Corps Teams typically comprise three members: Technical Lead (TL), Entrepreneurial Lead (EL) and I-Corps Team Mentor (IM)” (2019). Of the eight teams that participated in the University of South Florida I-Corps site program, four of the teams had I-Corps Mentors and the other four teams did not. It is important to note that the program administrators at the USF Site program allowed teams to continue to participate in the program if the I-Corps Mentor position was not filled. As a result of this team member limitation, team member measures in this study cumulatively for all eight teams involved only the Entrepreneurial Lead (EL), and Technical Lead (TL).

The overall team count of eight teams was also too small to conduct virtually all inferential analyses with any reasonable sense of reliability. Singh related that, “It is about using data from a sample and then making inferences about the larger population from which the sample is drawn. The goal of the inferential statistics is to draw conclusions from a sample and generalize them to the population. It determines the probability of the characteristics of the sample using probability theory” (Singh, 2018).
An additional study limitation is the I-Corps program seems to be designed to foster greater entrepreneurial competencies in Entrepreneurial Leads than Technical Leads. This program design assumes that Technical Leads already possess a respective level of entrepreneurial competencies because of their status in most cases as faculty researchers.

This study was also further limited in regard to the overall safety concerns around the COVID 19 Pandemic. Following the data collection in the Fall of 2019 at the University of South Florida, the I-Corps Site program hosted Spring and Fall semester cohorts in 2020. Due to the Coronavirus (Covid 19) Pandemic, the researcher out of fear for his personal safety elected to self-quarantine. This self-quarantine limited the researcher’s ability to access and interact with the I-Corps Teams that were participating in the Spring and Fall 2020 cohorts at the University of South Florida for further data collection purposes.

Finally, this study was also limited by the response bias, Furnham related that, “response bias which is a generic term for a whole range of responses to interviews, surveys or questionnaires which bias the response (from the correct, honest, accurate response). They include the socially desirable or faking-good response as well as its opposite faking bad (or mad), acquiescence or yea-saying (the tendency to agree irrespective of the question) or its opposite or nay saying, extremity response set (always choosing extreme opposites) or its opposite. mid-point response set etc. These response sets may be due to the nature of the question as much as the motives of the respondents” (Furnham, 1986, p. 385).

**Future Research**

The researcher believes that the findings in this dissertation has provided a strong and unique case towards further and continuous examination of I-Corps Teams, team selection, building better teams, and the relationship with entrepreneurial competencies in its varied
program settings. The visualization, dimensional analysis and cues that “radar charts’ offers are compelling in the evaluation of teams.

The utilization of Action Design Research and Elaborated Action Design research methods could be further expanded upon in future research by repeat of this study, as my findings in this study are not meant to be representative of a final endpoint, or final assumption regarding how to build better I-Corps teams. The utilization of Action Research methods as related by Sein et al. (2011), “Action Research aims to link theory with practice, and thinking with doing (Susman, 1983). It is typically an iterative process based on working hypotheses refined over repeated cycles of inquiry (Davison et al., 2004; Susman & Evered, 1978)”. As the initial researcher in this dissertation, Sein et. al. (2011, p.37) further states the following: “While the researcher may guide the initial design, the ensemble artifact emerges through the interaction between design and use.” It is through repetition of this study and the further design and use of this artifact in multiple I-Corps settings is where the further insight and development into I-Corps Teams and Entrepreneurial competency development will occur.

I propose this study be redone done as a prospective longitudinal study over the next 3-5 years. In a longitudinal study, “researchers conduct several observations of the same subjects over a period of time, sometimes lasting many years. The benefit of a longitudinal study is that researchers are able to detect developments or changes in the characteristics of the target population at both the group and the individual level. The key here is that longitudinal studies extend beyond a single moment in time. As a result, they can establish sequences of events” (Wong et al., 2021, p.41).

In collaboration, and with the approval of the I-Corps faculty at the University of South Florida the plan would be to collect data from additional University of South Florida I-Corps
cohorts over a 3-5-year period of time. Consideration will also be given to supplementing the collection of data with alternate I-Corps sites or regional nodes. The goal in collecting this data is to provide a more robust sample group in which inferential analysis can be applied. Additionally, a larger scale study would allow researchers an opportunity to improve the survey questions, and recruit more sites to participate, opening a larger sample pool to collect more relevant data from over an extended period of time.

Currently the National Science Foundation has begun to employ the I-Corps program outside of academia, to both federal and state-run agencies. This expansion into other agencies is a testament to the program’s success and the interest it has created outside of the National Science foundation. Future research into applying the methods in this study to these external agencies, including developing a practical model that could be developed and utilized cross-functionally outside of the programs current academic setting should also be investigated.

An additional area for future research is the enhancement of I-Corps program design function specific to individual team member roles. In its current form the program is designed to foster greater entrepreneurial competencies growth in Entrepreneurial Leads versus Technical Leads. With the further examination of individual team roles, the focus could be shifted towards overall growth in E-competencies of all team members. Especially considering the continued proliferation of entrepreneurship through university-based technology transfer offices and business schools.

**Conclusion**

The I-Corps Program has been revolutionary in opening the doorway to a discussion that needed to be had regarding government sponsored tech transfer. Previously vast sums of money
had been allocated congressionally to the National Science Foundation with little return on investment from university-based recipients.

As academics would argue their respective competency in their chosen field of discipline, the I-Corps program has shown that entrepreneurial competency attainment and growth is imperative to complete the tech transfer process. Since its 2011 inception, NSF I-Corps has trained 1,315 I-Corps teams with a total of support startup development and created 644 startups with potential societal impact. Following I-Corps training, I-Corps teams have raised $301 million in funding to support startup development and created 644 startups with potential societal impact.

Twenty-eight USF I-Corps teams have been selected for the prestigious NSF national-level I-Corps program to date. USF leads the state of Florida as the university with the most national I-Corps teams. Teams selected for the national program receive $50,000 and intensive training to take their idea/product to the next level.

What follows is a recommendation towards the implementation of radar chart-based measures of team entrepreneurial competencies. All I-Corps programs have some form of initial application process for team selection. The recommendation offered would be to incorporate these radar chart-based measures in conjunction with established screening processes.

In regard to the University of South Florida I-Corps Site Program and the selection process of the next I-Corps teams, the recommendation would be that after the teams have submitted their initial applications to the I-Corps faculty for evaluation, applicants should then be instructed to take a Preprogram assessment of their entrepreneurial competencies.

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6 National Science Foundation Innovation Corps (I-Corps) Biennial Report in accordance with Public Law 114–329 Spring 2019
7 http://innovation.usf.edu/icorps/teams-usf.php
This initial assessment would then be utilized to generate radar charts for each team. The visualization of baseline entrepreneurial competencies provide by the radar charts are valuable in providing University of South Florida I-Corps faculty an idea of the Entrepreneurial competency make-up of the potential teams. This additional step of evaluation could also be presented to the teams as a component of a four step/round process:

1. Initial Application
2. Pre-Program Assessment of Entrepreneurial Competencies
3. Team Interview
4. Faculty Final evaluation
REFERENCES


National Science Foundation. (n.d.a) At a Glance. retrieved from https://www.nsf.gov/about/glance.jsp


National Science Foundation. (n.d.e). *Innovation Corps Program (I-Corps).*


National Science Foundation. (n.d.g). *Industrial Innovation and Partnerships.*


*National Science Foundation - Where Discoveries Begin.* US NSF - Grant Proposal Guide 04-23 About the National Science Foundation.


https://doi.org/10.1177/000312240406900209


APPENDIX A:
INFORMED CONSENT

Informed Consent to Participate in Research Involving Minimal Risk

Pro # 00041352

You are being asked to take part in a research study. Research studies include only people who choose to take part. This document is called an informed consent form. Please read this information carefully and take your time making your decision. Ask the researcher or study staff to discuss this consent form with you, please ask him/her to explain any words or information you do not clearly understand. The nature of the study, risks, inconveniences, discomforts, and other important information about the study are listed below.

We are asking you to take part in a research study called:

The Identification of Entrepreneurial Competencies in I-Corps Site Teams at The University of South Florida

The person who is in charge of this research study is Mark Gidдар. This person is called the Principal Investigator. However, other research staff may be involved and can act on behalf of the person in charge. She is being guided in this research by her Faculty Advisor, Jung Park.

The research will be conducted in person / online using teleconferencing software to perform the interview and surveys will be used to answer and record responses during the interview.

Purpose of the study
The objective of this research seeks to identify the entrepreneurial competencies of successful I-Corps site teams.

Why are you being asked to take part?
We are asking you to take part in this research study because you are a member of an I-Corps team and are participants in the current fall 2019 I-Corp cohort program

Study Procedures:
If you take part in this study, you will be asked to: Provide details around specific identified competencies that pertain to entrepreneurship. This information will be used to ascertain competency levels in each of the respective areas that are also specific roles. The Principal Investigator will interview each member of an I-Corps team and ask respondents to select options from 1 to 5, ranking their perceived competency level.

The entire study should take approximately 10-15 minutes for each participant.

Total Number of Participants
About 24 individuals will take part in this study from the Muma College of Business.

Alternatives / Voluntary Participation / Withdrawal
Your participation is voluntary. You do not have to participate and may stop your participation at any time. There will be no penalties or loss of benefits or opportunities if you do not participate or decide to stop once you start. The answers that you provide are for informational and educational purposes only.

Benefits
The potential benefits of participating in this research study may include: having a better understanding of your individual entrepreneurial competencies

Risks or Discomfort
This research is considered to be of minimal risk. That means that the risks associated with this study are the same as what you face every day. There are no known additional risks to those who take part in this study.

Compensation
You will receive no compensation for taking part in this study.

Costs
It will not cost you anything to take part in the study.

Privacy and Confidentiality
We will do our best to keep your records private and confidential. We cannot guarantee absolute confidentiality. Your personal information may be disclosed if required by law. Certain people may need to see your study records. The only people who will be allowed to see these records are: Mark Giddarie, the Principal Investigator, Dr. Jung Park, the Faculty Advisor, and The University of South Florida Institutional Review Board (IRB).

The research involves complete confidentiality. This survey research is based on using a group of participants. Individual participants will not be identified. Any participant can withdraw from the study at any point for whatever reason. Should you decide to withdraw, any information provided to the study will be excluded.

We will keep your study records private and confidential. Certain people may need to see your study records. Anyone who looks at your records must keep them confidential. These individuals include:

- The research team, including the Principal Investigator, Faculty coordinator, and all other research staff.
- Certain individuals at the university who need to know more about the study, and individuals who provide oversight to ensure that we are doing the study in the right way.
- The USF Institutional Review Board (IRB) and related staff who have oversight responsibilities for this study, including staff in USF Research Integrity and Compliance.

It is possible, although unlikely, that unauthorized individuals could gain access to your responses because you are responding online. Confidentiality will be maintained to the degree permitted by the technology used. No guarantees can be made regarding the interception of data sent via the Internet. However, your participation in this online survey involves risks similar to a person’s everyday use of the Internet. If you complete and submit an anonymous survey and later request your data be withdrawn, this may or may not be possible as the researcher may be unable to extract anonymous data from the database.

Even if the findings from this study are published, we will keep your study information private and confidential. Anyone with the authority to look at your records must keep them confidential.
You can get the answers to your questions, concerns, or complaints
If you have any questions, concerns or complaints about this study, or experience an unanticipated problem, call Mark Giddarie at 678.665.0156.
If you have questions about your rights as a participant in this study or have complaints, concerns or issues you want to discuss with someone outside the research, call the USF IRB at (813) 974-5638.

Consent to Take Part in this Research Study
I freely give my consent to take part in this study. I understand that by signing this form I am agreeing to take part in the research. I have received a copy of this form to take with me.

Statement of Person Obtaining Informed Consent
I have carefully explained to the person taking part in the study what he or she can expect from their participation. I confirm that this research subject speaks the language that was used to explain this research and is receiving an informed consent form in their primary language. This research subject has provided legally effective informed consent.
APPENDIX B:

USF-ICORPS E-COMPETENCY SELF-ASSESSMENT (PRE/POST)

Entrepreneurial Competency Self-Assessment

I-Corps Fall 2019 - University of South Florida

Team Number / Name:

I-Corps Team Role (TL) – Technical Lead, (EL) – Entrepreneurial Lead, (IM) I-Corps Mentor, Please indicate your Role:

The information collected in this assessment is intended to capture your current perceptions of your own individual Entrepreneurial Competencies.

Rankings respective to Entrepreneurial Competencies will be measured on a Skill Level scale from 1 to 5:

SKILL LEVEL: Your level of experience demonstrating each Entrepreneurial Competency:

1.) Not Skilled: I have not learned this skill.

2.) Minimally Skilled: I have little experience demonstrating this competency and need substantial direction to perform it effectively.

3.) Somewhat skilled: I have some experience demonstrating this competency but still need guidance.

4.) Skilled: I have a good amount of experience demonstrating this competency independently.

5.) Very skilled: I always demonstrate this competency and could provide guidance/training to others.
### Assessment Questions:

<table>
<thead>
<tr>
<th>Please circle the response that you feel correctly represents your current skill level</th>
<th>Not Skilled</th>
<th>Minimally Skilled</th>
<th>Somewhat skilled</th>
<th>Skilled</th>
<th>Very skilled</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Opportunity Recognition</strong>&lt;br&gt;I often make novel connections and perceive new relationships between various pieces of information.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td><strong>Opportunity Assessment</strong>&lt;br&gt;I can distinguish between profitable opportunities and not so profitable opportunities. When facing multiple opportunities, I am able to select the good ones.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td><strong>Risk Management/Mitigation</strong>&lt;br&gt;I am more of a risk avoider than a risk manager.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td><strong>Conveying a Compelling Vision</strong>&lt;br&gt;I find it difficult to get others committed to my vision or dreams.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td><strong>Tenacity</strong>&lt;br&gt;I often set a goal but later choose to pursue a different one.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td><strong>Creative Problem-solving</strong>&lt;br&gt;I am creative when asked to work with limited resources.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td><strong>Resource Leveraging</strong>&lt;br&gt;There is always a way to obtain a resource even if you cannot afford it.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td><strong>Guerilla Skills</strong>&lt;br&gt;I could quickly identify three guerilla ideas to help a start-up venture.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td><strong>Value Creation through Innovation</strong>&lt;br&gt;New business ideas often come to me when directly observing how people interact with products and services.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td><strong>Ability to focus yet Adapt</strong>&lt;br&gt;I tend to look for the right answer, rather than realize there might be multiple ways to get to an end result.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td><strong>Resilience</strong>&lt;br&gt;I believe that I can grow in positive ways by dealing with difficult situations.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td><strong>Self-efficacy</strong>&lt;br&gt;I can shape whatever environment in which I find myself operating.</td>
<td>1</td>
<td>2</td>
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<td>5</td>
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<tr>
<td><strong>Building and Using Networks</strong>&lt;br&gt;I often attend social functions for purposes of building professional relationships.</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>5</td>
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</table>
APPENDIX C:

USF I-CORP FACULTY TEAM ASSESSMENT

Faculty Team Assessment

I-Corps Fall 2019 - University of South Florida

Instructor:

Team Number/ Name:

The information collected in this assessment is intended to capture your current perceptions of each I-Corps Teams abilities respective to the specific NSF I-Corps Program Outcomes

Rankings will be measured on a Likert Scale of 1 to 5.

LIKERT SCALE:

1.) Very Poor:
2.) Poor:
3.) Fair:
4.) Good:
5.) Excellent:
<table>
<thead>
<tr>
<th></th>
<th>Very Poor</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Customer Discovery Interviews</strong></td>
<td></td>
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<tr>
<td>How would you rate this team’s ability to effectively conduct customer discovery interviews</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td><strong>Go or No-Go Decision</strong></td>
<td></td>
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<tr>
<td>How would you rate this team’s ability to make a go/no-go decision based on an assessment of the viability of the overall business model</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td><strong>Compelling Narrative for Future Partners</strong></td>
<td></td>
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<tr>
<td>How would you rate this team’s ability to effectively communicate a compelling narrative for their technology?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td><strong>Product Market Fit</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>How would you rate the team’s decision-making ability for/ or against a product market fit for their technology</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td><strong>Pivoting</strong></td>
<td></td>
<td></td>
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<tr>
<td>How would you rate this team’s decision-making ability around pivoting</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td><strong>Instructor Recommendation</strong></td>
<td>YES</td>
<td></td>
<td></td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>Would you recommend this team to advance to the national NSF I-Corps Program?</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>


September 27, 2019

Mark Giddarie
Muma College of Business
3350 Vas Dyke Road
9241
Lutz, FL 33558

RE: Exempt Certification
IRB#: Pro000041352
Title: The Identification of Entrepreneurial Competencies in I-Corps Site Teams at The University of South Florida

Dear Mr. Giddarie:

On 9/25/2019, the Institutional Review Board (IRB) determined that your research meets criteria for exemption from the federal regulations as outlined by 45 CFR 46.101(a):

(2) Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met:

(i) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects; or

(ii) Any disclosure of the human subjects' responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation, or

(iii) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects can readily be ascertained, directly or through identifiers linked to the subjects, and an IRB conducts a limited IRB review to make the determination required by 45 CFR 46.111(a)(7).

As the principal investigator for this study, it is your responsibility to ensure that this research is conducted as outlined in your application and consistent with the ethical principles outlined in the Belmont Report and with USF HRPP policies and procedures.

Please note, as per USF HRPP Policy, once the exempt determination is made, the application is closed in AEC. This does not limit your ability to conduct the research. Any proposed or anticipated change to the study design that was previously declared exempt from IRB oversight...
must be submitted to the IRB as a new study prior to initiation of the change. However, administrative changes, including changes in research personnel, do not warrant an Amendment or new application.

We appreciate your dedication to the ethical conduct of human subjects research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,

[Signature]

Kristen Salomon, Ph.D., Chairperson
USF Institutional Review Board
APPENDIX E:
USF FALL 2019 I-CORPS SYLLABUS

USF I-CORPS Program: Course Syllabus

Fall 2019

Instructors:
Dr. Richard Berman
Email: rberman@usf.edu
Phone: 813-974-9694

Dr. Matthew Mullarkey
Email: mmullarkey@usf.edu
Phone: 813-974-5524

Dr. Kaushik Dutta
Email: duttak@usf.edu
Phone: 813-974-6338

Dr. Glenn Wichard
Email: gwichard@usf.edu

Teaching Assistant: Gilbert Rotich
Email: grotich@mail.usf.edu

Meeting Time: Monday 1:00 - 4:00 PM
September 16, 23, October 7, 14, 28, November 4
Meeting Location: Oak View Room, 1st Floor, Interdisciplinary Research Building, 3720 Spectrum Blvd.
Suggested References: Business Model Generation, Alexander Osterwalder and Yves Pigneur
The Start-Up Owner’s Manual, Steve Blank and Bob Dorf
About the NSF I-CORPS Program:

The NSF Innovation Corps (I-Corps) is the agency’s signature effort to assist teams of university scientists and post-doctoral or graduate students to go outside of their laboratories and into the marketplace where they can learn first-hand about entrepreneurship while they explore and validate the commercial landscape surrounding their innovation. The primary goal of NSF I-Corps is to provide University scientists and researchers the program, process, and resources to investigate and validate the commercialization of their science.

Requirements for Participation:
1. Each team must consist of a Principal Investigator (PI), Entrepreneurial Lead (EL), and Mentor. The I-CORPs course is open to pre-approved I-CORPs teams only.
2. Each team must be willing to commit to class time and be able to devote approximately 10 hours per week for Customer Discovery, plus 2 hours per week for team meetings.

Basic Course Structure:
- Teams must view the assigned videos before each class and review the relevant material in the texts. Most of the videos are on the “VentureWell” and “Udacity” websites. Links are provided at the end of this document. Access to the “Udacity” videos will require you to access the free online course titled “How to Build a Startup”: https://www.udacity.com/course/how-to-build-a-startup--ep245
- A minimum of 5 interviews are to be conducted every week, per team, that will help you complete your weekly assignment.
- Live weekly presentations by each team on their “lessons learned” from getting out of the building. PowerPoint presentation will be submitted to the below Google Drive I-Corps Teams folder by 8:00 AM each Monday.
- Each team must keep detailed notes for all interviews. This record of your customer discovery interviews will be submitted to the below Google Drive I-Corps Teams folder by 8:00 AM each Monday.

Link to the Syllabus

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**Course Topics and Schedule (subject to change)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
</table>

Page 2 of
### Course Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sept. 16</td>
<td>Team Introductions&lt;br&gt;Intro to Business Model Canvas&lt;br&gt;Customer Discovery – What is it?</td>
</tr>
<tr>
<td>2</td>
<td>Sept. 23</td>
<td>How to Get Valid and Valuable Customer Feedback via Interviews&lt;br&gt;Business Model Canvas:&lt;br&gt;- Customer Segments</td>
</tr>
<tr>
<td>3</td>
<td>Oct. 7</td>
<td>Business Model Canvas Continued:&lt;br&gt;- Value Proposition&lt;br&gt;Pains &amp; Gains / Product Market Fit</td>
</tr>
<tr>
<td>4</td>
<td>Oct. 14</td>
<td>Business Model Canvas Continued:&lt;br&gt;- Channels&lt;br&gt;- Customer Relationships&lt;br&gt;- Revenue Streams</td>
</tr>
<tr>
<td>5</td>
<td>Oct. 28</td>
<td>Business Model Canvas Continued:&lt;br&gt;- Key Activities&lt;br&gt;- Key Resources&lt;br&gt;- Key Partners&lt;br&gt;- Cost Structure</td>
</tr>
<tr>
<td>6</td>
<td>Nov. 4</td>
<td>Lessons Learned... Key Pivots,&lt;br&gt;Customer Discovery: The Aha Moments!&lt;br&gt;Final Presentations</td>
</tr>
</tbody>
</table>

### Upon completion of this course, participants will:

1. Understand Lean Start-up Concepts
2. Know how to test the market fit of a technology
3. Understand the basic elements of a start-up