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ISSN: 1042-6337

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USFSP
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**Fall, 2015**

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Dear JBE Readership:

Welcome to the fall 2015 issue of the *Journal of Business and Entrepreneurship*. We are looking forward to another exciting year at JBE. Increased exposure in national and international organizational sponsorship is rapidly expanding the name of the journal across the country and the world. This year we have been a major sponsor at the ICSB International Conference, the USASBE National Conference, the Southern Management Association Annual Conference, and of course our own ASBE Conference.

If you were unable to attend our ASBE conference you missed one of the best in years. Guest speakers such as Gerald Puccini, Heidi Neck, and Nathan Schwagler made this a conference to remember. Please look for upcoming announcements on the 2016 conference and mark your calendar for that event.

If you haven’t submitted a manuscript to JBE recently (or ever) make that a 2016 New Year Resolution. The journal will only grow its reach and reputation if we continue to receive quality submissions representing leading edge research in the field.

We at JBE wish all of you a happy and prosperous New Year!

We would also like to encourage every subscriber to contact their university library and ensure that they have a subscription for the journal.

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INFUSING BUSINESS AND ENTREPRENEURSHIP EDUCATION INTO A COMPUTER SCIENCE CURRICULUM – A CASE STUDY OF THE STEM VIRTUAL ENTERPRISE

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ABSTRACT

Innovation has become a focal point for those in Science, Technology, Engineering, and Math (STEM) areas. Federal funding programs by the National Science Foundation (NSF) to support technology commercialization efforts, combined with legislation such as the Jumpstart Our Business Startups (JOBS) Act have contributed to this new focus. As a result, STEM education is required to address this new economic dynamic by providing college students with the opportunity to develop business and entrepreneurial skills, which can complement and reinforce their knowledge of their chosen STEM disciplines. This paper surveys existing research on entrepreneurial education with a special emphasis on STEM, describes the Virtual Enterprise (VE) entrepreneurship simulation pedagogy and platform, and gives recommendations of how it can be infused into existing STEM courses. To illustrate the latter, the paper concludes with a case study that demonstrates the infused process of VE into an e-commerce course.

Keywords: entrepreneurship education; STEM; business simulation; experiential learning; virtual enterprise Infusing Business and Entrepreneurship Education into a Computer Science Curriculum – A Case Study of the STEM Virtual Enterprise

INTRODUCTION

There is a growing effort in the United States to support the innovation economy and future entrepreneurs. For instance, the National Science Foundation (NSF) strives to support the development of an innovation ecosystem
that links academic research output to commercialization efforts through its Innovation Corps (I-Corps) Program (NSF, 2014). Another example is the recently approved Title II of the Jumpstart Our Business Startups (JOBS) Act that allows entrepreneurs to use crowdfunding as a mechanism to raise investment funding publicly through a general solicitation. Through this process companies are now able to publicly advertise their offering in order to attract accredited investors to invest in a company (Barnett, 2013). This legislation is particularly important for technology start-ups, which, given the high volition of the path to market, can now raise equity quicker without necessarily depending on larger Venture Capital or Angel funding.

Identifying a need to accelerate innovation in emerging technologies, federal investment in Science, Technology, Engineering, and Math (STEM) education increased by 6% from FY2012 to FY2014 in the United States. This is a first step towards achieving the strategic goal of “increasing the number of undergraduates with a STEM degree by one million over the next decade” (Whitehouse.gov, 2013). Building on that promise, the next generation of STEM entrepreneurs requires the appropriate support that will allow them to move their innovative product ideas into successful, properly sourced and commercially viable businesses.

As result, STEM education has to broaden its focus to engage in a cross-disciplinary exchange among academic disciplines, and to situate its programs and curricula within a business and entrepreneurship context. According to the U.S. Bureau of Labor Statistics, computer or IT related industries are projected to have the fastest growing output in 2012–2022 (Dohm & Shniper, 2007). Rationally it follows, that STEM graduates who are able to apply their skills and knowledge within an increasingly fast changing economy will have a competitive advantage.

In order to illustrate how entrepreneurship education can help promote innovation and entrepreneurship among STEM programs, this paper (1) explores existing research and approaches to entrepreneurship education, (2) describes the National Science Foundation (NSF) Advanced Technological Education (ATE) funded Virtual Enterprise (VE) entrepreneurship simulation pedagogy and platform, and (3) presents a curriculum framework where VE was infused into an existing e-commerce course.
REVIEW OF LITERATURE

Entrepreneurship education in higher education

The Global Entrepreneurship Monitor (GEM) defines entrepreneurship education as a subset of a larger entrepreneurship ecosystem that influences entrepreneurs’ attitudes, activities and aspirations (Kelley, Singer, & Herrington, 2012). It encompasses – particularly within a higher education context – “the teaching of skills and cultivation of talents that students need to start businesses, identify opportunities, manage risk, and innovate in the course of their careers” (Torrance & Rauch, 2013, p. 1).

Entrepreneurship education is omnipresent and has gained widespread adoption across the globe. In the United States alone, presently over 2,000 colleges offer courses in entrepreneurship (Cone, 2012). According to a recent report by the Kauffmann Foundation on the developments of entrepreneurship education in higher education (Torrance & Rauch, 2013), entrepreneurship education is showing a widespread proliferation across university campuses that goes way beyond traditional entrepreneurship course offerings and programming. Even more so, universities become more entrepreneurial by emphasizing an exploration of new and innovative ways to create entrepreneurial support and learning environments for their students.

To date, there are many best practices in entrepreneurship education and associated methods and pedagogical approaches (Jones, Penaluna, & Pittaway, 2014; Winkler, 2014), however, there seems to be little consensus among the research community about the actual efficacy of these approaches (Griffiths, Kickul, Bacq, & Terjesen, 2012; L. Pittaway & J. Cope, 2007; von Graevenitz, Harhoff, & Weber, 2010). For instance, a meta-analysis by van der Sluis, van Praag, and Vijverberg (2008) showed that entrepreneurship education influences students’ actual selection into entrepreneurship. In addition, a survey of Babson alumni (n=3,775) who graduated between the years 1985 and 2009, showed that entrepreneurship education has a positive impact on start-up capital raised. In addition, the study highlighted the important link between entrepreneurship education and real world experience for entrepreneurial success (Lang, Marram, Jawahar, Yong, & Bygrave, 2011).

While some of these results are promising, research at the program-level provide a different picture. For example, a recent study by the World Bank (Valerio, Parton, & Robb, 2014) identified ten higher education programs across
the globe and conducted a subsequent meta-analysis. The results showed a positive program impact on entrepreneurial capabilities as well as entrepreneurial mindset, but did not provide clear evidence with regards to actual career paths towards entrepreneurship. The report, however, emphasized that entrepreneurship education programs tend to go beyond traditional technical and business skills development. Moreover, these programs are beginning to broaden and supplement these offerings through a series of competitions and mentoring approaches by “innovation driven entrepreneurs.” These examples are indicative of a trend towards support systems that encourage students’ self-selection directly into entrepreneurship. These and other examples demonstrate the important role that education is playing within entrepreneurship. Without a doubt, the importance of entrepreneurship education is well established, however, further research is needed to investigate which approaches to teaching and learning entrepreneurship yield the best outcomes.

The challenge lies in finding a consensus to determine: what entrepreneurship education is, why we teach it, and how it supposed to support entrepreneurial learning; especially given the richness and diversity of entrepreneurship education programs across the globe (Jones et al., 2014). For instance, existing evaluation methods are often weak in nature and make it difficult to draw broader conclusions and make generalizations about the impact of entrepreneurship education (Glaub & Frese, 2011; Rauch & Hulsink, 2014; Rideout & Gray, 2013). These findings are not surprising since entrepreneurship as a whole is still in search for a unifying theory, which potentially would allow educators to better streamline and inform their curriculum and program development and delivery. To bridge the gap between research and practice, Winkler (2014) suggests an action research framework in order to deal with this complexity (or dichotomy) and to emphasize the ongoing improvement of programs and student learning vis à vis traditional research.

Similarly, Neck and Greene (2011) address conceptual and definitional issues by approaching entrepreneurship education and research through the lens of entrepreneurship as a method. In detail, they emphasize a wide selection of applied approaches in the entrepreneurship curriculum. By approaching entrepreneurship education as a method, students will be given an opportunity to not only learn about entrepreneurship but also “practice” entrepreneurship through starting businesses, serious games and simulations, design-based learning or reflective practice. The ultimate goal is to make entrepreneurship education both student-centered and student-led, encompassing a variety of
variables that facilitate learning by moving from a “learn then do” to a “doing then learn” approach. Ultimately, entrepreneurship education should follow an “actionable theory” approach in order to give students a theoretically grounded mechanism to learn entrepreneurship through actions and practice (Neck, Greene, & Brush, 2014). Vanevenhoven (2013) even goes one step further when he suggests that “entrepreneurship education, in part, must be provided at an individual level and there cannot be a generalized optimal process that can be introduced into any given higher education institution” (p. 467).

It seems intuitive that best practices in entrepreneurship education have to be derived from theory and applied within a local context where students can do entrepreneurship in any academic discipline. Subsequently, students should be able to learn from their experiences inside and outside the entrepreneurial classrooms in order to gradually (and iteratively) acquire a broad set of entrepreneurial skills and competencies. To illustrate this point, let’s focus on an early adopter of entrepreneurship outside of the business discipline (Warhuus & Basaiawmoit, 2014): Science, Technology, Engineering and Math (STEM).

**Entrepreneurship education in STEM disciplines**

Entrepreneurship education has traditionally been the domain of business and engineering schools, however, universities have begun to embrace entrepreneurship more broadly in a multi- and interdisciplinary way (Katz, Roberts, Strom, & Freilich, 2013; Morris, Kuratko, & Pryor, 2013). Shinnar, Pruett, and Toney (2009) showed that there is substantial evidence that even non-business majors (such as students in STEM programs) show interest in entrepreneurship. Further, L. Pittaway and J. Cope (2007) highlight the importance of the role that entrepreneurship education can play with regard to students’ employability, thus also focusing also on the intrapreneurial competencies of college graduates.

Perceiving the need for a new technology business, and successfully launching it, requires an entrepreneurial mindset, attitudes and the corresponding skills. To date, very few studies in STEM entrepreneurship education emphasized the actual efficacy of its entrepreneurial content selected, and the corresponding pedagogical methods deployed (Warhuus & Basaiawmoit, 2014). On the contrary, STEM student samples have been used primarily to advance theory development in entrepreneurial intentions research. For instance, a study of MIT engineering students (n=512) revealed a strong relationship between
personality traits and students’ attitudes to start a business, which is strongly linked to entrepreneurial intentions (Lüthje & Franke, 2003). Other research (Souitaris, Zerbinati, & Al-Laham, 2007), however, has shown that STEM students’ attitude and intentions to start a business are influenced by entrepreneurship education (and not personality traits).

The use of intention as a primary determinant of success of entrepreneurship programs seems insufficient (Lautenschläger, 2011; L. Pittaway & J. Cope, 2007) since the path from intention towards entrepreneurship is not a direct one; especially among STEM graduates. A recent study by Benedict, McClough, and Hoag (2012) showed that STEM education may not necessarily lead directly to self-employment. Moreover, STEM graduates are more likely to work in larger firms. The exceptions are technology students with a bachelor’s degree and computer science students with a master’s degree. Likewise, a 2008 study by the Kauffman Foundation (Wadhwa, Freeman, & Rissing, 2008) highlighted that tech entrepreneurs do not typically start their ventures straight out of college. On the contrary, survey respondents (n=652) often wait years (twelve or more) before they actually founded their companies. One reason for this delay could be a perceived need by students to acquire more business knowledge and experiences before actually pursuing an entrepreneurial venture (Duval-Couetil & Long, 2014).

Regardless of whether graduates of STEM programs start a business or not, it can be argued that entrepreneurially-oriented STEM graduates are better equipped to navigate an increasingly complex and uncertain economic landscape (Atkinson & Mayo, 2010). Moreover, university-based STEM programs require a focus on entrepreneurship in order to prepare graduates for their respective careers; regardless of whether they start a business or work in industry (Atkinson & Mayo, 2010; West, 2012). This notion was also highlighted in the 2010 National Science Foundation (NSF) Advanced Technological Education (ATE) “Birds of a Feather” report on the entrepreneurial workforce from the 2010 Principal Investigators Meeting (Patton, 2011).

To date, there is very limited research with regards to the actual value of entrepreneurship education within STEM programs (Hixson, Paretti, & Lesko, 2012; Warhuus & Basaiawmoit, 2014). Thus, more evaluation research is necessary to better understand the impact of entrepreneurship education programs with regards to “student attitudes, behaviors, career goals, and professional competence” (Duval-Couetil, 2013, p. 394). Nonetheless, entrepreneurship has been identified as a key mechanism within STEM programs
to help accelerate entrepreneurial activity and increase economic competitiveness within the U.S. (Atkinson & Mayo, 2010).

There are many best practices and cases that have been proven to be successful in fostering an entrepreneurial mindset and skills, increase students’ entrepreneurial intentions, and – ultimately – establish a causal link towards actual business creation. For instance, Warhuus and Basaiawmoit (2014) compared five STEM entrepreneurship education programs in the Nordic region and found program effectiveness and success are not contingent on a single pedagogical approach. Important determinants of success were the interdependence of program design (e.g., blurred lines between curricular for-credit demands and actual start-up activities), founders, and social support structures (e.g., mentors and academic entrepreneurs).

Building successful and sustainable STEM entrepreneurship programs also requires institutional support and buy-in, which are often met with budgetary and bureaucratic hurdles (Warhuus & Basaiawmoit, 2014). Thus, educators often have to resort to quicker (and simpler) ways to enrich their STEM classrooms and curricula with entrepreneurial content and experiences. Simulations, in particular, have been identified to fill that void (Luke Pittaway & Jason Cope, 2007) in order to give students the ability to experience and practice entrepreneurship in a fun and safe environment (Neck & Greene, 2011). To demonstrate how entrepreneurship simulations can be applied within a STEM context, the following section will give an overview of the Virtual Enterprise (VE) entrepreneurship simulation program at the City University of New York (CUNY), and how it has been infused into a Computer Science curriculum.

The Virtual Enterprise (VE) program at CUNY

Since 2002 the team at the CUNY Institute for Virtual Enterprise (IVE) has built a comprehensive entrepreneurship education program that utilizes Virtual Enterprise (VE) in order to educate aspiring entrepreneurs in a variety of academic disciplines, ranging from high school to graduate students.

In its essence, VE is an in-classroom entrepreneurship simulation pedagogy that gives students the ability to identify, develop and launch a business in a virtual global market place called The MarketMaker (IVE, 2015b). VE is deeply rooted in principles of experiential learning (Kolb, 2014) and aims to give entrepreneurship students the ability to practice entrepreneurship in a safe simulation environment. It connects personal entrepreneurial behavior and
collaborative learning with a larger entrepreneurship ecosystem of student entrepreneurs from across the globe. It is important to note that unlike traditional browser-based business simulation programs such as *The Sims: Open for business* (Neck & Greene, 2011), here the term “simulation” refers to entrepreneurial tasks that are contextualized within the entrepreneurial classroom and supporting technology. Learning is therefore an inherently social process and communication in a VE simulation happens both online and face-to-face. A VE simulation is comprised of three interconnected components: (1) experiential learning pedagogy, (2) virtual economy, and (3) social network (Winkler, 2015):

(1) *Experiential learning pedagogy*: In a VE students act as members of an entrepreneurial team of approximately three to six students. Students seek to identify real entrepreneurial opportunities and exploit them in a simulated environment. During this process, students identify a business idea, and subsequently develop it into a business model that will serve as the foundation for the actual business launch in IVE’s simulated market place, the *IVE MarketMaker* (see Virtual Economy below). During this process VE students assume leadership roles and tasks, and corresponding responsibilities are developed within the self-determined team construct. Thus, students are required to make both strategic and operational decisions alike. The instructor’s role is to structure the learning environment (e.g., room setup that mirrors an actual work environment), tasks (e.g., development of a business model using the business model canvas (Osterwalder & Pigneur, 2010)), and context (e.g., tech sector). Further, the instructor shadows the various VE business teams as the students develop their simulated businesses. He or she intervenes only when students need additional scaffolding during discussions by asking questions or providing different viewpoints (Borgese, 2008). In comparison to traditional internships, these entrepreneurial experiences afford students to solve higher-level problems while taking ownership of their learning processes. In addition, the learning opportunities are rich and diverse in nature and account for skills improvement in career competencies, as well as soft- and entrepreneurship skills (Morgulas, 2007).
(2) Virtual Economy (The MarketMaker): Once students completed the development of a business model they are ready to launch their simulated business on IVE’s virtual economy (IVE, 2015b), a global market place for VE businesses. It is comprised of a bank, an e-commerce network, a credit card system and a stock market. As part of their VE experience, students are able to apply for funding, upload elevator pitch videos, build a company website and e-commerce interface, manage their overall operations and finances, and even take their companies public. Products and services offered on The MarketMaker are not real and sales transactions are simulated using a virtual credit card system. The virtual economy was developed by CUNY IVE and is the technological backbone that brings together VE students from across the globe through a social network.

(3) Social Network: VE students do not operate within the confines of their classroom. By launching their simulated business within the virtual economy, students are able to interact with other VE students around the globe online or through CUNY IVE’s semi-annual Online Trading Daysiii (IVE, 2015a). Trading Days in particular provide students with an interactive venue where they can present their simulated businesses through web-based conferencing technology. These semi-annual Trading Days are comprised of a series of one-hour sessions that engage students from 35 to 50 VEs, covering multiple time zones and continents. Following each session, participating students take on the role as consumers and purchase from one another by using their virtual credit cards. In addition, students are able to track their company sales (monetarily and geographically) through their corporate MarketMaker account. To date over 100 institutions have participated in a VE simulationiv. However, the social network is not only for participating VE students. The MarketMaker also allows for student to share their work (e.g., pitches, websites, and products) with their real social network in order to seek validation of their work through Facebook likes and comments. As a result, VE combines the benefits of a safe simulation environment with the benefits of real world validation.
By combining these three elements, VE students are constantly engaged in entrepreneurial learning, starting with the identification of an entrepreneurial opportunity to the actual exploitation (and validation) of that opportunity in IVE’s simulated virtual economy. Similar to what Neck and Greene’s (2011) coined as the “doing then learn” method, VE students are constantly engaged in the entrepreneurial process by making the connections between their learning experiences inside the simulation and its application outside. Students do not operate in isolation. They contribute toward their own learning in a collaborative and experiential learning environment (Schulman & Deutsch, 2004).

Curricular adaptations of VE

It is important to note that VE is not a curriculum, but rather an entrepreneurship pedagogy or method that can be (1) developed into a free-standing course or (2) infused within an existing course of any content discipline.

In a free-standing course, VE students develop and run a simulated business over the course of the semester, moving their business from its ideation to implementation (as outlined above).

The infused version of VE offers a more flexible approach to curriculum adoption. Emphasis is given to maintaining the overall integrity of their course content and objectives, while contextualizing the course within a VE framework. VE has proven to be easily customizable across a wide range of academic disciplines. For instance, in a biotech lab course that teaches students how to sequence DNA, the instructor could use VE to contextualize students’ actual lab assignments (or projects) within an entrepreneurship simulation framework. As a result, students do not only emphasize the biotech content and technical aspects of the course (e.g., learn how to extract, amplify and sequence DNA), but also engage in a substantive analysis about potential market opportunities for a product (e.g., development of a DNA swab kit), build a website that showcases their product (e.g., the actual kit), and even sell them to other VE students as part of a simulated trading day experience.

The potential applications of VE are virtually limitless, independent of academic discipline and educational level. Over the past thirteen years, CUNY IVE has built a track record to become “one of the most distinctive teaching models in the United States” (Borgese, 2014, p. 395). It has successfully trained and supported faculty in VE pedagogy through online resources and peer mentorship. To date, CUNY IVE has engaged over 350 faculty members from
over 100 universities, colleges and high schools across the globe, resulting in the development of over 2,800 student-run simulated businesses.

The STEM Virtual Enterprise

Through a grant from the National Science Foundation (NSF), CUNY IVE has been able to extend the VE program to the fields of biotechnology and information technology (IT). The project resulted in the development of two course formats that target the development of soft- and entrepreneurship skills in technician education programs (Winkler & Troudt, 2008):

*veIT*-Careers, a course for entry-level IT students, aims to increase students’ motivation to pursue careers in IT. At the center of this approach is an exploration of the range of jobs in the field and associated skills and career pathways. The VE simulation would engage students in an existing IT department in a firm, which could be predetermined by the instructor or developed by the students. Students would then research the associated positions, apply for them and operate the respective department by solving a technical business problem.

*veIT*-Capstone is a course for the IT student near graduation, where IT skills are put into practice within an entrepreneurial learning framework. Here, students would build a simulated enterprise, based on a product/service that has an IT focus. Students would address all aspects of a business start-up ranging from opportunity identification, to business modeling, to securing virtual funding, to eventually launching and operating their business in IVE’s virtual economy. Similar to a traditional VE, students are responsible for the development of the overall structure of their IT-related business, while the instructor serves as a consultant by providing content and technical support to the respective simulated IT businesses.

The main objective of this work is to create a nationally replicable and scalable model for technician education that promotes innovation and entrepreneurship among the technical workforce. Like other applications of VE, veIT can be adapted across multiple educational levels, ranging from two-year associates, to four-year baccalaureate, to master’s degree STEM programs. To illustrate this work, the next section will provide a sample case of how VE has been infused into a computer science course.

Virtual enterprise implementation in an e-commerce course
Virtual Enterprise (VE) was incorporated into an Electronic Commerce (e-commerce) course, part of an undergraduate computer science curriculum at St. John’s University. The course consisted of mostly junior and senior level computer science majors. The objective of infusing VE was to expose STEM students to entrepreneurial and business skills in a meaningful way through the process of business planning and simulation. VE is naturally suited for an e-commerce course, since it allows for the creation of a virtual e-business.

The VE component was infused into the course, as students worked on the development of an e-commerce business in a series of phases that correspond to the e-commerce content areas. A set of topics from this course is listed in Table 1, along with the timing of the VE group project phases. Throughout the semester, the students completed individual assignments related to the course topics (various web technologies), in addition to taking part in a VE group project. The phases of the VE project are introduced when the students have learned the material needed for that phase. Compared to the way this course was taught without VE, the revised group project spans most of the semester, giving students more time to design and implement a more comprehensive, higher quality final project.

At the beginning of the semester, students formed groups with, on average, four members to serve as teams for their Virtual Enterprise firms. In the first phase of the project, students were tasked with evaluating existing e-commerce businesses for a type of industry, product, service, or organization of their choice. Industries were varied, including online booksellers, auction websites, travel agencies, digital content and streaming media providers, and mobile phone services. Students also had the option of creating a non-profit organization; in this case, purchases would represent donations. In the evaluation phase, the groups also had to design the evaluation criteria they would apply to these e-commerce sites, which could include categories such as website content and design, product or service offerings, competitiveness, navigation and search features, marketing and business strategies. The groups were also asked to highlight the unique features of each e-business and analyze the competitive advantages and weaknesses of each. This phase resulted in a final ranking and comparison of e-commerce sites, which the groups presented and discussed with the class.

The second phase of the project was the design of a new concept for an e-commerce venture and development of a prototype for their e-commerce website. Each group developed a pitch to introduce and promote the concept for their e-
business and, given their background research, needed to determine how novel their ideas were and subsequently identify a competitive advantage over existing businesses. Each student firm also needed to request and justify the need for start-up funds, then sought approval of the instructor. After completing the business concept pitches, students began the third phase of the project. In this phase, students developed a prototype of the e-commerce business in the Virtual Enterprise environment.

Within the VE platform, each group setup a corporate account and associated employee accounts. The corporate accounts are used to manage finances, human resource tasks, inventory, and the company website. The VE employee accounts were for individual employees, and were used for receiving salaries from the e-business and making purchases from classmates’ groups in the virtual economy using the IVE credit card system. As a group, students had to assign company roles to each group member, develop a company website and inventory, as well as manage employee salaries and the company stock portfolio.

There was a need for a student to emerge as the leader of each group to facilitate the group’s interactions. However, major decisions were to be agreed upon as a group with input from all members; each “employee” needed to be comfortable with his or her designated roles. For example, a group member who is skilled in graphic design may work on the company logo and images for the inventory database, someone who has a background in finance will manage the virtual stock portfolio investments in the IVE MarketMaker, and another teammate with strength in web design may be responsible for developing the company website. At this stage, the elements of group collaboration were essential. The most successful groups were those that established good coordination and communication early. Student groups that were comprised of members with a variety of disciplinary strengths benefited from multiple perspectives and better coverage of required tasks.

The last phase of the group project is the development of an e-commerce business plan. The e-commerce business plan phase included revenue model selection, marketing and Customer Relationship Management (CRM) strategies, and a survey of enabling technologies. Groups were also asked to define how their e-business would utilize social networking capabilities to enhance CRM in terms of customer identification and target marketing, how GIS information from the customer tracking feature can be used, and how customer web experiences could be personalized. The business plan included a timeline for future development of the enterprise and specifications for technologies that will be
required for its implementation. At the end of the semester, the students presented their Virtual Enterprises to the class, along with their business plan. Students then "voted" for their classmates' e-businesses by making purchases from their websites in the virtual IVE economy.

Overall, utilizing VE in an e-commerce course, the course was able to introduce higher levels of interactivity to the students, since they had to work closely together to brainstorm concepts and create their business prototype. It also gave the students an immediate venue to apply concepts covered in the course. Given that this is a computer science course, students were also assigned an individual project for which they had to implement one aspect of their e-business. Choices included creating a web system, database, enhanced web interface, web search engine, or mobile application. While the above case study describes using VE in an e-commerce course, there are several additional courses that could be enhanced utilizing VE. These courses include software applications (comprising topics such as spreadsheets and databases) to give context and content to projects and assignments using the applications taught.

CONCLUSION

It is vital that students are equipped with the necessary foundation and exposed to a variety of skills before venturing into the workforce or developing their own innovative ideas into a business. Innovative approaches of experiential entrepreneurship have the potential to better prepare STEM students for an increasingly demanding and rapidly changing economy. The case study above illustrated that infusing entrepreneurship education does not compromise the integrity of the actual STEM content taught. On the contrary, students did not only develop IT projects but also experienced the creation of a virtual e-business, gained awareness of the various facets of a business and associated collaboration skills needed to work well with a (start-up) team. Simulated experiences such as a STEM VE can support students in their development toward becoming an entrepreneur, as well as innovative and effective members of any organization. Leadership, communication, and business skills, along with knowledge from multiple STEM disciplines are desirable and valuable assets in a variety of career paths.

Future work will involve adapting the VE experiential learning pedagogy to additional STEM areas. We invite all STEM educators to embrace a
contextualized approach to entrepreneurship education in their disciplines in order to help build, accelerate and support the larger entrepreneurship ecosystem.

REFERENCES


Note 1: This work was supported by a grant from the National Science Foundation (NSF/ATE DUE-0802365; Winkler, C., Troud, E.; CUNY). The views expressed are those of the authors and investigators, and do not necessarily reflect the position of NSF.

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics (existing course)</th>
<th>VE Phases (infusion)</th>
</tr>
</thead>
</table>
| 1    | Introduction to e-commerce  
*Product / Service Case Study |                      |
| 2-3  | Web Technologies (Part 1)  
*HTML, creating and hosting a website | **Phase 1**: Website evaluation and comparison |
| 4    | Revenue Models             | e-commerce Concept Pitch Presentations |
| 5    | Internet Marketing         |                      |
| 6    | Social Networking, Mobile Commerce, and Online Auctions | **Phase 2**: Design of e-commerce business / organization concept |
| 7-8  | Web Technologies (Part 2)  
*JavaScript, PHP, MySQL database |                      |
| 9    | Social Media Analytics     | **Phase 3**: Develop prototype of Virtual Enterprise |
| 10   | Customer Relationship Management |                      |
| 11   | B2B in e-commerce          |                      |
| 12   | Business Planning for e-commerce | **Phase 4**: Finalize e-commerce Business Plan |
| 13   | Web Services               |                      |
| 14   | Presentation of Virtual Enterprise group projects (website and e-commerce Business Plan) | |
This work was supported by a grant from the National Science Foundation (NSF/ATE DUE-0802365; Winkler, C., Troudt, E.; CUNY). The views expressed are those of the authors and investigators, and do not necessarily reflect the position of NSF.

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COMPREHENSIVENESS IN START-UPS: THE ROLE OF THE ENVIRONMENT IN START-UP DECISION MAKING

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ABSTRACT

Little understanding exists on the decision-making processes used by entrepreneurs and how these processes interpret environmental dimensions. This study looks at the effects of perceived environmental conditions on the level of comprehensiveness in decision-making in business start-ups. The proposed hypotheses are tested with a data set including 147 entrepreneurs from a wide range of start-up organizations. The findings suggest that complexity, instability, and munificence are key components of perceptions of environmental conditions that need consideration when studying strategic decision-making in start-ups. These findings question the argument that business founders use heuristics and biases when faced with environmental instability, complexity and scarcity suggesting that comprehensiveness is a relevant construct in entrepreneurial decision making.

INTRODUCTION

Most people interested in entrepreneurship wonder why some start-ups survive and some fail. It is not surprising that start-up survival remains an issue of interest for academics and practitioners alike since in the last 10 years business survival rates have not changed. According to the Bureau of Labor Statistics (2015), around 50 percent of businesses fail by their 5th year of existence and only around 38 percent survive after 10 years. While there is much to learn about start-up survival, more is needed in studying the context in how entrepreneurs make decisions that affect survival or failure.

Research suggests that the decisions made by business founders in the early days of a business define the success of a venture both in the short- and long-term (Venkatatraman & Saravathy, 2001; von Gelderen, Frese, & Thurik, 2000). The strategy-making literature indicates that one of the most important factors influencing business success start-ups is the degree of which
comprehensiveness, understood as how exhaustive and inclusive the decision making process is, affects how a business is created (Baird, Lyles, & Orris, 1994; Davidsson, 2013; Gruber, 2007; Talaulicar, Grunde, & Werdern, 2005). However, organizational survival does not depend on the level of comprehensiveness alone but on its interaction with the environmental conditions in which the new venture is embedded and, more importantly, on the way the founder perceives such environment. Empirical findings suggest that comprehensiveness is contingent on environmental conditions such as the level of instability, complexity, and availability of resources within each industry (Dean & Sharfman, 1996; Fredrickson & Iaquinto, 1989; Hough & White, 2003).

The lion’s share of the debate among scholars on strategic decision making processes and environmental conditions has mainly focused on assessing the impact of comprehensiveness on performance in large businesses. Entrepreneurship scholarship, on the other hand, has centred the debate on the degree of formal and informal planning in start-ups and its implications on performance (e.g., Baird et al., 1994; Bourgeois & Eisenhardt, 1988; Chwolka & Raith, 2012; Delmar & Shane, 2003; O’Regan, Ghobadian, & Sims 2006; Perry, 2001). Some studies suggest that entrepreneurs will engage in strategic planning to deal with uncertain and fast-paced environments (Bourgeois & Eisenhardt, 1988; Liao & Gartner, 2006; Matthews & Scott, 1995) while others suggest that the level of uncertainty in fast-changing environments, of which start-ups are characterized to operate in, makes it virtually impossible for founders to engage in comprehensive approaches to decision making (Mintzberg, 1994; Sarasvathy, 2001; 2008). Despite this lively debate, little understanding exists of the decision-making processes used by entrepreneurs, particularly on the level of comprehensiveness in the decision making processes and how these processes interact with environmental forces in the initial stages of an enterprise (Gruber, 2007).

Thus, this paper examines the underlying processes by which business founders perceive their environments, especially in start-up conditions and how this perception influences the level of comprehensiveness in strategic decision making processes. The authors contend that this relationship is uniquely distinct from large organizations since large organizations have access to resources to gather and analyze information, as well as past historic data that can facilitate comprehensive decision making process, while start-up have often limited resources and time to gather and analyze information and do not have historic data to inform their decisions. Additionally, decision makers in large firms also
have experiences responding to the environmental conditions in which their business operate and often the resources to respond to changes or adverse environmental conditions. Start-up founders typically have not had the time to build resources to respond to environmental changes and may not have knowledge and experience on the environmental forces operating in the industry. Therefore, even though the relationships studied in this paper might have been studied and established in ample research in large organizations these relationships may prove to be fundamentally different in business startups.

To test the hypotheses, the authors used a robust data set that includes 147 respondents. The data included a wide range of new businesses spanning organizations in the emergence and early growth stages. Thus, the sample collected enabled the recording of the different start-up contexts, allowing the codification of environmental conditions in the relationships. This is significant since few opportunities exist for study that provide this fine-grained level of detail regarding the underlying framework of business strategy, as reflected in the comprehensiveness of founders decisions relative to the environmental conditions these same founders face. A more flexible approach that encompasses the different environmental conditions that occur simultaneously will better explain how founders become more comprehensive when making strategic decisions and albeit more strategic. This will allow for a robust assessment of how start-ups are created in different environmental contexts where much prior research has been inconclusive (Bourgeois & Eisenhardt, 1988; Fredrickson & Iaquinto, 1989). Furthermore, the investigation of the decision-making process in the early stages of a business provides evidence that instability increases comprehensiveness of founders. In fact, more environmental instability was associated with more comprehensiveness contrary to other popular frameworks (Busenitz & Barney, 1997; Simon, Houghton, & Aquino, 1999). This study extends prior research on the effects of comprehensiveness on start-ups by (1) illuminating the effects of resource munificence in the environment on comprehensive decision-making in start-ups, and (2) distinguishing between instability and complexity that business founders confront in being comprehensive.

LITERATURE REVIEW AND HYPOTHESES

Decision Making and Comprehensiveness
Strategy, as defined in the literature, includes concepts related to goals and resource allocation and is understood as an integrated plan that reflects the alignment between external environment and internal resources (Chandler, 1962; Frederickson & Mitchell, 1984; Jemison, 1981; Miles & Snow, 1978; Mintzberg, 1978; Snow & Hambrick, 1970). In the strategic decision making literature, ample attention has been given to the role of comprehensiveness in the strategy and decision making process (Dean & Sharfman, 1996; Hitt & Tyler, 1991; Miller, 2008; Meissner & Wulf, 2014). Comprehensiveness refers to the extensiveness in which information from the environment is gathered and processed (Forbes, 2007; Frederickson & Mitchell, 1984; Hart, 1992; Perry, 2001) and is defined as “the extent to which organizations attempt to be exhaustive or inclusive in the making or integrating of decisions" (Frederickson & Mitchell, 1984, p. 399). Research related to comprehensiveness typically focuses on large, established organizations in which it is expected that businesses have the resources to carry out exhaustive and inclusive decisions (Dess, Lumpkin, & Covin 1997; Kisfalvi 2002; Mintzberg, Ahlstrand, & Lampel 1998; Porter 1996; Steiner 1979). The results of these studies show that the impact of comprehensiveness on business performance is largely dependent on the environmental conditions in which the business operates (Hart & Banbury, 1994). While it is generally agreed in the literature that comprehensiveness increases performance because it gives decision makers a thorough insight into the environmental and leads to more realistic evaluations of strategic choices, empirical findings have offered varied and inconclusive results (Forbes, 2007; Miller, 2008; Meissner & Wulf, 2014).

Little research has been done, however, to understand the role that comprehensiveness may have on newly created organizations where resources and information may be restricted. This is due in part to existing research agreeing that the level of uncertainty in start-ups, the speed of the business creation process, and the lack of analysable data and experience, are such that entrepreneurs frequently use biases and heuristics to make decisions (Busenitz & Barney 1997; Freeman & McVae, 2001; Parnell, Long & Lester, 2015; Simon et al., 1999). Comprehensiveness, however, has been found to encourage more holistic analysis of relevant factors in the strategy process and in turn result in more realistic perceptions of important factors in the environment (Dean & Sharfman, 1996). Comprehensiveness has also been suggested to reduce the adverse effect of cognitive bias (Tor & Bazerman, 2003) which results from fast
or deficient searches for relevant information (Miller, 2008). Based on this findings, the authors contend that relying on cognitive abilities is more effective and beneficial than simply employing intuition regardless of the size or life stage of the business (e.g. Browne, Shawn, & Benson, 1997; Dean & Sharfman, 1996; Talaulicar et al., 2005; Miller, 2008). Comprehensiveness, to the extent it serves the purpose of businesses in early stages, will help start-ups survive and move on to following stages. The stage of emergence, for instance, begins when the organization is formally created. The organization still suffers at this stage from the liabilities of smallness and newness and founders act under greater uncertainty with regards to resources, routines, products, and the environment (Churchill & Lewis, 1983; Kazanjian & Drazin, 1989; Hite & Hesterly, 2001; Scott & Bruce, 1987). At the succeeding stage of early growth, legitimacy or reputation may be established but organizations still face great uncertainty and need more resources because the needs of the start-up are greater than before. These two stages challenge founders to locate and access the resources necessary to navigate and operate with uncertainty about the environment (Romanelli, 1989). It is at these early stages, in which limited resources, such as access to information, that comprehensiveness in the decision making process may have an important effect in reducing biases and allowing founder to make more holistic considerations of environmental factors. For this reason, this study focuses on the level of comprehensiveness in the decision making process in start-ups in the emerging and early growth stages of the business cycle.

Of course there are differences in start-up decision strategies that are due to variations in individual characteristics and preferences. Some are inherently conservative and oriented toward safe and proven solutions to problem situations. Others are more venturesome and perhaps creative by nature. These differences can be due to variations in individual value systems, experience, education, personality, and other personal attributes. In turn, these patterns are recognized but not explicitly examined in the present study.

**Environmental Conditions**

Even though environmental conditions have been widely studied in the literature for decades, its conceptualization and operationalization varies in the literature (Sharfman & Dean, 1991; Beckett 2015; Lueg & Borisov, 2014). Environmental conditions are conceptualized either as an objective reality or a
perceptual phenomenon. Scholars generally agree that the perceptions of environmental conditions by decision makers are a more accurate predictor of their behaviors, particularly with regards to environmental scanning and decision making with a focus on comprehensiveness (Atuahene-Gima & Li, 2004; Boyd & Fulk, 1996; Daft, Sormunen, & Parks, 1988; May, Stewart, & Sweo, 2000; Meissner & Wulf, 2014, Beckett, 2015; Pondeville, Swaen, & De Rongé, 2013). For example, Boyd and Fulk (1996) suggest that objective measures are more appropriate when external phenomena are studied such as level of competition, government influence, and scale and mode of entry (Delios & Henisz, 2003; Folta & O'Brien, 2004; Henisz & Delios, 2001). Jauch and Kraft (1986) suggest that objective measures have little impact on decision making processes or strategic choices, and that perceptual measures have more impact on these processes. Perceptions of the environment are dependant on how decision makers cognitively process environmental stimuli (Downey, Hellriegel, & Slocum 1975; Miessner & Wulf, 2014). Since the main focus of this study is the strategic decision-making process of founders, environmental conditions are considered a perceptual phenomenon. Respondents, in this study, were asked how they had actually conducted their analysis of the environment when they formed their current companies. This form of retrospective self-reporting can be highly accurate and valuable as it relies on experience not inference in discussing environmental conditions (Morrell & Arnold, 2007).

Besides debating whether environmental conditions are an objective or perceptual phenomenon, scholars have also disaggregated the environment into several categories or dimensions such as instability, dynamism, munificence, diversity, competition, and hostility among others. However, the various terms used to categorize the environment have been found to fall into three major categories: instability, complexity and munificence (Child, 1972; Dess & Beard, 1984; Rajagopalan et al., 1993; Sharfam & Dean, 1991, Beckett, 2015; López-Gamero, Molina-Azorín & Claver-Cortés, 2011). Each environmental dimension offers different challenges and requires different resources to respond to such challenges.

**Environmental Instability**

Environmental instability has been defined using several terms such as dynamism (e.g. Dess and Beard 1984), stability (e.g. Fredrickson, 1984; Fredrickson, 1985; Fredrickson & Iaquinto, 1989; Mintzberg, 1978), velocity (e.g. Bourgeois & Eisenhardt, 1988, Eisenhardt, 1989), and turbulence (e.g.
Aldrich, 1979). Environmental instability considers (a) the level and speed of changes in the environment as a result of changes in market conditions, (b) the emergence of new markets, (c) the emergence of new products, (d) technological developments, (e) and changes in consumer preferences. Findings related to the use of comprehensive decision making on instable environments and its impact on performance is inconclusive. Scholars have established that different levels of environmental instability affect a decision maker’s capacity to determine which strategic choices will lead to desired outcomes (Forbes, 2007). Research has also suggested that unstable environments require fast decision-making which runs against comprehensiveness in decision-making. Several studies also suggest that faced with uncertainty and information scarcity, decision makers tend to focus on business aspects that they can control rather than planning that may require the use of predictions and assumptions (Forbes, 2007; Sarasvathy, 2001; Wiltbank, Dew, Read, & Sarasvathy, 2006; Parnell et al., 2015). Opposing findings suggest that unstable environments force decision makers to use rational decision-making processes by accelerating the collection and analysis of information (Bourgeois & Eisenhardt, 1988; Eisenhardt, 1989; Talaudicar et al., 2005; Miller, 2008).

Information processing theorists hold that the need to reduce uncertainty created by unstable environments is a critical task for organizations. This uncertainty may be reduced through processing and analyzing further environmental information (Galbraith, 1991; Forbes 2007). However, for decision makers to be able analyze additional environmental information, such information must first be available to them. In conditions where little information is available, the level of strategic understanding may be so low that it renders comprehensiveness ineffective as a way of improving decision making (Galbraith, 1991; Forbes 2007). A firm’s ability to adapt and respond to changes in the environment as part of their strategic decision making process depends on gathering information and interpreting it accurately (Analoui & Karami, 2002; Beal, 2000). However, start-ups are characterized by having limited access to information and resources that would allow them to foresee and respond to changes in an unstable environment (Churchill & Lewis, 1983; Kazanjian & Drazin, 1989; Hite & Hesterly, 2001; Romanelli, 1989; Scott & Bruce, 1987). The perception of unstable environments and lack of knowledge and information about environmental changes will increase the founder’s perception that they do not have the time to engage in comprehensive decision making processes (Busenitz 1999; Busenitz, West, Shepherd, Nelson, Chandler, & Zacharakis,
2003; Bhide, 1994; Eckhard & Shane, 2003; Von Gelderen, Frese, & Thurik, 2000). In fact, extant research agrees that the level of uncertainty in new business ventures and the speed of the business creation process are such that entrepreneurs frequently avoid formal strategic formulations and use biases and heuristics to make decisions rather than comprehensive decision making processes (Busenitz, 1999; Busenitz & Barney, 1997; Parnell et al., 2015; Parnell, Long, Lester & Koseoglu, 2012). Therefore, in an environment characterized and perceived by high levels of instability, it is expected that the founder will not engage in comprehensive decision-making processes since founders will perceive that they lack information about the changes in the environments, the resources to respond quickly to changes in the environment, and the time to engage in comprehensive processes. This suggests that:

\[ H1 \text{ Environmental instability will be negatively related to comprehensiveness in start-ups.} \]

**Environmental Complexity**

Environmental complexity refers to the diversity of knowledge requirements and capabilities that a founder has to deal with and the sophistication of this knowledge and information necessary to act in a specific environment (Mintzberg, 1978; Sharfman & Dean, 1991). Research suggests that complex environments influence how organizations are structured since organizations divide work to allow for specialized knowledge (Keatz & Hitt, 1988). Complex environments can be identified by the number and diversity of inputs (suppliers) and outputs (products) within an industry. Environments are characterized as complex because organizations will find it more challenging to locate resources and place or dispose of products in the market (Dess & Beard, 1984; Keatz & Hitt, 1988). Complex environments require the monitoring of diverse information, call for intensive coordination efforts, and can make strategic decisions difficult (Child, 1972).

Literature in cognitive processes suggests that when dealing with high and diverse amounts of information, decision makers will use cognitive simplification processes like heuristics and biases (Schwenk, 1988). It is not surprising then that entrepreneurship research has found that business founders, who lack the resources and information at the early stages of a business, rely heavily on biases and heuristics to deal with complex environments (Busenitz & Barney, 1997). Such cognitive simplifications may restrict the number of
alternatives and the information used to evaluate alternatives (Rajagopalan et al., 1993). Thus, in an environment characterized and perceived by high levels of complexity, it is expected that the founder will not engage in comprehensive decision-making. The perception of a complex environment and the lack of access to information and resources will most likely limit the ability to use comprehensive decision-making processes. These cognitive mechanisms suggest that:

\[ H2 \quad \text{Environmental complexity will be negatively related to comprehensiveness in start-ups.} \]

**Environmental Munificence**

Munificence is generally understood as the extent to which the environment can provide resources needed to perform in such environment (Castrogiovanni, 1991; Dess et al., 1997). Empirical studies suggest that munificence is positively related to the range of strategies used and the level of comprehensiveness an organization manages (Lieberson & O'Connor, 1972; Tushman & Anderson, 1986). In a munificent environment, where resources are plentiful, organizations may be more able to determine and pursue goals rather than focus on reactive actions led by survival concerns only (Castrogiovanni, 1991; Şener, 2012). Research suggests that munificent environments allow organizations to bank resources that may provide organizations with a cushion when there is scarcity in the market (Keatz & Hitt, 1988). If the environment has abundant resources, it is more likely that organizations in that industry will be able to grow since growth is easier to achieve in resource-rich environments (Dess & Beard, 1984; Tushman & Anderson, 1986). In a low-munificence environment, the environment becomes more competitive (Dess & Beard, 1984; Hambrick, 1983; Hofer, 1975; Porter, 1980; Şener, 2012; Bradley, Wiklund, & Shepherd, 2011). Firms operating in low-munificent environments find it more difficult to locate quality resources such as labor and raw materials (Castrogiovanni, 1991; Desa & Basu, 2013).

The perception of high levels of competition and low levels of resources available in the industry matched with the limited availability of internal resources characteristic of start-ups, decreases the perception that founders have the ability to access resources needed to perform in a low munificent environment. This condition is particularly challenging for start-ups since the
availability of resources will influence the entry, survival, and growth in such environments (Randolph & Dess 1984; Baumol, 2010; Shane, 2003; Shane & Venkataraman, 2000; Brush, Manolova, & Edelman, 2008; Villanueva, Van de Ven, & Sapienza, 2012). In such circumstances, the founder may adopt a satisficing approach and seek to combine available low-cost resources in the best possible manner, rather than comprehensive approaches to decision making (Desa & Basu, 2013). This suggests that:

\[ H3 \quad \text{Environmental munificence will be positively related to comprehensiveness in start-ups.} \]

**METHODOLOGY**

**Sample and Research Design**

The sample in this study was comprised of organizations in the emergence and early growth stages of firm development. The data collected was limited to organizations created between 2006 and 2012 complying with previous studies of start-ups (Zahra, Ireland, & Hitt, 2000). Businesses in the emergence and early growth stages are defined by having founders that are highly involved and hold a prominent role in the everyday operations of the business (Hite, 2005). To incorporate this aspect into our study only founders who were both owner and manager of the business were surveyed.

The sample was obtained through a number of resources that included the marketing and research company Infogroup, a Dun and Bradstreet million dollar database, several business incubators, and an extensive questionnaire. Businesses were emailed a link to the online questionnaire to businesses reflective of early stages of growth. A final sample of 147 complete responses was obtained representing 45% of the total surveyed. The questionnaire was designed for respondents to answer every question before moving forward to the next question so if a question was not answered, the questionnaire was considered incomplete and inadmissible. For this reason, no missing data problems were present in the database. Detailed characteristics of the data collected are presented in Table 1.

In this study we used a cross-sectional research design, which is characterized by measuring all variables in the same survey. Scholars agree that
one clear limitation for a cross-sectional research design is the possibility of common-method variance since dependent and independent variables are measures at the same time (Podsakoff, MacKenzie, & Podsakoff, 2003). Despite these limitations, cross-sectional survey based designs are often considered the only way of collecting primary data from decision makers in small-to-medium

| Table 1 |

| Characteristics of the Business Start-Ups and Founders |

<p>| New Business Information |  |</p>
<table>
<thead>
<tr>
<th>Items</th>
<th>N</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year of creation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>2</td>
<td>1.4</td>
</tr>
<tr>
<td>2007</td>
<td>41</td>
<td>27.9</td>
</tr>
<tr>
<td>2008</td>
<td>26</td>
<td>17.7</td>
</tr>
<tr>
<td>2009</td>
<td>30</td>
<td>20.4</td>
</tr>
<tr>
<td>2010</td>
<td>27</td>
<td>19.4</td>
</tr>
<tr>
<td>2011</td>
<td>18</td>
<td>12.2</td>
</tr>
<tr>
<td>2012</td>
<td>2</td>
<td>1.4</td>
</tr>
<tr>
<td>Industry</td>
<td>Services</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Construction</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>Manufacturing</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Arts, Entertainment, and Recreation</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Professional, Scientific, and Technical Services</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Retail Trade</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Transportation and Warehousing</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Finance and Insurance</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Health Care and Social Assistance</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Consulting</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>10</td>
</tr>
</tbody>
</table>

| Respondents Information |  |
| Previous industry experience (years) |  |
| 0 | 21 | 14.3 |
| 1-10 | 67 | 45.6 |
| 11-20 | 33 | 21.8 |
| 21-30 | 19 | 12.9 |
| 31 and over | 7 | 4.9 |
| Previous managerial experience (years) |  |
| 0 | 29 | 20.1 |
| 1-10 | 76 | 53.1 |
| 11-20 | 23 | 16.3 |
organizations (Podsakoff et al., 2003). Small businesses tend to be private organizations with little public information available and with executives often reluctant to share business information (Zellweger, Kellermanns, Chrisman, & Chua, 2012). Additionally, executives in this type of organization, particularly business founders, possess great discretion in the decisions made in these organizations that enables them to evaluate and have direct knowledge on strategic decision making processes (Agle, Nagarajan, Sonnenfeld, & Srinivasan, 2006; Meissner & Wulf, 2014). For these reasons, business founders, as top executives of their business, are considered accurate sources of information, particularly in strategic processes such as strategic decision making (Meissner & Wolf, 2014).

Measures

Main variables

Comprehensiveness - Respondents were asked to assess the comprehensiveness of their decision making process by determining the way they make decisions that they consider strategic for their organization. Comprehensiveness was measured using a seven-point Likert-type scale. The scale is comprised of three items that measure consideration of several options when making a strategic decision, the evaluation of such options, and the use of multiple criteria to assess each option. The scale used to measure comprehensiveness was developed by Talaulicar et al. (2005) and was similar to has been developed and used successfully in the past (Simons, Pelled & Smith, 1999; Talaulicar et al., 2005). The instruments used to measure this variable are included in Appendix 1.

Environmental conditions - Environmental conditions were categorized into three constructs: environmental instability (EI), environmental complexity (EC), and environmental munificence (EM). To measure environmental instability, complexity, and munificence, the scales developed by Miller and
Friesen (1982) were used. Similar items to measure these environmental conditions have been developed and used successfully in the past (i.e. Lueg & Borisov, 2014; Sanchez-Peinado & Pla-Barber; 2006). The instruments used to measure these variables are included in Appendix 1.

Control Variables

Based on the literature on comprehensiveness and start-ups, seven control variables were included in this study: business size, founder team size, human capital, performance, new product type, economic conditions, and industry. Evidence suggests that business size is directly related to the level of comprehensiveness (Fredrickson & Iaquinto, 1989). Business size was controlled for by determining the number of employees in the start-up. Founder team size has also been found to be a predictor of firm decision-making processes (Cohen & Bailey, 1997). Founder team size was controlled for by measuring the number of members of the start-up that play a prominent role in the decision-making in the organization. Human capital was measured by the decision-maker’s industrial experience (number of years of working experience in the industry), start-up experience (number of previous start-ups), and managerial experience (number of years of working experience in managerial positions). Obviously, experience in creating start-ups could affect comprehensiveness. The literature also suggests that success can increase the use of comprehensiveness (Von Gelderen et al., 2000, p.169). Since information on performance is limited at the early stages of the business creation, the founder was asked to provide a subjective report on performance in terms of the degree of success of their business as compared to competitors on sales and profit (Atuahene-Gima & Li, 2004). Founders were also asked to report on expected growth for the following year. New product type refers to level of innovation of the product or service offered by the start-ups. More innovative products will create more environmental uncertainty since there is limited knowledge on the level of demand and resources available in the environment (Atuahene-Gima & Li, 2004). It is expected that the conditions of the economy would affect perceptions of the environment. Therefore, this variable was measured by averaging the consumer confidence index and unemployment rate from each year since the business was created. These economic indicators are the most frequently used measure of economic health (Ransom, 2010). Finally, the literature on environmental uncertainty suggests that different industries experience different levels of environmental uncertainty (Child 1972; Dess & Beard 1984). This variable was measured by asking
founders to select an industry type from the North American Industry Classification System (NAICS).

RESULTS

The data analysis process was carried out as follows: First, multicollinearity was assessed by reviewing the Pearson correlations ($r$) between the main variables. Second, the reliability and validity of the scales used were assessed using Exploratory Factor Analysis (EFA) and Cronbach alpha ($\alpha$). Third, the presence of common methods variance was assessed using Harman’s one factor test. Finally, hypotheses were tested using hierarchical linear modelling analysis (HLM). The model obtained was tested to determine that no violations to the regression assumptions existed. The descriptive statistics, Pearson correlations, and scale reliabilities (Cronbach $\alpha$) of main variables are reported in Table 2. Pearson correlations suggested that no multicollinearity problems existed. Variance Inflation Factors were obtained as part of the regression analysis and are discussed further in subsequent sections. The coefficient alphas obtained for start-up comprehensiveness $\alpha = 0.892$, environmental instability $\alpha = 0.814$, environmental complexity $\alpha = 0.844$, and environmental munificence (reversed) $\alpha = 0.724$ indicate a good reliability of the factors used in this study.

The validity of the scales used was assessed using exploratory factor analysis (EFA). Kaiser’s cut-off criteria of eigenvalues greater than one, as well as scatter plots, were used to determine the number of factors in the data (Lance, Butts, & Michels, 2006). The factor model was determined using principal component analysis. Factors were rotated using an oblique rotation (direct oblim $\Delta = 0.0$). A model of four factors was extracted and all items loaded as expected. The scatter plot further supported these results yielding four factors.

Table 2

Descriptive Statistics, Pearson Correlations, and Reliabilities of Variables

<table>
<thead>
<tr>
<th>Individual-Level Variables</th>
<th>Mean</th>
<th>s.d.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Start-up comprehensiveness</td>
<td>5.31</td>
<td>1.18</td>
<td>(.89)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Environmental Instability</td>
<td>3.89</td>
<td>1.25</td>
<td>.27**</td>
<td>(.81)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Environmental Complexity</td>
<td>3.81</td>
<td>1.45</td>
<td>.29**</td>
<td>.55**</td>
<td>(.84)</td>
<td></td>
</tr>
</tbody>
</table>
To assess the possibility of the presence of common method variance in this study, the authors conducted the Harman’s single-factor test (Podsakoff et al., 2003). A principal axis factoring extraction with no rotation was conducted in which all manifest variables were included and constrained to one factor loading. The major component emerging in this factor analysis explained only 29.1% of the variance. These result indicates that no single factor dominated the variance between the measures and therefore indicates that common method variance is not of concern in this sample (Podsakoff et al., 2003).

All hypotheses were tested using hierarchical linear regression. In this study, consistent with the previous statement, all control variables were entered in step one. In step two, all independent variables--EI, EC, and EM--were introduced into the model. It is important to mention that the order in which the predictor variables entered was determined by the Pearson correlation of each predictor with the outcome variable (comprehensiveness) (Stevens, 1994). As shown in Table 2, complexity has the highest correlation ($r = 0.29$), followed by instability ($r = 0.26$), and then munificence ($r = 0.25$) with the dependent variable.

**Test of Linear Regression Model Assumptions**

**Multicollinearity**

Multicollinearity was initially assessed by observing the correlations between predictor variables. Even though no correlations were of a value that would indicate the presence of multicollinearity, the Pearson correlation between environmental instability and complexity $r=0.55 \alpha =0.001$ was considered relatively high. Thus, Variance Inflation Factor (VIF) was used to further assess the possible presence of multicollinearity and found that environmental complexity displayed a VIF=1.973, instability a VIF=1.878 and munificence a VIF=1.390. The average VIF of the model was 2.23. The VIF values for each predictor variable and the model were clearly bellow the conservative cut-off values suggested in the literature of 5 or higher (Bowerman & O’Connell, 1990; Cohen, Cohen, West, & Aiken 2003; Belsley, Kuh, & Welsch, 1980). Therefore, multicollinearity was not found to be an issue in the dataset.
Random Error Terms

To assess this assumption, the Durbin-Watson ($D$) test was used. According to Field (2009), values of $D$ close to two are indicative of no correlation problems. The D statistic for the regression model obtained was $D = 2.212$ indicating no violation to the assumption that the error terms in the model are random and uncorrelated.

Error Terms Normally Distributed

Skewness and Kurtosis test were carried out to test normality of error terms. The values obtained for our model were -0.431 and 0.395; standardized values were non-significant with $z_{skewness} = -1.55$ at $p < 0.01$ and $z_{kurtosis} = 0.99$ at $p < 0.05$. These results suggest no violation of normality of the error terms.

Error Terms with Equal Variance

To statistically test the presence of heteroskedasticity, the Breusch-Pagan test was used. This test was significant with $\chi^2 (20) = 31.387$ at $p < 0.05$, confirming the presence of heteroskedasticity. Therefore, a Box-Cox transformation of the outcome variable was conducted to compensate for the presence of heteroskedasticity. Using this procedure, it was concluded that the optimal transformation would be to square the outcome variable ($\lambda = 2$). After transforming the outcome variable, a new hierarchical regression analysis was carried out using the same set of steps as in the first analysis. As with the previous model, all regression assumptions were tested. The Breusch-Pagan test for heteroskedasticity was $\chi^2 (20) = 28.161$ and not significant at $p < 0.05$ suggesting equal variance of random terms. The results show that the Box-Cox transformation used solved the non-normality and heteroskedasticity problem present in the original model. Thus, the model using the squared value of the outcome variable was the final regression model used to test the hypotheses.

Hypotheses findings

Hypothesis 1 predicted a significant negative relationship between environment instability and comprehensiveness but was not supported. The relationship between environmental instability and comprehensiveness was significant ($\beta = 3.202, p < 0.001$) but in the opposite direction than hypothesized. In other words, the results indicate that as environmental instability increases, comprehensiveness in start-ups also increases.
Hypothesis 2 predicted a significant negative relationship between environmental complexity and comprehensiveness in start-ups. This hypothesis was also not supported. The relationship between environmental complexity and comprehensiveness was not significant ($\beta = 0.934, p = 0.275$). The coefficient is positive suggesting a positive relationship between these variables.

Hypothesis 3 predicted a significant positive relationship between environmental munificence comprehensiveness in start-ups. This hypothesis was fully supported. The relationship between environmental munificence and comprehensiveness was significant $\beta = 2.717, p < 0.001$). The coefficient for environmental munificence is positive suggesting a positive relationship between these variables. Hypotheses 1, 2, and 3 predicted a direct relationship between environmental instability, complexity, munificence and comprehensiveness. Model 2 is significant and shows that these variables explain 12.6% of the variance in the model (Model 2; $\Delta R^2 = 0.114; \Delta F = 7.397; p < 0.001$) (see Table 3).

**DISCUSSION**

The results suggest that environmental conditions do affect founders’ decision-making processes when making strategic decisions. Three dimensions of environmental uncertainty were hypothesized to influence comprehensiveness: instability, complexity, and munificence. While only Hypothesis 3 was supported in the proposed direction, Hypothesis 1 showed a significant positive relationship with comprehensiveness in start-ups. Even though there is a significant relationship, the effects of environmental instability cannot be overlooked. Strategic decision-making process studies in large organizations have suggested that comprehensiveness is not used in unstable environments and that, in fact, comprehensiveness may be counterproductive since it would limit the organization’s ability to quickly respond to environmental changes (Fredrickson & Iaquinto, 1989; Frederickson & Mitchell, 1984; Galbraith, 1991). The finding in this study contradicts this notion by providing support that firms actually are more comprehensive when faced with environmental instability, most likely due to business founder compensation in trying to make sense of their environments.

The entrepreneurship literature, however, suggests that start-ups at the emerging and early growth stages are characterized by limited access to resources, knowledge, and information, which makes it even more difficult to
### Table 3
Results of Hierarchical Regression Analysis

<table>
<thead>
<tr>
<th>Step 1:</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$B$</td>
<td>SEB</td>
<td>Beta</td>
<td>$R^2$</td>
<td>Adj $R^2$</td>
<td>$\Delta R^2$</td>
<td>$F$</td>
</tr>
<tr>
<td>Control Variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-86.723</td>
<td>47.928</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business Size</td>
<td>1.179</td>
<td>0.815</td>
<td>0.158</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Founder Teams size:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Founders</td>
<td>0.982</td>
<td>1.537</td>
<td>0.072</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Decision Makers</td>
<td>0.109</td>
<td>1.455</td>
<td>0.009</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human Capital:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry Experience</td>
<td>-0.127</td>
<td>0.113</td>
<td>-0.110</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management Experience</td>
<td>0.194</td>
<td>0.125</td>
<td>0.154</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start-up experience</td>
<td>-0.658</td>
<td>0.873</td>
<td>-0.740</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales</td>
<td>5.472</td>
<td>1.854</td>
<td>0.347</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profit</td>
<td>0.246</td>
<td>2.149</td>
<td>0.014</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growth</td>
<td>0.017</td>
<td>0.022</td>
<td>0.065</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Product Type</td>
<td>2.257</td>
<td>1.796</td>
<td>0.133</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic Conditions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumer Confidence Index</td>
<td>0.823</td>
<td>0.415</td>
<td>0.251</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployment Rate</td>
<td>5.137</td>
<td>2.930</td>
<td>0.224</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry</td>
<td>0.246</td>
<td>0.152</td>
<td>0.137</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 2:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-53.137</td>
<td>46.265</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EU-Complexity</td>
<td>0.822</td>
<td>0.847</td>
<td>0.098</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EU-Instability</td>
<td>3.125**</td>
<td>0.958</td>
<td>0.322</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EU-Munificence(r)</td>
<td>2.609**</td>
<td>0.751</td>
<td>0.309</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < 0.01, **p < 0.00*

Engage in comprehensive strategic decision-making. Under this condition, business founders will frequently use biases and heuristic rather than engage in rational decision making (Busenitz, 1999; Busenitz & Barney, 1997; Hite & Hesterly, 2001; Simon et al., 1999). Literature on strategic planning for start-ups have also suggested that the return on performance from business planning is limited when in unstable environments (Brinckmann, Grichnik, & Kapsa, 2010). Based on the assumption of resource and information limitations in these early phases, the presence of environmental instability makes it difficult for founders...
to use comprehensiveness. The results of this study suggest that business founders may be more diligent when faced with this uncertainty in acquiring resources and information to make more informed decisions. In other words, comprehensive decision making processes, not reactive ones, are used by business founders when faced with instability in the environment.

Previous research on large organizations support the findings in this study of small firms. These studies suggest that unstable environments may make individuals use more comprehensive decision-making processes by accelerating the collection and analysis of information to make decisions (Bourgeois & Eisenhardt, 1988; Eisenhardt, 1989; Talaulicar et al., 2005). As supported by the results of Hypothesis 1, we conclude that regardless of the lack of information and knowledge about the changes in the market, small business founders seem to make more comprehensive decisions as instability increases. This finding is important for entrepreneurship literature because it suggests that founders should be seen not as individuals who are reactive when making decisions for the sake of survival of their business but as individuals who think through, analyse their decisions, and seek alternatives for action. This finding also contributes to the strategic decision-making literature since it provides support for a comprehensive decision making model that was previously seen only in studies of large organizations, suggesting that start-ups may emulate large organizations with regard to information seeking and resource acquisition.

Hypothesis 2 stated that environmental complexity would be negatively related to comprehensiveness. The results show that a non-significant relationship exists between environmental complexity and comprehensiveness. To understand this result, a hierarchical regression analysis was carried out in which each variable was examined individually on each step. When introduced on its own, environmental complexity had a significant positive coefficient of $\beta = 1.839$ at $p < 0.05$. However, when environmental instability was introduced, environmental complexity was insignificant ($p = 0.329$) with a value of $\beta = 0.879$. Since multicollinearity does not seem to explain this finding our results suggest that environmental complexity and instability might be confounded and partially redundant. According to Cohen et al. (2003), partial redundancy is present when an indirect effect of one independent variable partially takes place through a second variable. In this study, this would mean that environmental complexity may have a direct effect on comprehensiveness but also an indirect effect through environmental instability or vice versa.
A Pearson correlation between these predictor variables higher than the correlation each has with the outcome variable is indicative of this situation. Supporting this conclusion is that the value of the Pearson correlation between instability and complexity is $r = 0.52$ and the correlation of both complexity and instability with comprehensiveness are $r = 0.29$ and $r = 0.27$ respectively. The partial redundancy between instability and complexity is supported by the seminal work of Duncan (1972) who concluded that instability is a more important contributor to perceptions of environmental conditions than complexity and that businesses in unstable environments experience greater uncertainty regardless of the level of complexity. Other empirical studies have shown that environmental instability accounts for a greater amount of the variance explained in their models than environmental complexity (Sharfman & Dean, 1991; Lukas, Tan, & Hult, 2001). In this study, since instability is significant in the final model, this dimension seems to account for a greater amount of the variance in the model over complexity, making this last variable confounded.

Since complexity was not significant in the model, it was deleted to assess whether the model was improved. This test showed that even though the complexity coefficient is not significant, this variable contributes to a better regression model. Deleting this variable slightly reduced the value of $R^2$ from 0.330 to 0.326 and the $\Delta R^2$ from 0.126 to 0.120 in the model of step two. It was therefore decided to retain complexity since these dimensions (instability and complexity) are well established and are widely used in the literature as separate constructs.

**Hypothesis 3** stated that environmental munificence would be positively related to comprehensiveness and was supported. Munificence is related to making decisions about whether or not a business can actually place its product or service in the market based on the access it has to resources not in its control. When the level of munificence is low, the founder may question the ability to deliver a product or service to customer and therefore may engage in non-comprehensive decision-making. Non-comprehensive decision-making, in this sense, runs opposite to comprehensiveness as the former is characterized by a lack of opportunity to analyse and weigh options.

Model 2, which accounts for the relationship of environmental instability, complexity, and munificence, shows $\Delta R^2 = 0.126 \ (p < 0.001)$ after control variables have been accounted for in the model. These findings suggest that
these environmental conditions explain 12.6% of the variance in comprehensiveness of strategic decision making in start-ups. This is an important contribution to the literature since it suggests that environmental conditions need to be accounted for in the structuring and planning of new ventures and in the investigation of studying decision-making in new firms.

CONCLUSIONS

The purpose of this study is to contribute to the debate in the entrepreneurship literature on strategic decision making in start-ups through the use of comprehensive decision making processes. To this end, the study focused on looking not at what is of value for start-ups but at what founders actually do when making strategic decisions for their business. The findings suggest that painting all start-ups, and by extension entrepreneurial activities, with the same broad brushstrokes is to take a myopic view of these businesses. When properly considered, decision-makers using comprehensiveness may lead to better responses to environmental uncertainty. As a result, scholars are well-advised to assess the meaningfulness of the variables in this study relative to business size, founder team size, human capital, performance, new product type, economic conditions, and industry in which they are situated. Future research measuring the impact of these variables would be ideal.

The model presented in this paper may be of value to firms who are highly concerned with understanding, predicting, and dealing with particular competitors. For instance, a rival may display a decided preference for comprehensiveness at the time of start-up. This could lead to predictions that management of the rival has the personality and disposition to carefully and diligently seek comprehensiveness in other decisions, such as those involving market segmentation, brand positioning, and pricing. Another rival could have a history of relying upon impulse and subjective judgment in arriving with solutions over a wide range of issues and be expected to continue a path that is difficult to justify.

Additionally, one important managerial implication is that entrepreneurs who select a particular start-up decision-making strategy, such as fixating on comprehensiveness, may be expected to continue this course of action in the future for other decision-making situations. Conversely, reflecting on experiences in the past may pave the way for emerging into strategies that have
been neglected and could be improved. For example, perhaps management has been unduly consumed with comprehensiveness in the past, and this has considerably slowed implementation of decisions or has restricted creative thinking in the company. These kinds of decision-making habits should be avoided in the future especially when faced with instability or scarcity of resources in the environment.

This research contributes new knowledge and improves the understanding of comprehensiveness in the decision-making process by reopening the debate about the process of new business venture decision-making through a comprehensiveness lens of the environment. Comprehensiveness in the reality of a start-up, in which individuals make decisions based on projections and scenarios due to the lack of past performance to inform their decisions, differs from comprehensiveness as defined for large organizations. Comprehensiveness for large organizations is understood as “the extent to which organizations attempt to be exhaustive or inclusive in the making or integrating of decisions” (Frederickson & Mitchell, 1984, p. 399), and it includes the analysis of past performance as part of the analysis process. Since these two differ in the use of projections for start-ups, and past performance for large organizations, a detailed comparison of comprehensiveness for start-ups and large organizations may provide more understanding on the value of each with regard to performance.

The findings also suggest that start-up founders are more comprehensive than what is generally suggested in the literature (Perry, 2001). Our results extend prior research on the effects of comprehensiveness on founders by illuminating the effects of resource munificence on comprehensive decision-making in business start-ups and distinguishing between instability and complexity that business founders confront in being comprehensive. Future research could expand our approach by seeking other methods of explaining the relationship between start-up comprehensiveness and subsequent effects on performance.

This study contributes by demonstrating that environmental conditions have an influence on the decision making processes that entrepreneurs use in their start-ups. The study shows that the level of instability, complexity and munificence in the industry in which start-ups operate influence the founders’ perceptions to successfully operate their business. It is possible that founders may not be aware of the biases and heuristics they use. Regardless, this study offers evidence to suggest that the conditions of the environment influence how
founders respond to perceptions of the environment suggesting that greater instability, complexity and scarcity (low munificence) move entrepreneurs to seek and evaluate more alternatives to respond to such conditions.

This study also has several limitations which could affect the interpretation of the results. The positive relationship between instability and comprehensiveness suggest that business founders think through and assess courses of action in unstable environments, which is contrary to what some of the literature in entrepreneurship suggests (Bourgeois & Eisenhardt, 1988; Talaulicar et al., 2005). The possibility of instability and complexity being partially redundant or confounded suggests that the two dimensions of the environment explain similar environmental conditions which need further consideration.

Finally, measures used in the study are also retrospective self-reports which may cause retrospective bias. Respondents may recall past events in a way that favors their self-image and justifies their decisions. For instance, individuals may want to appear more socially desirable by recalling their past decisions as being more comprehensive than they actually were (Golden, 1992). Also, the role of founder teams was only considered as a control variable in this study. This is a limitation since founder teams are important when studying group processes and performance (Cohen & Bailey, 1997; Gladstein, 1984; Guzzo & Shea, 1992). Future research may be necessary to assess the founder team impact on the level of comprehensiveness.

REFERENCES


**Appendix 1**

**Comprehensive Decision-Making Instrument**

Instructions: Please answer the following questions with regards to the way you make strategic decisions for your organization. Please circle the number that better describes your answer.

1. When (strategic) decisions have to be made, to what extent do you consider several options?

<table>
<thead>
<tr>
<th>Very little</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

2. To what extent is every option considered and evaluated extensively?

<table>
<thead>
<tr>
<th>Very little</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

3. To what extent do you apply multiple criteria to evaluate each option?

<table>
<thead>
<tr>
<th>Very little</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

**Environmental Conditions Instrument**

Instructions: Please answer all of the following questions with regards to the way you perceive the conditions of the industry in which your business is. Please circle the number that better describes your answer.
Environmental Instability

4. Firms in our industry change their marketing practices to keep up with the market and competitors

<table>
<thead>
<tr>
<th>Marketing practices change extremely rarely</th>
<th>Marketing change frequently (e.g. semiannually)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

5. The rate at which products/services are getting obsolete in the industry is:

<table>
<thead>
<tr>
<th>Very slow</th>
<th>Very fast (as in some fashion goods and semi-conductors)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

6. Actions of competitors are:

<table>
<thead>
<tr>
<th>Easy to predict</th>
<th>Unpredictable</th>
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<td>7</td>
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</tbody>
</table>

7. Demand and consumer tastes are:

<table>
<thead>
<tr>
<th>Fairly easy to forecast</th>
<th>Almost unpredictable (e.g. high fashion goods)</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

8. The production/service technology is subject to change:

<table>
<thead>
<tr>
<th>Not very much change and is well established (e.g. in steel production)</th>
<th>Changes often and in a major way</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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</tbody>
</table>

Environmental Complexity

9. Your firm offers:

<table>
<thead>
<tr>
<th>One or only a few standard product/service</th>
<th>A diversity of product/services to cater to the different tastes in the consumer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<tr>
<td>3</td>
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</tbody>
</table>

10. Are there great differences amongst the products/services you offer with regards to customers’ buying habits

<table>
<thead>
<tr>
<th>About the same for all our products</th>
<th>Varies a great deal from one line to the other</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>2</td>
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<td>7</td>
<td></td>
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</table>
11. Are there great differences amongst the products/services you offer with regards to the nature of the competition?

<table>
<thead>
<tr>
<th>About the same for all our products</th>
<th>Varies a great deal from one line to the other</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>2</td>
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</table>

12. Are there great differences amongst the products/services you offer with regards to market dynamism and uncertainty?

<table>
<thead>
<tr>
<th>About the same for all our products</th>
<th>Varies a great deal from one line to the other</th>
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<tbody>
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<td>2</td>
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</table>

Environmental Munificence

13. Tough price competition is a challenge in our industry that poses a threat for us.

<table>
<thead>
<tr>
<th>NOT a severe challenge</th>
<th>A severe challenge that poses a very substantial threat for us</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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</table>

14. Shrinking markets for our product/service is a challenge in our industry that pose a threat for us:

<table>
<thead>
<tr>
<th>NOT a severe challenge</th>
<th>A severe challenge that poses a very substantial threat for us</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
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</table>

15. Scarce supply for raw materials is a challenge in our industry that pose a threat for us.

<table>
<thead>
<tr>
<th>NOT a severe challenge</th>
<th>A severe challenge that poses a very substantial threat for us</th>
</tr>
</thead>
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<td>1</td>
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</table>
REVISING THE ENTREPRENEUR OPPORTUNITY FIT MODEL: ADRESSING THE MODERATING ROLE OF CULTURAL FIT AND PRIOR START-UP EXPERIENCE

Laura Serviere-Munoz
University of Dallas

Kevin J. Hurt
Columbus State University

Richard Miller
University of Dallas

ABSTRACT

Entrepreneurial research has paid scant attention to the fit between the entrepreneur and the opportunity. Thus, this paper focuses on addressing the entrepreneur-opportunity match needed to increase the likelihood of success when a specific opportunity is selected. The model proposes that the closer the entrepreneur’s characteristics, such as knowledge, skills, abilities, and opportunity recognition, match those of the opportunity, such as financial capital and market realities, the greater the possibility of attaining a strong fit. In turn, this can lead to venture success. Last, cultural fit and prior start-up experience are proposed to moderate the venture’s success.

Keywords: Entrepreneur-Opportunity Fit, Venture Success, Cultural Fit, Start-up Experience

INTRODUCTION

An old economics adage states that in an efficient market, a $20 bill on the sidewalk must be a fake; otherwise, someone would have already picked it up. Of course, this adage assumes that everyone sees the $20 bill to begin with, but of course, this is not always the case. Entrepreneurs have become adept at spotting those $20 bills and have become particularly proficient at seeing the inherent value lying before them. However, questions remain: ‘How do they see $20 bills that no one else sees, or sees but do not recognize the value?’ and ‘How do they seize the opportunity and turn it into success?’

The first question addresses the importance of opportunity recognition, which has become one of the dominant themes in the field of entrepreneurship
research (Crump, Singh, & Abbey, 2011; Hashemzehi, Bahrinejad, Lashgari, & Hashemzehi, 2013; Shane & Venkataraman, 2000). The second question focuses on opportunity exploitation, which has also emerged as a dominant theme in entrepreneurship research with scholars placing a significant amount of attention on individual attributes and mental schemas (Cachon, Codina, Eccius-Wellmann, McGraw, & Myers, 2013; Grégoire, Corbett, & McMullen, 2011; Haynie, Shepherd, & McMullen, 2009; Kyu Soo & Sang Bum, 2013; Zhao, Seibert, & Lumpkin, 2010). A third stream of research has focused on factors leading to venture success and failure (Kessler, Korunka, Frank, & Lueger, 2012; Lussier & Pfeifer, 2000; Song, Podoynitsyna, van der Bij, & Halman, 2008).

These three areas of entrepreneurship research have expanded the understanding of how the entrepreneur recognizes opportunity and exploits it, but very few studies have considered the notion of fit in the entrepreneurial process. Yet, as a construct related to performance, “fit matters” (Naman & Slevin, 1993, p. 146). Fit theories attempt to depict an ideal match between a person and some defined idea (e.g., environment and organization). While person-environment fit has long been established (Bretz & Judge, 1994; Carless, 2005; Verquer, Beehr, & Wagner, 2003) as well as person-organization fit (Brigham, De Castro, & Shepherd, 2007; Morley, 2007; van Vianen, Shen, & Chuang, 2011) in the management literature, it has only recently begun to gain ground within the realm of entrepreneurship (Hurt & Serviere-Munoz, 2011; Markman & Baron, 2003; Prottas, 2011).

Markman and Baron (2003) introduced a person-entrepreneurship framework to suggest that individuals high on certain dimensions (e.g., self-efficacy, opportunity recognition, perseverance) were more likely to become entrepreneurs. For example, individuals with a higher ability to recognize an entrepreneurial opportunity would have a greater propensity to create a new venture. Daly (2012) identified additional individual qualities (e.g., small egos, systems-based experience) necessary for a person to have success within the context of franchising, suggesting that people without the right characteristics should not pursue this type of venture. Prottas (2011) extended the person-environment framework to choice of work arrangements, identifying a need for autonomy among those that were self-employed. Each of these studies focused on the individual, failing to make any comments about the potential effect of the opportunity itself.

The inclusion of opportunity with the individual is critical as Shane and Venkataraman (2000) reveal that not all opportunities are created equal because
each opportunity has its own characteristics that may influence venture creation and performance. Hurt and Serviere-Munoz (2011) extended the fit concept by focusing on how the individual and the opportunity are both important and inseparable considerations in the entrepreneurial process. Their Entrepreneur-Opportunity (E-O) model suggests that venture success or failure is a function of how well the entrepreneur’s characteristics fit those of the opportunity implying that a stronger fit would lead to a greater probability of success.

Despite our understanding that the individual and the opportunity both matter in the entrepreneurial process, research focusing on various contextual factors that could shape the relationship between E-O fit and venture outcomes is limited. For example, most of the findings related to entrepreneurship have been based on western cultures. Whether these findings are culture and context free, or whether they can only be understood within the context in which they occur has yet to be determined. Similarly, prior entrepreneurial experience has the potential to influence E-O fit, though it does not always result in improved new venture performance (Toft-Kehler, Wennberg, & Kim, 2014).

The present work builds upon Hurt and Serviere-Munoz’s (2011) E-O model and augments their reach by identifying additional individual characteristics important for entrepreneurs. We also introduce and put forth propositions related to the moderating effects of cultural fit and prior entrepreneurial experience. In so doing, we provide a more nuanced understanding of the fit between the entrepreneur and the opportunity, and the likelihood of venture success. We conclude with suggestions for future research.

A MODEL OF ENTREPRENEUR-OPPORTUNITY FIT

The proposed model depicts the direct relationship on the entrepreneur’s and opportunity’s characteristics on fit as well as the moderating impact of cultural fit and prior start-up experience on venture success, as shown in Figure 1. A more detailed listing of the entrepreneur and opportunity characteristics can be found in Table 1. The following section contains the development of the model and the propositions.
FIGURE 1. Revised Entrepreneur-Opportunity Fit Model

TABLE 1:
Entrepreneur’s and Opportunity’s Characteristics that Influence Opportunity-Fit

<table>
<thead>
<tr>
<th>Entrepreneur’s characteristics:</th>
<th>Opportunity’s characteristics:</th>
</tr>
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<tbody>
<tr>
<td>- Knowledge, skills, abilities and other characteristics</td>
<td>- Resources</td>
</tr>
<tr>
<td>Social skills, self-efficacy, perseverance</td>
<td>Resources profile, financial and social capitals</td>
</tr>
<tr>
<td>- Opportunity Recognition</td>
<td>- Market realities</td>
</tr>
<tr>
<td>Alertness, access to information and use of information, previous knowledge or field or industry, pattern recognition</td>
<td>Market niche, timing (first mover advantage), and adaptation (in mature industries)</td>
</tr>
<tr>
<td>- Resources</td>
<td></td>
</tr>
<tr>
<td>Human, financial, and social capitals</td>
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</table>

Prior Start-up Experience

Venture Success

Venture Failure

E-O Strategic Choice: Maximizing vs. Satisficing
Entrepreneur’s Characteristics

Knowledge, Skills, Abilities and Other Characteristics

Knowledge, skills, abilities and other characteristics have been shown to play an important role in influencing entrepreneurial intentions and decision processes (Shook, Priem, & McGee, 2003). There is growing evidence that entrepreneurs organize their knowledge based on an “entrepreneurial mindset” (Mitchell, Smith, Seawright, & Morse, 2000), which traces its roots to the idea that these individuals develop knowledge structures and process information in a different way than non-entrepreneurs (Mitchell et al., 2000). According to the expert information processing theory explanation, this mindset is acquired through entrepreneurial cognitions, which are knowledge structures that allow them to use the information better than non-entrepreneurs (Ericsson, Krampe, & Tesch-Römer, 1993; Glaser, 1984; Mitchell et al., 2007). In conjunction with knowledge, experience is another characteristic contributing to the start-up of a venture by influencing the construction of prototypes. In the case of entrepreneurship, these prototypes encompass an individual’s basic notions of what is a good venture opportunity (Baron, 2004).

In addition to knowledge and experience, a varied set of skills and abilities are needed in venture creation and management. One set of skills is initiating and managing the social interactions of raising capital, engaging employees by generating enthusiasm and commitment, connecting in an effective manner with partners and employees to create business networks (Markman & Baron, 2003), and presenting valuable offers to customers to engage in a profitable long-term relationship. In addition, personal characteristics such as self-efficacy (Bandura, 1993), the ability to recognize opportunities, and personal perseverance contribute to the explanation of why some individuals are more successful as entrepreneurs than others (Markman & Baron, 2003).

A person’s skills, abilities, and potential experience influences one’s determination as to whether or not a venture is a good match. If one deems a prospective opportunity is compatible with his or her personal and professional goals and is economically viable, one will engage in preliminary steps to start a venture (Hormozi, 2004). Thereafter, the individual relies on his or her psychological and sociological characteristics which, along with the technical and managerial skills, provide direction to the venture (Sexton & Bowman, 1985). Thus, the following proposition is put forth:
Proposition 1: The greater the knowledge, skills, abilities and other characteristics that entrepreneurs possess towards a prospective venture opportunity, the greater the influence towards a good E-O fit

Opportunity Recognition

Opportunity recognition, defined as the process through which ideas for potentially profitable new business ventures are identified by specific persons (Kirzner, 1979; Shane, 2003), is considered an essential element in becoming an entrepreneur (Farmer, Yao, & Kung-Mcintyre, 2011). Cognitive in nature, opportunity recognition aids in launching new products or service ideas by attempting to connect the dots around the changes, events, and trends that surround them (Baron, 2006). An underlying assumption to the study of opportunity and entrepreneurial cognition is that entrepreneurship focuses on distinctive ways of thinking and behaving (Kirzner, 1979; Mitchell et al., 2007). Research in this area has allowed for greater understanding of the entrepreneurial process (Baron & Ensley, 2006). For example, alertness, which refers to receptivity to opportunities and recognizing them (Baron & Ensley, 2006), is partially based on cognitive capacities, such as high intelligence and creativity of individuals (Shane, 2003). Additional skills, such as access to information or better use of it (Baron & Ward, 2004; Shane, 2003), previous knowledge of a field or industry (Shane, 2001), or other cognitive factors such as attributions and intentions (Krueger, 2003) and pattern recognition (Baron & Ensley, 2006) are critical components of opportunity recognition. Thus, it is proposed that:

Proposition 2: The greater the opportunity recognition abilities possessed by an entrepreneur, the greater the influence towards a good E-O fit

Resources

The translation of an opportunity to a venture is not an easy one, as it requires different types of resources to be able to succeed. Aldrich and Martinez (2001) propose that entrepreneurially minded individuals need three essential resources: human capital (e.g., education, labor, experience), financial capital (e.g., personal savings, venture financing), and social capital (e.g., social networks). However, possession alone is not sufficient as initial endowments are
critical to survival and those who start with limited resources tend to be at a greater risk for desertion (Baum, 1996; Fichman & Levinthal, 1991). For instance, well-educated individuals with access to large financial inputs are more likely to create sustainable firms than those who have less access to education and financial inputs (Bates, 1990). This does not mean that those with smaller amounts of resources that turn to self-employment to improve their situation cannot succeed; they simply face additional challenges (Serviere, 2010). Therefore, because the amount of resources possessed plays a critical role in entrepreneurial activities, the following proposition is put forth:

**Proposition 3: The greater the resources an entrepreneur possesses, the greater the influence towards a good E-O fit**

**Opportunity Characteristics**

In addition to the amount of resources needed to start a venture, it is also important that there is a match in the characteristics required by the opportunity and those possessed by the individual. For example, as noted in a study of venture internationalizations, such internationalizations are opportunities characterized by, among other things, requiring adaptive measures to be able to cope with an increasing organizational complexity. Thus, if an individual is a match to the opportunity’s characteristic, the internationalization will likely result in a competitive advantage (Trapczynski & Wrona, 2013). Another example lies in necessity entrepreneurship, a condition where “individuals are pushed to entrepreneurship for reasons such as; low income, lack of job opportunities, and limited government support,” (Serviere, 2010, p. 41). This form of entrepreneurship is largely preferred, as it does not call for large financial investments or advanced educational levels but for tasks requiring manual labor (Serviere, 2010). As a result, self-employment is the option that becomes a match between the type of activities or skills these individuals have (e.g. gardening, laundering, housekeeping) and the opportunity characteristics (manual labor) to be able to gain employment (Serviere, 2010).

To further illustrate the importance of the opportunity’s characteristics, one can consider the opportunity to supply corrugated boxes as originally presented by Hurt and Serviere-Munoz (2011). One opportunity is to start a manufacturing venture to produce the boxes, which might require large financial and human capital resources to attain the equipment and technical capability as demanded by the opportunity. On the other hand, a startup corrugated brokerage
operation might need much less financial resources but greater focus on the individual’s social capital to cultivate the ties required for success in this type of venture (Hurt & Serviere-Munoz, 2011). Thus, it is proposed that:

*Proposition 4: The greater that an opportunity’s required resources match those of the entrepreneur, the greater the E-O fit*

**Market Realities**

Along with an understanding of the attributes (e.g., knowledge, skills, abilities) and resources (e.g., human, financial, social), a clear and sound grasp of market realities such as market size, timing and adaptation are needed by prospective entrepreneurs. Regarding market size, its importance rests on the fact that it helps an individual to judge if they have “what it takes” (Markman & Baron, 2003) to be able to succeed with any given venture opportunity (Hurt & Serviere-Munoz, 2011). Market size, whether measured as the potential existence of a buyer for the product or service (Stancill, 1981) or measured as gross domestic product per capita (Ojala & Tyrväinen, 2007) is vital for the individual to understand. For example, a market that is too small for the venture to be profitably managed will limit profit levels and thus survival and growth (Gatewood, 1993) of the venture. Likewise, if a market is too large, a venture may not be able to withstand the competition from large market players (Stancill, 1981) and it will tend to be more attractive for potential entrants (Harada, 2005). Therefore, an individual should conduct research to establish the size of the market niche that can be profitably served. Thus, it is proposed that:

*Proposition 5a: In terms of market size, the more defined the market niche the greater the influence towards a good E-O fit*

With regards to timing, one of the key decisions that individuals face is when to start a business (Hurt & Serviere-Munoz, 2011), and this has long been identified as a leading factor in product success or failure (Crawford, 1977). Entering a market has to be carefully organized and balanced to overcome the risks of premature versus late entry (Lilien & Yoon, 1990). Early-entry can signify first-mover advantages that lead to higher returns, especially in emerging industries (Lilien & Yoon, 1990; Tegarden, Echols, & Hatfield, 2000) or in industries that represent a “big market” with easy entry due to their nature (i.e.
large markets with unmet needs and few competitors) (Baron & Ensley, 2006). Thus, it is proposed that:

Proposition 5b: If the opportunity permits for first-mover entry, the influence on good E-O fit will be stronger due to the obtained first-mover advantage from such entry

As an industry has matured, the importance of adaptation becomes paramount. First-mover start-up firms tend to have a lower survival rate if they exhibit a lower ability to adapt to technological and industry changes that follow technological progress (Tegarden et al., 2000). Market entry at the mature stage enhances the likelihood of success if adaptations such as higher quality products or more efficient marketing programs are part of the entry strategy (Lilien & Yoon, 1990) as consumers have matured as well and become more sophisticated in terms of their product or service expectations. Thus, it is proposed that:

Proposition 5c: In mature industries, the greater the ability to adapt products or services to consumers, the stronger the influence towards a good E-O fit due to the obtained second-mover advantage from such entry

Entrepreneur – Opportunity Fit

The effectiveness of decision making has been found to be an important factor in the performance of new ventures (Baron & Ensley, 2006). Along with decision making, the term fit has also been linked to such success (Markman & Baron, 2003). The term “fit” measures the match between a person and a construct such as environment, job, organization, or entrepreneurship (Kristof, 1996; Markman & Baron, 2003; Young & Hurlic, 2007). In this paper, the term fit is employed to mark the match or congruence between an entrepreneur - an individual actively seeking to create a new venture, and the opportunity to be pursued. Based on Hurt and Serviere-Munoz (2011), it is argued that such individual will select starting a venture from either a single or a multiple set of opportunities that he or she has identified. E-O fit is considered to be augmented when the degree to which the entrepreneur’s characteristics match those of the
opportunity. Thus, a closer or stronger fit will be observed when both the entrepreneur and opportunity exhibit a high degree of agreement. It is proposed then that a strong fit leads more likely to venture success while a weaker fit might lead to venture failure (Hurt & Serviere-Munoz, 2011).

To define venture success, this paper follows Hurt and Serviere-Munoz’s (2011, p. 33) definition: “the prosperous endeavors of an entrepreneur, culminating in the creation of a new venture capable of providing sustained profitability and autonomous lifestyle.” Based on the previous arguments, it is proposed that the better the individual and the opportunity are a match for each other, the greater the likelihood of success. Thus, the following propositions are put forth:

Proposition 6a: The stronger the fit between the characteristics of the entrepreneur and the opportunity, the greater the likelihood of venture success

Proposition 6b: The weaker the fit between the characteristics of the entrepreneur and the opportunity, the greater the likelihood of venture failure

Decision Making Strategies

A caveat that occurs with success is that it can be especially hard to achieve when individuals have to make inferences and decisions that are constrained by limited knowledge, resources, and time in a complex environment (Hoffrage & Reimer, 2004). Thus, under constrained circumstances, the literature identifies that individuals have two choices to be able to create and implement strategies: maximizing and satisficing (Simon, 1955, 1956). Both strategies have been employed by individuals judging entrepreneurial endeavors (Baron, 2004; Bryant, 2007). Maximizing is a methodical strategy aimed at choosing the best available alternative and calls for a thorough examination of all the available opportunities (Baron, 2008; Simon, 1955, 1956, 1997). Maximizing strategies have demonstrated to produce superior choices (c.f., Iyengar, Wells, & Schwartz, 2006) as they are believed to improve decision performance (Djamasbi, 2007).

In contrast, satisficing is designed for searching until the first acceptable option is found (Simon, 1997), in other words, striving for “good enough” (Simon, 1955, 1956) as individuals often have to make quick decisions with
imperfect or incomplete information (Baron, 2008) due to time constraints. Some propose that satisficing is a better fit for these individuals because it reduces time-consuming processing allowing for fast and efficient decisions (Baron, 2008; Mitchell et al., 2007). In addition, solving by experience and trial and error reduces complexity by decreasing the number of choices (Payne, Bettman, & Johnson, 1993) and the cognitive effort needed (Åstebro & Elhedhli, 2006) so the individual is able to make fast and reasonably accurate decisions (Hoffrage & Reimer, 2004). Under these circumstances, selecting a satisficing strategy becomes critical if the individual considers he or she has a strong E-O fit. Therefore, for individuals who might not have the time, or are consumed by other constraints, and observe that they have a strong E-O fit; satisficing is then the proposed strategy as it reduces cognitive processes. On the other hand, when time is not a constraint and the individual considers that he or she may have a weak E-O fit, maximizing is then the recommended choice as it allows for an in-depth consideration of such opportunity. Thus, it is proposed that:

**Proposition 7a:** Under time constraints and the determination of a strong E-O fit, satisficing will increase the likelihood of venture success

**Proposition 7b:** When time is not a constraint and a weaker E-O fit is suspected, maximizing will increase the likelihood of venture success

**The Moderating Role of Cultural Fit**

Entrepreneurial research has shown that an individual can control the success of new ventures (Breslin, 2008). To succeed, it is important not only that these individuals exhibit a capacity that allows them to use knowledge, skills, and abilities relevant to their entrepreneurial activities (Collins, Smith, & Hannon, 2006) but that they are also capable to adapt and fit the cultural prototype of the country where a new venture is desired (Rozell, Scroggins, Amorós, Arteaga, & Schlemm, 2010). Cultural fit, also known as a cultural prototype, is defined as how well the entrepreneur matches the unique characteristics of a given culture (Rozell et al., 2010). This fit is important as a society’s cultural characteristics have a significant influence on the organizations within a given civilization (House, Hanges, Javidan, Dorfman, & Gupta, 2004). Furthermore, such societal traits serve as a filter for the preference exhibited for
some entrepreneurial behaviors, making some traits more desirable than others (Hayton, George, & Zahra, 2002).

It becomes clear then that entrepreneurial ventures that fit the cultural prototype and are endorsed by the culture where the venture operates have a stronger opportunity to succeed (Rozell et al., 2010). After all, organizations established within a certain society tend to be influenced by the cultural characteristics of the environment (House et al., 2004). An example of this relationship is the ethnographic work of Rozell et al. (2010) where cultural fit was deemed relevant to increase the likelihood of new venture success within populations from Brazil, Chile and Ecuador. A strong cultural fit contributed to the entrepreneur having a better opportunity to succeed and be effective. Although it was not directly tested, cultural fit, represented by areas such as knowledge of the prototypes, networking, interpersonal skills, and management style, was also pictured as a moderator between the entrepreneur and entrepreneurial success and effectiveness (Rozell et al., 2010). Thus, it is proposed that:

Proposition 8: Cultural fit will have a positive moderating relationship between E-O fit and venture success

The Moderating Role of Prior Start-up Experience

As part of the start-up process, prior experience has been found to be particularly important as it generates positive outcomes (Davidsson & Honig, 2003; Ucbasaran, Westhead, & Wright, 2009). This was the case among individuals who based on past entrepreneurial experiences were able to exploit opportunities and enter into nascent ventures (Davidsson & Honig, 2003). Furthermore, entrepreneurial experience have been positively correlated with individuals identifying a greater number of opportunities and exploiting those that seemed to be more innovative (Ucbasaran et al., 2009). Once they gain this knowledge, entrepreneurs have a better idea of what needs to be done to accomplish their identity aspirations (Farmer et al., 2011).

Prior start-up experience has been found to play a moderating role between entrepreneur identity aspiration and entrepreneurial behaviors being stronger for individuals with prior start-up experience (Farmer et al., 2011). Such
a moderating role was based on the notions that prior experiences can be a source of knowledge, provide role familiarity, which facilitates a successful transition into an entrepreneurial role, and strengthen the identity-behavior link via social ties from previous start-ups involvement (Farmer et al., 2011). Thus, it is proposed that:

**Proposition 9:** Prior start-up experience will have a positive moderating relationship between E-O fit and the venture success

**CONCLUSION**

This paper contributes to the understanding of entrepreneurship, particularly with respect to venture creation and success. While researchers have known that the opportunity is an important component in the entrepreneurial process (Shane, 2003; Shane & Venkataraman, 2000), the opportunity itself has received scant attention (Gregoire & Shepherd, 2012; Hurt & Serviere-Munoz, 2011; Shane, 2003). Thus, consistent with the work of Shane (2003), we have described and augmented the model of E-O fit and contend that both the entrepreneur and the opportunity are equally important variables in the entrepreneurship process advancing in this way our understanding of entrepreneurship and new venture creation. The model and propositions in this work suggest that the individual and the opportunity must not be considered independently of each other and that the relationship between the two is subject to contextual influences. Taken together, we provide theoretical arguments to explain, to a certain extent, why some entrepreneurial ventures might succeed while others fail. Individual characteristics are a necessary component of entrepreneurship (Markman & Baron, 2003); however, individuals who possess the right characteristics are not guaranteed a successful venture. This paper puts forth that the likelihood of venture creation and success are enhanced when the right person has a strong fit with the right opportunity. Last, such fit is positively moderated by the entrepreneur’s prior experience and cultural fit with the environment in which the venture is created.

**FUTURE RESEARCH**

Further insights can be gained when the opportunity itself has a larger role in the new venture creation process. Specifically, additional work is needed to understand the magnitude of influence presented by the opportunity itself. For
example, it is not clear how the opportunity may persuade an individual to exploit, or shy away from, a new venture. Similarly, it would be relevant to assess whether certain opportunity characteristics have the greatest influence on venture creation, or whether a prospective entrepreneur is influenced by the aggregate opportunity. In addition, the E-O model of entrepreneurship has identified resources and market realities as important characteristics of the opportunity. It would be worth exploring how changes in resources and market realities influence an individual’s view of entrepreneurship and whether and to what extent business and personal evolution occur. We concur with Gregoire and Shepherd (2012) that there is a need for future research to focus on discovering other differences (e.g., type, size, newness) among entrepreneurial opportunities and assess their respective influence on venture creation and success.

Our moderation analysis of cultural fit and prior start-up experience raises interesting questions regarding the context in which venture creation and success or failure occur. Indeed, more moderator analysis is needed to understand the ramifications on E-O fit and on other entrepreneurial relations. Industry-type, for example, may play a very significant role in E-O fit as survival rates among entrepreneurial firms is known to vary by industry (Phillips & Kirchhoff, 1989). Similarly, how does the global status of a new venture influence E-O fit and venture success? While the risks of internationalization pose added concerns for the global startup firm, is a domestic new venture at a disadvantage if the markets in which it operates are global? Geography is also worth exploring. Many domestic new ventures are created in towns bordering other countries. Such geographical position allows access to neighboring customers and to suppliers and distributors with different capacities, which poses the question: are domestic new ventures situated along country lines at a competitive advantage due to improved access to customers and suppliers?

There are some methodological implications that must be considered when attempting to test models such as the E-O model or to understand entrepreneurial behavior regarding the entire or partial model. When pursuing a quantitative data collection strategy, the development or adaptation of a scale is an effort that needs to be undertaken with its appropriate validation measures. In addition, a sample that truthfully represents entrepreneurs and their perceptions is needed so the results obtained offer the greatest utility and knowledge advancement to practitioners and researchers. To do so, such a sample must strive to include responses from several states or regions of a country. A sample
that captures only one city or small area can make a limited contribution to entrepreneurial research, as it might not be a true representative sample (Serviere 2010). This type of limited sample can fail to capture important variations that might occur when accounting for geographically dispersed individuals within a country (Serviere 2010). Clearly, much work remains to be done and it is our hope that the propositions in this study will encourage future researchers to quantifiably explore the E-O fit model of entrepreneurship.

REFERENCES


BENEFITING FINANCIALLY FROM ALLIANCES: DISENTANGLING ANTECEDENTS TO UPFRONT AND CONTINGENT MONEY

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High Point University

ABSTRACT

I examine the antecedents to two different types of remuneration promised early-stage technology ventures in alliance contracts: upfront versus contingent monies. I argue that the importance of the antecedents that predict upfront money paid to the early-stage technology venture at the beginning of the alliance are, for the most part, distinct from contingent money that is paid as the alliance progresses, and those types of funding should be disentangled in research that attempts to identify the monetary benefits derived from collaborative agreements. I find the predictors normally associated with funding amounts have differing impacts on upfront versus contingent money promised in the alliance contract in a sample of biotech firms.

Key Words: Technology, Innovation, Small Businesses, Entrepreneurial Business, Funding Businesses

INTRODUCTION

There is still much to be learned about alliances. We know a great deal about alliance structures and networks (Coombs, Mudambi & Deeds, 2006), but we know little about the alliance formation process that precedes the alliance (Ahuja, 2000). Similarly, the potential for alliances to create economic value in general is also well accepted and researched (Kale, Dyer & Singh, 2002), but we know little about the flow of monetary resources among collaborating firms (Coombs, Mudambi & Deeds, 2006). Finally, existing research has focused more on the benefits large established firms gain from alliances and more research on the benefits early stage technology firms receive from the alliances is still needed (Alvarez, Ireland & Reuer, 2005; Coombs, Mudambi & Deeds, 2006). This
research addresses the need for more research on the monetary benefits early-stage technology ventures receive from the alliances they form by examining the determinants of different types of remuneration (upfront versus contingent money) promised early-stage technology ventures in alliance contracts and in the process also address the flow of money within collaborative efforts.

Many researchers agree the typical early-stage technology venture needs to acquire both money and complementary resources from established firms when they form alliances (e.g. Coombs, Mudambi & Deeds, 2006; Rothaermel and Boeker, 2008; Teece, 1986). Unfortunately, recent research on alliances tends to use some measure of stock market performance, revenue coming into the firm as the alliance progress, and/or managerial evaluations to measure an early-stage technology ventures ability to profit from an alliance (see: Anand & Khanna, 2000; Arend, 2006; Coombs et al, 2006; Kale, Dyer, & Singh, 2002). These measure, while important, measure profiting as the alliance progresses and/or are potentially noisy measures that may, or may not actually reflect the money the early-stage venture receives directly from the collaborative agreements. The money promised firms in alliance contracts is available from secondary sources, is precise measure of the potential revenue a firm would expect from an alliance and thus, is a better measure of monetary benefits early stage technology ventures can expect from a collaborative effort.

In addition to problems with measurement, the type of money offered seems particularly important when early-stage technology ventures are involved. Early stage technology ventures often desperately need cash to continue product development (Coombs, Mudambi & Deeds, 2006; Kogut, 1988; Patzelt, Shepherd, Deeds, & Bradley 2008). A given number of early-stage technology venture owners may want to cash out of the firm in the foreseeable future and thus, upfront money would most likely be very important to the owners of these early-stage technology ventures. Similarly, venture capitalists will be planning to cash out if they are involved with the firm. Thus, it seems reasonable to assume the founders, current managers, and venture capitalists, if involved, will want to bring as much money into the firm as quickly as possible to provide needed revenue and/or in preparation to cash-out of the firm.

There are two distinct kinds of money negotiated in an alliance contract: upfront money and contingent (or milestone) money. Generally, upfront money is delivered to the early-stage technology venture when the alliance contract is signed, and contingent amounts are typically delivered to the early-stage technology venture as technological hurdles in the development of the innovative
product are overcome. Upfront money is guaranteed income and can be used immediately by the target firm while contingent money may or may not flow to the target firm sometime in the future. Evidence from trade journals indicates biotech firms prefer and negotiate for larger upfront amounts in lieu of larger contingent amounts (Carroll, 2012). Thus, disentangling the guaranteed, upfront monies is critical to a better understanding of how early-stage technology ventures can benefit from the alliances they form.

Existing research already indicates that the early-stage technology venture’s patent portfolio is an important factor for predicting the value of the early-stage technology in the biotech industry (Baum, Calabrese, & Silverman, 2000; Kortum & Lerner, 2000; Roberts, 1999; Stuart, 2000; Silverman & Baum, 2002; Stuart, Hoang & Hybels, 1999), and prior experience forming alliances is an important factor for predicting a firm’s ability to benefit from alliances as the alliance progresses (Kale, Dyer, & Singh, 2002). In this work, I combine these two streams of research on patenting and experience to explain the importance of, and differing antecedents that predict upfront and contingent remuneration. Specifically, I develop theory and hypothesis to show how patent portfolios and prior experience with alliances predict remuneration promised the early-stage technology venture in the alliance contract and discuss the importance of the results. To my knowledge, no one has previously attempted to disentangle factors that predict these two distinct types of funding.

In the following sections, I test four hypotheses. Hypothesis 1a and 1b test the impact of the early-stage technology ventures’ patent portfolio on upfront and contingent remuneration promised in the alliance contract. Hypothesis 2a and 2b test the impact of previous collaborative experience on upfront and contingent remuneration promised in the alliance contract.

THEORY AND HYPOTHESES

Money, The Control Of Resources, And Cooperative Agreements

A resource-based view of the firm (Wernerfelt, 1984) postulates that firm generates above normal revenue with the unique combination of resources (Barney, 1991) that are hard for other firms to duplicate (Dierickx, & Cool, 1989). Alliances arise from a strategic need for critical resources held by another firm (Eisenhardt, & Schoonhoven, 1996) and of course, the collaborative effort is
intended to create more value compared to each firm working independently in open markets or merging the two firms (Zajac & Olsen, 1993).

Collaborative efforts like alliances do not entirely exclude competition among the firms in the alliance. An inherent tension exists among partnering firms as each firm balances the urge to maximize their own benefits against the desire to achieve collaborative goals (Coombs et al., 2006; Kogut, 1988; Patzelt et al., 2008; Zeng and Chen, 2003). Opportunistic behaviors tend to be prevalent in knowledge-intensive collaborations, like those in the biotech industry, as firm position themselves to maximize their own returns at the expense of their partner (Deeds and Hill, 1998; Gans & Stern, 2003).

The control of valuable resources provides firms with leverage that can be used to demand top dollar for its product or services (Pfeffer, & Salancik, 2003). The amount of money negotiated in an alliance contract is to a great extent determined by the value of the resources each partner controls (Forshey, 2014). Specifically, the ability of the early-stage technology venture to leverage the control of the innovation (or product) will determine the value it can extract from the collaborative effort (Hamel, 1991), and the ability of the funding partner to leverage the control of complementary resources needed to bring the innovative idea to market will determine the value the funding partner can extract from the alliance (Rothaermel, 2001a; Rothaermel, 2001a; Teece, 1986). Thus, the money an early-stage technology venture can extract from the alliance is rooted in both value of the innovative idea (or product) and the ability leverage the control of the innovative idea (or product) during negotiations while controlling for the value of the funding firms complementary resources and the funding firm’s ability to leverage complementary resources for its own financial advantage. Going forward, I use patent portfolios as a measure of product value, and use the firms past experience with alliances as a proxy for the ability to leverage the value of the innovative idea in such a way as to maximize the revenue coming into the early-stage technology venture.

**Up-front Versus Contingent Monies**

One can conceptualize upfront money in at least two ways. Upfront money can represent buying-in to the early-stage venture’s innovative idea: the funding firm believes there is future value in the innovative idea and wishes to gain access to a valuable product that is currently controlled by another firm.
(Folta & Miller, 2002; McGrath, 1997; McGrath & Nerkar, 2004; Reuer & Tong, 2005; Vassolo, Anand, & Folta, 2004). Second, upfront money can be conceptualized as compensation given to the early-stage venture for progress already made on innovation. Risks diminish and products become more valuable as they overcome technical hurdles as the product approach release to the secondary markets (Santoro & McGill, 2005). So, upfront money compensates the early stage technology venture for work already completed and buys access to any future value the innovative product may produce.

As mentioned in the introduction, contingent amounts are typically paid as technical hurdles are overcome during the product-development process sometime in the future. Contingent amounts are a means of reducing risk for the funding firm by delaying payments until contractual obligations are met or technical hurdles are overcome (Bowman & Hurry, 1993; Folta & Miller, 2002; McGrath, 1997; McGrath & Nerkar, 2004; Reuer & Tong, 2005; Vassolo, Anand, & Folta, 2004). The probability a product will reach the product market where it can generate revenue increases as each hurdle is successfully completed (Rothaermel & Deeds, 2004), and the early-stage technology venture is compensated only after that progress is demonstrated.

### Patent Portfolios

In the biotechnology and pharmaceutical industries, patent statistics provide an effective measure of a firm’s intellectual property (e.g., Sorenson & Stuart, 2000). In general, patents transform knowledge and skills (an intangible asset) into a tangible, protected asset that can be bought or sold (Levin, Klevorick, Nelson, & Winter, 1987). Patents also provide relatively strong legal protection for the early-stage technology venture’s intellectual property by providing a means to exclude others from using patented resources (Lerner & Merges, 1998; Levin et al., 1987).

Specifically, patents demonstrate the value of early-stage technology ventures in multiple ways. Important patents represent the depth of a firm’s technological knowledge base (Stuart, Hoang, & Hybels, 1999). The early-stage technology venture’s technological knowledge base in turn reflects the overall innovative ability of a firm (Baum, Calabrese & Silverman, 2000; Kortum & Lerner; 2000; Roberts, 1999; Stuart, 2000). The accumulation of patents over time demonstrates technical accomplishment, and a firm’s patent portfolio in the
biotech field serves as a public display of progress, typically called patent races, that helps differentiate high-performing early-stage technology firms from lower performing competitors (Silverman & Baum, 2002). Thus, patent portfolios are a useful means to assess the relative value of early-stage technology ventures compared to its peers in the biotech industry.

Past research has linked patents to investments by foreign companies (Shan & Song, 1997) and investments by investors in the equity markets (Deeds, DeCarolis, & Coombs, 1997). Past research also indicates that experienced firms in competitive markets can glean valuable information from patent data (Hall, Trajtenberg & Jaffe, 2005; Levitas & McFadyen, 2009) and tend to be skilled investors in other companies (Lerner, Shane, & Tsai 2003; Rothaermel & Hill, 2005). Thus, one would expect the firms providing the funding to early stage technology ventures through alliance to be skilled at assessing the potential value of patents filed by early stage technology ventures and making investment decisions based on in part on assessments of patent portfolios. Since patent portfolios represent both the value of the innovative idea the early-stage venture owns and the current state of product development, one would expect more valuable ideas to garner more up-front money at the onset of the alliance.

**Hypothesis 1a:** There is a positive relationship between the early-stage technology venture's patent portfolio and the upfront money it is promised at the time of alliance agreement.

Alliances are a complex organizational form governed by a contract that is incomplete and incapable of specifying all the contingencies that may arise in the future and thus, alliances are fraught with a multitude risks (Anand & Khanna, 2000). Contingent payments are a means to control for future risks, and are only paid out as technical hurdles are overcome and risk diminishes. Thus, one would not expect contingent payments to be highly influenced by an innovation’s current state of development assuming the funding firm has already fairly compensated for the current value of the innovation at the beginning of the alliance with upfront money.

**Hypothesis 1b:** The early-stage technology venture's patent portfolio is not a significant predictor of contingent amounts promised at the time of alliance agreement.
Prior Experience Forming Alliances

Similar to a patent portfolio that represents both the current state of development and technical expertise held within the firm, prior experience with alliances is potentially a measure of managerial expertise. Evidence suggests higher levels of “collaborative know-how” (Simonin, 1997) tended to increase the tangible rewards firms captured from an alliance using a data set of large firms. “Collaborative know-how” (Simonin, 1997) is retrievable knowledge built up over time from past experiences that is embedded in and unique to the firm (Dierickx, & Cool, 1989; Penrose, 1959). “Collaborative know-how” includes, but also goes beyond the experience of individuals within the firm (Dierickx & Cool, 1989; Simonin 1997). Embedded, retrievable knowledge will mostly survive within the firm even as people leave the firm. Simonin (1997) specifically defined “collaborative know-how” in the context of alliances as the ability to successfully identify and select potential partners, negotiate the terms of the alliance contract, and establish the initial structure of the collaborative effort (among other things that relate managing the ongoing alliance that do not pertain to this research). More recent research supports Simonin’s (1997) findings. Anand & Khanna (2000) identify firm experience as one of the most important factors for generating higher stock returns from a collaborative alliance. Kale, Dyer, & Singh (2002) noted that both research and anecdotal evidence tends to support the idea that firms with more collaborative experience glean more value from alliance. As before, I measure monetary rewards with the upfront and contingent remuneration promised in the alliance contract. However, in contrast to patent activity, a firm’s prior experience with alliances should have a positive impact on all aspects of finding a good partner and negotiating a contact and thus, have a positive impact on both upfront and contingent money.

Hypothesis 2a: More alliance experience will result in more upfront money promised to the early-stage technology venture in the alliance contract.

Hypothesis 2b: More alliance experience will result in more contingent money promised to the early-stage technology venture in the alliance contract.
METHODS

Industry Setting

The biotechnology industry is the setting for this research. Ahuja (2000) noted that success in the biotech-pharmaceutical industry is partly a function of successful partnering. The innovative nature of the industry and tendency of biotech firms to specialize in the development of new products while established pharmaceutical companies concentrate on developing specialized complementary assets makes this industry an ideal setting for research examining the flow of money among early-stage technology ventures and established firms controlling complementary resources.

In addition, early-stage technology ventures in the biotech industry need money and other complementary resources for an extended period of time. The development time required to bring a new drug to market generally takes about 15 years, with costs that exceed 500 million dollars (Rothaermel & Deeds, 2004). These conditions potentially leave biotech firms in need of funding sources for years or even decades if they are to survive (Coombs, Mudambi, & Deeds, 2006). Thus, the ability to find finding funding through alliances should be a critical factor in the success early-stage ventures in this industry.

Data and Sample

The sample for this research consists of US-based, publicly traded biotech companies operating in standard industrial classification codes 2834, 2835, and 2836 focused on the development of new technologies who entered into research and development alliances with pharmaceutical firms that between 1989 and 2008.

I constructed a unique data set using multiple sources of information. Deloitte and Touche's RDNA database identifies the alliances of these early-stage venture firms both prior to and after turning public, the upfront and contingent amounts negotiated for those alliances, the disease/research category of the early-stage venture’s products, and the developmental stage of the products at the time of the alliances. The Securities and Exchange Commission’s (SEC) S1, SB2, or 10K filings found on the SEC’s EDGAR database or the focal company’s web pages provide private-public status, and age of the firm. The
IMS Life Cycle database provides product pipeline and other product data. The National Bureau of Economic Research (NBER) patent citation database is the source for patent data, and the Wharton School Research Data Services’ (WRDS) Compustat and CRSP databases provide financial and other filing data.

**Variables**

**Dependent Variables**

The two dependent variables in this study are the amount of upfront money and all contingent money promised to the early-stage technology venture by the partner (or funding firm) at the time of collaboration’s announcement. Upfront money is all the money promised the early-stage technology venture at the beginning of the alliance. Contingent money is any money that is promised in the future and includes milestone amounts and royalties. Milestone amounts are dispersed as the early-stage technology venture accomplished predetermined contractual obligations, and royalties are received only after the product reaches the product markets. Both of the dependent variables are skewed and therefore are transformed using the natural log of the raw data. All monetary variables, including both dependent variables, are all adjusted to 2009 dollars (in millions) to provide consistent values over time and thus, more accurate measurement.

**Independent Variables**

Consistent with previous research (Hall, Jaffe, & Trajtenberg, 2005; Kelly & Rice, 2002), I use patent citations to capture the value of funding firm’s patent portfolio. Patents reveal the accumulation of economically valuable knowledge. Patent usefulness, similar to academic journal articles, can be measured using subsequent patent citations (Hall et al., 2005; Trajtenberg, 1990). Patents that are cited more often by subsequent patents are considered more valuable vis-à-vis patents receiving fewer citations (Hall et al., 2005; Trajtenberg, 1990). In addition, the USPTO (United States Patent and Trademark Office) classifies patents by technological category. Each of technological classification tends to demonstrate differing rates of patenting, technical advancement, and value (Trajtenberg, 1990). Thus, this procedures take into account both citation rates and technological classification when assigning a value to a firm’s patent portfolio.
Specifically, I count the number times each patent is cited, divide the citation count by the mean patent citation count for all patents produced by all U.S. publicly traded biotechnology firms I identified in the focal patent’s filing year and technological class. I then add together the firm’s standardized patent citation values. The sum of the standardized patent citation values represents the “Patent Stock” by the focal firm by year. More recently issued patents, due to lower exposure time, may receive fewer citations than older patents. Thus, I add the current yearly patent stock to the previous four years’ patent stock to capture recent innovative output of the focal firm. Patent Stocks have been used frequently in the patent-based innovation research (e.g., Henderson & Cockburn, 1994). The advantage of using Patent Stock in this research is that it provides a multi-year aggregate signaling value for recent patent activity. The variable ESTV Patents (ESTV is constitutently used for the early stage technology venture variables) is the patent stock measure.

Previous research indicates that a firm's experience in forming alliances impacts a firm’s ability to extract benefits from the alliance (Anand & Khanna 2000; Kale, Dyer, & Singh, 2002; Rothaermel & Deeds, 2006; Simonin, 1997). ESTV Prior Alliance is the sum of the early-stage technology venture’s previous alliances.

Control Variables

Past research on alliances suggests the need to include several control variables in the empirical models. Firm’s seeking funding turn more often to alliances when the availability of funding in the capital markets drops (Lerner, Shane, and Tsai, 2003). I use the variable IPO Market to account for "hotter" or "cooler" IPO markets. This variable is a measure of the total number of successful biotech IPOs in the year preceding the alliance, and is a measure of the receptivity for new issues in the biotech sector (Brown, 1970). I account for the size of both the funding firm and the early-stage venture using the number of employees. FF employees (FF is constantly used to identify funding firm variables) is the number of people employed by the funding firm. ESTV employees is the number of people employed by the early-stage technology firm. FF Patents utilizes the same procedure to assign value to the funding firm’s patent portfolio that I used for the early-stage technology venture.

Specialized complementary assets by definition require time and money to develop. Funding firms with more years of experience will have spent more time developing the expertise needed to get products through clinical trials, spent
more time developing specialized manufacturing techniques, and spent more
time establishing the necessary contacts to implement successful marketing
campaigns and distribute products. *FF experience* measures the funding firm’s
experience in the same product market as the early-stage technology venture’s
innovative idea or product. *FF experience* is the year of the alliance minus the
year the funding firm enters the same product market as the early-stage
technology venture’s product. Consistent with Teece (1986) and more recent
research (Rothaermel 2001a; Rothaermel 2001b) I expect more experience in the
product market to have a negative impact on the amount of money the early-
age stage technology venture is promised in the alliance contract.

Ongoing growth and profitability in the biotech-pharmaceutical industry
are a function of bringing a string of new successful products to market (Roberts,
1999), thus advancing potential drugs through the US Food and Drug
Administration (FDA) clinical trials process is a public measure of an important
complementary resource controlled by the pharmaceutical companies. Early-
age stage biotechnology ventures, often not possessing competencies associated with
the clinical trials process themselves, seek out partners who have expertise in
successfully navigating FDA’s approval process (Pisano, 1990). This rigorous
approval process includes several considerable hurdles and has led to a high
failure rate among potential drugs (Rothaermel & Deeds, 2004). Navigating the
clinical trials process is a function not only of a potential treatment's therapeutic
efficacy and safety, but also of other competencies such as managing
administrative demands of clinical trials, the ability to manufacture enough
product to supply clinical trials, and the ability to fund the clinical trial process
sufficiently (e.g. Pisano, 2006, Rothaermel & Hill, 2005). I use the variable *FF
Drugs Failed* to account for failures in the clinical trial process. *FF Drugs Failed*
is the number of failures in the year prior to the alliance. I expect more failures to
result in more remuneration going to the early-stage technology venture since
funding firms will need to restock a depleted product pipeline.

I use the variable *ESTV Public Status* to differentiate between alliances
that occur while the firms are still privately owned and alliances that occur after
the early-stage technology venture is a publicly traded company. *ESTV Public
Status* is a dummy variable coded 0 when the firm is a private entity and 1 after
the firm’s IPO. Products in the pipeline in conjunction with patent activity are a
well-accepted measure of performance and serve as a proxy for successful
innovative activity in the biotech/pharmaceutical industry (Baum Calabrese, &
Silverman, 2000; Kortum & Lerner; 2000; Roberts, 1999; Stuart, 2000). I created
the variable *ESTV Product Pipeline* by summing all the products in preclinical through phase 3 clinical trials as reported by the IMS life cycle database for each early-stage technology venture. I control for repeated alliances among the same partners with the dummy variable *Repeat Alliance*. I code *Repeat Alliance* 1 when the alliance is between partners who have a previous alliance together and 0 when the alliance is not between partners who have previous alliance experience with each other. As mentioned earlier, many early-stage technology ventures desperately need funding (Coombs, Mudambi, & Deeds, 2006; Kogut, 1988; Patzelt, Shepherd, Deeds, & Bradley 2008). Desperate firms may accept an alliance contract they could otherwise reject. Consistent with Kim, Mauer, and Sherman (1998) I created the variable *ESTV liquidity* to account for varying funding needs. *ESTV liquidity* is Cash + Equity/Total assets. Firm location is known predictor of firm performance (DeCarolis, & Deeds, 1999). I also control for known clusters of biotech research. Locations with a p>.8 were dropped from the final analysis. *Location Boston, Location San F Location San D etcetera* are code 1 when the early-stage technology venture is in that location and 0 when it is not (See Appendix B for a complete list of locations used in this study).

The Food and Drug Administration (FDA) requires drugs go through a detailed screening process. Drugs tend to become more valuable as they advance though the clinical trials process (Lerner, Shane, & Tsai, 2003). I use *Stage Code 1, Stage Code 2, and Stage Code 3* to control for advancement through the later stages of the clinical trials process. Stage 1 marks the beginning of human safety testing for therapeutic drugs. Stage 2 marks the beginning of small-scale human efficacy trials, and Stage 3 is the beginning of large-scale human efficacy trials. These dummy variables are coded 0 when the drug is not in the corresponding stage of development and 1 when the drug is in the corresponding stage of development when the alliance is formed.

Different therapeutic classes tend to have different values to potential partners (Folta, 1998). The dummy variables *Therapeutic Class A, Therapeutic Class B, Therapeutic Class C* and so on account for each therapeutic class in this study (See Appendix A for the definitions corresponding to each therapeutic class in this research). I coded each of these dummy variables 1 when the product in the target therapeutic class and 0 when it is not.

**Model and testing**
This research has two distinct dependent variables, upfront and contingent remuneration, utilizing the same independent and control variables, and I anticipated some relationship between the two regression equations. Therefore, I used a seemingly unrelated regression to account for any correlated error between the two regression equations. The Breusch-Pagen test of independence confirms a correlation among the residuals (see Table 2).

**Results**

Table 1 contains the descriptive statistics and the correlation matrix. There are 295 dyads in this study. For clarity, the stage code, location, and therapeutic class dummies are omitted from this table. A completed correlation table with all 33 variables is available upon request. The sample is split with 70% of the alliances formed while the early-stage technology venture is a public firm and 30% of the alliances formed prior to the early-stage technology venture trading on public markets. Repeat alliance accounted for 34% of the alliances in this sample. The highest variance inflation factor (VIF) among the variables is 1.88. Thus, the VIF scores are sufficiently low and do not indicate any serious multicollinearity among the variables. Complete VIF scores are available upon request.

Table 2 shows the results of our regression analysis. The table is set up side by side for clarity in publication. The left 3 columns show the results for upfront money and the right 3 columns show the results for contingent money. The specific results for the stage code location, and therapeutic class dummy variables are omitted when p>.05 to make the table easier read.
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<td>0.1391*</td>
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<td>9</td>
<td>ESTV Public Status ³</td>
<td>0.2878*</td>
<td>0.1641*</td>
<td>0.1272*</td>
<td>0.1790*</td>
<td>-0.2811*</td>
<td>0.1600*</td>
<td>0.0714</td>
<td>-0.1637*</td>
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<tr>
<td>10</td>
<td>ESTV Product Pipeline</td>
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<td>31.5172</td>
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<td>-0.0345</td>
<td>0.0163</td>
<td>-0.0406</td>
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<tr>
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<td>Repeat Alliance ⁴</td>
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<td>0.0326</td>
<td>0.0309</td>
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<td>-0.0341</td>
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<td>-0.0101</td>
<td>0.1513*</td>
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<tr>
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<td>0.1328</td>
<td>0.0121</td>
<td>-0.0048</td>
<td>0.1691*</td>
<td>-0.4891*</td>
<td>-0.1010</td>
<td>0.0032</td>
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<td>0.0142</td>
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* p<.05  
² = Log Adjusted  
³ = Dummy Variables  
⁴ = Dummy Variables

The stage code, therapeutic class, and location dummies are removed for clarity.
Model 1 tests the control variables. The variables *FF Experience, FF Drugs Failed, Location Boston* and a *Therapeutic Class L* reached a significant level of p<.05 for upfront money while *FF Employees, Stage Code 2 & 3, and Therapeutic Class N* reached a significant level of p<.05 for contingent money in Model 1. The control variables that reach a significant level mostly differ when the dependent variable changes from upfront to contingent money. Providing partial support for the overall premise.
that the antecedents that predict upfront monies differ from those that predict contingent monies. Stage of development is the only control variable that consistently predicts both upfront and contingent monies in this sample. Model 2 test Hypotheses 1a and 1b. The variable ESTV Patent Portfolio is significant, p<.05 for upfront monies. Thus, Hypothesis 1a, there is a positive relationship between the early-stage technology venture's patent portfolio and upfront money, is supported. In addition, the variable ESTV Patents is not significant, p>.05 for contingent monies. Thus, Hypothesis 1b, the early-stage technology venture's patent portfolio is not a significant predictor of contingent amounts, is supported. Model 2 tests Hypotheses 2a and 2b. ESTV Prior Alliances is significant p<.05 for both upfront monies and contingent monies. Thus, Hypotheses 2a, more alliance experience will result in more upfront money, is supported, as is, Hypothesis 2b: More alliance experience will result in more contingent money. Model 3 reinserts ESTV Patents back into the regression as a control variable to account for the physical resources of the early stage technology firm. ESTV Prior Alliances is still significant p<.05 for both upfront monies and contingent monies adding further support for Hypotheses 2a and 2b. In sum, these finding support not only the individual hypotheses but also, the overall premise of this research: there are important differences in the antecedents that predict upfront money compared to contingent money.

**DISCUSSION**

I began this research project because popular literature indicates early stage technology ventures value upfront money differently than contingent money (Carroll, 2012), academic work has long postulated that immediate funding is important to early stage technology ventures (Coombs, Mudambi & Deeds, 2006; Kogut, 1988; Patzelt, Shepherd, Deeds, & Bradley 2008), and with the idea that there are different antecedents to the different types of remuneration early-stage technology ventures negotiate in an alliance contract.

Measuring remuneration directly is also important if one is to understand the flow of money among alliance partners. Precisely measuring how much money the early-stage venture is promised in the alliance contract provides a reasonably clean measure of the financial benefits an early-stage technology venture generates directly from a partner. In addition, this allows one to separate upfront from contingent monies. I argue this measure is superior to using stock prices after the alliance is formed because stock prices are potentially influenced...
by factors other than the alliance. Understanding the factors that bring immediate, unconditional revenue to the early-stage technology venture should be important to practitioners in general, and particularly important to entrepreneurs and other owners who wish to cash out of the company in the near future.

I assert that the control of a valuable innovative idea should be a strong predictor of upfront money (Das, Sen, & Sengupta; 1998; Sarkar, Echamadi, & Harrison, 2001), and that one could conceptualize upfront money, at least in part, as compensation for the time and money the early-stage technology venture has already invested developing the innovative idea. I measured the value of the innovative idea using patents citations, and found a positive relationship between the value of the early-stage technology ventures patent portfolio and the upfront remuneration promised in the alliance contract.

Contingent money, in contrast to upfront money is by definition offered only as the early-stage technology venture meets contractual obligations sometime in the future. Contingent monies reduce the risk for the funding firm by withholding payments until after contractual conditions are met and delays payments to some future date (Bowman & Hurry, 1993; Folta & Miller, 2002; McGrath, 1997; McGrath & Nerkar, 2004; Reuer & Tong, 2005; Vassolo, Anand, & Folta, 2004). The contractual obligations in innovative markets like biotech often involve overcoming technical hurdles that advance the product toward market release. I did not expect a patent measure to be a significant indicator of contingent money, because patents primarily represent the current state of development and, most likely, will offer limited information about the ability to overcome future technical hurdles. My results supported the assumption that a patent portfolio was not a significant predictor of contingent money.

Prior experience with alliances, in contrast, was a significant predictor of both upfront and contingent money. More experience tended to result in larger amounts of money for the early-stage venture. The results support the idea that the early-stage technology venture builds up collaborative know-how that assists in the selection of partners and the negotiation of contracts with each successive alliance (Simonin, 1997). Practitioners should be aware that experience matters, and less-experienced firms that held innovations of similar value tended to accept lower values in alliance contracts.

Consistent with past research on alliance experience (Anand & Khanna 2000; Kale, Dyer, & Singh, 2002) the early-stage technology venture’s patent
portfolio was also inserted as a control variable when testing prior experience with alliances. The early-stage technology venture’s patent portfolio does not reach a significant level \( p > 0.05 \) as a control variable when firm experience is in the regression equation. This is a somewhat surprising result given the previous literature on the value of patents (Baum, Calabrese & Silverman, 2000; Deeds, DeCarolis, & Coombs, 1997; Kortum & Lerner; 2000; Roberts, 1999; Shan & Song, 1997; Silverman & Baum, 2002; Sorenson & Stuart, 2000; Stuart, 2000; Stuart, Hoang, & Hybels, 1999); however, it does indicate that experience matters a great deal when negotiating the alliance contract.

Firm location is another common control variable (i.e. DeCarolis, & Deeds, 1999). Recent evidence indicates specialized local economies (often called clusters) still provide a competitive advantage even in a global economy with effective long-distance communication systems and efficient supply chains connecting firms (see: Porter, 2000 for a recent discussion on the value of clusters). The location of the firm is a significant predictor of how much upfront money early-stage technology ventures are promised in the alliance contract but not for contingency money. Overall, our results indicate that location is one of the factors that is unique to only the one type of funding, so if entrepreneurs have a choice, locating near a known cluster of similar businesses would tend to generate more upfront money in addition to supporting the development of their product.

In addition, it is generally accepted that product markets tend to differ in munificence (Dess, & Beard, 1984), so firms in some product markets tend to be more profitable than firms operating in different product markets (Porter, 1980). Our results indicate certain product markets are consistently more valuable. I measure product markets using therapeutic classes. Certain therapeutic classes are significant predictors of upfront money, and certain therapeutic classes are a significant predictor of contingent money. However, no single therapeutic class is a significant predictor of both contingent money and of upfront money.

Latter stages of development tend to predict both upfront and contingent money, but only the last two stages of development predict higher contingent amounts. A larger amount of money going to products in later stages of development is consistent Lerner, Shane, & Tsai (2003). In sum, both our independent variables and our control variables support our overall premise that upfront and contingent monies have different antecedents. Upfront and contingent monies benefit the firm in different ways and should be separated out in future research.
LIMITATIONS AND FUTURE DIRECTION

First, to my knowledge this is the first attempt by anyone to disentangle upfront monies from contingent monies and as a result there are a few concerns. I focused on the root sources of value creation. There are undoubtedly additional factors that could refine these results either as direct affects or moderators. This study is a single industry study, so any findings should not be generalized to other industries. I used several control variables from past research on alliances and then, applied them to a different type of question: alliances as a funding source. Consequently, a couple of variables, location for example, could use additional research in the context of early-stage technology ventures using alliances as a funding source. Finally, this is also a firm level analysis that does not address the contributions of individuals within the firm, so a finer grained analysis of “experience” could be useful.

While this data does indicate the location and the market the early-stage technology venture chooses to enter is a meaningful consideration for the owners of early-stage technology ventures, the data here does not allow for the full exploration of the specific impact associated with different locations or different market segments for the early-stage technology venture. Future research could help provide a more detailed explanation of the impact specific locations and technological areas have on early-stage technology ventures.

The resource based view of the firm postulates that firm performance is the result of the unique configuration of resources by managers (Barney, 1991). Thus, some interaction among managerial experience (previous alliance experience) the tangible resources (the patent portfolio) held by the early stage technology firm would be anticipated. In a post hoc, there is not any interaction among the variables in this study (results available upon request). This result is most likely because patenting and previous experience with alliance are both knowledge bases even if the knowledge itself is very different: technical knowledge versus managerial knowledge. Studies looking at different independent variables may provide different results, and would add to the existing literature.

Finally, the use of firms turning public allows the use of multiple secondary sources of data, and provides some important control variables like firm liquidity. However, limiting a data set to firms have public sources for financial data also potentially introduces survivor bias, and eliminates firms that
choose to stay private corporations. More work including, or exclusively on private firms would also be useful.

CONCLUSIONS

I began this research with the hope of adding to the existing literature by disentangling different types of alliance funding. I found that both the inherent value of the innovative idea (or product) is an important predictor of upfront money, but does not significantly impact contingent money. Firm experience, in contrast, is consistently a significant predictor of both types of remuneration, and several of the control variables that reached a significant level are different. Thus, it is probably wise for researchers to separate the types of remuneration in future research because managers view the two types of remuneration have differently (e.g. Carroll, 2012) and upfront monies and contingent monies have different antecedents.

REFERENCES


Appendix A: Definitions of the Therapeutic Classes

A  Alimentary Tract And Metabolism
B  Blood And Blood Forming Organs
C  Cardiovascular System
D  Dermatologicals
G  Genitourinary System And Sex Hormones
L  Antineoplastic And Immunomodulating Agents
M  Musculoskeletal System
N  Central Nervous System
NR Not Reported

Appendix B: Locations

Location Seattle
Location San Francisco
Location San Diego
Location Philadelphia
Location NY Tri-state area
Location Los Angeles
Location DC area
Location Boston
TRANSPORTING SERVICES TO THE CUSTOMER: 
EXPLORING USER-GENERATED CONTENT AND 
ENTREPRENEURSHIP

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ABSTRACT

Marketing education in the application of User-Generated Content (UGC) has become increasingly more important for the entrepreneur. UGC gives consumers the ability to engage with brands and develop virtual relationships. This can prove especially helpful to nascent brands facing a competitive landscape continually barraged with marketing messages. This study explores UGC as it pertains to the mobile business entrepreneur and the challenges entrepreneurs face in developing nascent brands. Data is used to assess the UGC influence on existing mobile businesses and consumer perceptions brand personalities. The findings confirm the importance of developing and maintaining active web presence and social media campaigns as important steps in establishing a brand. Guidelines are provided for organizations looking to develop marketing campaigns.

Keywords: User-Generated Content, Marketing, Brand Personality, Mobile Business

INTRODUCTION

Entrepreneurship has become an increasingly popular career opportunity among the Millennial generation (Fenn, 2010; Ribitzky, 2011). Growing up hearing the wildly successful stories of entrepreneurs such as Steve Jobs, Bill Gates, and Mark Zuckerberg, this generation of tech-savvy professionals are inclined to take risks in pursuit of their passions and career aspirations. This large demographic generation (born between 1982-2000) is now entering the workplace and quickly becoming an increasingly influential force impacting career paths and workplace dynamics (Reiser, 2010). Key to addressing this career mindset is consideration of education and its impact on supporting their entrepreneurial success. As such, entrepreneurial education developments and
focus involves methods of practice to create and support entrepreneurial mindsets and action (Neck & Greene, 2011).

One skillset often underappreciated among new entrepreneurs is the development of entrepreneurial marketing skills. In fact, recent research suggests that traditional marketing courses would benefit from a more entrepreneurial perspective (Hultman & Hills, 2011). Whether your business concept is grooming pets or developing circuit boards, the ability to market yourself and your organization may determine the success or, unfortunately, the failure of your business. Therefore, marketing skill development is proving to be an important component in the pursuit of entrepreneurship and the evolution of entrepreneurship education. “Selling” your business idea at a business plan competition requires interpersonal communication in order to build relationships with potential investors. Effectively developing your brand image including the development of your website, social media strategies, and press materials often falls into the hands of the entrepreneur themselves. Further, marketing includes the creation and innovation of ideas and disciplined risk-taking opportunities. Studies have found that entrepreneurship education is lacking at all levels including higher education (Regele and Neck, 2012) and developing a theoretical understanding through entrepreneurial marketing may assist in filling this gap (Hultman and Hills, 2011).

Our study explores the growing popularity of mobile businesses or businesses on wheels. This mobile concept of bringing products to consumers has expanded far beyond simple pizza delivery and car window replacement services. Mobile businesses now encompass a wide array of product and service categories including, but not limited to, food trucks, pet grooming, knife sharpening services, grocery delivery, clothing boutiques, salon services, video gaming and even dental care. For example, recently, medical doctors who are registered anesthesiologists have begun to deliver the cure for a hangover. The Hangover Doctor (based in Waikiki, Oahu) provides customers with an intravenous therapy called the Myer’s enabling those who overindulged the night before to quickly get back to their daily lives. With prices reaching $349, the mobile hangover cure must uphold an image of professionalism and customer relationship in order to sustain success. This organization’s ability to establish a reputable brand perception and credibility among its target consumers greatly impacts business growth and sustainability. As part of the marketing process, the entrepreneurial perspective should be continually evaluated by the business organization (Hultman and Hills, 2011).
The acceptance of mobile truck businesses as a professional business platform stems from the changes in professional business environment. For example, the traditional suit and tie attire may not be the sought after dress code for the upcoming millennial business professional (Reiser, 2010; Ribitsky, 2011). Additionally, climbing the ladder to secure the coveted corner office does not hold the prestige as it formally held in past generations. Technology gurus and app developers working out of the garage and strolling to work in board shorts and flip-flops has become an acceptable level of professionalism in some circles. Paired with the evolving focus on balance between work and life, this enables the mobile business entrepreneur to attain higher levels of brand prestige by presenting a new model for a retail store presence. A new wave of entrepreneurs has propagated the popularity of ‘food trucks’. Once solely associated with hot dog vendors the mobile retail truck has moved into other industries as an affordable business venture strategy. These changes present educators with an opportunity to explore marketing strategies to support these nascent, moving brands.

Many popular television shows embrace the growing trends of mobile businesses. For example, in 2014, the documentary “Chef” starring Jon Favreau as “El Jefe” explores the dramatic success and challenges of entrepreneurial food truck chefs (Alexander, 2014). In addition, the Cooking Channel developed their version of food truck evaluation with the television show “Eat St.” The show starring comedian James Cunningham seeks out food truck business across North America found (www.cookingchanneltv.com, retrieved June 13, 2015). Recently owners of over 200 mobile retail trucks have come together to create an association geared at helping entrepreneurs launch their mobile business in areas all across the United States. The American Mobile Retail Association (AMRA) has over 200 members in Southern California and continues to expand across North America (http://americanmobileretailassociation.blogspot.com/p/about.html, retrieved June 8, 2015). According to the National Federation of Independent Businesses, businesses on wheels have come to encompass everything from hair salons, high-tech repair shops and even the makers of artificial limbs (Wee, 2013). The expansive development of this style of business has lead to our research on the exploration of brand development and consumer perceptions of these nascent brands.

Examining mobile businesses with an entrepreneurial marketing perspective provides a unique opportunity to identify the important skills in the
world of marketing required when establishing nascent brands utilizing an emerging retail placement strategy. These skills and strategies involve usage of technology and social media, two areas in which the newest group of entrepreneurs and their consumers are most comfortable (Lingelbach, Patina, and Pitta, 2012). Additionally, transactional payment developments such as the Square mobile credit card reader and Apple Pay make the collection of electronic customer files much easier to manage and thus provide entrepreneurs with the data to effectively engage with their customers across online platforms. The challenge of how to best utilize this data collection in support of a new business puts more focus on the importance of brand building and marketing development. In this paper, we consider the mobile business platforms across three scenarios 1) as an extension of an existing retail brick and mortar space, 2) as a supplement to an ecommerce website, and, 2) as a sole retail delivery platform, to improve the success of these businesses.

MOBILE BUSINESS ENTREPRENEUR

Mobile business is not a new concept, rather it is a developing area of business platforms due to changes in technology and shifts in the business landscape (Linnekin, Dermer, Galler 2012). There are obvious reasons for the influx of mobile businesses such as lower cost of entry, advances in mobile commerce technology and changes in consumer expectations involving retail brand experiences. Costs associated with building a mobile truck pale in comparison to the costs of building out and leasing a traditional brick and mortar storefront. Technology advancements make it easier to keep track of consumers digitally as well as provide simple, secure credit card payment services. Finally, the ability to provide a fluid work environment makes the traditional retail front location seem outdated (Wee, 2013). Further, incorporating the retail experience into the consumer lifestyle via a mobile operated business delivers more than just convenience. This strategy can evoke a deeper level of engagement and consumer loyalty. Add to this a powerful generation of Millennials entering the workforce who find it perfectly acceptable to run a business out of a car or truck, and you are faced with real opportunity for budding entrepreneurs to manage around one of the key barriers of entrepreneurship, that is securing the financial resources to get your product or service in front of your customer.

Individuals in the millennial generation are part of a changing lifestyle segment and see the allure of nontraditional work environments (Wee, 2013).
This next generation of business owners rejects the traditional work lifestyles and continues to look for new opportunities in a stagnant economy. Autonomy has become the key to success not the corner office. This demographic force has become so significant that the Small Business Administration now has dedicated part of their website to providing learning resources for young entrepreneurs (www.sba.gov). Besides the financial benefits of eliminating a storefront, the mobility of these businesses and the opportunities for creative marketing approaches make the mobile retail business a viable option for individuals entering a new market.

After assessment of the role of mobile businesses, we were able to distinguish between three primary strategies behind the mobile business. One strategy is an extension of an existing brand with a traditional brick and mortar retail space. Another strategy entails supplementing an internet-based only retail site with a mobile business retail space. And, the third strategy involves a mobile retail space as the primary physical business presence with all aspects of the service (product) completed (sold) within the physical location of the truck. For further clarification let's look at a couple of examples of both levels of mobile business in the entrepreneurial ecosystem.

Example 1: Best Buy and the Geek Squad. Over the last several years, Best Buy has developed a relationship with the Geek Squad, a mobile technology services company. The Geek Squad, which houses itself inside Best Buy brick and mortar locations, brings the computer repair services directly to the consumer. The relationship builds marketing services for Best Buy because individuals are aware of the services component of taking care of their products even if they are not bought from Best Buy. However, customers perception of the relationship built between Best Buy and the Geek Squad allows customers to feel ‘taken care of’ when they may run into a problem with their new technology purchases. The Geek Squad cars are very recognizable by consumers around town as moving billboards, which heightens awareness for consumers possibly bringing them back into the store Best Buy retail store.

Example 2: For a boutique fashion retailer, like K.McCarthy Fashion Truck, a mobile truck retail space allows these businesses to extend beyond the web presence and personalize the shopping experience for their consumers. Many of these boutique fashion retailers have leveraged
the mobile truck as a way to grow their business beyond just an Internet only placement strategy. This can be especially beneficial since many shoppers are still hesitant to shop from a clothing retailer they are unable to experience or visit. Not only, does the mobile truck provide an opportunity to see and try on the merchandise, but it also allows the business owner to customize consumer experiences that enhance the shopping experience based on specific customer preferences and lifestyles. Several of these fashion boutique mobile retailers provide custom parties for their customers where clients can shop with their friends and family directly from the retail truck at their house.

Example 3: Bark’n Bath is a mobile pet salon services company that brings the health services of pets and animals to your door or your driveway. The mobile pet salons are fully contained within the mobile unit and able to provide all the services that could be provided from a grooming and pet salon retail location. Bringing the services to the consumer has many benefits. One benefit for the consumer is the time transporting the pet to the grooming facility multiple times for drop off and pick up. Additionally, animals with social anxiety or aging pets would benefit from the use of mobile pet services eliminating their need to enter a facility filled with other animals.

While any of these three strategies may be relevant for the small business entrepreneurs, strategies two and three are most attractive to the new entrepreneur facing resource constraints in moving their venture forward.

**BRAND DEVELOPMENT IN ENTREPRENEURSHIP EDUCATION**

Entrepreneurship is a vast and evolving field of study (Aldrich & Martinez, 2001; Low, 2001). Research has been continually fueled by steady growth in self-employment within the labor force in the United States and around the world (GERA, 2007). The SBA reports that small businesses (500 employees or fewer) account for 99.9% of the nearly 26 million firms in the United States. These businesses employ 50.7% of the private sector work force and generate about half of the non-farm private gross domestic product. In the United States, the Small Business Administration (SBA) defines an entrepreneur as “one who assumes the financial risk of the initiation, operation and
management of a given business or undertaking” (Small Business Administration, 2001).

For many small business entrepreneurs, the cost of entry can be a daunting and risky point of entry. This is especially daunting when evaluating the significant costs associated with a brick and mortar storefront (Davis, 2013). The risks and investment associated with a traditional storefront in some cases becomes the barrier that prevents a budding entrepreneur from pushing forth their business idea. Many entrepreneurs opt to invest solely in an ecommerce site to enter the market and forego the brick and mortar retail store investment. However, for service-based offerings or those ideas which the entrepreneur feels strongly that the ability to interact face-to-face with the customer is central to their success an exclusively ecommerce storefront is not an option.

A growing trend in the United States for small business entrepreneurs is to invest first in a mobile retail business as a retail placement strategy. According to Stacey Steffe, president and founder of the American Mobile Retail Association (AMRA), membership grew from 5 members in California to 70 members nationwide within two years of launching the association in 2011 (Davis, 2013). In addition to a lower cost of entry, which has been estimated to be between $20,000-30,000 (AMRA, 2015), the mobile truck retail option provides business owners with a more tangible and unique experience that an ecommerce site cannot. In a time where consumers are also evaluating the emotional connections that a brand is able to provide, the ability to test out ideas and create unique shopping experiences can be a real advantage for nascent small business entrepreneurs (Diller and Rhea, 2005).

The constant movement associated with a mobile business, leads business owners to viral marketing campaigns as a key component of their promotional mix. A successful mobile business is reliant on the entrepreneur’s ability to establish a strong brand reputation, to positively influence consumer’s perception of the mobile brand and to create engaging marketing campaigns for the nascent brand. Central to addressing these requirements is the need to equip small business entrepreneurs with an understanding of effective marketing strategies and techniques.

A recent study on the Botox brand looks at the shifting of the brand image over time. The actor-network theory is used to describe how brand-mediated conflicts over nature-technology relationships influenced Botox’s marketing success over time (Giesler 2012). Actor-network theory states that success of anything relies on its ability to tie the competing interests of multiple
actors together (Giesler 2012). This involves understanding how important connectivity is to the consumer (Armano 2012). For a business to be mobile, it means mobile information, convenience, and social information all served up on the go, across a variety of formats and devices (Armano 2012) to include the mobile business storefront.

Consumer perception of the role the mobile business placement strategy effects the organizational brand is something that must not be taken lightly. Consumers may quickly discount a mobile business as being transient or of lower quality. For example, a consumer may perceive a food truck to have lower quality food based due to truck size and associated kitchen limitations. Therefore, part of the brand campaign may need to proactively address and communicate the quality and high-standards of the mobile business product. Additionally, the consumer may be reluctant to purchase large ticket items from a mobile business because of the business fluidity. Will the consumer be able to return the product or even find the company if something goes not work for the consumer? These concerns need to be addressed in the marketing campaign for the mobile business. To overcome these belief systems, the business owner needs to connect with the consumer through a variety of online sources. For example, AMRA (2015) highly recommends that mobile businesses provide a website, Facebook, Twitter, Instagram, direct email as well as names of the mobile business owners in order to reduce the disconnect effects consumers would have by not having a traditional retail location. This makes managing the online networks become a central focus for mobile business owners as they work to ease any negative perceptions associated with the mobility of their offering.

An increasing focus on brand development has led organizations to seek out opportunities to evoke meaning within consumer experiences. This is accomplished through making purposeful connections between the business offering and the culture and value sets of their target market (Diller et al., 2005). Mobile businesses provide organizations with the opportunity to more seamlessly connect these brands into the daily lifestyle of their customers. The value of convenience is augmented with the ability of the brand to provide design and service experiences that are in line with how the consumer lives (Diller et al., 2005). Mobile businesses are able to appeal to the consumer’s need for individualized goods and services through a more intimate retail strategy. This strategy includes a uniquely personalized approach where goods and services are delivered directly to where their consumers are already living their lives be it at home, work or niche events. The experiential approach by which mobile
businesses deliver their goods and services sets the platform for establishing meaningful consumer connections that benefit consumers and organizations alike.

**USER-GENERATED CONTENT IMPACT ON MARKETING STRATEGIES**

User-generated content (UGC) refers to media content created by users to share information and/or opinions with other users (Tang, Fang, & Wang, 2014). Because UGC is created and shared by users as opposed to the firm, it has the benefit of being perceived as credible and trustworthy (Mudambi & Schuff, 2010). Brand managers can easily access consumers’ opinions, perceptions, and attitudes toward a brand by analyzing UGC. In the case of the small business entrepreneur, the owner is typically playing the role of the brand manager. Understanding how to measure and gauge consumer perception through UGC becomes a vital role in the survival of the organization. With UGC the ease of information and the minimal funds needed to implement social media tools becomes a useful tool for entrepreneurs looking to engage with the customer (Hultman & Hills, 2011). Brand managers can use UGC such as social tags as a proxy to measure brand familiarity (Nam and Kannan, 2014). Additionally, encouraging individuals to communicate through UGC improves when there is a shared vision (Li, Yang, and Huang 2014). As more companies become users of UGC tools, it is important for academic researchers to assist in establishing relevant brand building guidelines for entrepreneurs across all stages of the business lifecycle.

Social media is a component of the online world in which people interact with one another, often changing roles from reader to author and seeking various benefits of social interaction (Morarity, 2009). With the growth of social media, UGC and social tagging grow in importance among entrepreneurs in establishing and growing their businesses and as such is has become a necessary skillset. Because UGC is created and shared by users as opposed to the firm, it has the benefit of being perceived as credible and trustworthy (Mudambi and Schuff, 2010). Studies have found that brand managers often use UGC such as social tags as a proxy to measure brand familiarity (Nam & Kannan, 2014). Brand familiarity is defined as the consumers’ number of product-related experiences (Alba & Hutchinson, 1987). In the Web 2.0 age, consumers acquire product-related experiences from organic word-of-mouth and buzz created by social
Nam and Kannan (2014, p.28) argue “the social tagging creation process is similar to the brand recognition or brand recall test.” For example, consumers are given a brand-related cue (e.g. blog or article) and then they create keywords or tags that come to mind. In this way, brand managers are given insight to both the volume and the extent to which consumers recognize brand-related content.

Because brand awareness consists of brand recognition and brand recall performance (Keller 1993, p. 3), UGC can also serve as a proxy to measure brand awareness. Entrepreneurs often wish to grow their business but when asked simple questions such as where you want to grow (i.e. top line growth, market share) the answer is all of the above (Eliadis, 2013). Brand managers are interested in the level of consumer brand familiarity and brand awareness as it affects the consumer decision-making process and development of a brand personality. High brand familiarity and brand awareness increases the likelihood of the brand being included in the consideration set (Nedungadi, 1990) as well as influencing the strength of brand associations (Keller, 1993). Brand image is derived from the brand associations (strength, favorability, types, uniqueness) held in the consumer’s memory (Keller, 1993). As Keller (1993) proposes, brand awareness and brand image are dimensions of brand knowledge. Giving thought and resources to how a nascent brand will be launched into a competitive market can be central to small business success. Some brands may never get a second chance, therefore a commitment to a thoughtful marketing and promotional plan is key to supporting an entrepreneurial venture already mired with obstacles and challenges.

Entrepreneurs wear many hats as they implement product development, supply chain effectiveness, technology specifications, product rules and regulation. Often the role of marketing becomes an afterthought and the ideas and belief for the products effectiveness is self-embedded in the customer themselves. Over the last two decades, research from the literacy field has been incorporated into marketing research. Researchers have noted how the characteristics of literature or drama have become important factors in the development of consumers’ perspectives of advertisements (Deighton, 1985; Stern, 1988 Scott, 1994). These elements also impact brand development and awareness.

This research uses existing theoretical understandings on the importance of the reader response in UGC and how companies can begin measuring their associated return on investment. Communities are created around a theme, idea, or subject, and integrate the original postings, the links, and the readers’
comments (Droge, Stanko, and Pollitte, 2009). Of course, research on media differences and their effects on the consumer is not uncommon in academic circles. Huang, Su, Zhou and Liu (2013) study on viral video (as UGC) found that managers need to consider purchase intention as well as their sharing intention as the platforms of communication continue to evolve. Droge et al.’s (2009) study on new product development found that the use of blogs can range from simply tracking a bloggers’ community to advertising on influential blogs. Various studies have provided evidence that blogs (as UGC) have relational benefits in the eyes of the consumers (Kelleher and Miller, 2006; Sweetser and Metzgar, 2007). Additionally, previous research has found UGC can be also a measure of consumer interest and attention to determine future product demand (Liu, 2006) and stock returns (Tirunillai and Tellis, 2012). Obviously, the relevance of UGC in the business has come full circle and determining the effects within a business is crucial to success for the future.

RESEARCH METHODS

Often the implementation of a mobile business has many positive aspects including low cost of entry as discussed earlier. However, implementation of a mobile business can have negative effects such as the consumer perception of products bought or sold out of a truck. One area of threat includes the lack of information and business movement for the consumers. For example, consumer questions may arise that include product quality consistency, ease of return and availability of a mobile retail location. Therefore, the current study will assess the consumers’ perception of the business providing insight into these questions. The majority of mobile business organizations are entrepreneurs looking to develop a consumer following without the overhead of the brick and mortar locations. The trend of mobile businesses as a more acceptable form of business interaction has developed the need for business owners, entrepreneurs and start-up organizations to understand the unique attributes that a mobile business might bring to their organization before investing a great deal of time and money into marketing. However, the perception of a mobile business may intimidate organizations that perceive a business sold out of a mobile truck as less structured and dependable as those with a brick and mortar location. The current study explores a marketing strategy implementation of the mobile business that engages consumers in the mobile business concept.

Survey Questionnaire and Participants
A questionnaire was constructed to determine levels of effectiveness among consumers based on inputs derived from social media, perception and brand personality. These are major areas of interest in developing entrepreneurial marketing as a social science in the scholarly field. Research continues to address the lack of entrepreneurial process design processes and their early stages of development (Goldsby and Nelson 2012). Our research addresses these concerns by providing guidance to further support academic research in the area of entrepreneurship and marketing. Based on the lack of research conducted on mobile businesses some minor modifications were made to existing scales in order to test the social media aspects of the organizations. Demographic questions were also collected in order to eliminate any bias that may occur constructed on the exploratory results of the study.

There are three main scales used in the inquiry. The first scale in the study embodies measures of product quality. The scale is derived from Dodds, Monroe and Grewal (1991) to measure the perceptions of quality that a consumer has about a product he or she has knowledge of. Consumer perception of mobile type businesses may have an influence on their intention to purchase the product. Therefore, understanding consumer perception may help build a company’s awareness of the barriers they must overcome as well as understand how to build brand loyalty. The scale consists of 5-items, which are rated on a 7-point likert scale from very low to very high. The questions discuss the reliability, workmanship, durability, dependability, and overall perception of product quality.

The second scale in the study measures the perceptions of the personal and social benefits or cost of social media advertising. A unique attribute of mobile businesses is the lack of physical address location. Online presence and UGC including social media play a major role in the product/service marketing campaign. Additionally, this measure was chosen for the study based on recent research, which suggests measures to interpret the consumer’s perception of social media content. The scale as originally developed by Alwitt and Prabhaker (1992) to understand the perception of personal and social benefits or costs of television advertisements. Since many mobile business owners do not have the resources for television advertisements and the popularity of social media marketing, the scales have been modified for analysis on social media as a form of advertisement with consumers.

The third scale in the study is a new measure of brand personality developed by Gruens, Weijters and De Wulf (2009). This scale is an extension
of the Aakers (1997) popular brand personality scale. The measure was chosen for the study to better understand the brand personality consumer perceive for a mobile business. The measure includes a five-factor, 12-item measure: (1) Responsibility (3 items), (2) Activity (3 items), (3) Aggressiveness (2 items), (4) Simplicity (2 items), and (5) Emotionality (2 items). All items were scored on a 7-point likert scale ranging from not characteristic of the brand to very characteristic of the brand. Items were summed and averaged within each factor to drive mean scores as stated in the original study (Gruens et al 2009).

Study participants had the opportunity to opt into the mobile business study through an online Qualtrics survey system. The participants were then given an image of the mobile business, followed by the company website and then a Yelp page with three customer reviews of the company services. Real websites and live Yelp pages were used to review the study in order create realism in the study. The order of how the participants received the three stimuli was randomly distributed to test for perception variability. No significant findings were found between the order in which each brand image was shown to the participants. Participants were then asked a series of questions based on their experience with mobile businesses and the three study measures items listed above. The significant results are listed in Table 1 below.

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>F (p value)</th>
<th>Cell Mean Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceptions of Social Media</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facebook</td>
<td>4.6 (.04)</td>
<td>4.0(1.0) 3.3(.9)</td>
</tr>
<tr>
<td>Instagram</td>
<td>4.0 (.05)</td>
<td>4.2(.8) 3.5(1.1)</td>
</tr>
<tr>
<td>LinkedIn</td>
<td>4.4 (.01)</td>
<td>3.8 (.4) 4.0 (.9)</td>
</tr>
<tr>
<td>Bath Petals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tag Business</td>
<td>5.6 (.02)</td>
<td>4.0(.6) 3.25(1.2)</td>
</tr>
<tr>
<td>Post Before Visiting</td>
<td>5.1 (.03)</td>
<td>3.8(.7) 4.6(1.2)</td>
</tr>
<tr>
<td>Trust of Social Media</td>
<td>3.8(.05)</td>
<td>4.0 (.5) 4.2 (.4)</td>
</tr>
<tr>
<td>Perception of Social Media</td>
<td>3.8(.05)</td>
<td>3.56(1.1) 3.8(1.76)</td>
</tr>
<tr>
<td>Like After Visiting</td>
<td>3.9(.05)</td>
<td>3.89(.67) 3.8(1.1)</td>
</tr>
<tr>
<td>Games</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aggressive</td>
<td>8.5 (.01)</td>
<td>3.05 (1.6) 4.17 (1.8)</td>
</tr>
<tr>
<td>Simplicity</td>
<td>8.4 (.05)</td>
<td>4.61 (1.5) 3.17(1.5)</td>
</tr>
<tr>
<td>Emotionality</td>
<td>6.8 (.01)</td>
<td>3.89 (1.7) 2.15 (1.3)</td>
</tr>
</tbody>
</table>
FINDINGS AND RESULTS

Our results are based on a convenience and snowball sample of student participants in a small private institution in Southern California. Out of 110 surveys completed, 93 were completed in full and were available for use in the data analysis. The demographic information for the participants include 51% male, 87% between the ages of 18-25, and 69% full-time domestic students. One of the questions addressed in our data analysis was the influence of familiarity with the mobile business products and frequency of consumption could bias our results. The researchers agreed that purchase frequency and prior experience with the product would influence the perception results of the study. Therefore, the participants were asked a series of questions on their frequency of consumption for the top mobile business categories including clothing and accessories (i.e. Bath Petals), food and beverage, entertainment (i.e. Games2U), automotive and car care, as well as pet services (i.e. dog grooming). All categories had a very low frequency of consumption and familiarity with less than 3% overall all survey participants. The only category that received higher frequency includes the food and beverage mobile business (<8% frequency per participant). This particular category of mobile businesses has seen the fastest awareness over the last decade. Popular television shows such as ‘Eat Street’ and the recent movie release ‘El Chef’ has provided a means for consumers to possibly change familiarity with mobile businesses outside the traditional food trucks. Because of the popular general public consensus of food and beverage mobile businesses we did not include this category in the main study. After controlling for frequency and experience with food and beverage mobile businesses we found significant results on the perception of mobile businesses not exclusive to food and beverage category.

The results from the study can be found in Table 1. A multivariate analysis was run comparing the dependent variables perception of social media, brand personality and product quality controlling for the different types of mobile businesses, Games2U and Bath Petals. Based on the results there were some interesting results that entrepreneurs and managers alike may find useful. Based on the product quality scale, there was limited result information related difference between the dependability, workmanship, perception and product quality of the product. However, the one item with high levels of significance includes the ability to purchase and return a product (F=3.8, p<.05). This is an interesting finding given that individuals may feel comfortable with purchasing...
the products from a mobile business because of the lack of support after the final purchase. It would be worthwhile for the organizations to seek out opportunities to build relationships with customers after the completion of the sale. For example, having a warranty or return policy through the website or the social media platform could elevate the customers hesitation to complete the purchase. This information can be supported with the next discussion on social media perception and usage.

As stated earlier the participants were asked a number of questions related to perception of mobile businesses and social media. Several factors were significant in the level of interpretation through the social media relationships. In Table 1 we provided the significant F-factor analysis and cell mean differences broken out for each the Bath Petals and Games2U mobile business types for the most significant social media platforms. The most signification findings include Facebook (F=4.6 and p<.05); Instagram (F=4.0 (p<.05) and LinkedIn (F=4.39, p<.01). These findings could help potential customers overcome the negative perceptions of purchasing products from a mobile business. For example, a customer may feel more comfortable purchasing from a Games2U truck that had a strong LinkedIn profile displaying the local community connections, recent customers and support for company-established reputation. In addition to LinkedIn, Facebook and Instagram were significant sources of mobile business perception. Companies should not feel obligated to be a part of all three social media site, however, the organization should be aware of the top three websites customers are associating with the style of business.

The results from the brand perception study show that consumers are able to build a brand personality for a company based on their website and their UGC specifically their social media assessment. The most significant results are found in Table 1 explain that the brand Aggressiveness (F=8.5, p<.01), Simplicity (F=8.4, p<.01) and Emotionality (F=6.8 p<.01) were significant for both types of mobile businesses. Cell mean differences find the Games2U truck to have higher aggressive (X=4.17, SD=1.8) while the Bath Petals truck rater higher on Simplicity (X=4.61, SD=1.46) and Emotionality (X=3.89, SD=1.7). These findings are consistent with the brand profile for the different company products. Bath Petals sells organic and natural beauty products, which would be more emotional and simple brand personality. Even though the participants in the survey have never had experience with the product or the mobile business truck, they were still able to build this perception through the website and the Yelp
This information can build a powerful story for business looking to set
themselves up for success with the correct company demographic.
Finally, one last area of significance important to the mobile business discussion
includes the reflection of the social media in correlation with mobile businesses.
For both the Bath Petals and Games2U Mobile Business the customer perception
of the social media presence was significant on developing the brand for the
consumer. The most significant findings including the individuals willingness to
tag the business (F=5.6, p<.05), post before visiting the mobile business (F=5.1,
p<.05), like after visiting (F=3.9, p<.05), overall perception of social media
(F=3.8, p<.05) and trust in social media (F=3.8, p<.05). Additionally, the study
shows that the effects of social media perception plays a significant role in the
mobile business marketing campaign (3.8) with increasing the customers
willingness to pay higher products for those with an active social media
presence. Finally, the study reveals that without ever stepping foot into the
mobile business, the presence of the website and social media enables the
customer to assess the business brand personality. Further discussion and
guidelines will be explored in the following section.

**MANAGERIAL GUIDELINES**

To the best of our knowledge, research has not been conducted on this
unique aspect of entrepreneurial business platform. As the field continues to
grow, so does the need for researchers to further explore various factors facing
mobile retail businesses in order to provide guidelines and reduce the
vulnerability of consumers in this retail space. Our research fulfills the request to
improve the lack of entrepreneurship education at all levels (Regele and Neck,
2012) including the incorporation of marketing literature and entrepreneurship.
Further, the increased acceptance of mobile retail business organizations may be
linked to research that continues to explore the United States ability to increase
innovation, ingenuity and capitalism (Regele and Neck, 2012). The mobile
business platform may be considered part of the entrepreneurial ecosystem
(Regele and Neck, 2012) and our research allows consumers to expand on these
accepts in order to develop an entrepreneurial perspective that is necessary inside
and outside of the organization.

Our recommendations based on the current study provide guidelines for
businesses looking to explore the mobile business retail industry. The type of
product or service does not seem to have an effect on the perception of the
consumer as long as you build a strong company brand personality that is reflected across online sources. Online sources that are the most effective include LinkedIn, Facebook and Instagram because of the mobility of the business. Additionally, the mobility of the business has negative perception effects on the customer’s ease of return affecting the trust of the business owner. Therefore, building a strong presence through your UGC systems allows consumer and potential consumers to feel more confident in their purchase decision. Allowing the positive UGC profiles to gain awareness with your brand image will allow customers to build a relationship with the business. Therefore, based on the study consumers are more likely to apply UGC knowledge to tag themselves with the mobile business as well as post information before and after visiting the location.

CONCLUSION

Because the many overlapping concepts of marketing that play a vital role in the entrepreneur role, the current study provides interesting results for those looking to explore mobile business style companies. Beyond the mobile business, individuals who wish to build brand personality online and through UGC may find the results valuable in the competitive landscape among a consumer base that is barraged with marketing messages. This study finds that UGC plays a major role in the development of the mobile business entrepreneur and provides guidelines for building a reputable brand image. Although the research just scrapes the surface for building the gap between entrepreneurial research and marketing theory, the conversation and study has many promising findings. The findings confirm the importance of developing and maintaining active web presence and social media campaigns as important steps in establishing a mobile retail business brand. Overall, we find that entrepreneurs will benefit from insight on a social media strategy including UGC in the development of trust at early stage brand awareness. Further research must be continued in order to fully understand the ever-evolving entrepreneurial style business platforms such as those entering the mobile business industry.
APPENDIX 1: Yelp Review Example Bath Petals Beauty Truck

REFERENCES


FORECASTING KENYA’S MANUFACTURING OUTPUT WITH TIME SERIES DATA

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ABSTRACT

Manufacturing sector is a major source for jobs and growth in Kenya. The sector’s evolution shows characteristic of growth cycles, with approximate slump and boom periods. Prediction of manufacturing production is crucial in designing appropriate interventions to increase the sectors contribution to employment and growth. The paper uses historical manufacturing output data to forecast possible future realizations of manufacturing output through a trend, dynamic autoregressive and a multivariate time series models. Though, the trend model predicts a deterioration of manufacturing output in the next three years, a dynamic AR model predicts a stable 3 percent growth rate for the period. But, a recursive model which incorporates structural dependencies between output and factor inputs, and the influences of macroeconomic variables provides 4.3 percent growth in 2012 which that rises to 5 percent in 2014. Probable causes of changes to manufacturing output could expected from improvements in productivity probably due to innovations or adoption of superior technologies, or on the downside, vast external shocks to the country that may interrupt regional markets for Kenya’s manufactured products.

Key words: forecasting; manufacturing output; productivity

INTRODUCTION

Following a decade of anemic performance of manufacturing sector, the late 1990s marked a slow turn around for the sector especially following the introduction of business environment reforms such as fiscal incentives on export firms, and reforms on business registration and tax administration. Subsequently, improved political environment after the 2002 elections further improved the sector. For example, the sector grew steadily from 4.5 per cent in 2004 to 6.2 per cent in 2007. Manufacturing growth was, however, again compromised in 2008
following a chaotic electoral process, drought, oil price shocks, and the global financial crisis.

Structurally, the sector appears unchanged with limited changes in productivity, sectors aggregate size in the GDP, uncompetitiveness, and sometimes use of dated technology. For example, Kenya’s manufacturing is less competitive relative to countries such as China and India. In addition, Kenyan manufacturing firms hardly venture into research and development; rather rely on imported technology with limited development of innovative local technologies (Ikiara et al., 2002). Interestingly also, the sector is dominated by low-technology informal enterprises which constitute about 83 percent of enterprises (World Bank, 2004). Weaknesses in the sector still remain, for example: low productivity, over reliance on imported technology, and predominant production of low technology products.

Even though this account of the evolution of the sector establishes a fairly resilient sector, there is limited information of its future performance. Undoubtedly, we are unaware of any study that uses available historical information to forecast future performance of sector. This is what this study accomplishes by setting up an econometric based framework to predict medium term output of this sector. Forecasts for the sector will greatly complement the broader forecasts of economic aggregates from the KIPPRA Treasury Macro Model, and continually inform policy makers through various reports.

While its structural stability and possible resilience provides a useful forecasting scheme of the future evolution of the sector, the sectors time path may present forecasting challenges. Recent 2003-2007 turnaround which saw the sector grow by 4.7 percent in 2005, and 6.9 percent in 2007 was affected following the 2008 post-election disturbances and drop in manufacturing demand associated with the global economic and financial crisis. Despite these challenges, the analysis of the sectors historical trends can help make at least conservative future forecasts of the sector performance which can readily be used to inform medium term government policies for the sector and broadly for the long term Vision 2030.

This paper traces the historical evolution and output performance of the sector leading to its current status and estimates several models that form the basis for forecast of its performance in the medium term. The estimated models assume that evolution of the output of the sector is influenced by labour and capital in a basic production function. The forecasts are based on assumed structural stability of estimated coefficients of manufacturing output and non-stochastic errors in the forecasts. The following section reviews pertinent developments in the manufacturing sector over time; Section 3 presents literature review while Section 4 presents the methodological framework. Section 5 discusses data sources and results, while Section 6 concludes.
REVIEW OF MANUFACTURING SECTOR AND EMPIRICAL EVIDENCE

The development of Kenya’s manufacturing sector after independence was marked by substantial government involvement through promotion of import substitution – a key feature of the effort to indigenize industry. However, excessive inward orientation, the use of inappropriate technology, wrong choice of products, lack of production of intermediate and capital goods, dependence on imported equipment, and the largely catalytic effects of the sharp rise in oil prices in 1979 and the fall in international agricultural prices were some of the problems that precipitated the decline in Kenya’s manufacturing sector. Further, the inability of Kenya to undertake second stage of import substitution focusing on production of intermediate goods denied the country the momentum to transform its production structure to production of high value yielding exports.

The government moved towards outward-looking industrialization strategy in mid-1980s, but this was constrained by structural rigidities, low productivity and macroeconomic instability. Structural programmes had limited impact on industrial exports throughout the second half of 1980s. In any case, some of the structural changes involved reduced support to the fragile import substitution industries: for example, the elimination of price controls, privatization, and tariff reforms (Hecox, 1988; Bigsten and Kimuyu, 2002). The problem of the manufacturing sector persisted in 1990s following accelerated liberalization. Indeed, investment declined from about 15 percent of GDP in 1980s to 9.2 percent in 1992 (Bigsten, 2002; World Bank, 2004). But, some of the reforms, particularly business climate reforms and fiscal incentives, had some marked positive effect on the sector performance.

Above problems notwithstanding, what other reason can help explain the sectors lukewarm performance? Various studies point to low productivity, over-reliance on imported technology, and the predominant production of low technology products. On productivity, some studies show that capacity utilization of Kenyan firms, investment levels, and capital productivity were much lower than important competitors such as China and India. Bigsten (2002) notes that manufacturing growth has been primarily driven by the rise in factor inputs and not productivity growth, with the mean total factor productivity of Kenyan manufacturing between 1964 and 1994 was estimated at -0.12 percent.

Investment levels to the sector, for example, had fallen from about 30 percent in the 1970s to less than 14 percent by 2002, partly attributed to political risks, poor infrastructure and high utility prices, and a weak intellectual property rights regime (Levin and Ndung’u, 2002; Bigsten, 2002). Technological development and innovation is also limited. For example, it has been noted that Kenyan manufacturing firms hardly venture into research and development; instead relying on imported technology, and as a result forgoing the competitive
edge possible through development of innovative local technologies (Ikiara et al., 2002).

One, notable factor about Kenya’s manufacturing is that about 95 percent of the firms are low-skill enterprises producing basic products such as food, beverages and building materials, and the export of medium to high technology products is limited and only confined to re-exports (World Bank, 2003; GOK, 2007). About 50 percent of the manufacturing enterprises are also of medium size, typically employing less than 50 workers. Further, the structure of the economy in general has spawned the presently dominant informal sector, which relative to the formal manufacturing sector, has grown rapidly producing low-technology products mainly for the low income groups. Nevertheless, despite frequently noted resilience of informal sector firms to the difficult conditions of 1990s, Biggs and Srivastava (1996) still suggested the need to shift firms from informality as a way to achieve long-term sustainable growth. Still, Kenya’s firm entry barriers and widespread existence of the informal sector points to important structural weaknesses in Kenya’s manufacturing.

The foregoing discussion points to some pertinent firm-level and national level issues that explain the performance of the manufacturing sector in the economy. These include quality of infrastructure, credit constraints, and markets. Infrastructure is important in production particularly as it affects variable and fixed costs faced by a firm hence affecting the scale of production, pricing of products and profits. Improved infrastructure lowers the cost of production, opens up markets, and improves growth and performance of firms (Kayizzi-Mugerwa and Kimuyu, 2002). Poor infrastructure may increase both variable and fixed costs hence affecting factor intensities, productivity and profitability of firms. In Kenya, firms respond to poor infrastructure through self-provision of infrastructure without huge outlays (Kimuyu and Kayizzi-Mugerwa, 1998; Kimuyu, 1998). Studies using data collected in late 1990s noted inadequate credit access to firms, even after financial sector reforms (Isaksson and Wihlborg; Biggs and Srivastava, 1996). Notably, financial contracts enforcements were weak which was further undermined by weak property rights (Söderbom, 2002). Lack of long-term debt instruments may have discouraged investment in new capital equipments and technology resulting in widespread use of antiquated technology in many Kenyan firms.

Largely, despite these conditions, Kenya’s investment climate improved since 2002, but poor infrastructure, limited access to financing especially for the micro enterprises and informal enterprises, are some of the factors which continue to affect Kenya’s competitiveness. The recent manufacturing growth performance shows that the sector has the potential to boost economic growth and employment in Kenya and is very prominent in the Vision 2030 (GOK, 2007; GOK, 2008). For example, the sector contributed 13.6 percent to formal wage employment in 2008. However, manufacturing sector output declined from 6.5 percent in 2007 to 3.8
percent in 2008. This deceleration in growth was due to demand contractions in the early part of 2008, inflationary pressures that also affected consumer demand, and increases in energy costs especially the unprecedented rise in crude fuel prices and electricity tariffs. Further, since the fourth quarter of 2008, the world economy has endured a steep recession triggered by the global financial crisis. Clearly, the full impact of weak demand and tight credit conditions can be expected to affect the recovery in 2010 and the medium term and manufacturing sector is likely to follow the trends and swings in the global economy.

**FORECASTING FRAMEWORK**

Forecasting normally includes structural and non-structural methods. The structural approaches involve setting the modeling framework on the basis of explicit economic theory. Nonstructural models instead use statistical methods to forecast future evolution of variables. Diebold (1997) observes the decline of structural forecasting in 1970s due to the rise in nonstructural which was supported by advances in computing and statistical time series methods, such as univariate autoregressive moving average (ARMA) models and multivariate extensions such as the vector autoregressions (VARs). Other extensions include the development of the idea of cointegration and error correction developed by Engle and Granger.

These methods can be used to forecast manufacturing data particularly at the aggregate level where data is available. The review above presented provides limited information about turning sector forecasting. The microlevel studies are nevertheless useful in understanding the structure of manufacturing and are hardly intended for forecasting output. Alternatively, firm level information from surveys may also be used to make short-term forecasts. These are primarily multivariate approaches that relate industrial production and closely related indicators from a firm survey responses (Mitchell et al 2005), or those that use preliminary information of the production indices themselves to predict aggregated manufacturing output (Battaglia and Fenga, 2003).

These approaches draw from the fact that firm expectations about their own output growth or business conditions can be linked to official data using either probability. This approach typically uses qualitative survey data of firms on output prospects at time \( t - 1 \) to predict expected growth of output in time \( t \). Battaglia and Fenga (2003) alternatively apply a method that forecasts the composite industrial production index, prior to the release of final statistics, using past information of key indicators and current information of some of the components of data. Another thing to note from review of micro level studies is that factors that may affect aggregated manufacturing output can be predicted from various micro studies (for example, size of firm, use of technology, factor productivity) and at the macro
level (public investment in infrastructure, business climate such as security, regulations, export competitiveness, comparative advantages etc.).

Manufacturing sector includes various firms employing different production systems to produce output. The firms also make use positive spillover effects of physical infrastructure provided by government; hence government spending in the development sector will be critical in our analysis. Manufacturing output is an aggregation of various outputs from various firms. At the firm level, output is produced through a combination of different inputs and this relationship can be represented by a production function. In combining different inputs, the firm seeks to maximize output under the assumption of diminishing marginal productivity. A general production function could also be expressed as \( Q = f(x) \), \( i = 1,2,...n \) where \( x \) is a set of inputs. Assuming a Cobb-Douglas production function, \( Q = AK^\alpha L^{1-\alpha} \), where \( L \) is labour, \( K \), capital, and \( A \) represents total factor productivity which may also include an exogenous index for technology. By linearizing and estimating this model, we can use it to make forecasts of the dependent variable.

Thus, this study assumes Cobb-Douglas technology and goes further to estimate and predicts the future values of manufacturing output. The forecasts are made using the trend, autoregressive models, and recursive multivariate model. Save for the trend and AR models, we need the values of the exogenous right hand variables to make out-of-sample forecasts. For structural AR and the multivariate model, the procedure starts with the estimation of the equation followed by the forecasts using the estimated coefficients and the values of right-hand variables for the periods of the forecast. As noted above, capital and labour are important factor inputs in production and can help explain output variation. In this study, we assume that these firm outputs can be aggregated and the same relationships hold at the aggregate manufacturing sector level. Further, to account for potential autocorrelations in the model we specify a structural AR(1) model of manufacturing output. The structural autoregressive (AR (1)) process for the manufacturing output may be written as:

\[
Y_t = \beta_0 + \beta_1 K_t + \beta_2 L_t + \beta_3 X_t + u_t
\]

\[
\mu_t = \rho_1 u_{t-1} + \varepsilon_t
\]

Where \( K \) and \( L \) represent capital and labour respectively and \( X \) are additional factors such as interest and inflation rates. \( \rho \) is the first order serial correlation coefficient. Adequate considerations ought to be made on the time series properties of the variables used. For instance, we should test for stationarity of every variable to ensure reliability of the theoretical relations used in the estimations. While not of primary concern in this analysis, it is reasonable to assume that if the variables are cointegrated, then it provides evidence for stable
relationships between say capital, labour and output which would justify forecasts for many periods ahead. With necessary substitutions of above equation we estimate the non-linear model:

\[ Y_t = \rho Y_{t-1} + \beta_0 + \beta_1 K_t + \beta_2 L_t + \beta_3 X_t - \rho(\beta_0 - \beta_1 K_t - \beta_2 L_t - \beta_3 X_t) + \varepsilon_t \]

Multi-period forecasts using this equation are obtained by applying the values of the exogenous variables on the estimated equation. Where \( b_0, b_1, b_2,\) and \( b_3 \) are estimated coefficients, the forecasts from this model of manufacturing output is expressed as:

\[ \hat{Y}_t = b_0 + b_1 K_t + b_2 L_t + b_3 X_t \]

We can either make one-step-ahead static forecasts or dynamic forecasts. One-step-ahead forecasts instead use the actual values of lag of dependent variable to make forecasts for the dependent variable. The dynamic approach uses the values of endogenous variables preceding the forecast sample, and any lagged variables and AR terms are computed from forecasts from the previous periods. For the AR model, dynamic forecasts use the lagged dependent and fitted residuals in the immediate forecast and the lagged residuals of the forecasts for the subsequent periods. Dynamic forecasts based on the structural equations (or recursive system of equations) uses the lagged actual values \( Y_{t-1} \) to make the forecast for the first forecast period and then uses lagged values of previously forecasted values for subsequent observations. The equation below shows the general representation of the forecasts \( j, j+1, j+2 \ldots \) using the structural model:

\[ \hat{Y}_{t+j+k} = b_0 + b_1 K_{t+j+k} + b_2 L_{t+j+k} + b_3 X_{t+j+k} + \hat{Y}_{t+k-1} \]

Above approaches assume that we have a single endogenous variable, however, we can endogenize the K variable. This means requires simultaneous or recursive solution to the resulting equation system and performing the forecasts. Consequently, assuming no simultaneity between equations, the simple model could be specified as follows:

\[ Y_t = F(K_t, L_t, X_t) \]
\[ K_t = G(X_t) \]

Where, \( K \) is determined by \( X \), interest rates and inflation rates. This formulation is expected to enrich the forecasts from the previous approach. The model can be solved and used in making dynamic forecasts of the dependent variable, using either stochastic or deterministic approaches. Multi-period forecasts are made using the model once we can obtain out-of-sample values for
the exogenous variables for which we wish to construct forecast observations for the dependent variable (manufacturing output).

These econometric based forecast methods assume that the error term $\varepsilon$ is independently identically distributed and the estimated coefficients are stable. However, forecast errors may arise due to uncertainty about the distribution of error terms and the estimated coefficients. Most forecasts are done with a potential of these type of errors, but we can assess the reliability of our forecasts through constructing reasonable errors bounds where we would be certain that the actual value of the predicted value would fall. For instance, in forecast evaluation, if the forecast values fall within 2 standard error bounds, it would be equivalent to saying that we believe that the true value of the manufacturing forecast will fall within the error bounds at about 95 percent confidence level.

Errors in forecasting often arise from residual uncertainty or coefficient uncertainty. Coefficient uncertainty arises if the standard errors of the estimated coefficients from the true coefficients are very large, and forecasts will be made with large errors. Forecast error may also arise due to the uncertainty about the $\varepsilon_i$ in the forecast period. The greater the variation of errors in the sample period, the more the forecasts is prone to error. Decision can be made in forecasting whether we can incorporate residual or coefficient uncertainty. As stated earlier, the analysis assumes that the structure of manufacturing will remain stable for the foreseeable future. Thus, we do not anticipate coefficient uncertainty in the medium term, but we can address residual uncertainty by assuming deterministic errors or stochastic errors.

**DATA, GENERAL TRENDS AND DIAGNOSTICS OF THE VARIABLES**

Data sources include the statistical abstracts, economic surveys, manufacturing surveys and data bases of international organizations such as the International Labor Organization and the World Bank. Graph 1 depicts the growth of manufacturing output, capital and labour since 1982. The manufacturing output grew steadily to 1990, followed by a brief dip in early 1990s. a recovery is seen in the period 1995-1996, but this was followed significant fall in 1997-2000 that appear to coincide with the destructive *el nino* rains and subsequent drought in 2000. A stable but slow recovery was again seen in the years after the 2002 elections. For instance, growth in manufacturing rose from 0.1 in 2002 to 6 percent in 2003. After growing at annual average of 5.5 percent, manufacturing output was again interrupted by the 2008 political disturbances, drought, and rising fuel prices. This contributed to a decline in manufacturing from 6.5 percent in 2007 to 3.5 in 2008 and 1.3 percent in 2009.

A visual assessment of the time series path shows that the manufacturing output is potentially nonstationary. Coincidentally, the labour growth series
(Graph 1) appears to closely follow the output series with a few lags. In several periods the decline in manufacturing jobs seems to have followed the decline in manufacturing output. For example, there was sustained decline in jobs from about 1996 to 1998, and again after year 2000 to about 2002. We anticipate the series to have a unit root. Capital on the other hand fluctuated wildly in most periods shows limited evidence of positive trending. Some of the sharp dips occurred particularly in 1997-1999, 2000 to 2002 and again in 2008, which also shows up in the declines in the manufacturing output series. Further, diagnostic tests are carried out for each series in the following sections.

The manufacturing output series was found to contain autocorrelation both from the plot of the correlogram and the test for the significance of the correlations for up to 25 lags. The autocorrelations in the correlogram appear to die off geometrically towards lag 15, whereas the partial autocorrelation tends towards zero after one lag but contain notable humps at lag 8. Presence of autocorrelation suggests the need to use autoregressive models to account for it. The series also satisfies normality (value of Jarque-Bera statistic, 2.7, and a \( p \)-value of 0.26). Both capital growth and labour growth series show limited autocorrelation, but while labour series appears normally distributed, the capital series is not.

The remaining 2 explanatory variables, interest rates and inflation, show marked autocorrelation and the test of normal distribution for both series is also rejected at about 5 percent significance level. Autocorrelation in the dependent variable, manufacturing growth and capital growth for the capital equation could
be a problem and may be corrected through autoregressive models or appropriate lag terms of the dependent in the regressions. The gains in model robustness of fitting such models are in the present case weighed against the overriding goal of making reliable or reasonable medium term forecasts.

Even in making forecasts, we desire to use structural equations which mean that apart from the autocorrelation structure of the individual series, we also test for the stationarity of all the series. We use either the Augmented Dickey-Fuller (ADF) or the Phillips-Perron\textsuperscript{ii} (PP) tests including necessary lags to correct for higher order autocorrelation to test for unit roots in all the series. Strikingly, under different specification for test regressions (notably a pure random walk, a random walk with either drift or stochastic trend or both drift and stochastic trend) all the variables, growth of manufacturing, growth of capital, labour growth, interest rates and inflation, were found to have a unit root and can therefore be differenced once to make them stationary. The results for the tests are summarized in the Table A1.

<table>
<thead>
<tr>
<th>Test Model:</th>
<th>Phillips–Perron statistic ( p – value)</th>
<th>Integration-unit roots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>Drift, trend</td>
<td>-4.341 (0.007)</td>
</tr>
<tr>
<td></td>
<td>Drift</td>
<td>-3.983 (0.004)</td>
</tr>
<tr>
<td>Labour</td>
<td>Drift, trend</td>
<td>-5.065 (0.001)</td>
</tr>
<tr>
<td></td>
<td>Drift</td>
<td>-4.761 (0.004)</td>
</tr>
<tr>
<td>Capital</td>
<td>Drift, trend</td>
<td>-7.489 (0.000)</td>
</tr>
<tr>
<td></td>
<td>Drift</td>
<td>-7.532 (0.000)</td>
</tr>
<tr>
<td>Interest Rates</td>
<td>Drift, trend</td>
<td>-5.952 (0.000)</td>
</tr>
<tr>
<td></td>
<td>Drift</td>
<td>-5.809 (0.000)</td>
</tr>
</tbody>
</table>

In addition, given that labour, capital, manufacturing output and interest are all I(1), the Engle and Granger (1987) approach can be used to test for cointegration. Using both the PP and ADF tests, it was found that the residual for the regression of manufacturing growth on labour and capital growth is stationary. Hence, the specification means that there is a stable longrun relationship between growth of manufacturing output and labour and capital. This is important since it establishes the theoretical link between manufacturing production and the inputs. This provides the benefit that the knowledge of future values of say, capital or labour can be used to predict the future values of manufacturing output growth. This is explored in the structural forecasting model of manufacturing output.
Trend Forecasts and Auto Regressive Models of Manufacturing Output

One simple way of predicting the future values of manufacturing output is by assuming that the future values follow historical trends. This is done by estimating a trend-line through the manufacturing output series and extending this several periods to the future. Graph 2 shows the fitted trend line and trend forecasts up to 2015. This forecast shows a gradual decline in growth of manufacturing, which could hardly represent reality. But, this helps capture the uncertain growth pattern of manufacturing with a historical propensity to decline rather than sustainably pick up growth over time. These depressing forecasts hardly pick up the 2003 to 2007 upturn in manufacturing output performance. This leads us to the next forecasting models, starting with an AR(1) that models the autocorrelations in the series, and next a structural model is based on the theoretical relations between production output and factor inputs in manufacturing.

Firstly, we estimate and make forecasts using an AR(1) specification. Table A2 presents the AR(1) model of manufacturing output. The coefficients of the AR (1) term is significant even though the fit of the model is weak from the small R squared. The model is stable since the inverted roots of the autoregressive characteristic polynomial lie within the unit circle. The AR(1) can be used for forecasting. First we check the performance of the model from 1990 to 2006. This generates a Theil Inequality Coefficient of the forecast equal to 0.38, which indicates a modest fit. Much of the loss in forecasting accuracy is as a result of the
mean, with a bias proportion of 0.48, but the variation in the forecast is not so different from that of the actual series. To see how the forecasts perform further, a plot of a two standard error bound alongside the actual and forecast series is presented. The forecast appears to bound the forecast and actual series, including the sharp downturn in growth in 1999) within the two standard error margin, which provides some confidence on the forecast quality (Graph 3).

**Table A2: Manufacturing Output: Autoregressive (1) Model**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>2.980</td>
<td>1.231</td>
<td>2.421</td>
<td>0.023</td>
</tr>
<tr>
<td>AR(1)</td>
<td>0.698</td>
<td>0.149</td>
<td>4.702</td>
<td>0.000</td>
</tr>
</tbody>
</table>

R-squared 0.479, Mean dependent var
Adjusted R-squared 0.458, S.D. dependent var
S.E. of regression 1.868, Akaike info criterion
Sum squared resid 83.741, Schwarz criterion
Log likelihood -52.098, F-statistic
Durbin-Watson stat 1.735, Prob(F-statistic)
Inverted AR Roots 0.70

Sample: 1982 to 2010

**Graph 3: Forecast error bounds for AR(1)**

Dynamic forecasts of manufacturing output are made up to 2015 using the AR(1) model. This approach tends to smooth the volatility in manufacturing growth but doesn’t capture the output cycles well. The predictions presented in Graph 4 show that the sector output would grow modestly at a stable 3 percent up to 2015. We would expect a superior model to at least track the movements in cyclic nature of manufacturing. These results are further compared with structural specifications of manufacturing output in the following sections.
Forecasts from a Small Structural Model of manufacturing output

The analysis is extended through the estimation of a multivariate model as a base for a recursive forecasting model of manufacturing output. Labour and capital are the primary factor inputs in the aggregate manufacturing production process. Thus, manufacturing output is determined by capital and labour, under the assumption that labour is exogenously determined and there is no simultaneity in the model. Interest rates and inflation rates are included in the manufacturing output equation to capture macroeconomic factors. Endogenously determined capital growth is also affected by inflation and interest rates, and also by growth of capital in the previous period.

To make out of sample forecasts of the dependent variable will require observations of the future periods of the independent variables. One way to obtain future observations for the independent variables (capital and labour) would be to use informed guesses or to make forecasts using their respective equations. Among the factor inputs only informed guesses for labour input are required. the path of labour input may also depend on the time path or historical process, thus fitting a trend line is one way which is employed here to obtain future values of labour growth. Capital growth is endogenously determined, which only requires future estimates for inflation and interest rates. It is easier to formulate forecasted values of interest rates and inflation (from various publications) than the rates of capital growth. Indeed, as with labour growth an alternative way explored in this analysis is to use the trend values of interest and inflation rates.
Though we can estimate the manufacturing model and then use it for forecasting in the normal way, introducing these equations in a model affords an easier way of making alternative policy simulations. The model is then recursively solved to obtain the dynamic forecasts for the dependent variable, manufacturing output in this case. The forecasts of individual independent variables and forward looking policy simulations are performed in the next section. To see the robustness of the manufacturing output specification used in the model, the base equation of manufacturing output is presented in Table A3. Output growth is determined by the growth in factor inputs, capital and labour, and interest rates and inflation. Capital, labour, and interest rates are significant.

The estimation also shows that rising interest rates are associated with lower growth in manufacturing output. This could indicate associated cost of borrowing by manufacturing firms in the production process. It could also imply deterioration of consumer demand conditions which could directly affect demand for manufacturing products in the domestic economy. The AR terms are introduced to remove autocorrelation and improve the fit. To test the forecasting robustness of this equation, we perform within-sample dynamic forecasts of manufacturing output growth. As an illustration of the forecasting ability of the equation, graph … shows the within sample dynamic forecasts of manufacturing output growth for the period 1990 to 2010 assuming we had knowledge of the independent variables for that period. This helps us gauge the robustness of the forecasts given the actual values of the independent variables.

Table A3: Manufacturing Output Equation
We see that the forecast tends to do well in tracking the movements of actual manufacturing growth series, with more stable growth during the sharp downturns in late 1990s. The 2008 political crisis and economic turmoil is also picked up in the dynamic forecasts as shown by the sharp downturn in the forecast between 2008 and 2010. This could indicate a breakdown in the stability of the model or a structural break. But, there was limited persistent or permanent change in the economic structure or manufacturing output processes, thus the shocks during that time represent some prolonged though non-permanent effect of the political and economic shocks on manufacturing.

This equation also does well in standard forecast tests and the 2 standard error bounds evaluations. The dynamic forecasts from this equation report small values of bias and variance proportions (0.01 and 0.08 respectively). Supported by small Theil Inequality coefficient (0.198), the forecasts are quite good. Relative to the AR(1) model, this equation also reports a smaller root mean square error of 1.648 relative to 2.479 for the AR(1) model above. Thus, structural equation makes notable improvements in the forecasts. Further, this equation is used to formulate the recursive model.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>4.744</td>
<td>1.120</td>
<td>4.235</td>
<td>0.000</td>
</tr>
<tr>
<td>Capital growth</td>
<td>0.052</td>
<td>0.019</td>
<td>2.711</td>
<td>0.014</td>
</tr>
<tr>
<td>Labour growth</td>
<td>0.497</td>
<td>0.192</td>
<td>2.585</td>
<td>0.018</td>
</tr>
<tr>
<td>INFLATION</td>
<td>0.039</td>
<td>0.036</td>
<td>1.072</td>
<td>0.296</td>
</tr>
<tr>
<td>INTEREST</td>
<td>-0.200</td>
<td>0.046</td>
<td>-4.327</td>
<td>0.000</td>
</tr>
</tbody>
</table>

AR(1)  -0.108  0.236  -0.456  0.653

R-squared 0.986121  Mean dependent var 24.89254
Adjusted R-squared 0.984733  S.D. dependent var 0.469595
S.E. of regression 0.058023  Akaike info criterion -2.745836
Sum squared resid 0.100999  Schwarz criterion -2.566264
Log likelihood 50.67922  F-statistic 710.5193
Durbin-Watson stat 1.434897  Prob(F-statistic) 0.000000

Inverted AR Roots .92
Sample: 1970 - 2003
The model variables are the same as those in the manufacturing equation above, but capital is assumed determined within the model. Labour, interest and inflation are exogenous. Thus, their future values are first determined through informed guesses, policy statements, or simple trend forecasts. The model is recursively solved to obtain deterministic or stochastic simulations and to make multi-step forecasts. To assess simulation performance of the model, we construct deterministic in sample dynamic forecasts. Relative to above in sample forecasts where capital is exogenous, Graph 6 shows better forecasts for the most part since 1998. For instance, from 2002 towards 2010 the model simulations are fairly stable and appear to respond largely to large changes in its determinants following the 2008 shocks. In this sense, the model simulations appear to capture economic shocks better than the structural equation predictions.

Unlike the fairly diminutive volatility in the forecasts in Graph 5, the model forecasts for the period 1992-1998 was unstable for unexplained reasons. This could reflect probable instabilities in the macroeconomic variables such as interest rates and inflation compared to the levels of capital: for example, unlike the 2002-2010 periods, sharp economic turmoil was quite pronounced in the macro variables which were further transmitted to capital accumulation in former period. The model forecasts also appear fairly modest and realistic in the end period 2010. It can be noted that the equation forecasts in Graph 5 appear to sharply track the fall in manufacturing output in 2009, which could probably be out of step with the fundamentals well captured in Graph 6 resulting in a potentially more realistic or smoother forecasts. Though, dynamic model forecasts seem to nearly uphold the long run growth path of manufacturing output to about 2010, it should be useful to compare these with stochastic dynamic forecasts.
Could the forecasting power of the model improve if we dropped the deterministic assumption of model residuals? Stochastic forecasting can be used to introduce randomness in the model solutions. Relative to the deterministic approach, this introduces uncertainty in the residual errors or on the coefficients taken by the model equations. For example we could let the model errors change in the forecast period, or even make more limiting assumptions that the coefficients may change over the forecast period. Clearly, a sharp change in the production structure and input use is not anticipated, so we may keep the historical structural coefficients in making the forecasts. So we retain the deterministic forecasts which assume stable structural coefficients and no residual uncertainty. From above discussions, dynamic forecasts appear to approximate the actual values of manufacturing growth reasonably well particularly towards the end of the forecast period. Well, this can largely be used to approximate the long run growth of manufacturing and can be used to forecast periods ahead.

**Medium Term Forecasts and Policy Simulations**

This section uses available information about the sector and general economic environment to make medium term forecasts. The key assumption is that we do not expect a major shift in the structure of the economy, nor on the way manufacturing production systems are organized. Thus, we can assume the sectors contribution remains at 2008s 10.6 percent to GDP. Further, the effects of the global financial crisis are assumed to have tapered off in 2010, but it is possible that the performance of the economy will remain modest. The current drought shocks and sluggish global economy could affect manufacturing demand. Indeed,
depressed demand owing to creeping inflationary pressures and depreciation of the shilling in the EAC could affect exports. Investments into the sector may also remain low, this may mean that the robust growth of 2003-2007 turnaround cannot be guaranteed if external shocks persist or the internal economic conditions to not improve drastically. In particular, the full impact of weak demand and tight credit conditions globally and domestically, and political uncertainty in the lead to the 2012 election year may still affect the recovery in manufacturing, with future growth likely to follow the trends and swings in the global economy.

On the positive side, following the economic down turn occasioned firstly by post-election violence and subsequent financial crisis, direct government interventions through fiscal stimulus helped restore growth in manufacturing. Kenya’s manufacturing exports to the EAC region have generally remained secure since economic growth rates in the EAC trading bloc have decelerated less dramatically. Continued investment in infrastructure (construction of roads, improving the rail commuter system, and energy generation), and other measures including fiscal incentives, regulatory reforms, and deepening of the EAC trading bloc could help sustain manufacturing recovery.

These arguments about possible manufacturing performance can be simulated using the model described above. Three scenarios are assessed to allow for reasonable margins of error and to accommodate various economic possibilities in future performance of the sector. The baseline scenario assumes maintenance of prevailing economic factors. For instance, inflation may remain high inflation for much of 2011, averaging about 12 percent. This assumes that a likely fall in inflation towards the end of the year could keep down the average inflation rate. We further assume that the election year inflation will be about 12 percent, but will decline sharply in 2013 to 6 percent, and the CBKs 5 percent target for inflation could be met in 2014. For the baseline scenario, interest rates may remain stable at about 14 percent in the medium term despite price increases owing to increased liquidity in market, reduced borrowing appetite. For this scenario, labour grows at the recent historical average (2003-2007), which is maintained for the other two scenarios. Under this scenario, which also assumes the absence of structural change in the composition of manufacturing output in the total GDP in the medium term, manufacturing output is projected to grow by about 4.4 percent in 2011, 4.5 in 2012 and 4.3 in 2014. This is fairly realistic growth rates with modest economic recovery (see graph 7).
The next scenario is more optimistic than the baseline. This assumes some improvement in the macro variables such as inflation and interest rates. Inflation and interest rates are assumed to reach 4 percent and 11 percent in 2014, respectively. Labour and capital growth remains fairly the same as in the previous scenario. Manufacturing output under this scenario will expand by 4.4 percent in 2011, expand further to 4-5 in 2012, but outperform the baseline scenario projections by reaching 4.7 percent growth. The third scenario incorporates worsening economic conditions coupled with demand conditions. But, without a perfect way of predicting how low the conditions could turn to be given the current worsening economic conditions, we use the trend growths of the main variables to build a scenario.

The trend growths turn out to be grimmer than the baseline assumptions. For example, the interest rates could worsen and reach close to 18 percent, while inflation remains at double digits (10 percent) in the medium term. This scenario as expected leads to less favourable growth rates for manufacturing output. Indeed, manufacturing sector output world grow at a conservative 3 percent in the medium term. This in any case implies persistence of some risks in manufacturing and the actual conditions could worsen. From above analysis, where our model incorporates structural dependencies between output and factor inputs, above analysis has shown that manufacturing output trends upwards over time with a discernible path determined by movements in macroeconomic variables and variable inputs.
CONCLUSION/RECOMMENDATIONS

This paper assesses historical trends of manufacturing output and makes medium term forecasts of the growth in aggregate manufacturing output using various types of models including a recursive model. The forecasts were made assuming an AR representation of the manufacturing output, through a simple trend model, and also through a small multivariate dynamic model. The trend forecasts show deterioration in growth of manufacturing, while the dynamic AR model predicts a stable 3 percent growth rate in the medium term. But, the recursive model well incorporates the structural dependencies between output and factor inputs and is therefore more realistic. The model was set assuming the persistence of historical structural relationships in manufacturing production and that the size composition of manufacturing output in the total GDP remains stable.

In addition, vital macroeconomic variables such as lending interest rates and inflation take different values in the medium term based either on our believes about their future values or using trend projections. In the baseline scenario, the model assumed limited improvements in inflation, and with the interest rates falling modestly to nearly their 2004 levels in the medium term. This scenario led to nearly stable 4.3 growth rate in output. But the second scenario assumed some marked improvements in macroeconomic conditions with inflation rates falling below the 5 percent target while the interest rates fall to about 11 percent by 2014. while the labour employed in the sector remains the same as in the baseline scenario, improved macroeconomic conditions lead to acceleration in manufacturing growth to 4.7 in 2012 which is again reached in 2014. This growth rate tallies well with historical manufacturing growth performance, in the absence of major changes in the structure of manufacturing. The scenario that assumes that most of the variables maintain their trends, which in any case is downward looking, the results are similar to that of the AR model. In this case, growth of manufacturing declines from 4.5 in 2010 to 3.2 by 2014.

These results primarily provide useful information about the structural stability of manufacturing production and output relationships. As a result, save for major structural changes in production or other factors, manufacturing growth tends to converge to its historical trends, 3 percent to 5 percent. Nevertheless, higher levels of growth cannot be ruled out in coming years as the beneficial effects of government spending on energy, roads and other infrastructure occasion positive investment and output effects on manufacturing. Major structural changes could also lead to improvements in productivity and efficiency, probably through adoption of high end technologies and also knowledge. The full recovery of consumer spending both locally and in Kenya’s export destinations could scale up growth if that occurs in the medium term. Conversely, any additional risks to the global economy generally represent the main risks to manufacturing exports which are critical in the performance of the sector.
REFERENCES


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1 Under the Export Promotion Zones programs, the offered incentives such as a ten-year tax holiday with a tax of 25 percent thereafter, Value Added Tax and duty remission on importation of plant, capital equipments, raw materials, among others. Further, reforms of the taxation regime, business registration and other business regulations were also of great significance to the sector and the economy.

ii PP tests preferable when it is suspected the serial correlation of the disturbances is of AR or MA form
SUSTAINABLE OPERATIONS MANAGEMENT AND BENCHMARKING IN BREWING AT NEW BELGIUM

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University of Northern Iowa

Keywords: Operations, Brewery, Benchmarking, Sustainability, Conservation

INTRODUCTION

Jeff Lebesch, co-founder of New Belgium Brewing (NBB) Company, was well aware of the paradigm shifting trends that were occurring in the brewing industry. From the early days of brewing beer in his basement in the early 1990’s Jeff had always show concern for the environment. Many of the large commercial breweries had started the practice of issuing corporate and environmental sustainability reports aimed at publicizing their successes and progress. The consumer demands were also showing a trend from large-scale mass production brewed products to those produced by craft and microbreweries as well as cideries seemingly overnight. Today, any entrepreneur anywhere in the world could start a brewery and Jeff and co-founder Kim Jordan were entrepreneurial examples of this. Many of these new market entrants also seemed to care about sustainable brewing operations. It was common knowledge that commercial breweries use a great deal of water and energy to convert one gallon of water into one gallon of beer. In order to stay at the fore-front of the industry in terms of sustainable business practices, New Belgium hired a team of external consultants from XYZ Services, Inc. and a university partner in the Northeastern United States. Along with the newly hired consultants, the NBB executive leadership team began a benchmarking analysis of sustainability in brewing operations. The consulting team from XYZ reviewed the sustainable operations and supply chain management practices at NBB and compared them to various international breweries to assess brewery performance and establish common metrics for sustainability in the beer supply chain. The consultants reviewed corporate sustainability reports and scholarly articles on the subject to determine the current state of the brewing industry as well as to establish a scorecard for best in class breweries.
The preliminary research work by the consultants found parallels between the brewing process and the field of applied biology (Thomas & Rahman, 2006), which was not surprising given the chemical and biological processes involved in the manufacture of beer. The various fermentation, maturation, and waste process strategies were key elements in producing an environmentally friendly product. The consultants also found that improvements in sustainable brewing production processes were documented in some instances, including topics such as biological treatment (Driessen & Vereijken, 2003); wastewater reuse for electricity production (Wen, et al., 2010); and yeast processing systems (Mensour, et al., 1997). Fortunately for Jeff, the consultants also found that NBB was one of the breweries commonly referenced and profiled as being a leader in sustainable brewing by various authors including (Hirshberg, 2008) and (McCorry, 2011). Gary Hirschberg, CEO of Stonyfield Farms and himself an eco-entrepreneurial pioneer, has said that Jeff Lebesch, New Belgium’s co-founder “…worked harder than anybody else in the brewing industry to achieve true carbon reduction and sustainability…” (Hirshberg, 2008).” The hiring of the consultants to embark on this project further validated these reports. Jeff acknowledged that NBB already spent a great deal of time and effort on environmental sustainability, but re-iterated that they also concurrently consider economic and social sustainability and that they wanted to remain considered as a ‘best-in-class,’ brewery in terms of their sustainable operations. Jeff wanted to stay ahead of all the entrepreneurs starting breweries; particularly those ecologically focused entrepreneurs entering the space where NBB had carved their name as the industry best.

**COMPANY BACKGROUND: NEW BELGIUM BREWING (NBB) COMPANY**

New Belgium Brewing (NBB) Company is located in Ft. Collins, Colorado and has used the terminology “Alternatively Empowered” to describe their commitment to environmental sustainability (New Belgium Brewing, n.d.). While conducting some client due diligence found that “New Belgium Brewery began when co-founder Jeff Lebesch created two home beers from Belgian inspired ingredients, Fat Tire and Abbey. Along with his co-founder and wife at the time, Kim Jordan, New Belgium Brewing went commercial in 1991, and outgrew their basement operations in 1995 and moved to 500 Linden Street, Fort Collins, Colorado, which now currently houses two Steinecker brewhouses, five
quality assurance labs, kegging line, canning line, state of the art bottling line, and a wastewater treatment facility (New Belgium Brewing, 2007).” In “Stirring It Up: How to Make Money and Save the World,” Gary Hirschberg details the management team and their work in the area of sustainability. In 2000, co-founder Jeff Lebesch transitioned from CEO to director of the board naming his wife Kim Jordan CEO and later creating an executive level director of sustainability position. In addition, Jeff and Kim had been actively engaged and recognized for their work by numerous state and federal agencies. They have created a workplace that is typically scored as one of the best places to work in the United States by agencies such as the Wall Street Journal and Outside Magazine (New Belgium Brewing, n.d.).

Based on their publically available self-reported data, they appeared to be a leader in the brewing industry in terms of defining, monitoring, and acting to minimize their environmental impact. Their Corporate Sustainability Report (New Belgium Brewing, n.d.), a Sustainability Management System (New Belgium Brewing, Inc., 2009), and a Sustainability Blog were made available by the management team on their website (http://www.newbelgium.com/Sustainability.aspx). The level of transparency present in the online documentation of their corporate sustainability program was staggering and they were considered to be a first mover in the area of sustainable brewing operations. They take their commitment to the environment, social responsibility and corporate sustainability very seriously. The company documentation suggested that they were a very responsible company.

NBB set very lofty goals for their organization in terms of energy usage, greenhouse gas emissions, water usage, and recycling. Their first corporate sustainability report was published in 2007 and in 2009-2010 they reported that the only goal they had met in 2009 was their waste diversion goal, indicating an internal focus towards continual improvement in this area. While the consultants knew that further validation and verification would be necessary to substantiate these claims, it was noteworthy that NBB’s eco-entrepreneurial reporting seemed to be an ‘honest’ appraisal and reflection on their actual performance. The consulting team noted that rarely do companies not claim to achieve goals in such forms of public disclosure.

NBB is a privately held company and is a 100 percent employee owned company (New Belgium Brewing Company, 2013) with no public financial disclosures. The consultants were very intrigued by NBB management’s ability to have ingrained environmental sustainability into the corporate culture of the
organization. It has become more commonplace for both legacy breweries and entrepreneurial start-ups to exhibit a concern for the environment, and to the consultants this seemed to fit naturally in the brewing industry in terms of advertising and marketing; i.e., beer buyers tend to acknowledge that quality ingredients (e.g., barley, hops, etc.) make for quality beers. Think about the Papa John’s tagline of “Better ingredients, better pizza, Papa John’s.” The same could be said for the brewing industry. The consultants noted that the New Belgium brands should definitely take advantage of the environmental culture they had built and use it as a platform to sell their products. management was concerned that others in the industry had already started to do this, and the consultants verified that the growth of the American Craft Beer sector should be of concern; their research showed that craft brewing sector had now grown to be 13 percent of the overall market (Anon., 2013) with over 2,500 craft breweries and a market value of $100 billion (Hindy, 2014).

**CONSULTANT BENCHMARKING METHODOLOGY**

One of the objectives of the XYZ consulting team was to analyze the environmental and corporate sustainability reports and practices of various breweries. Some of the breweries the team reviewed in addition to New Belgium included Anheuser Busch-InBev (AB-InBev), MillerCoors, Woodchuck Cidery, Heineken, Sierra Nevada, and Guinness (Diageo). For more detailed profiles on some of the other breweries, see Exhibit 1. This provided the consultants with a cross sectional sample of large international breweries and smaller, more entrepreneurial, “micro” or “craft” breweries. A scoring system was devised for four of these breweries to compare their performance to establish baseline benchmarks for the industry. The consultants found a handful of organizations and consortiums supporting and encouraging sustainability activities including:

- The Beverage Industry Environmental Roundtable (BIER)
- United Nations (U.N.) Global Compact CEO Water Mandate
- U.S Environmental Protection Agency’s (EPA) Climate Leaders
- Regional EPA partnerships
In addition to the organizations reviewed by the consulting team, several external frameworks had been developed by others outside the brewing industry to assess environmental sustainability and performance:

- Global Reporting Initiative (GRI, http://www.globalreporting.org/Home),
- Electronic Industry Citizenship Coalition (EICC, http://www.eicc.info/),
- The Sigma Project Guidelines (http://www.projectsigma.co.uk/Guidelines/SigmaGuidelines.pdf)
  - http://www.projectsigma.co.uk/Toolkit/SIGMARiskOpportunity.pdf,
- U.S. Environmental Protection Agency (EPA). Design for Environment (http://www.epa.gov/oppt/dfe),

The consulting team found that these external frameworks generally did not provide specific metric recommendations for the brewing industry. Therefore, the next step the consultants undertook was to outline criteria breweries should use to establish sustainability scores in terms of social responsibility and environmental responsibility (e.g., a scorecard approach). This included greenhouse gas (GHG) emissions, water conservation and reuse, energy consumption, energy intensity, and waste diversion rates. Four of the breweries that were selected for benchmarking were New Belgium, Heineken, AB-InBev, and Sierra Nevada. These four breweries were then evaluated to determine
scores for best in class for sustainability in the brewing industry. The consultants than reported in the scores and the implications of these findings to provide an indication of what NBB should focus their energies on as well as present industry best practices.

Their analysis provided NBB with a quantitative analysis comparing the breweries based on reported data and information extending beyond previous qualitative research. Reporting was found to generally be voluntary and organizations in this sector did their own reporting. The reports seemed to be well put together and fairly comprehensive; if a company in the industry was interested in developing a sustainability platform they could review the publicly available information presented by firms such as New Belgium, Sierra Nevada, MillerCoors, Diageo (Guinness), etc. to guide their sustainability programs. For example, Stelios Pesmajoglou, discussed MillerCoors as an example of an organization setting voluntary intensity targets for greenhouse gas emission reduction; they set a goal of 18 percent per barrel reduction in GHG emission from 2001-2006 (Pesmajoglou, 2011).

THE PRELIMINARY DEVELOPMENT OF THE SCORECARD

The following specific criteria was developed to evaluate and determine a ‘best-in-class’ brewery with respect to environmental impact and responsibility. Eight parameters were identified for the scorecard by the consulting team:

1. Greenhouse Gas Reduction or Mitigation Policy
2. Corporate sustainability index or measure / reporting
3. Quantitative carbon footprint measure / reporting
4. Process improvement initiatives (e.g., six sigma) projects focused on environmental impact
5. Donations to environmental causes
6. Recycling / Reuse Programs (e.g., water stewardship)
7. Waste Management Programs
8. ISO 26000 compliance (International Organization for Standardization, n.d.)
These criteria were deemed as important because an organization must be able to measure their impact on the environment in order to change vision, policy and procedures to make improvements. To this end, the consultants felt that companies should strive to measure their greenhouse gas emissions (GHG) and have some form of reduction and/or mitigation policy in place. For example, in the case of New Belgium, the consultants found that had been tracking their direct and indirect GHG emissions and had set a very lofty 25 percent reduction goal for 2015 (New Belgium Brewing, n.d.).

The consultants let Jeff know that, in their opinion, leading breweries in environmental sustainability should be actively tracking and reporting their carbon emission footprint and should be specifying reduction goals as NBB had for 2015. This was typically accomplished through some form of organizational process improvement initiatives. It was noted that in this particular industry sector, it seems that the breweries were donating to a considerable number of various environmental causes; so another measure the consultants added to the scorecard was organizational spending on donations to specific environmental agencies benefiting from this philanthropy. For example, the consultants found that on February 23, 2011 MillerCoors donated $80,000 to benefit local river organizations (Platt, 2011) while NBB has donated more than $6 million since the company was founded (New Belgium Brewing Company, 2014).

Recycling and reuse in the brewing process was also deemed as critical to success due to the amount of water used. Another industry terminology the consultants came across to describe this function was ‘water stewardship.’ For example, MillerCoors recycled or reused 98 percent of their waste in 2008 (Miner, 2009) and had three zero waste facilities in 2010 (Hincha-Ownby, 2010). Waste management was another critical metric for breweries, in particular waste water. The consultants recommended that the common metric of water used per gallon of beer produced should be used. The XYZ team did note that traditional breweries typically had a different target value when compared to other production processes such as cider brewers, distilleries, etc. One example of a stated objective in this category was that of ‘zero waste’ production operations.

For global breweries and exports, the standardization of processes internationally was also found to be an important consideration. For example, ISO 26000 is an international standard for social responsibility and The American Society for Quality (ASQ) had a 2011 conference program titled “Pathways to Social Responsibility,” which was held June 16-17, 2011 in San Francisco, CA to address these topics (ASQ, n.d.). This conference focused on
quality in the area of social responsibility including the, “opportunity to share ideas and best practices surrounding the social responsibility principles in [our] organization[s].”

AN INTERNAL INVESTIGATION OF SUSTAINABILITY AT NBB: A SUMMARY OF KEY FINDINGS

Next the consultants embarked on an internal investigation of the sustainable operations at NBB. Here are some of the NBB environmental pillars from their reports:

“At New Belgium to be environmental stewards we believe we need to:

- Lovingly care for the planet that sustains us.
- Honor natural resources by closing the loops between waste and input.
- Minimize the environmental impact of shipping our beer.
- Reduce our dependence on coal-fired electricity.
- Protect our precious Rocky Mountain water resources.
- Support innovative technology.
- Focus our efforts on conservation and efficiency.
- Advocate for policies which enable restorative practices.
- Share our wealth with non-profits working to protect natural resources.
- Model joyful environmentalism through our commitment to relationships, continuous improvement, and the camaraderie and cheer of beer.
- Remember that if it’s not fun, it’s not sustainable! (New Belgium Brewing, n.d.)”

It did not take the consultants many visits to Ft. Collins, Colorado to come to the immediate conclusion that they were a leader in the brewing industry (the inundation with the “Alternatively Empowered” tagline didn’t hurt either). The consultants also understood Jeff’s concern with competitors threatening their leadership position in the area. The consultants found NBB to have a differentiating competitive advantage in terms of defining, monitoring, and
acting to minimize their environmental impact. Despite NBB being best-in-class, the NBB team had to find ways to keep the passion for environmental stewardship a top priority for the company’s culture.

While New Belgium was referenced in nearly every article the consulting team came across, they found it noteworthy that Sierra Nevada was also commonly referenced; formidable competitor for Jeff to consider. The XYZ team also found that the most common form of pollution in the industry was water pollution, with one high profile case coming in March 2011 when it was reported that Starr Hill Brewery in Virginia had complaints of water pollution filed linking its waste water to the death of wildlife in their area (Johnson, 2011).

IMPLEMENTING THE SCORECARD AT NBB USING FACTOR WEIGHTING METHOD

Once the scorecard elements and metrics were determined, and the external and internal environment were reviewed, the consulting team implemented the industry specific criteria deemed to be important in the brewing sector to help measure their impact on the environment in order to change vision, policy and procedures to make improvements. The team developed the criteria as detailed above to evaluate the organizations and for the comparative analysis and benchmarking. NBB’s results are detailed below to illustrate the implementation. The consultants found that the 2007 and 2009 NBB sustainability reports contained many, many more examples than those that could be listed below; therefore only selected significant contributions to each criteria have been listed below. The scorecard implementation made use of a method commonly referred to as the Factor-Weighted or Factor-Weighting Method (FWM) (Heizer & Render, 2013).

A breakdown of each element in the scorecard matrix is detailed below. It is assumed that each element carries an equal weight of 10 percent for each of the 10 elements and scoring for specific breweries is conducted on a 10 point scale (e.g., 0/10 = worst, 10/10 = best). For a summary of the criteria, please see Exhibit 2.

- **Social Responsibility (total 50%)**:  
  - Donations to environmental/social causes and community involvement (10%)
In 2009, New Belgium donated $490,000 via their local grants program (New Belgium Brewing, n.d.; New Belgium Brewing, n.d.).

- NBB donated 1 percent of revenues to environmental non-profits (New Belgium Brewing, n.d.).

  - Transparency / self-review process / communications (10%)

    - New Belgium was found to be very critical of their performance in their annual sustainability reports. Detailed reports can be found online at their website (2007 and 2009).

  - Employee sustainability culture/benefits to employees for 'green' behavior (10%)

    - The alternatively empowered initiative captured the essence of New Belgium’s commitment to a culture of sustainability.
    - Typically voted as a top workplace for employees, including being a bike-friendly business.

  - Greenhouse gas reduction/mitigation plan (10%)

    - There is a detailed discussion of this below in the environmental sustainability criteria section, but the objective is to reduce their GHG emissions by 25 percent by 2015.

  - Distribution efficiency (10%)

    - The Climate Conservancy found that 8.4 percent of GHG emissions for Fat Tire were from distribution of their products, thus there was a focus on reducing transportation costs (The Climate Conservancy, 2008). New Belgium is now tracking all of their scope 1, 2, and 3 emissions from distribution of their products and making improvements to their supply chain and logistics management (New Belgium Brewing, n.d.).
    - Purchased 39 hybrid vehicles for the company fleet (New Belgium Brewing, n.d.).
The maximum possible total social responsibility score set by the consultants was 50/50. The other half of the scorecard consisted of environmental responsibility measures.

- **Environmental Responsibility (total 50%)**:
  - Water management (critical resource, 10%)
  - Water management was found to be mission critical for breweries, in particular waste water. The team considered the common metric of water used per gallon of beer produced. In the case of New Belgium, it was found to take an average of 3.9 gallons of water to produce 1 gallon of Fat Tire beer, less than the industry average of 5 gallons of water per 1 gallon of beer (New Belgium Brewing, n.d.). Figures 1 and 2 summarize these findings.
  - 15 percent of New Belgium’s electricity comes from on-site waste water treatment plant which cleans all of their waste water

![Graph showing water usage over years]({filename}

**FIGURE 1: New Belgium Water Usage (New Belgium n.d.)**
Recycling / Reuse (management of waste created, 10%)

- New Belgium’s on-site Process Water Treatment Plant uses microbes to clean all production wastewater (New Belgium Brewing, n.d.). The process produces methane gas which later is recycled to produce electricity. A methane cogeneration process cleans waste water and produces electricity (Hirschberg, 2008).
- 50 percent of New Belgium’s glass usage is from recycled sources (Goldman-Armstrong, 2007).
- The brewery recycles or resells 99.3 percent of spent grain and yeasts and have collected data to measure the waste diverted from landfills as partially shown in Figure 3 (New Belgium Brewing, n.d.).
- 12 and 24 pack packaging are made of 88 percent recycled materials; all other product packaging is 100 percent recycled content (New Belgium Brewing, n.d.).
- Production efficiency (waste reduction, 10%)
  - The “Merlin” brewing kettle is 65 percent more efficient than competitors (Hirschberg, 2008)
  - 99.9 percent of all waste was diverted from landfills as shown in Figure 3 (New Belgium Brewing, n.d.).

- Supply chain management (energy efficiency, GHG reduction, 10%)
  - The energy used per gallon of beer sold was reduced by 3% between 2008 and 2009. Furthermore the Brewery plans to increase its energy efficiency by 25% by 2018 as shown in Figure 4 (New Belgium Brewing, n.d.).
  - For example, in the case of New Belgium, they have been tracking their direct and indirect GHG emissions and have set a very lofty 25 percent reduction goal for 2015 as shown in Figure 5 (New Belgium Brewing, n.d.). Use of heat exchanges provides for more energy efficient operations (Hirschberg, 2008)

![Figure 3 New Belgium Energy Reduction Targets](New Belgium Brewing, n.d.)
Figure 4 New Belgium GHG Emissions (New Belgium Brewing, n.d.)

- Energy procurement (incorporation of renewables, 10%)
  - New Belgium subscribed to the Platte River Power Authority’s Wind Power program between 1999 and 2012 which is estimated to have eliminated 28 million pounds of CO\textsubscript{2} emissions from 1999-2002. (Hirschberg, 2008).

Like the social responsibility score, the maximum possible total environmental responsibility score set by the consultants was 50/50, for a total score of 100/100.

During the development of the scorecard, one of the consultants noted that “New Belgium Brewing Company worked with The Climate Conservancy to complete a greenhouse gas life cycle assessment for a six-pack of the brewery’s flagship Fat Tire beer. Their assessment concluded that only a minor portion (5% or 172 g of CO\textsubscript{2}e) of the carbon footprint can be attributed to the brewing process. The remaining 95% are distributed among raw material cultivation and distribution (48%, 1531g of CO\textsubscript{2}e) and downstream distribution costs (47%, 1484g of CO\textsubscript{2}e) for a total carbon footprint of 3,188 grams of CO\textsubscript{2} equivalents (g CO\textsubscript{2}e) (The Climate Conservancy, 2008).” The consulting team next decided to locate carbon footprints for other common household goods for comparison:

- Fat Tire: 7.03lb of CO\textsubscript{2} per six pack

- According to National Dairy Holdings, a gallon of milk has a carbon footprint of 6.19 to 7.59 lb. A gallon of laundry detergent carries an environmental footprint of 31 pounds; and a small sedan has a carbon footprint of 97,000lb. (Ball, 2009).
o According the Wall Street Journal, Timberland advised that flip-flop sandals have a footprint of 22 to 44 lbs., shoes 66 to 132 lbs., and hiking boots 154 to 198 lbs. while Patagonia advised the carbon footprint for one of their jackets is 66 lbs. (Ball, 2009).

o New Belgium was once again found to be at the forefront of assessing carbon footprints of products in the brewing industry. This could lead to an increased visibility of energy usage in this industry similar to the labeling used by companies such as Timberland (Figure 6).

![Figure 5 Timberland Boots Energy Usage Label](Background Stories, 2008)

**FINAL SCORECARD RESULTS AND COMPARATIVE EXAMPLE**

Some of the consultant’s primary deliverables from this project were the development of the scorecard along with providing a comparative example of its use. Table 1 provides a summary of the key metrics for brewing sustainability for four organizations: New Belgium, Heineken, Anheuser Busch – InBev (ABInBev), and Sierra Nevada.

**Table 1: Sustainability Based on 2008 Reporting and Data**
The final step was for the consultants to quantify the scoring matrix for each organization as provided in Exhibit 3. In addition, strengths and weaknesses for each brewery were also reported.

**Exhibit 1. Consulting Team Brewery Research Profiles**

The initial phase of this consulting research involved the selection of breweries to establish common sustainability reporting. This section highlights some of these findings for three breweries.

**I.A. Company Overview: Woodchuck Cidery (WC)**

Woodchuck Cidery (WC) is based in Middlebury, Vermont and they take pride in the amount of water they use; one gallon of water per gallon of beer

<table>
<thead>
<tr>
<th>Company name</th>
<th>New Belgium (goal for 2015)</th>
<th>Heineken (goal for 2020)</th>
<th>ABInBev</th>
<th>Sierra Nevada</th>
</tr>
</thead>
<tbody>
<tr>
<td>L water/L beer</td>
<td>3.9 (3.5)</td>
<td>5.1 (3.7)</td>
<td>3.5</td>
<td>5.8</td>
</tr>
<tr>
<td>GHG emissions kg (CO2/hL)</td>
<td>32.1 (22.8)</td>
<td>10.4 (6.8)</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Energy consumption (kWH/bbl)</td>
<td>16.95</td>
<td>NA</td>
<td>NA</td>
<td>16.45</td>
</tr>
<tr>
<td>Energy Intensity (MJ/hl)</td>
<td>162 (121)</td>
<td>175</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Waste diversion rate (%)</td>
<td>99.3</td>
<td>NA</td>
<td>NA</td>
<td>99.6</td>
</tr>
<tr>
<td>Waste diversion rate (%) excluding spent grain</td>
<td>73.3 (95)</td>
<td>NA</td>
<td>NA</td>
<td>92.9</td>
</tr>
</tbody>
</table>

1—Includes soft drink, cider and water in the denominator
2—Goal of 2018
3—Based on 2009 data
compared to the industry average of six gallons of water per gallon of beer. They also use 100 percent recycled material and utilize local sourcing of apples to reduce transportation emissions (Woodchuck Cidery, n.d.). In addition, they are part of the Central Vermont Public Service Cow Power™ initiative which uses methane from waste to generate electricity (Central Vermont Public Service, n.d.) and they donate to American Forests (American Forests, n.d.).

There was not as much readily available documentation for Woodchuck Cidery as compared to the other companies profiled in this article. This is likely a matter of scale; Woodchuck is much smaller than NBB and MillerCoors (MC) for example, so they likely have fewer resources dedicated to tracking, monitoring, documenting, and marketing their environmental sustainability efforts. As with NBB, WC’s claims need further validation and verification by independent third parties of their reports. The consulting team was not able to initially locate the specific goals for the organization in terms of energy usage, greenhouse gas emissions, water usage, and recycling. Their most notable brand is their name-sake “Woodchuck [Amber] Cider.”

I.B. Company Overview: MillerCoors (MC) LLC

As a large joint venture headquartered in Chicago, they have much larger centralized operations than either of the other two companies profiled (NBB and WC). Miller’s division offices remain in Milwaukee and Coors’ in Golden, Colorado. Due to the scale and scope of their operations, public disclosures and reports are readily available. Recent MillerCoors financial results were to be reported and released on May 7, 2014 for the end of Q1-2014 results (MillerCoors LLC, 2014). Their most notable brands are Miller, Coors, Molson, and Pabst and they carry a wide array of products which they distribute and sell.

According to their 2009 Corporate Social Responsibility Report, MillerCoors “claims to recycle or reuse 98 percent of all brewery waste (Miner, 2009).” According to their 2010 Sustainable Development Report they are targeting use of 3.5 gallons of water per gallon of beer by 2015 (MillerCoors, 2010), which is still much greater than what Woodchuck Cidery reported. MillerCoors is trying to reduce their energy usage by 15 percent and they are analyzing their logistical infrastructure to reduce carbon emissions associated with their transportation network.
Exhibit 2: Consulting Team Selected Criteria for Sustainability

- **Social Responsibility**
  - Donations to environmental/social causes and community involvement 10%
  - Transparency / self-review process / communications 10%
  - Employee sustainability culture/benefits to employees for 'green' behavior 10%
  - Greenhouse gas reduction/mitigation plan 10%
  - Distribution efficiency 10%

- **Total Social Responsibility component**
  50%

- **Environmental Responsibility**
  - Water management (critical resource) 10%
  - Recycling / Reuse (management of waste created) 10%
  - Production efficiency (waste reduction) 10%
  - Supply chain management (energy efficiency, GHG reduction) 10%
  - Energy procurement (incorporation of renewable) 10%

- **Total Environmental Responsibility component**
  50%

Total Social and Environmental Responsibility Score 100%

Exhibit 3: Consulting Team Selected Criteria for Sustainability

NBB Score (100/100):
Weaknesses: Water management-’09 at 3.93 water use per hectoliter and 3.5 goal for 2015;
Strengths: wind power for electricity and co-generation of methane for heat; LCA on 6-pack of beer production; 95.6% waste diverted as of ‘09

Heineken (83/100):

- Weaknesses: Water management, 2010 water consumption dropped to 4.5 hectoliters, they have a 25% reduction goal by 2020.
- Strengths: Company is buying fridges that use environmentally friendly hydrocarbon refrigerants, LED lighting, energy management systems. Goal of 50% reducing in energy from cooling by 2020.

ABInBev (71/100):

- Weaknesses: need to conduct full LCA on operations in order to identify cost savings associated with their lightweighting of packaging and implementing a more formal Supplier assessment/GHG innovation program like Walmart; only has 8% alternative energy sources = Bio-Energy Recovery Systems (BERS) which captures methane from water leftover from the brewing process to produce steam;
- Strengths: Water management and reduction efforts=overall 8.5% reduction from ‘08 to ‘09 and 4.3 water use per hectoliter production in ‘07 to 3.5 in ‘09; met goal of 5% GHG reduction by 2010 early, so further reduction commitment by 15% by 2013

Sierra Nevada (83/100):

- Weaknesses: Water Management, Transparency, Quantitative Sustainability Indices.

REFERENCES

Available at: http://www.americanforests.org/


New Belgium Brewing Company, 2013. *We are 100% Employee Owned.* [Online] Available at: http://www.newbelgium.com/community/Blog/13-01-16/We-are-


**DISCUSSION QUESTIONS**

(1) How did NBB Company’s public disclosures early on create a first mover advantage in terms of sustainability?
a. The availability of sustainability reports back in 2007 created consumer and industry knowledge of their sustainable production processes and care for the planet. As farm-to-fork style food and beverage production have cast light on the importance of these practices, NBB was immediately acknowledged as an industry leader in a very important aspect of the industry. The consultants found this to be the case based on their analysis.

(2) How can a leadership team, such as NBB’s, create a culture of environmental sustainability?
   a. Leadership at NBB, as well as the Timberland story, provide us with a great example of top-down leadership in terms of entrepreneurial environmental sustainability. By communicating this importance, such as by creating a chief sustainability officer, line works can see the importance of this function within the business.

(3) Did the XYZ Consulting team do an adequate job selecting a diverse cross section of breweries? Could they be considered peers to NBB?
   a. This is one area that could be critiqued as the article mentions the importance of craft and microbreweries, but the consultants spent most of their time as large breweries. The reason for this was the availability of publically available information; small and private breweries do not tend to have the resources required to report as much sustainability data and information as the large breweries.

(4) Should the XYZ Consulting team have considered implementing a Net Promoter Score (NPS) metric to assess customer satisfaction and referral likelihood based on environmentally sustainable business practices?
   a. NPS has become a very popular metric, particularly with firms in the Fortune 500. As such, it would be beneficial to use an NPS metric to establish the following (example for NBB Fat Tire):
      i. Are you satisfied with the environmental sustainability with NBB Fat Tire?
      ii. Based on your answer to (i), how likely would you be to purchase NBB Fat Tire again?
iii. Based on your answer to (i), how likely would you be to recommend NBB Fat Tire to a colleague or friend?

b. With this information, detractors and advocates of sustainable brewing practice, and in the example the NBB Fat Tire brand, could be determined. This might be done using a demographic taxonomy, etc.

(5) Is the scorecard approach undertaken by the consultants a satisfactory application of the traditional balanced scorecard?

a. Traditional scorecard approaches have been used in Human Resources, for supplier development, for performance appraisals, for business unit performance, etc. for many years. This environmental sustainability scorecard is relatively new, but is used in some form by many organizations. Perhaps the most common our supplier sustainability surveys, such as those developed by Wal-Mart, etc.

(6) Should the global operations components have been considered by the consultants? Was it outside the scope of domestic breweries, entrepreneurial start-ups, etc.?

a. The scope and scale of the breweries reviewed for this study are somewhat limiting. Ideally, benchmarking should be for established peer organizations. The consultants would have been better served first establishing peers before analyzing and collecting brewery data. Again, this was partially a function of publically available information.

(7) Is it important for an entrepreneurial start-up, such as a brewery, to have an environmental sustainability mission statement?

a. Absolutely – as mentioned above, it sets the top from the senior and executive leadership team that this is a top priority.

(8) Use the FWM scorecard developed by the consultants to compare at least two breweries.

a. This activity will require the student to seek answers from the brewery disclosures, sustainability reports, etc. This could be used as a problem based learning module (a sample PBL example
can be provided by the author upon request). Students can be directed to the exhibits for guidance on how to tabulate the scorecard valuation (out of 100).

b. Have students research different aspects of sustainability that fit the criteria listed in exhibit 2. Have them score each item as X out of 10 points and sum them to get a score of X out of 100. Compare them quantitatively, as well as qualitatively, as summarized in Exhibit 3.

EPILOGUE

The strengths and weaknesses shown in exhibit 3 were qualitative summaries used to justify the quantitative scores determined by the consulting team based on the reported data as of 2011. The consulting team later supervised a follow-up consulting project conducted for Diageo (Guinness) in 2012 and continued to note the need to validate and verify the self-reported data and claims by working with individual breweries. This work provides an industry overview and methodology for measuring sustainability and environmental performance in the brewing industry. This case provides an overview of a consulting report, turned conference research paper, turned academic case study. It is based on real events and dramatized for the purposes of the case. The author(s) continue to conduct academic research and consulting work in the field.

Acknowledgements:

Thank you to the following individuals for their contributions to the field research for this project:

Yodi Melinkov, Ph.D. Candidate, Yale University
Jeremy Asprey and Katie Levy, Graduate Students, Harvard University
Jonathan Buonocore, Graduate Assistant, Harvard University

Author’s Note: this article was written as a narrative based on a combination of actual and fictional events. The original consulting report and conference research paper are also available as support materials upon request to the author. XYZ Services, Inc. is a fictional consulting firm.
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