

Behavioral Management Patterns: Small Firms' Recipe for Growth

by

Fadi Abou Chacra  
Master of Business Administration

and

Joshua Rocha  
Bachelor of Science in Business Administration; Finance & Project Management

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Signature of Author: \_\_\_\_\_

Fadi Abou Chacra  
Department of Supply Chain Management  
May 10, 2019

Signature of Author: \_\_\_\_\_

Joshua Rocha  
Department of Supply Chain Management  
May 10, 2019

Certified by: \_\_\_\_\_

Dr. Josué C. Velázquez-Martínez  
Executive Director, Supply Chain Management Residential Program  
Capstone Advisor

Certified by: \_\_\_\_\_

Dr. Cansu Tayaksi  
Postdoctoral Associate  
Capstone Co-Advisor

Accepted by: \_\_\_\_\_

Dr. Yossi Sheffi  
Director, Center for Transportation and Logistics  
Elisha Gray II Professor of Engineering Systems  
Professor, Civil and Environmental Engineering



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Fadi Abou Chacra

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Joshua Rocha

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## ABSTRACT

More than 99% of the companies in the world are micro, small, or medium size enterprises and account for ~70% of the jobs, on average, in OECD countries. However, due to a lack of productivity, among other factors, only a third of them survive beyond 42 months. This paper explores the potential associations between behavioral management patterns and business growth and productivity in micro and small enterprises in Latin America. We analyze survey data collected from Mexico and Colombia and observations from company visits and workshops conducted in Mexico with managers of micro and small firms. We observe that risk, delegation, and goal setting are all influential predictive features for business growth and productivity. We also find that the associations between business performance and these behavioral patterns are better captured through non-linear models when compared to linear models. For example, when evaluating the out-of-sample accuracy for revenue growth, the non-linear model performs ~27.29% better than the linear model. This suggests that behavioral patterns are not independent from each other, but rather interact and combine in ways that can create different formulas for successful behavioral management. In addition, our results suggest that behavioral patterns should not always be viewed in terms of extreme terms such as “high” or “low”, as suggested by linear models; but rather that there are optimal, potentially moderate, bounds for the levels of each behavior. For example, the non-linear model for employee growth shows that managers with moderate levels of risk-tolerance have an increased probability of high growth compared to those who exhibit risk levels outside of the optimal bounds. Last, we also observe evidence that suggests that the willingness to adopt new technologies and processes as a behavioral management pattern has little predictive contribution to business growth and productivity, and may instead, be an indicator of the manager’s inability to perform a particular task or job well.

Capstone Advisor: Josué C. Velázquez Martínez

Title: Executive Director, Supply Chain Management Residential Program

Capstone Co-Advisor: Cansu Tayaksi

Title: Postdoctoral Associate

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## 1. Introduction

More than 99% of the companies in the world are micro, small, or medium size enterprises (MSMEs) and account for ~70% of the jobs on average in OECD countries. Additionally, MSMEs in OECD countries represent, on average, more than half of total exports in value added terms. (Organization for Economic Cooperation and Development, 2017). However, due to a lack of productivity, among other factors, only a fraction of them survives and develops into high-growth firms.

The purpose of this study is to explore and identify which behavioral management patterns may contribute to the growth and productivity of micro and small enterprises (MSEs) in Latin America. Abiding by the OECD definition, we define MSEs as firms with no more than 50 employees. MSEs are significant because of the important role they play in the economies of developing countries. An International Labor Organization (ILO) study (2003) specifically found that firms with fewer than 10 employees make up more than 50% of all employment in countries such as Mexico, Paraguay, and Bolivia.

Many MSEs either fail to grow, or simply fail altogether, contributing to instability and inefficiencies throughout many supply chains. A 2005 study conducted by the Global Entrepreneurship Monitor (GEM) found that the survival rates for firms beyond 42 months were only ~33% for Latin American countries such as Argentina, Venezuela, Chile, and Mexico (Von Broembsen, Wood, & Harrington, 2005). Many studies have found that Latin America's stagnation in macroeconomic performance in recent decades is the result of low labor productivity (Cole, Ohanian, Riascos, Schmitz Jr, 2005; Lederman, Messina, Pienknagura, Rigolini, 2014).

While much research has been conducted related to MSEs in recent decades, we find that there is an opportunity to contribute to the growing research literature by expanding the understanding of behavioral management patterns and their potential effects on the growth and performance of MSEs. In an ever-changing marketplace, organizational growth and productivity improvements are key for a firm's

survival. To this end, we focus our research on four key behavioral management patterns; 1. Risk (tolerance vs. aversion), 2. Goal setting, and one's belief in their innate ability to achieve goals (self-efficacy or an internal locus of control), 3. Delegation of tasks to employees, and 4. The willingness to adopt new processes and technologies.

We test the following hypotheses:

1. Higher levels of risk-tolerance are associated with increased productivity and growth in MSEs.
2. Higher levels of goal-setting and self-efficacy are associated with increased productivity and growth in MSEs.
3. Higher levels of delegation of tasks to employees is associated with increased productivity and growth in MSEs.
4. Higher levels of adoption of new processes and technologies is associated with increased productivity and growth in MSEs.

We measure growth by analyzing sales revenues and employee counts in 2018 compared to 2016. Sales revenues and employee counts are usually the few reliable metrics that can be gathered within MSEs since many MSE managers do not have access to advanced technology resources and typically do not implement advanced business management practices. Past research has found these metrics to be common forms of measurement, and relatively methodologically uncontroversial (Delmar et al., 2003; Freel and Robson, 2004; Robson and Bennett 2000; Dobbs and Hamilton, 2007).

Since productivity is a key factor for the success of a firm (Cole et al., 2005), in this study we present a productivity index that is calculated from the few metrics available to us. "The central mission of a productivity index is to illuminate how a business can get more units of output per labor hour, per machine, and/or per pound of materials than its competitors" (Chew, 1988, para. 9). We will measure

productivity by taking a ratio of annual sales revenues divided by employee count for each of the three years (i.e., 2018, 2017, and 2016). We then calculate the average ratio from these three years to better capture the business's productivity across time. The resulting ratio allows us to measure output (sales) given a certain input (employees) and create a comparable productivity metric.

We utilize both qualitative and quantitative methodologies to analyze the potential associations of behavioral management patterns to growth and productivity. For the quantitative methodologies specifically, we utilize logistic regression as well as classification and regression tree (CART) modeling and compare the models on classification accuracy and model generalizability.

Our research is performed in conjunction with the MIT GeneSys project – a research initiative started in 2016 that focuses on contributing to small business growth in the developing countries by improving supply chain management and business expertise (<https://ctl.mit.edu/mit-genesys>). At the time of this research, the MIT GeneSys project has partnerships with 16 universities and one government institution in Latin America.

## 2. Literature Review

An increasing number of studies have been conducted related to MSEs in recent decades. Churchill and Lewis (1983) published a key article in the field of small business nearly 40 years ago, analyzing the five stages of small business growth. Since then, small business research has received increasing interest from the academic and regulatory arenas. For example, the OECD, as well as the ILO, have made small business a key research focus within their organizations, each publishing annual reports related to small businesses. We explore the research conducted in this field as well as research conducted in the field of psychology since we are inherently studying behavioral management patterns.

Bloom and Van Reenen (2007) challenged the basic assumption of whether management practices matter in the performance and growth of medium-sized firms. Their research concludes that, in fact, better-managed firms do perform better in terms of both productivity and sales. They also find that the quality of management practices strongly correlates to per-capita income at the country level. McKenzie and Woodruff (2016) pose the same basic question but explore the realm of MSEs rather than medium size firms. They find that the effects of management practices on MSEs is very similar to those found for medium size firms.

Further, McKenzie and Woodruff (2016) propose that management practices should be segmented into two realms; “human relations” and “business practices.” They build on this concept by concluding that “human relations” practices are more important for medium and large firms, and less important for MSEs. On the other hand, they claim that “business practices” such as marketing, record keeping, financial planning, and stock control are more important for MSEs. They find that an increase of one standard deviation in business practice scores, is associated with a 35% increase in labor productivity and a 23% increase in overall productivity. Building upon this research, we analyze if and what behavioral management patterns may potentially lead to, and predict, better “business practices,” and therefore, increased productivity and growth.

Mel, McKenzie, and Woodruff (2014) assess the impacts of two factors on MSE growth: managerial training and capital infusion. They find that both factors have only a temporary positive impact on small business growth that diminishes rapidly after the trials end. The authors suggest that selecting factors based on managerial ability or aspirations may provide better predictive insights into MSE’s ability to sustain business growth.

Sharma and Tarp (2018) find that MSEs in Vietnam that display higher levels of risk aversion are more likely to experience lower revenues. Additionally, Hanifzadeh, Talebi and Sajadi (2017) research the

same hypothesis, but in a positive correlative form. They find that small and medium enterprises in the Tehran Province that exhibit higher levels of risk taking achieve higher levels of growth than those who do not. Our first hypothesis regarding risk tolerance/aversion will test these findings in Latin American countries and build upon this research.

Sharma and Tarp (2018) also find that managers who exhibit higher levels of locus of control are more likely to obtain higher levels of revenue. Our second hypothesis assessing goals and self-efficacy is derived from the concept of locus of control. Locus of control was first coined by Rotter (1966). Later, Bandura (1977) built on this psychological concept by coining the term “self-efficacy”. Both terms allude to one’s innate belief in their ability to accomplish difficult tasks or goals. The underlying concept posed by Bandura is that perceived self-efficacy creates perceived outcomes. In other words, those who have low self-efficacy, or an external locus of control will tend to perceive difficult tasks or goals as unobtainable, and they may never attempt to accomplish them. Whereas those who have high self-efficacy or an internal locus of control, will be more likely to perceive difficult tasks or goals as obtainable, creating self-motivation and a movement to action.

Sharma and Tarp (2018) also find that innovativeness is not only associated with higher chances for increased revenues, but it is also associated with an increased probability of product innovations. They describe innovativeness as “openness and creativity of individuals, and a willingness to look for new ways and solutions” (Sharma and Tarp, p.2). From this description, the concept of innovativeness encompasses a vast area of topics, including product innovations. Therefore, we attempt to breakdown this idea of innovativeness into a smaller subset, and focus on one aspect of innovativeness, namely; a manager’s willingness to adopt new technologies or processes.

Nunes and Paulino (2018) present a system dynamics model that hypothesizes that organizations can only grow as much as they have available in capacity, and therefore, there can be no growth without,

first, an increase in capacity. Increased capacity is not only needed for equipment and machinery, but also in the form of human capital; hiring, training, and delegation.

Arizaleta-Valera and Zhu (2018) reinforce the research of Nunes and Paulino (2018) and also build on the research of Churchill and Lewis (1983). They suggest that as a firm grows, a small business owner must be able to trust others with certain tasks and responsibilities in the organization if the business is going to grow beyond the individual owner's capabilities and capacities. We will test this concept of trust and delegation as a variable on growth and productivity.

### 3. Data and Methodology

Our research explores and evaluates behavioral management patterns and business performance, each of which inherently include both qualitative and quantitative aspects. Therefore, in order to properly evaluate these concepts, our research methodology combines both qualitative and quantitative methodologies. There are two qualitative methodologies: 1. Company visits and 2. Interactive workshops. There are two quantitative methodologies: 1. Structured-disguised survey and 2. Classification and Regression Tree (CART) Analysis as well as Logistic Regression Analysis. We will explain each methodology in detail in the following four sections. A visual depiction of the research methodology is provided in Appendix C.

#### 3.1 Company Visits

In order to obtain a better understanding of the day-to-day operations and challenges that MSEs face, we visited three companies within Latin America, namely in Mexico. These visits allowed us to examine the company at a micro level where we were able to examine details of the products, equipment, services, and environments found within the firm. All three companies that we visited were from the retail

trade industry and the types of services and products included stationery, hand-made jewelry, and cosmetics. During our visits we utilized two techniques to gather relevant information.

The first technique was visual observation, which allowed us to observe the company's assets and operations such as products, equipment, processes and customer interactions. Additionally, we were able to analyze processes such as manufacturing, packaging, selling, inventory management and administrative work. Furthermore, we observed the relationships and behaviors between the owners, employees, and customers. This technique gave us a general idea of how the businesses are operating overall and shed light upon organizational strengths and potential areas of improvement.

The second technique was the use of open-ended questioning to gain additional insights from the owners and employees. This inductive method was conducted in parallel with our visual observation. We used this Q&A interaction to obtain more information about the business practices that are not immediately apparent through passive observation. Many of the questions aim to provide insights around the four behavioral and managerial patterns outlined earlier in the paper: Risk tolerance/aversion, goal-setting and self-efficacy, delegation of tasks to employees, and the willingness to adopt new processes and technologies.

### 3.2 Interactive Workshops

In addition to the company visits, we also conducted a workshop in Guadalajara, Mexico, with the participation of 25 MSE owners. The workshop was organized with the following three segments: 1. an introduction and overview about the MIT GeneSys project, and a discussion about the current status of MSEs in Latin America; 2. an interactive activity that we have named "The Tower Challenge" (adapted from the Marshmallow Challenge, Wujec, 2010); and 3. an interactive, reflective group discussion where participants are encouraged to share their personal insights and observations.

The first segment provides the participants with an introduction to the workshop and explains the goals of the research for the MIT GeneSys project. As stated by Velázquez Martínez, et al. (2018), the objective of MIT GeneSys is to provide a “framework of managerial insights aimed at improving productivity and competitive advantage in the small firms.” Additionally, the participants are provided with information around previous research conducted through MIT GeneSys and how their participation will help to continue the research in the future.

The second segment includes what we have named “The Tower Challenge”. The Tower Challenge is our modified version of what is commonly known as the “The Marshmallow Challenge” and aims to simulate a small business environment that allows MSE owners to make businesslike decisions. The Marshmallow Challenge is a team challenge designed by Peter Skillman in the early 2000’s. Tom Wujec (2010) discussed this challenge in his TED Talk, “Build a Tower, Build a Team.” The Marshmallow Challenge is relatively simple; a team of 4 is provided with 20 spaghetti noodles, 1 yard of tape, 1 yard of string, and one marshmallow. The objective is for the team to build the tallest free-standing structure by using the provided supplies in 18 minutes. The main constraint is that the one marshmallow has to be placed on top of the tower, and the tower must remain standing on its own.

Wujec (2010) concludes that in order to have a high rate of success in this challenge, teams must recognize the importance of the iterative creation process and build fast, successive prototypes, starting with the marshmallow. The hypothesis is that this iterative process helps the respective team formulate a more cohesive structure around the marshmallow.

We have redesigned Skillman’s “Marshmallow Challenge” to be more aligned with our research in business and behavioral management patterns. This simulation acts as a medium for us to observe how the participants actually behave when faced with business decisions similar to those in real life. The Tower

Challenge will help us to test the potential biases that may exist in the participant's responses of the structured-disguised survey (discussed in Section 3.3).

We have strategically integrated some of the survey questions into the Tower Challenge as actionable decisions. As the participants are making decisions throughout the Tower Challenge, they are also, unknowingly, answering many of the survey questions through real decision-making. This allows us to compare the participant's survey responses with their actual behaviors exhibited during the challenge.

The Tower Challenge is played individually rather than in teams, as is done in the Marshmallow Challenge. Additionally, we introduce monetary incentives and financial markets into the Tower Challenge. The objective of the Tower Challenge is not to necessarily create the tallest tower overall (although it does help), but rather to have the most cash on hand at the end of the challenge. At the beginning of the challenge, each participant is supplied with 10 spaghetti noodles, 20 medium-sized marshmallows, and a goals/budget worksheet where participants can keep track of their financial transactions and goals (the sheet is collected at the end of the workshop to examine the level of goals/KPIs that the participant adopted for the challenge).

The Tower Challenge includes three 15-minute rounds, with a ten-minute break in between each round to let participants buy supplies and change or develop new strategies. The participants are awarded \$0.10 for every centimeter in tower height at the end of each round. Participants are also given the opportunity to purchase additional supplies such as spaghetti noodles and marshmallows for the price of \$0.25 each and a ruler at the price of \$1. Moreover, players can take out bank loans up to \$5 with 20% compound interest rate accrued each round it is unpaid; however, a contestant cannot take out another loan if he or she already has an outstanding loan balance. An outline of each round is shown here:

- Round One: Participants are given the option to receive \$3 at the beginning of Round One or wait and receive \$5 at the beginning of Round Two. Towers are measured at the end of the round and the money is awarded respective to the participant's tower height.
- Round Two: New supplies are introduced in addition to the original supplies. Participants now have the option to purchase straws and Styrofoam cups at a cost of \$0.50 each. Furthermore, a tower design guide can be purchased for \$3. In this round, we are imitating new market dynamics to measure the participant's levels of adoption of new processes/technologies. Towers are measured at the end of the round and the money is rewarded respective to the participant's tower height.
- Round Three: What was applicable in Round Two is applicable in this round with no changes. Towers are measured at the end of the round and the money is rewarded respective to the participant's tower height. At the end of this round, all unpaid bank loans will be due and deducted from total winnings, and the participant with the most cash on-hand wins.

We close the workshop with an interactive, reflective session where we elicit feedback from the participants and ask about their own internal observations of their behavioral patterns and strategies.

Some of the questions we ask are:

- Who took \$3 at the beginning of round one and why? Who instead waited until round two to get \$5 and why?
- Who made goals? Did you achieve them? Were they important?
- Who kept a budget and tracked all transactions? Was it helpful?
- Who took a bank loan? When and Why?
- Who purchased better supplies/tower guide? Why? Were they helpful?

The closing session is important as it allows us to extract internal information from the participants that can't be observed during the activity. Moreover, conducting this session minimizes the probability of misinterpreting the participants' behavior in the workshop.

### 3.3 Structured-Disguised Survey

In addition to our observational methodologies, we also apply quantitative methodologies through the administration of a survey in Mexico and Colombia. This survey allows us to explore the behavioral management patterns from the internal perspective of the participant, rather than relying solely on our external observations in the research. We can then superimpose these external and internal observations to derive deeper insights into each participant's behavioral management patterns. Additionally, because we can only physically visit a limited number of companies, and only a limited number of companies are able to participate in our workshop, this survey significantly increases the number of observations available to us.

It is well known that one of the main challenges in collecting data and information from surveys is the possibility that respondents may provide untruthful or inaccurate responses to survey questions. This tends to happen more frequently when survey questions contain sensitive topics or contain an aspect of "social desirability" (Tourangeau & Yan, 2007; Rosenfeld, Imai, & Shapiro, 2016; Brenner & DeLamater, 2016). Social desirability is the extent to which a survey question elicits a response that is seen to be socially (un)acceptable or socially (un)desirable (Tourangeau et al., 2000). Brenner et al. (2016) further hypothesize that identity theory also introduces potential bias in survey respondents. "Because these behaviors are valued and widely seen as good—for the individual, his or her community, or society—they are claimed on surveys even when the respondent's behavior does not support such claims" (Brenner & DeLamater, 2016, p. 1).

Given that our research explores the realm of behavioral management, we are aware that our research could be susceptible to some levels of social-desirability and identity-theory biases. The research

literature surrounding social desirability bias and identity theory bias is large, and we do not seek to provide a comprehensive review of the literature within this paper, rather we simply use them as foundational theories for the structure of our survey.

Velázquez Martínez, et al. (2018) also realized the potential of these biases when developing the survey model and data collection guidelines for the MIT GeneSys project. Therefore, in an attempt to mitigate this bias, they incorporated “validation” questions.

The MIT GeneSys survey consists of many direct questions that usually reference a specific business management practice, such as comparing product price offerings to the competitor’s product price offerings. The direct question would elicit a simple yes or no response; e.g. the respondent either does or does not compare prices. The validation questions are asked after a direct question and are meant to confirm the response to the direct question. This validation question is usually framed as an open-ended question and requires the respondent to recall some fact about the referenced business practice, e.g. how frequently are you comparing prices with your competitors?

Taking guidance from the vast literature on social desirability bias and identity theory bias, as well as guidance from the MIT GeneSys leadership experiences, we have developed what we call a “structured-disguised” survey. A structured survey is one that “...consists of a set of standardized questions with a fixed scheme, which specifies the exact wording and order of the questions, for gathering information from respondents” (Cheung, 2014, p. 6400). Disguised methods are usually referenced when describing observational surveys, where the participants do not know that they are being observed. However, our survey is not observational in nature, but we have applied the concept of a disguised method to it. Simply put, we do not tell the participants what the specific purpose of the survey is, and we disguise our questions so the participants cannot easily identify what our objectives are for the survey.

The survey was administered online, and the web link was provided to each manager via email. This method allowed the participants to complete the survey on their own time and in the comfort of their own environments. The survey consists of 33 questions, of which the first 13 questions are descriptive and demographic in nature, including: name, gender, company name, industry, city/country, annual revenues, and annual employee counts.

The last 20 questions are structured-disguised questions, which can all be found in Appendix B with detailed information for each question. The 20 structured-disguised questions consist of five questions for each of the four behavioral management patterns: goals, risk, delegation, and adoption of new technologies/processes. All 20 structured-disguised survey questions are multiple-choice with scaled responses. Most structured-disguised questions provided the participant with two statements, along with four options to select from on a typical Likert scale (strongly agree, agree, etc.).

The structured-disguised questions are written such that the available choices are phrased in a positive reference, in an effort to avoid loaded, leading, or biased statements. For example, the structured-disguised question shown in *Table 1* provides two positive statements that seem neutral to the participant, mitigating potential bias towards either response.

*Table 1. Example of Positive-Positive structured survey question*

<i>I enjoy working with others.</i>		<i>I enjoy working on my own.</i>	
<i>Strongly Agree</i>	<i>Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>

This is in contrast to the structured-disguised question shown in *Table 2* which provides a positive and negative option for the participant to select from on the Likert scale. This positive-negative question structure may lead to bias towards the positive response under the identity theory and social desirability theory structures.

Table 2. Example of Positive-Negative structured survey question

<i>I enjoy working with others.</i>		<i>I do not enjoy working with others.</i>	
<i>Strongly Agree</i>	<i>Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>

It is important to note here that three of the five structured-disguised questions in the risk section are somewhat different from the typical Likert scale shown in tables one and two. For these three specific risk questions, we provided the participant with a scenario and multiple options to select from in response to that scenario. The economics research community has provided a vast amount of literature around the measurement of individual risk aversion and risk tolerance. One of the most common forms of individual risk measurement that is utilized is asking a survey participant for the reservation price of a hypothetical lottery ticket (Ding, Hartog, and Sun, 2010; Donkers, Melenberg, Van Soest, 2001). Our version of this lottery scenario is written as: “Assume that if you buy a lottery ticket, you will have a 10% chance of winning \$1,000 USD. If you had exactly \$1,000 USD in your savings account, how much would you be willing to pay for the lottery ticket?”

However, we believe that this hypothetical lottery scenario has two underlying assumptions that prevent us from accurately measuring an individual’s true comprehensive risk profile based on this scenario alone. The first assumption is that everyone is willing to gamble in a lottery. A person may view gambling as against their religious or personal ideologies, and therefore, would likely respond to the lottery question with \$0 based solely on personal ideologies. This could be misinterpreted as the participant being highly risk averse.

A second assumption in the lottery scenario is that personal gambling risk is the same as other risks. Weber, Blais, and Betz (2002) challenge this assumption and find “...that risk-taking is indeed content-specific”. Their research expanded to include five content domains for risk measurement: financial decisions, health/safety, recreational, ethical, and social. We too have expanded our risk profile

measurements, but we will use four domains instead of five. Our four domains are segmented as: personal finance, business finance, family finance, and general safety. We believe these four domains will allow us to capture a more complete picture of a participant’s risk profile. The remaining 17 Likert-scale questions are explained in Appendix B.

With the survey responses, we are able to compile behavioral management profiles for each participant and for each area of focus (goals, risk, delegation, adoption of new technology/processes) by converting the responses into quantifiable “scores.” For the 17 Likert-scale structured-disguised questions, we simply record the response as 0, 1, 2, or 3. A score of three would represent a response that supports the respective hypothesis, whereas a score of zero would represent a response that is opposite of the hypothesis. If we use the same example from *Table 2* above, the scores associated with each respective response would be as shown in *Table 3* below.

*Table 3. Example of Positive-Positive structured survey question with associated scores*

<i>I enjoy working with others.</i>		<i>I enjoy working on my own.</i>	
<i>Strongly Agree</i>	<i>Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>
<i>3</i>	<i>2</i>	<i>1</i>	<i>0</i>

The question shown in *Table 3* is categorized within the delegation category. Our hypothesis is that higher levels of delegation of tasks to employees is associated with increased productivity and growth in MSEs. The question shown in *Table 3* posits that those who enjoy working with others are more likely to be delegators. This is not to say that those who prefer to work on their own are poor delegators. Rather, we argue that those who prefer to work on their own are less likely to hire additional employees, and therefore, will have fewer people to delegate to, resulting in a more centralized organizational structure, and therefore, lower levels of overall delegation. Therefore, participants who “Strongly Agree” with the statement, “I enjoy working with others,” would score a three on the Likert scale, whereas participants who “Strongly Agree” with the statement, “I enjoy working on my own,” would score a zero.

Once we convert all responses to the respective scores, we simply calculate the average score for all five questions from each of the four sections. The resulting score output for individual participants will look like the output shown in *Table 4*. With this method, a participant’s score will always be rangebound between zero and three. Within *Table 4*, we would derive that participant 18 is highly goal-oriented based on their high goals score of 3.0, while participant 13 is on the low end of the goals scale with a score of 1.0, making them more task-oriented. The same logic can be applied to all four areas in relation to the respective hypothesis. *Table 5* shows a high-level, comprehensive score scale for each of the four areas.

*Table 4. Example of aggregated average scores for each behavioral pattern category*

<i>Participant #</i>	<i>Goals</i>	<i>Risks</i>	<i>Delegation</i>	<i>Adoption</i>
<i>18</i>	<i>3.00</i>	<i>1.98</i>	<i>1.80</i>	<i>2.40</i>
<i>1</i>	<i>2.20</i>	<i>1.32</i>	<i>2.40</i>	<i>2.40</i>
<i>13</i>	<i>1.00</i>	<i>1.65</i>	<i>1.00</i>	<i>1.60</i>
<i>27</i>	<i>1.40</i>	<i>1.36</i>	<i>2.20</i>	<i>2.20</i>
<i>3</i>	<i>2.20</i>	<i>1.43</i>	<i>1.80</i>	<i>2.60</i>

*Table 5. Overview of scores associated with respective hypothesis*

<i>Goal-Oriented</i>	<i>3</i>	<i>2</i>	<i>1</i>	<i>0</i>	<i>Task-Oriented</i>
<i>Risk-Tolerant</i>	<i>3</i>	<i>2</i>	<i>1</i>	<i>0</i>	<i>Risk-Averse</i>
<i>High Delegation</i>	<i>3</i>	<i>2</i>	<i>1</i>	<i>0</i>	<i>Low Delegation</i>
<i>High Adoption</i>	<i>3</i>	<i>2</i>	<i>1</i>	<i>0</i>	<i>Low Adoption</i>

Finally, it is important to note here that the concept of a disguised survey should not be confused with an indirect survey method, which is commonly used in social psychology and economics research. “Indirect questioning/indirect response (IR) techniques are...meant to veil the answers of individual respondents’ engagement in sensitive behaviors to the investigators, enumerators, and other individuals” (Chuang, Dupas, Huillery, and Seban, 2019). As described by Chuang, et.al., IR techniques are meant to disguise the answers of the respondents from the researcher, rather than disguise the purpose of the survey from the respondent, as is the case for our survey.

### 3.4 Classification Tree Analysis & Logistic Regression

In total, we received 31 completed surveys, 29 from MSE owners located in Mexico and 2 from MSE owners located in Colombia. To analyze these survey results, we utilize logistic regression analysis as well as classification and regression tree (CART) analysis to identify the possible relationships in the data. We first use logistic regression to identify if the relationships are linear in nature, as past research has alluded to. We will then challenge the assumption of linearity through CART analysis which will allow us to observe potential non-linear relationships in the data. We will then compare both of these methods in terms of model prediction accuracy, model strength, and model generalizability.

“CART analysis is a tree-building technique which is unlike traditional data analysis methods... CART is often able to uncover complex interactions between predictors which may be difficult or impossible to uncover using traditional multivariate techniques” (Lewis, 2000). The research literature surrounding logistic regression and CART is vast, and we do not seek to provide a comprehensive review of the literature within this paper, rather we simply use them as foundational models for the structure of our quantitative methodology.

The quantitative methodology includes five stages:

1. Define and quantify the target metrics.
2. Convert the target metrics to binary classifiers.
3. Set target variables and predictive features.
4. Employ logistic regression and CART models.
5. Conduct cross-validation to measure model generalizability and classification accuracy.

Stage 1: Because we are inherently constrained to revenue and employee counts by the limited available data from MSEs, we define business growth through two measures: revenue growth and

employee growth. For both of these growth measures, we calculate the ratio of revenues and employee counts in 2018 to the revenues and employee counts in 2016. Past research has found these metrics to be common forms of measurement, and relatively methodologically uncontroversial (Delmar et al., 2003; Freel and Robson, 2004; Robson and Bennett 2000; Dobbs and Hamilton, 2007).

We can also measure productivity through the use of the same revenue and employee count metrics. Productivity is calculated by taking the ratio of annual revenues divided by the employee counts for each of the three respective years, and then averaged over all three years (2018, 2017, 2016). The resulting ratio allows us to measure output (revenues) provided each input (employees). It is important to note here that all company revenues were reported in the respective business country currency. All currencies were converted to US dollars using the annual average exchange rate for each respective year and each respective country in order to normalize the currencies.

Stage 2: Once the growth and productivity metrics are calculated for each participant, we then convert each of the three-individual metrics to a binary value. To do this, we first calculate the median value for the total sample population for each of the three-individual metrics: revenue growth, employee growth, and productivity. This median value becomes the threshold at which participants are evaluated and classified in respect to the sample population. If a participant's individual metric value is above the median, they are listed as high growth (HG) or high productivity (HP) (depending on the metric). If the participant's metric value is equal to or below the median, they are listed as low growth (LG) or low productivity (LP). The respective classifications are applied to each participant and each metric and can be analyzed through the logistic regression and CART models. High growth and high productivity are classified as 1, while low growth and low productivity are classified as 0.

Stage 3: Revenue growth, employee growth, and productivity are set as target variables, and the participant's four behavioral pattern (goals, risk, delegation, and adoption) scores, derived from the survey, are set as predictive features.

Stage 4: We first apply logistic regression and CART to the full dataset in order to derive a full-sample model that we can use to evaluate which features may be most important in predicting the target variables. The aim for these full-sample models is to provide an overall conceptual framework that describes which behavioral patterns are more likely to lead to increased business growth and/or productivity.

Stage 5: Last, we measure the generalizability and classification accuracy of both models by conducting leave-one-out cross-validation (LOOCV). LOOCV is the most extreme form of the common method, k-fold cross-validation. LOOCV allows for a model to be trained on  $n-1$  observations (where  $n$  is equal to the total number of observations). This method allows us to train the models on 30 observations, leaving one observation to be used as the test observation. The process is repeated 31 times, with each observation being used as a test observation exactly once. "Leave-one-out cross-validation provides a sensible model selection criterion as it has been shown to provide an almost unbiased estimate of the true generalization ability of the model" (Cawley and Talbot, 2004).

We selected LOOCV in favor of other cross-validation methods because of the limited number of observations available to us. Because we have 31 total observations available, it is quantitatively expensive for us to remove any number of observations from the dataset for testing, so we limit this cost by using LOOCV. LOOCV becomes more computationally expensive as  $n$  increases, but given the limited size of our dataset, computational cost is not an issue for our study.

When utilizing the CART model, we first need to calculate and determine the optimal tree-depth to reduce the risk of overfitting or underfitting. We want the model to be large enough to allow for the

possibility of all four features to be utilized as splits in the tree. Although, at the same time, we need to constrain the tree-depth, and therefore, the number of splits, to reduce the risk of overfitting. We have solved this through a simple optimization model, explained here:

The number of terminal nodes ( $tn$ ) in a tree can be calculated by taking two to the power of the specified depth (Molnar, 2019). We can then calculate the total number of possible splits ( $s$ ) as  $tn - 1$ . Therefore, we optimize the tree-depth to minimize  $s$  with the constraint  $s \geq 4$ .

If we were to select a tree-depth of two, we would have a maximum of three splits ( $s = 2^2 - 1$ ), only allowing for potentially three of the four features to be used in the model, and not satisfying the constraint. A tree-depth of three, however, allows for a maximum of seven splits ( $s = 2^3 - 1$ ), which is the first instance that satisfies the optimization constraint and the resulting minimized objective. Therefore, a tree-depth of three allows for the possibility of each of the four features to be used in the model at least once, reducing the risk of underfitting, and also reduces the risk of overfitting by minimizing the number of splits, and consequently, the tree-depth.

It is important to note here that this does not guarantee that all four features will actually be used in the model; rather, this only allows for the *possibility* for all four features to be used in the model. For example, one feature may be substantially stronger in predicting the target variable than another. In this case, the stronger feature may be used multiple times in a decision tree at different splits in place of the other feature(s).

## 4. Results and Findings

In this chapter, we discuss the results and findings of our study. We begin by showing descriptive statistics, then present qualitative observations through the tower challenge and company visits, and conclude with quantitative findings from logistic regression, CART and LOOCV.

### 4.1 Descriptive Statistics

Of the 31 survey participants, 13 participants are female, and 18 participants are male. The most common industries are retail, manufacturing, and wholesale trade, with these three industries making up ~75% of the total sample population. The vast majority of participants are located in Mexico (29), with two participants located in Colombia. *Table 6* shows the descriptive statistics for the size of the organizations of the survey population, with the median organization comprising of 13 employees and \$187,210 in annual revenues as of 2018.

*Table 7* shows the median revenue growth rate in 2018 over 2016 to be 27%, while the median employee count growth rate was 20% for the same years. The median productivity averaged over all three years amounts to \$13,570 per employee. There is large variation in these measures, as seen in the elevated levels of averages and high coefficients of variation (CV).

*Table 6. Descriptive statistics for sample population*

	<i>Number of employees in 2018</i>	<i>Avg Annual Rev 2018 USD</i>
<i>Avg</i>	<i>13.26</i>	<i>\$1,268,706</i>
<i>Median</i>	<i>13.00</i>	<i>\$187,210</i>
<i>Std Dev</i>	<i>8.94</i>	<i>\$4,566,475</i>
<i>CV</i>	<i>0.67</i>	<i>3.60</i>

Table 7. Descriptive statistics for target variables

	<i>Rev Growth</i>	<i>Employee Growth</i>	<i>Productivity</i>
<i>Avg</i>	1.84	0.65	\$64,802
<i>Median</i>	0.27	0.20	\$13,570
<i>Std Dev</i>	5.65	0.96	\$215,786
<i>CV</i>	3.08	1.49	3.33

Table 8 shows the sample population statistics for the four behavioral pattern scores derived from the survey responses. Each behavioral pattern is relatively uniform in nature, with relatively low variation in the data. We would expect these lower levels of variation given that the measures are constrained between the values of zero and three. Overall, the median scores for each behavioral pattern are in the range of 1.68 to 2.20. Assuming that a measure of 1.5 depicts an average score, we can conclude that the median group measures slightly above average in all four behavioral patterns.

Table 8. Descriptive statistics for behavioral patterns

	<i>Survey Goals</i>	<i>Survey Risk</i>	<i>Survey Delegation</i>	<i>Survey Adoption</i>
<i>Avg</i>	1.90	1.55	1.99	2.05
<i>Median</i>	2.00	1.68	2.20	2.20
<i>Std Dev</i>	0.52	0.52	0.56	0.43
<i>CV</i>	0.27	0.34	0.28	0.21

Risk is found to have the lowest median score of all behavioral patterns, while also having the greatest amount of variation. On the other hand, adoption has the highest median score of all behavioral patterns, and the least amount of variation. Given the characteristics of the risk data, we hypothesize that risk could be a strong feature for classification models. Additionally, based on the same logic, we hypothesize that adoption could be a weak feature for classification models. We will explore these hypotheses later in this section.

## 4.2 Findings from Qualitative Observations – Tower Challenge

All of the qualitative observations were conducted in the Guadalajara, Mexico, region in February 2019. We will explore each of the observation methods (Interactive Workshop and Company Visits) in chronological order, beginning with the Tower Challenge that was conducted at the workshop with 25 MSE owners from the Guadalajara region. Of the 25 attendees, 20 participated in the Tower Challenge for the entire duration of the challenge. Of the 20 participants, 14 completed the survey in full.

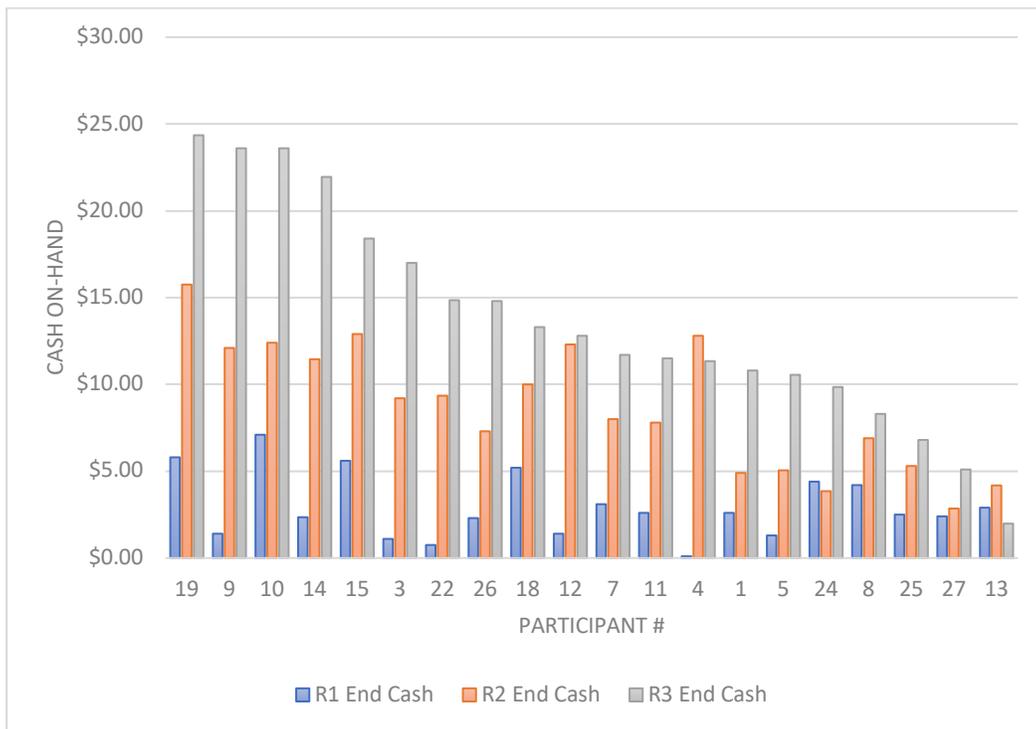
Attending the workshop as volunteers were six undergraduate students from Monterrey Institute of Technology, and six employees from Massachusetts Institute of Technology Enterprise Forum, also known as MITEF. The volunteers helped to organize materials, enforce rules, and facilitate transactions within the Tower Challenge. Additionally, before the workshop, we briefed the volunteers on our research and the objectives of the Tower Challenge for our research. This allowed the volunteers to take observational notes of the participant activities and behaviors throughout the challenge, providing a broader collection of observations for the research.

Additionally, before the workshop, we developed a cloud-based spreadsheet that was shared with the volunteers and would capture all participant decisions and financial transactions throughout the challenge. The volunteers were trained on how to use the spreadsheet before the workshop. This shared spreadsheet allowed the volunteers to capture data and transactions quickly, while also eliminating the need for paper transactions and manual calculations. It also provided us with all of the data in one comprehensive document, providing more accurate data and making the data analysis relatively fast compared to paper tabulation.

*Figure 1* shows the ending cash on-hand by round, by participant. Because the objective of the game is to have the most cash on-hand at the end of round three, we have sorted the values by ending cash on-hand for round three, highest to lowest. From this, we can correctly conclude that participant 19 won the challenge overall. *Figure 2* and *Figure 3* are sorted by the same value. *Figure 2* shows the amount

of supplies purchased each round, by participant; while *Figure 3* shows the tower height by round, by participant. We will explore this data and the corresponding behavioral patterns through the observational notes compiled during the challenge.

When we compare *Figure 1* and *Figure 3*, we find that having the tallest tower overall does not guarantee a winning position. The top five finalists all had similar tower heights, with third place having the overall tallest tower of the challenge. Additionally, comparing *Figure 1* and *Figure 2*, we find that there is somewhat of an inverse relationship between the amount of supplies purchased and the final cash on-hand amount.



*Figure 1. Tower Challenge – Ending cash on-hand by round, by participant*

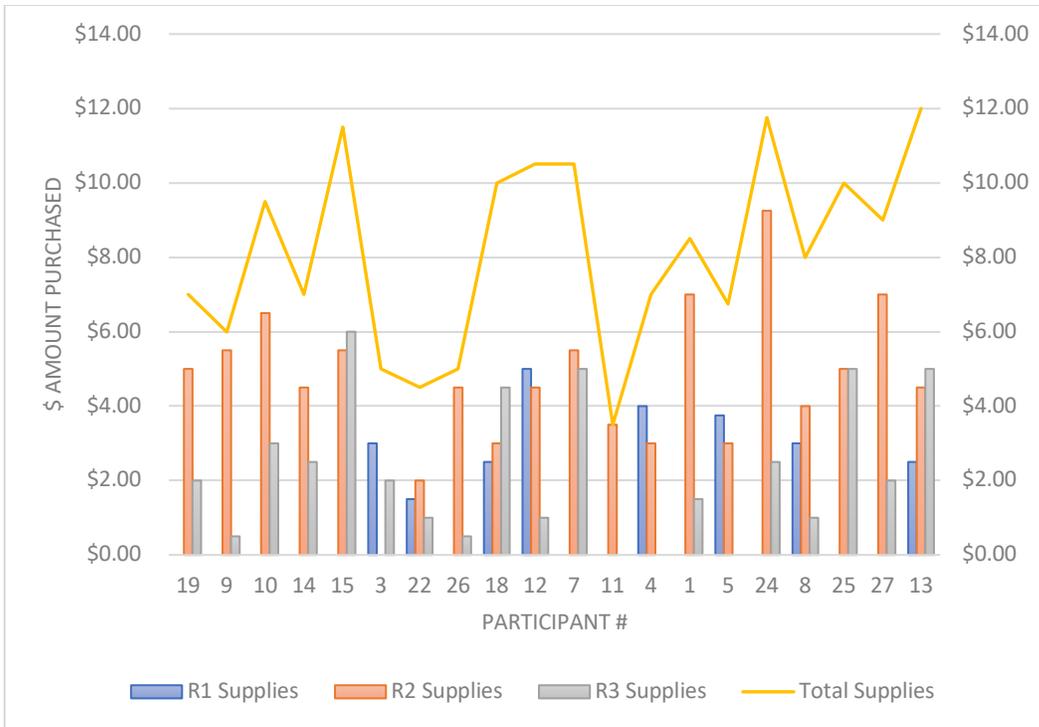


Figure 2. Tower Challenge – \$ Amount of supplies purchased by round, by participant

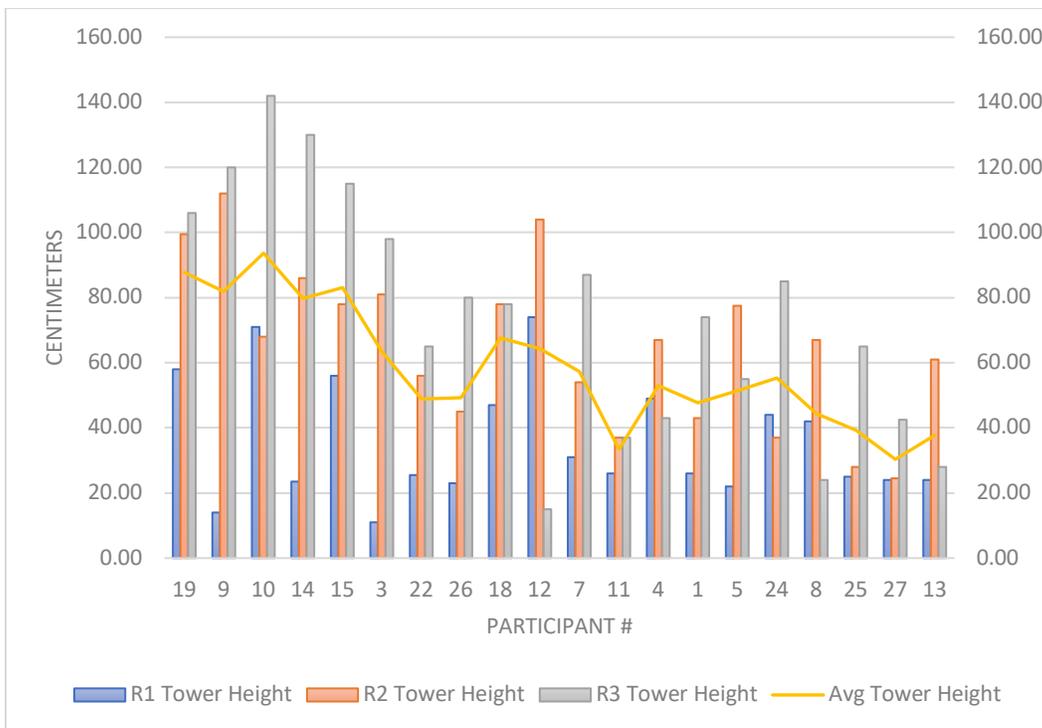


Figure 3. Tower Challenge – Tower height by round, by participant

Participant 19 seems to have performed above average in tower height and supplies purchased but does not necessarily perform best in any one particular area of the challenge aside from the final ending cash on-hand. Therefore, in order to obtain a better understanding of how participant 19 won the challenge, we turn to the observational notes. Here is an excerpt from the observational notes of a MITEF volunteer for participant 19:

*Participant 19 (the winner), said the key to winning was trusting in themselves and avoiding distractions. Participant 19 never bothered peeking at what the other participants were doing. Participant 19 seemed really confident they were going to win at the beginning of the third round. While some participants started building really tall towers, participant 19 asked one of the facilitators "Just to confirm, to win you need to have the most amount of money, right?"*

By confirming the objective throughout the challenge, and with statements such as “trust in myself” and “avoid distractions”, participant 19 seems to exhibit an internal locus of control and a strong focus on end objectives. Given these characteristics, we argue that participant 19 is goal-oriented rather than task-oriented. The behavioral pattern scores for participant 19 are as follows: Goals = 2.40, Risk = 0.93, Delegation = 3.00, Adoption = 2.60. The goals score is well above average and is 20% greater than the group median, which seems to confirm our hypothesis.

The Tower Challenge also allowed us to observe how the participants make decisions when grappling with the concepts of risk. Risk played a large role in many decisions for the participants in the challenge, and as we will explore later, is also a major factor for their business. One particular encounter with participant 12 provided some insights on the multi-dimensionalities of risk. Participant 12 has recently founded a startup in 2018 that works with small retailers in the Guadalajara region. Participant 12 chose to sit on the front row in the workshop and seemed intensely engaged throughout the first segment of the workshop.

When the Tower Challenge began, participant 12 immediately started to draw structural design sketches and calculate what additional supplies would likely be needed. By the end of round one, participant 12 had the tallest tower, and the second tallest tower by the end of round two. When we analyze the purchased supplies data for participant 12, we find that they decided to make an early, and large, investment in supplies. They chose to wait for the \$5 in round two but took a loan in round one to supplement the strategy of purchasing supplies early. Participant 12 made another large investment in supplies in round two, seeing an opportunity with the newly introduced Styrofoam cups in his structural designs.

By the end of round two, participant 12 was in fifth place and had the second tallest tower. At the beginning of round three, participant 12 approached us and asked, "Can I leave my tower as it is, and not build anymore?" We confirmed that all participants have the freedom to choose to leave the tower as it was from the previous round or that one could also continue to build if they preferred to try and make it taller. As we continued to observe participant 12, it was evident that they were struggling with this scenario. Should they play it safe and hope the tower was tall enough to win, or take a risk and try and make it taller to improve the chances of winning?

If we analyze this scenario at a deeper level, we find that a participant's levels of risk-tolerance, self-efficacy, and locus of control all influence the final decision. For example, a risk-tolerant participant with high self-efficacy and an internal locus of control would view this decision as a risk worth taking; believing in their ability to make the tower taller. This participant may say something like, "I have been successful in building the tower this tall so far, so I am sure I can make it even taller. If I become content, others might build taller towers and pass me in the standings."

On the other hand, a risk-averse participant with low self-efficacy and an external locus of control would likely be content with the existing situation, leaving the outcome of the challenge to be decided by

the other participant's abilities to do better. This participant might say something like, "I know I have done a good job, and it is not worth the risk to try and build a taller tower. I hope it is good enough to win, but if I'm not meant to win, then I'm not meant to win."

After contemplating this decision for a few minutes, participant 12 eventually decided to take a risk and try to make a taller tower. Participant 12 purchased a small amount of additional supplies and disassembled half of the tower to reinforce the base structure needed for a taller tower. From the data shown in Figure 3, we can see that this decision did not work out for participant 12 in the end. The newly constructed tower toppled to the ground and left the participant with only a small part of the tower standing. Participant 12 ended in tenth place, exactly average, but five spots lower than where they had been at the beginning of round three.

We decided to go back and analyze what would have happened if participant 12 had left their tower as it was. Assuming that the participant would not have purchased an additional \$1.00 in supplies at the beginning of round three, participant 12 would have finished in fourth place with a final cash on-hand of \$22.70. By this estimate, participant 12 made the right decision if their objective was to win.

Although, it is important to note here that the participants do not have visibility to the other participant's cash on-hand balances at any point in the challenge. They only have visibility to their own balances throughout the challenge. Therefore, participant 12 would have had to make an estimated guess of the competition's ability to win and measure that ability to win against their current position. We should also note that there was a lot of excitement in the room as round three began. Many participants were pushing the boundaries of tower height and we believe that participant 12's decision was likely influenced by this environment.

If we were to hypothesize about participant 12's behavioral pattern scores based solely on the decision made in round three, we would likely hypothesize that participant 12 is highly risk-tolerant and

goal-oriented. However, this would disregard all of the actions that participant 12 made earlier in the challenge. Recall that participant 12 was very disciplined in planning and decision-making in the first two rounds of the challenge, and actually mitigated risk by conducting such in-depth planning. Participant 12's behavioral pattern scores from the survey are as follows: Goals = 1.80, Risk = 0.91, Delegation = 2.20, and Adoption = 1.80.

Participant 12's scores are very similar to participant 19, whom we discussed earlier. However, participant 12 has slightly lower scores for goals and adoption, yet still above average. From the scores we would conclude that participant 12 is highly risk-averse, given the low risk score of 0.91. However, this scenario has shown us that being risk-averse does not necessarily translate to avoiding risk. Rather than avoiding risk altogether, participant 12 choose to, instead, mitigate risks through disciplined planning and scenario analysis. Here is an excerpt of some observational notes from a Monterrey Tech undergraduate student volunteer:

*Participant 12 was the only one I saw who drew some sketches before the game began. Participant 12 was also the only one I saw at the table who was organized with their cash flows. On the other hand, participants 1 and 18 were not very organized in these aspects since they asked me to tell them the numbers for investments, earnings, etc.*

From these observations, we hypothesize that keeping detailed financial records and being highly disciplined in planning and scenario analysis can mitigate inherent risks, and allow typically risk-averse persons to make, what may seem to others, high-risk decisions. Additionally, a person's surrounding competitive environment may influence one's willingness to take risks. Unfortunately, financial planning and competitive environments are beyond the scope of this study. Instead, from this scenario, we aim to provide a basic framework for the concept of risk, and to also highlight some of the limitations to our measure of risk.

Finally, it is important to note here that we do not claim that the Tower Challenge performance is exactly correlated to actual business performance. In fact, we have found that it is not. Trying to simulate a complete business environment would require many more constraints and variables, that we do not attempt to emulate for the sake of simplicity for the participants. Further, some people simply are not great engineers, architects, or builders, but may be great at sales, trade, or any other number of occupations. Recall that the main purpose of the Tower Challenge is to help us test the potential biases that may exist in the participant's responses of the structured-disguised survey and is solely a supplemental observation method in addition to the company visits that we will discuss next.

#### 4.3 Findings from Qualitative Observations – Company Visits

We visited three companies in the Guadalajara region, all of whom had attended the workshop the previous day. All three companies operate in the retail trade industry and the types of services and products included stationery, hand-made jewelry, and cosmetics. We will explore the observations from two of the three visits in this section.

Our first visit was to the stationary products store focused on school supplies, arts and crafts, and computer services. For the purposes of this study, we will call this company School, Inc. to keep the business and owner anonymous. School, Inc. is located in a suburban town about an hour outside of Guadalajara. The business operates from of a first-floor apartment, approximately 600 square feet in size, and was established four years earlier, at the time of this study. The store had a few metal racks used to display notebooks, pencils, paints, other arts and craft supplies, and toys. The store also had a small register counter, and the bedroom had been converted to a “cybercafé” where customers could pay to use a desktop computer with internet, as well as have access to printing services.

The metrics for the business owner’s behavioral patterns and for the organization are listed in *Table 9*. The business owner scores well above average on all four behavioral patterns, and the business has grown revenues at twice the rate of the sample population. However, average productivity is below the sample population median of \$13,570.

*Table 9. School, Inc. - behavioral pattern scores and organization metrics*

<i>Goals</i>	<i>Risk</i>	<i>Delegation</i>	<i>Adoption</i>	<i>Rev Growth</i>	<i>Employee Growth</i>	<i>Productivity</i>
2.20	2.01	2.20	2.20	55.4%	100.0%	\$8,002

The owner of School, Inc. contributes their rapid business growth to exceptional customer service. We were able to confirm this claim as we observed the interactions with customers during our visit. As we proceeded with the open-ended Q&A session, the owner expressed extreme interest in growth and expansion by opening another store location within the next six months. The ultimate goal for the business is to open a distribution center in the suburban region that could supply the stores as well as competitor’s stores. These goals and aspiration seem to confirm the high goals score of 2.20.

Additionally, we observed that the owner has a strong desire to continually learn about, and integrate, new technology. School, Inc., was one of the first locations in the town to offer internet on a desktop and a color printer. This seems to confirm the high adoption score of 2.20. Finally, the owner of School, Inc. has understood when additional employees and capital have been needed to support the business growth and operations. The owner has taken the necessary risks to hire employees and/or take out bank loans at those times. These actions would seem to confirm the high risk and delegation scores of 2.01 and 2.20 respectively.

Our second visit was to a business which offered hand-made jewelry, both through wholesale and retail channels. For the purposes of this study, we call this business Jewelry, Inc. for the same purposes of anonymity. The jewelry making process employed at Jewelry, Inc. is one that has been passed down over

hundreds of years through the generations of the family. The business operates out of the owner’s home and has operated as a business for many years. The metrics for the business owner’s behavioral patterns and for the organization are listed in *Table 10*.

*Table 10. Jewelry, Inc. - behavioral pattern scores and organization metrics*

<i>Goals</i>	<i>Risks</i>	<i>Delegation</i>	<i>Adoption</i>	<i>Rev Growth</i>	<i>Employee Growth</i>	<i>Productivity</i>
<i>1.60</i>	<i>0.83</i>	<i>1.60</i>	<i>1.80</i>	<i>-2.9%</i>	<i>0.0%</i>	<i>\$1,408</i>

Jewelry, Inc. offers hand-made art in the form of small trinkets and sandals embroidered with the special art pieces. The art pieces are all made through the same process from natural clay found in the region. Jewelry, Inc. sells the products to art galleries, museums, and collectors who are interested in the traditional artform. However, most revenues are generated from B2C sales at local expositions. All employees of the company are family members who have been trained in the traditional art making process.

As outlined in *Table 10*, the company has experienced flat revenues for the last three years, with a minor loss showing in 2018 as a result of currency exchange fluctuations. The owner’s behavioral pattern scores are far below the sample population median scores, with the third lowest risk score of the entire sample population. These scores were all confirmed through the observations during our visit.

The owner of Jewelry, Inc. expressed sincere interest in growth and expansion. This interest seemed to be spurred by recent positive experiences in social media marketing ventures. When we asked the owner how they would like to grow the company, the options were many. The options for growth ranged from opening a local store, to expanding through social media, to expansion of wholesale channels, and more. We asked why they had not yet pursued any of these options more aggressively, to which the owner stated that they are afraid to hire employees because of the risk of not being able to pay them. Although, the owner admitted that this fear was simply of fear from not knowing because they do not

keep detailed financial records or sales records. They manage finances and make business decisions by the amount of cash they have on-hand in a given week.

The owner of Jewelry, Inc. also alluded to the fact that they may not have the production capacity to keep up with an increase in sales. However, they also expressed that they do not want to explore new technologies for production because they believe it will take away from the unique value of the products. The culmination of these observations seems to confirm the behavioral pattern scores shown in *Table 10*.

#### 4.4 Findings from Logistic Regression

Much of the current literature around small business explains the relationships between management and business outcomes as a linear function, as discussed in the research literature section. We will test this assertion by measuring the predictive power of a logistic regression model and compare it to the predictive power of a non-linear CART model. We do not aim to statistically explain the relationships between behavioral patterns and business outcomes; rather, we aim to understand the predictive power of behavioral patterns for business outcomes, specifically growth and productivity. We first explore the findings from the logistic regression model.

*Tables 11, 12, and 13* (found in the next 2 pages) show the outputs for the logistic regression models for each of the three target variables. For now, we have applied the full sample population to the models to provide the model outputs using all available observations. We will later test the generalizability and classification accuracy in each model through cross-validation.

Table 11. Logistic regression output for revenue growth target variable

<b>Revenue Category</b>			
<i>Regression Statistics</i>			
<i>Chi Square</i>	3.373369206		
<i>Residual Dev.</i>	39.56949233		
<i># of iterations</i>	5		
<i>Observations</i>	31		
	<i>Coefficients</i>	<i>Standard Error</i>	<i>P-value</i>
<i>Intercept</i>	-3.07462625	2.422325552	0.204338733
<i>Survey Goals</i>	-0.716418508	0.831790552	0.389074619
<i>Survey Risk</i>	0.806668627	0.791060597	0.307856287
<i>Survey Delegation</i>	0.325326925	0.897425605	0.716969979
<i>Survey Adoption</i>	1.208752052	1.269036788	0.340845658
	<i>Probability</i>		
	1.79836104	0.857949308	
<i>Survey Goals</i>	3.0		
<i>Survey Risk</i>	3.0		
<i>Survey Delegation</i>	3.0		
<i>Survey Adoption</i>	3.0		

Table 12. Logistic regression output for employee growth target variable

<b>Employee Category</b>			
<i>Regression Statistics</i>			
<i>Chi Square</i>	11.67812028		
<i>Residual Dev.</i>	31.26474126		
<i># of iterations</i>	6		
<i>Observations</i>	31		
	<i>Coefficients</i>	<i>Standard Error</i>	<i>P-value</i>
<i>Intercept</i>	-1.487871337	2.870973602	0.604286461
<i>Survey Goals</i>	-1.504586067	0.980705743	0.124983639
<i>Survey Risk</i>	2.957058285	1.250306873	0.018026858
<i>Survey Delegation</i>	-0.627287794	0.990049586	0.526346928
<i>Survey Adoption</i>	0.414574478	1.354815081	0.759604049
	<i>Probability</i>		
	2.231405369	0.903034487	
<i>Survey Goals</i>	3.0		
<i>Survey Risk</i>	3.0		
<i>Survey Delegation</i>	3.0		
<i>Survey Adoption</i>	3.0		

Table 13. Logistic regression output for productivity target variable

<b>Productivity Category</b>			
<i>Regression Statistics</i>			
<i>Chi Square</i>	4.192290153		
<i>Residual Dev.</i>	38.75057138		
<i># of iterations</i>	5		
<i>Observations</i>	31		
	<i>Coefficients</i>	<i>Standard Error</i>	<i>P-value</i>
<i>Intercept</i>	-1.9285871	2.467121116	0.434381723
<i>Survey Goals</i>	1.631416512	0.896730081	0.068866443
<i>Survey Risk</i>	0.08610581	0.761274602	0.909945389
<i>Survey Delegation</i>	-0.249786431	0.916803033	0.785273143
<i>Survey Adoption</i>	-0.436927569	1.259454406	0.728652825
	<i>Probability</i>		
	1.163837865	0.762029375	
<i>Survey Goals</i>	3.0		
<i>Survey Risk</i>	3.0		
<i>Survey Delegation</i>	3.0		
<i>Survey Adoption</i>	3.0		

In the tables, we have applied a score of three for each feature in the models to assess the probabilities for each target variable assuming a participant possesses all of the behavioral patterns, to the largest amount, in favor of our hypotheses. We find that, with scores of three for each feature, the probability of being classified as high revenue growth is ~85.8%, the probability of being classified as high employee growth is ~90.3%, and the probability of being classified as high productivity is ~76.2%. At the basic level, this seems to imply that our hypotheses are in the right direction per se. However, it is important to point out that the models indicate that some features actually have negative effects on the probability of a desired outcome (i.e., high revenue growth).

For example, the revenue growth model indicates that the coefficient for the behavioral pattern, goals, is negative. This is contrary to our hypothesis that higher levels of goal setting are associated with higher levels of revenue growth. This negative coefficient would instead imply that higher levels of goal setting are associated with decreased probability of revenue growth. Therefore, if we replace the goals

score of three, with a goals score of zero in the revenue growth model in *Table 11*, the probability of being classified as high revenue growth increases to ~98.1% from the original ~85.8%.

Therefore, assuming that a higher probability for being classified as 1 (high growth/high productivity) is “better”, we would ideally want to find the managers who have a score of three for all positive coefficients, and a score of zero for all negative coefficients. Thus, the limitation to the linear models is that associations are unidirectional. If a feature coefficient is positive, the larger score will always be “better”, no matter how extreme; and if a feature coefficient is negative, a lower score will always be “better”, no matter how extreme.

#### 4.5 Findings from CART

The CART models allow for nonlinear relationships to be analyzed and is not limited to the unidirectional limitations found in the logistic regression models. Again, we have applied the full sample population to the CART models to provide the model outputs using all available observations. *Figures 4, 5, and 6* show the respective decision tree models for each of the three target variables.

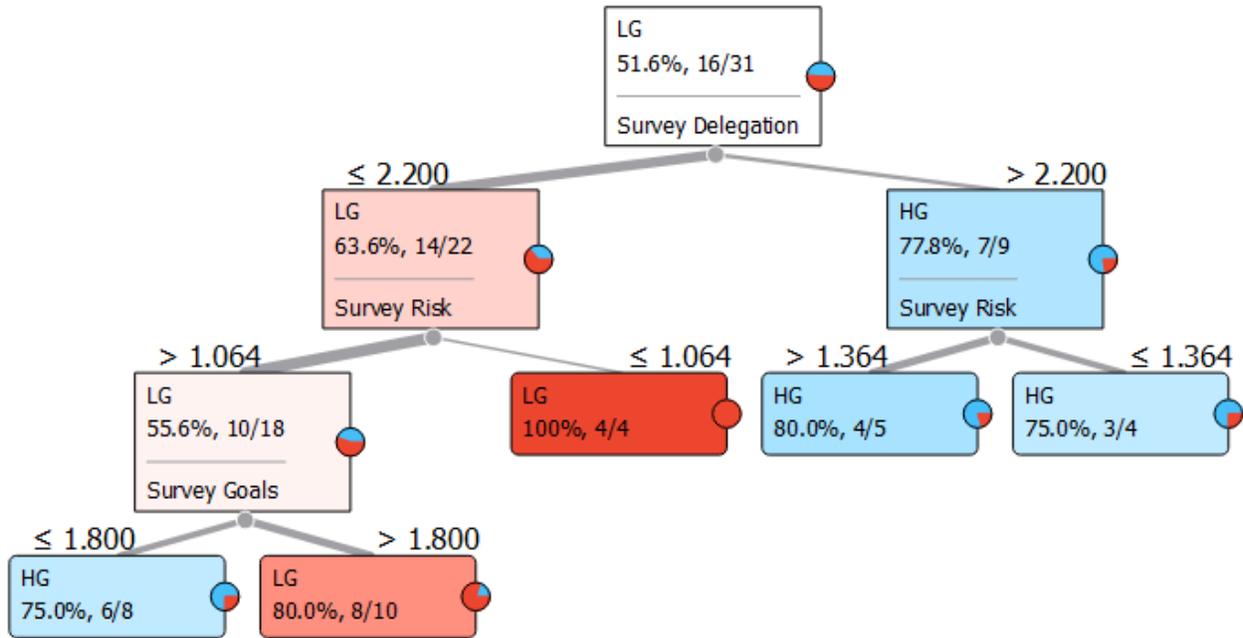


Figure 4. Decision tree model for revenue growth category

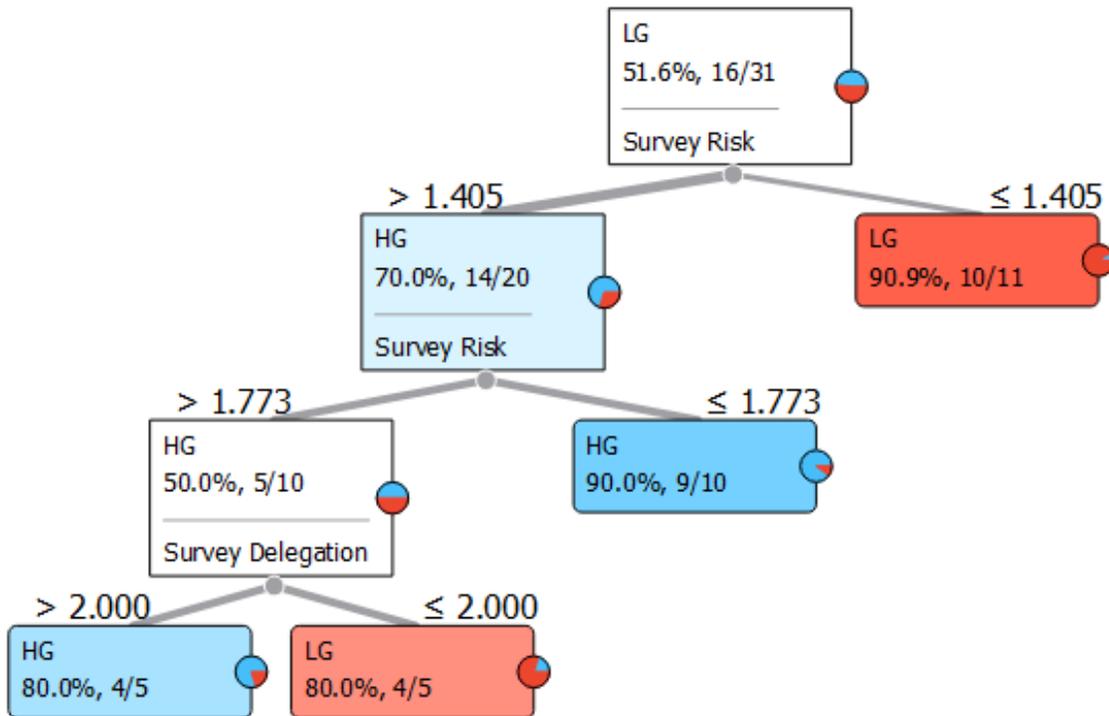


Figure 5. Decision tree model for employee growth category

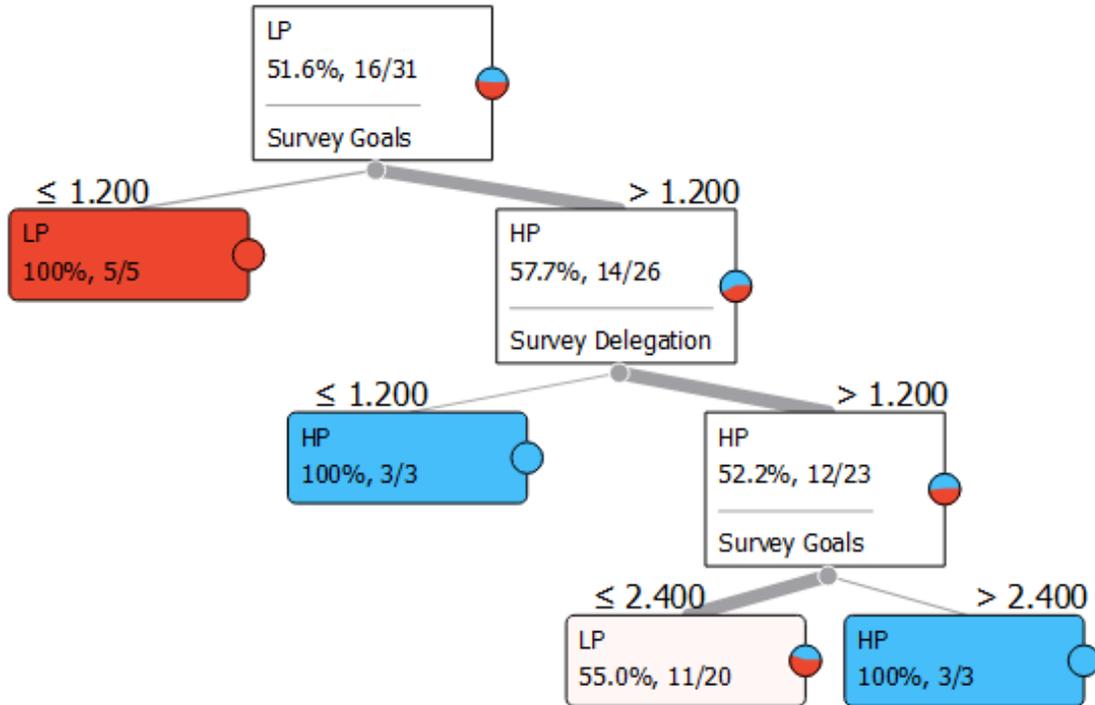


Figure 6. Decision tree model for productivity category

Beginning with the decision tree for the revenue growth category (Figure 4), we can see that that the most important feature is Delegation, followed by Risk, and finally, Goals. This model correctly classifies ~80% of the total sample population. The decision tree for the employee growth category (Figure 5) indicates that Risk is the most important feature, followed by Delegation. This model correctly classifies ~87% of the total sample population. Last, the decision tree for the productivity category (Figure 6) indicates that Goals is the most important feature, followed by Delegation. This model correctly classifies ~71% of the total sample population.

Each of these decision tree models can also be depicted as scatter plots as shown in Figures 7, 8, and 9.

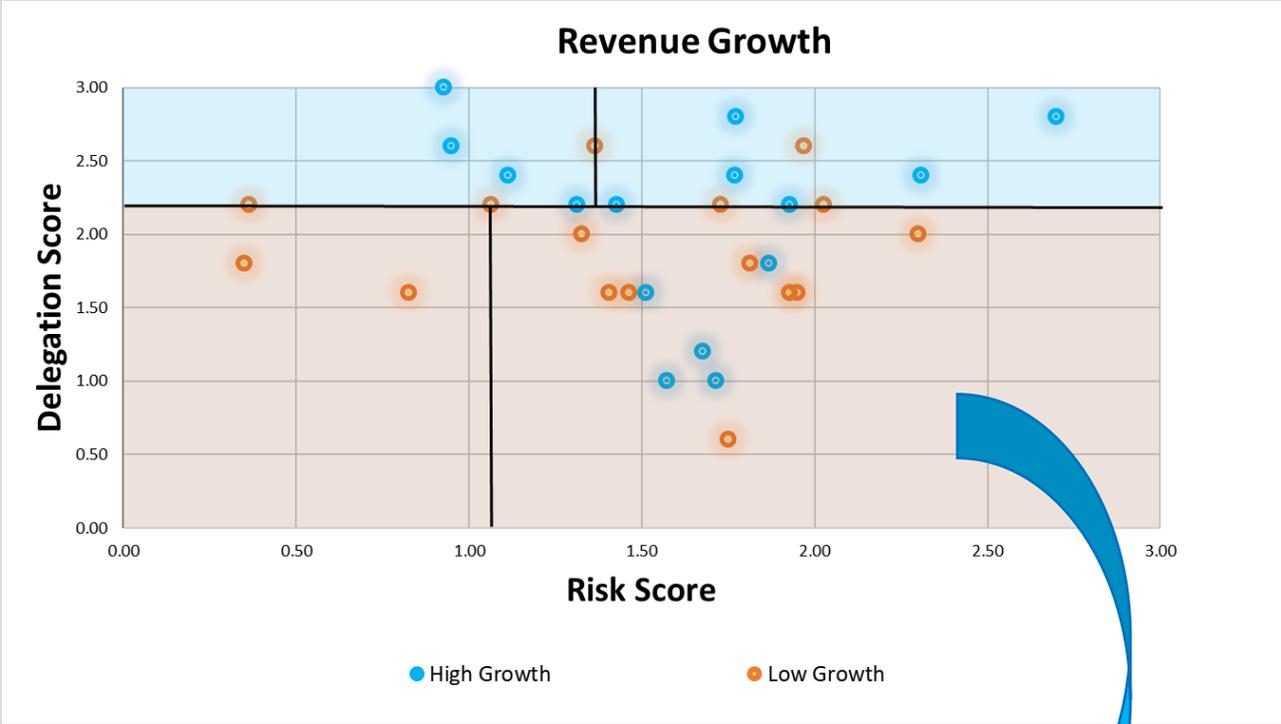


Figure 7. Scatter plot for decision tree model for revenue growth category



Figure 8. Scatter plot for decision tree model for revenue growth category (survey goals branch)

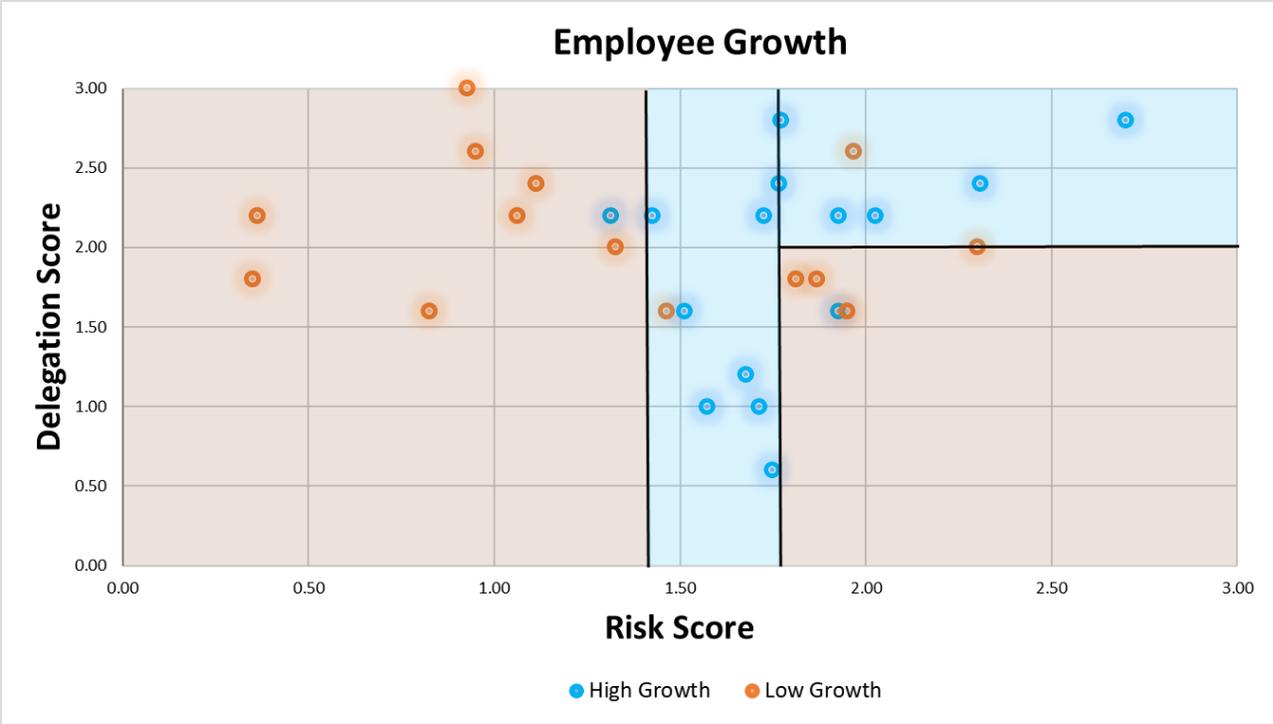


Figure 9. Scatter plot for decision tree model for employee growth category



Figure 10. Scatter plot for decision tree model for productivity category

These scatter plots allow us to visualize the decision tree in a two-dimensional space. The CART models seem to indicate that there are optimal scores for particular features, instead of solely unidirectional max/min scores. The best example of an optimal score range is depicted in *Figure 9* for the employee growth category. Here we find that there is an optimal score for Risk between 1.405 and 1.773. If a risk score falls outside of the optimal range, the participant will more likely be classified as 0 (low growth), unless the participant has a risk score above 1.773 *and* a delegation score above 2.0.

Note that none of the CART models indicate Adoption as an important feature at a tree-depth of three. Recall that the descriptive statistics showed low variation in the sample population for the Adoption score. Because there is little variation in the score, it is difficult for a model to find a strong split that significantly increases prediction accuracy. Additionally, the descriptive statistics for Risk showed the highest variation in the sample population of all scores. Risk is found to be a strong feature for predictive value for revenue growth and employee growth in both models. We note that the logistic regression model actually indicates Adoption to have a high coefficient value for revenue growth, alluding to some predictive strength for Adoption. We will continue to compare and contrast the models further in the next section through cross-validation.

#### 4.6 Findings from LOOCV

We measure the generalizability and classification accuracy of both models by conducting leave-one-out cross-validation (LOOCV). *Figures 11* and *12* show the resulting receiver operating characteristic (ROC) plots from the LOOCV analysis. The ROC points displayed in the figures represent the optimal classification threshold for each model and each target variable. The optimal classification threshold is defined by the threshold at which the Euclidean distance to [0,1] is minimized. *Table 14* shows the respective optimal thresholds for each model and each target variable. Additionally, the table provides

the metrics for the respective true positive rate (TPR), false positive rate (FPR), classification accuracy, total Euclidean distance, and the Euclidean distance ratio between both models for each of the targets.

Table 14. Euclidean distance optimization output metrics

	<b>Optimal Threshold</b>	<b>FPR (x)</b>	<b>TPR (y)</b>	<b>Classification Accuracy</b>	<b>Euclidean Distance</b>	<b>LOG/CART %</b>
<b>Rev Log</b>	0.5839	0.3750	0.3333	0.4839	0.7649	
<b>Rev CART</b>	0.6000	0.5000	0.6667	0.5806	0.6009	27.29%
<b>Emp Log</b>	0.4633	0.3125	0.8000	0.7419	0.3710	
<b>Emp CART</b>	0.3039	0.3750	0.7333	0.6774	0.4601	-19.37%
<b>Prod Log</b>	0.5175	0.3125	0.4667	0.5806	0.7003	
<b>Prod CART</b>	0.0328	0.6875	0.8667	0.5806	0.6181	13.29%

The CART model for revenue growth (rev) performs ~27.29% better than the logistic regression model in terms of total Euclidean distance from [0,1]. This revenue growth category has the largest total Euclidean distance disparity of all target variables between models. The classification accuracy of the logistic regression model equates to ~48.39%, making it slightly worse than random guessing. From this, we would conclude that the relationship between the behavioral patterns and revenue growth is represented better by a non-linear model. The CART model has a classification accuracy rate of ~58.06%, slightly better than random guessing. We would classify the CART model for this target variable as a weak model given its out-of-sample performance metrics.

For employee growth (emp), we find that the logistic regression model outperforms the CART model by ~19.37% in terms of total Euclidean distance from [0,1]. Both models perform relatively well, with classification accuracy of ~74.19% and ~67.74% and with total Euclidean distances of 0.3710 and 0.4601 from [0,1], making these the strongest models amongst all of the target variables.

The CART model for productivity (prod) performs ~13.29% better than the logistic regression model in terms of total Euclidean distance from [0,1]. However, it is important to note that the CART

model has a much higher FPR compared to the logistic regression model. Depending on the context, the logistic regression model could be perceived as more favorable than the CART model if FPRs are costly.

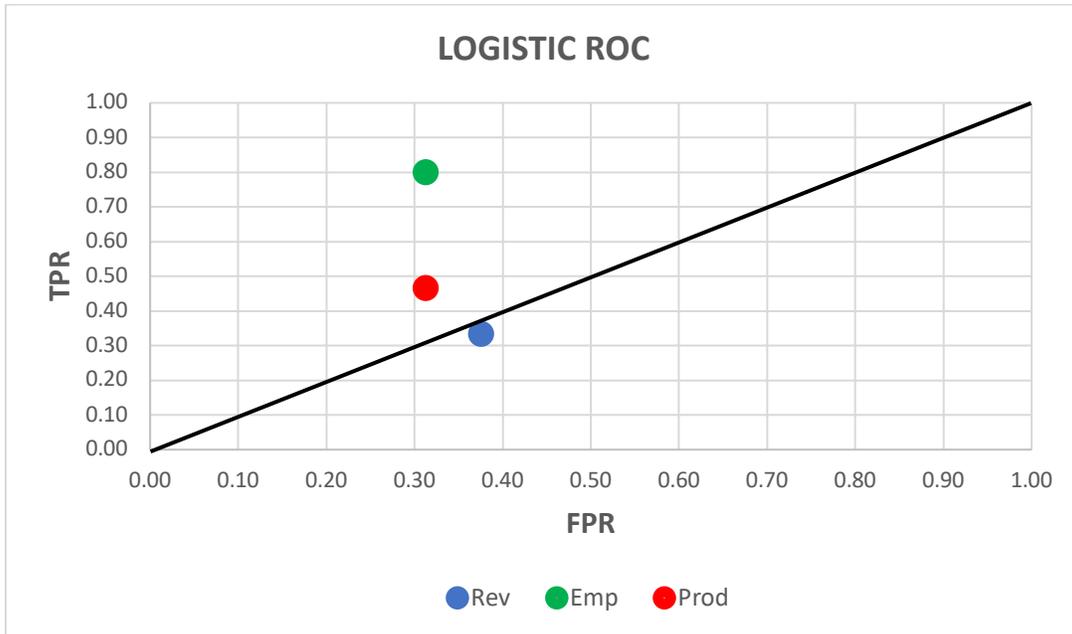


Figure 11. Optimized logistic regression threshold ROC points for each target

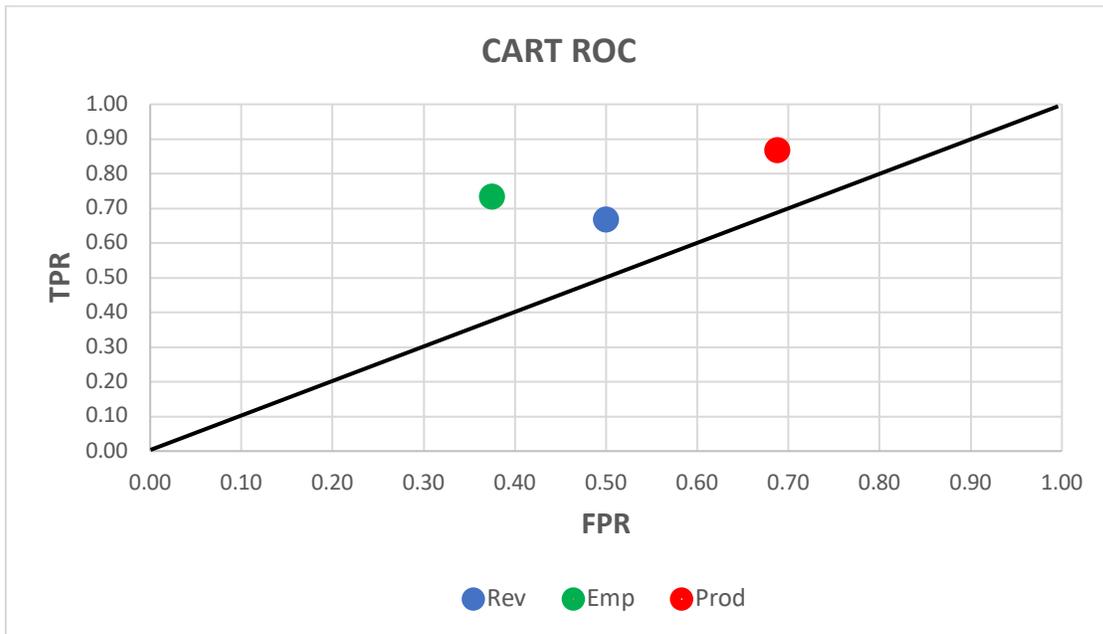


Figure 12. Optimized CART threshold ROC points for each target

Each model has pros and cons, but overall, the CART model seems to perform slightly better in terms of out-of-sample accuracy. The logistic regression model was better only for the employee growth category, and only marginally. The CART model was marginally better for the productivity category, but exceptionally better for the revenue growth category. These results provide some evidence that the associations between behavioral patterns and the target variable are potentially represented better by non-linear models.

## 5. Discussion and Future Research

Our findings show that three of the four behavioral patterns are moderately strong predictors for revenue growth, employee count growth, and productivity. Risk seems to be the strongest predictive feature for these business outcomes overall as it is listed in the first and second levels of both of the decision trees for growth and also has strong coefficients in the same logistic regression models. Delegation and Goals are also moderately strong predictive features found in the first, second, and third levels of the decision trees. The adoption of new technologies/processes is the only feature that does not seem to have a meaningful impact in the predictive models. Adoption only had one significant predictive contribution with a high coefficient value that is found in the logistic regression model for revenue growth; however, this was the poorest performing model of all models considered.

These quantitative results also reinforce our qualitative observations that we found in the field. For example, during our observations in the Tower Challenge discussed in Section 4.2, we found that risk and goals have a strong impact on the participant's final results in the challenge. Additionally, during our company visits, we found risk, goals, and delegation to be contributors to growth in the case of School, Inc., and limiting growth in the case of Jewelry, Inc.

After finding that adoption has little predictive influence in the quantitative models, we test if this conclusion also holds for the participant's performance in the Tower Challenge. We measure the level of adoption in the challenge by calculating the number of straws and Styrofoam cups purchased by each participant and compare this to their ending cash on-hand. We find that there is almost zero correlation between these factors as shown in *Figure 13*.

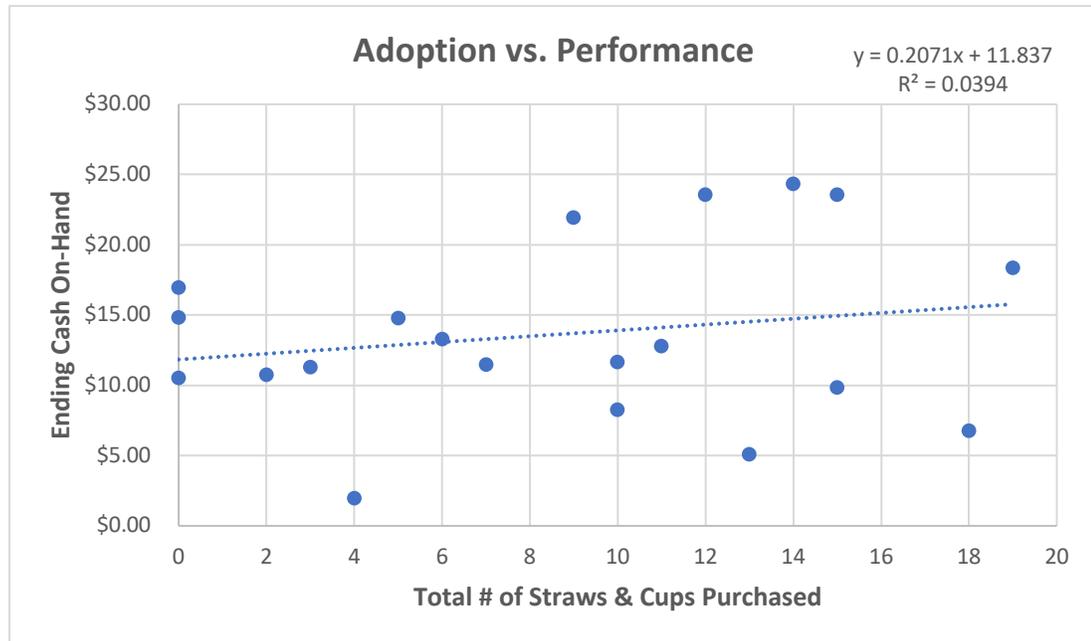


Figure 13. Scatter plot of participant's adoption of new supplies compared to ending cash on-hand

Additionally, we analyze the performance of the participants who purchased a tower building guide. There were only three participants in the challenge that purchased the tower building guide. We find that all three of these participants performed below average in the challenge. The dataset shows that each of the three participants purchased the guide in round two after having little success with their towers in round one. This data is confirmed by an observation made from one of the MITEF volunteers, provided here:

*Participant 5 had a plan that they were really confident in. They took a big loan during the first round and spent a lot on buying supplies; however, the design they had in mind didn't work and their towers kept falling down or being too short. Realizing their design wasn't working after round one, they*

*bought the guide and began building their tower based on the guide (with a few tweaks). After this design proved right in round two, they took a safe approach to build upon the same tower just enough so the height increases would allow them to pay off their debt to the bank. They said that, just like in real life, sometimes things just don't work out and you have to get some expert advice (the guide), adapt and change your priorities (from winning to making sure he didn't have any debt in the end).*

From this observation and the participant's respective data in the Tower Challenge dataset, it seems that those who purchased the tower building guide did so, not out of a desire to advance beyond the competition, but because they believed that they had to in order to finish with a positive cash balance. These participants believed that they could not design a successful tower on their own, leading them to purchase the guide. For these three participants, the competition in the challenge was no longer the other participants in the challenge, but rather, the competition had become keeping their own cash balance above zero.

From this, we conclude that a high level of adoption of new technologies/processes may actually be evidence for one's inherent inability to do a certain task well. A manager may try to make up for their shortcomings through the adoption of new technologies/processes to simply bring them up to par, ultimately adopting a strategy of playing not to lose, instead of playing to win. There seems to be a difference between adoption of new technologies/processes for the purpose of advancement versus the adoption of new technologies/processes for mere survival. We suggest that this concept should be explored further in future research.

Our findings for risk, delegation, and goals support past research that find that these behavioral management patterns are associated with improved business performance. However, we show that the associations between these features and business performance are better captured through non-linear models than through linear models. This suggests that the behavioral patterns are not independent from

each other, but rather interact and combine in ways that can create different formulas for successful behavioral management. It further suggests that behavioral patterns should not be viewed in terms of extreme behaviors, as suggested by a linear model, but rather that there are optimal bounds for the levels of each behavior. For example, our findings suggest that a moderate level of risk-tolerance is better than extremely high or low levels of risk-tolerance, implying that moderation and balance is the key to improved performance.

It is important to note here that because our dataset is limited to 31 observations, we do not control for the age of the company or company industry in this research. Therefore, the models presented here, and their corresponding performance are constrained by these limitations, along with countless other macroeconomic, socioeconomic, and political factors that could be considered in the complex global markets. However, we believe that this research provides a foundational framework for future research to build from and could be improved by acquiring a larger dataset with more observations and features and controlling for some of the additional factors mentioned.

Additionally, we find some discrepancies between the participant survey responses and actions in the Tower Challenge. For example, when we analyze the survey responses to the survey question related to the “willingness to wait” (see Appendix B, Goals/KPI’s/Self-Efficacy section, question 1), and compare them to the actions in the Tower Challenge, we find many inconsistencies. Some participants stated that they would take the \$1,000 today in the survey; yet, in the Tower Challenge, they opted to wait for the \$5 in round two. We also found the inverse to be true, where participants stated they would wait for the \$1,300 in the survey; yet they opted to take the \$3 at the beginning of the Tower Challenge.

Of the 14 workshop participants who also completed a survey, only six participant’s survey responses to the willingness to wait question matched their actual decisions in the challenge. Our research does not explore the psychological depths of why this discrepancy is happening, but we hypothesize that

it may be influenced by a person's state of wealth at the time when the survey is conducted. This concept is explained in detail by Kahneman (2011), elaborating on Fechner's law, which explains that an individual's "psychological response to a change in wealth is inversely proportional to the individual's initial amount of wealth" (Kahneman, p.273). We do not control for Fechner's law in this research, nor do we explore this theory at great detail, but rather suggest it as a potential theory to be explored in future research.

Finally, due to the limited time horizon of our research (six months), we are unable to control for changes in behavioral management patterns over time. For example, we measure behavioral management patterns in 2019, and they are assumed to be a constant variable against the three years of business performance. However, it is likely that behavioral management patterns change over time. Therefore, we strongly encourage future research to span multiple years and periodically evaluate behavioral management patterns throughout the time horizon to quantify any potential changes in the patterns and the resulting impacts on the models.

## 6. Conclusion

Micro and small enterprises are important to global economies and supply chains given that they account for more than 99% of all firms in OECD countries and have large contributions to overall employment and global trade. Because of factors such as low productivity and growth rates, among other economic and political factors, there is a high rate of failure for MSEs in Latin American countries. In this study, we utilize both qualitative and quantitative methodologies to explore the potential impacts of behavioral management patterns on business performance in terms of revenue growth, employee count growth, and productivity for MSEs in Latin America.

We gathered 31 survey responses, 29 of which are from MSEs in Mexico, and 2 of which are from MSEs in Colombia. We analyze these survey responses through logistic regression and CART analysis in an attempt to challenge the assertion of linearity between behavioral management patterns and business performance. Additionally, we conducted our qualitative observations through the Tower Challenge and company visits in the Guadalajara, Mexico, region. These qualitative observations were combined with the quantitative data to obtain a more complete picture of each participants behavioral management patterns.

The key implications of our findings are that risk, delegation, and goals are influential behavioral management patterns in predicting rates of business growth and productivity for MSEs in Latin America. Further, these factors are best represented in the context of non-linear models that can account for dynamic feature interactions and moderation. For example, when evaluating the out-of-sample accuracy for revenue growth, we find that the non-linear model performs ~27.29% better than the linear model. Additionally, the non-linear model shows that managers with moderate levels of risk-tolerance have an increased probability of business growth compared to those who exhibit risk levels outside of the optimal bounds.

We also find that one's willingness to adopt new technologies/processes as a behavioral management pattern has insignificant predictive contribution for business growth and productivity. Instead, our findings from the Tower Challenge seem to suggest that high levels of adoption may actually be indicators of one's inability to perform well at a specific task or operation. Subsequently the adoption of new technologies/processes is an attempt to compensate for these shortcomings, ultimately leading to a shift in strategy from "playing to win" to one of "playing not to lose".

We hope that this work and the resulting findings encourage further work in the arena of micro and small enterprises in Latin America, and around the world, as we strive to bring greater stability to global markets and supply chains.

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## Appendix

### Exhibit A – Survey Questions Template



### **CONSENT TO PARTICIPATE IN DATA COLLECTION**

#### **Leveraging Supply Chain Management and Business Practices in Micro and Small Firms**

You have been asked to participate in a research study conducted by Dr. Josue C. Velazquez Martinez from *Center for Transportation and Logistics* at the Massachusetts Institute of Technology (M.I.T.). The purpose of the study is contributing to the survival and growth of small business in the world, specifically in developing countries, by improving their operations and supply chain management decisions. You were selected as a possible participant in this study because you are a decision maker of a small firm in a developing country. You should read the information below, and ask questions about anything you do not understand, before deciding whether or not to participate.

The objective of the project is increasing the productivity of the micro & small firms in developing countries by improving their operations management and logistics decisions (i.e. Supply Chain Management decisions). The objective is to provide a set of Supply Chain Management best practices and

managerial insights aimed at improving productivity and competitive advantage in the small firms. With the usage of these practices and insights by micro and small firms, income levels in developing countries can catch up with the advanced economies with the effort of increasing productivity.

Your participation in this research study is voluntary. You have the right not to answer any question, and to stop the survey at any time or for any reason. We expect that filling the online survey will take approximately 10 minutes.

You will not be compensated for this survey.

Unless you give us permission to use your name and / or title, in any publications that may result from this research, the information you tell us will be confidential.

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. In addition, your information may be reviewed by authorized MIT representatives to ensure compliance with MIT policies and procedures.

By completing this survey, you confirm your voluntary consent to participate in this research study.

Please contact MIT GeneSys Project Group ([genesys@mit.edu](mailto:genesys@mit.edu)) with any questions or concerns.

If you feel you have been treated unfairly, or you have questions regarding your rights as a research subject, you may contact the Chairman of the Committee on the Use of Humans as Experimental Subjects, M.I.T., Room E25-143b, 77 Massachusetts Ave, Cambridge, MA, 02139, phone, 1-617-253-6787.

Please fill in the below personal information accurately:

First Name: \_\_\_\_\_

Last Name: \_\_\_\_\_

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What is your gender:

Male

Female

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Please fill in the below business information accurately:

Company Name: \_\_\_\_\_

Country: \_\_\_\_\_

City: \_\_\_\_\_

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What is the main sector that your company is operating in:

- Agriculture, Forestry and Fishing
- Mining
- Construction
- Manufacturing
- Transportation, Communications, Electric, Gas and Sanitary service
- Wholesale Trade
- Retail Trade
- Finance, Insurance and Real Estate
- Services
- Public Administration

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What was the average company's revenue (in local currency) for the last 3 years:

- 2018: \_\_\_\_\_
- 2017: \_\_\_\_\_
- 2016: \_\_\_\_\_

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What was the average number of employees working in the company during the last 3 years:

2018: \_\_\_\_\_

2017: \_\_\_\_\_

2016: \_\_\_\_\_

Please choose the statement that best describes you or your opinion:

	<b>Strongly Describes me</b>	<b>Somewhat Describes me</b>	<b>Somewhat Describes me</b>	<b>Strongly Describes me</b>	
I prefer to set goals to guide my decisions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I prefer to examine situations first and then make decisions based on those situations.
I enjoy adventures and surprises.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I prefer safe areas that are familiar to me.
I prefer to complete daily tasks myself.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I trust others to complete daily tasks.
I usually know the best way to do things.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I like to understand how other people do things.
When I fail to solve a difficult problem the first time, I prefer to stop working on it because I know I already did my best.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	When I fail to solve a difficult problem the first time, I prefer to continue to work on it until I eventually solve the problem.
I believe that saving my money and keeping it safe is best for me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I believe that investing my money in a new business or in the stock market is best for me.

Assume that if you buy a lottery ticket, you will have a 10% chance of winning \$1,000 USD. If you had exactly \$1,000 USD in your savings account, how much would you be willing to pay for the lottery ticket?

- \$50
- \$100
- \$200
- \$300
- \$400
- \$500
- \$600
- \$700
- \$800
- \$900
- \$1,000
- I would never buy a lottery ticket

---

If you were offered the choice of \$1,000 USD today, or \$1,300 USD in three months, which would you choose?

- \$1,000 USD Today
- \$1,300 USD in 3 Months

Please choose the statement that best describes you or your opinion:

	<b>Strongly Describes me</b>	<b>Somewhat Describes me</b>	<b>Somewhat Describes me</b>	<b>Strongly Describes me</b>	
If something is meant to happen, it will; there is little I can do to change it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	My future is in my control and depends on the decisions I make.
I like to share my ideas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I like to keep my ideas to myself.
I prefer to go to the restaurants that I know and trust.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I prefer to try new restaurants frequently.
Power and respect are the most important attributes of a leader.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Empathy and teamwork are the most important attributes of a leader.
My business will look completely different in 5 years.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	My business will look the same in 5 years.

-----

Assume one of your long-time customers' needs a new order worth \$500 USD and has asked you to ship it today if possible. This customer has not yet paid the invoice from the last order worth \$500 USD that you shipped them four weeks ago, but they promise that they will pay both invoices in full in 30 days. Would you be willing to ship the new order today?

- Yes, I would ship the order and wait to be paid \$1,000 in 30 days because they are a long-time customer.
  - I would be willing to ship the order if my customer paid at least \$250 today.
  - I would be willing to ship the order if my customer paid \$500 today.
  - I would only ship the order if the customer paid all \$1,000 today.
-

Your family member wants to start a business and needs a total of \$1,000 USD to start. They are asking for your help and have promised to pay you back in 6 months. Assuming you had exactly \$1,000 USD in your savings account, how much money would you be willing to lend your family member?

- \$50
  - \$100
  - \$200
  - \$300
  - \$400
  - \$500
  - \$600
  - \$700
  - \$800
  - \$900
  - \$1,000
  - I would never lend money to a family member
-

Please choose the statement that best describes you or your opinion:

	<b>Strongly Describes me</b>	<b>Somewhat Describes me</b>	<b>Somewhat Describes me</b>	<b>Strongly Describes me</b>	
People describe me as strong and independent.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	People describe me as collaborative and trusting.
New technology is bad for society and people.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	New technology is good for society and people.
I prefer to make a to-do list that I can complete each day.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I prefer to deal with tasks as they come up each day.
I enjoy working with others.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I enjoy working on my own.
Change is the key to business success.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Consistency is the key to business success.

## Exhibit B – Explanation of Survey Questions

### Goals/KPI's/Self-Efficacy

1. *If you were offered the choice of \$1,000 USD today, or \$1,300 USD in three months, which would you choose?*

This question provides insight into the participant's willingness to wait, and therefore, their level of self-regulation. Self-regulation is strongly associated to goal setting/achievement.

Locke & Latham (2002). Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. *American psychologist*, 57(9), 705.

2. *1) I prefer to set goals to guide my decisions. 2) I prefer to examine situations first and then make decisions based on those situations.*

This question provides insight into the participant's approach to making decisions. Are their decisions guided by goals or guided by the ad hoc situations that take place each day?

3. *1) When I fail to solve a difficult problem the first time, I prefer to stop working on it because I know I already did my best. 2) When I fail to solve a difficult problem the first time, I prefer to continue to work on it until I eventually solve the problem.*

This question provides insight into the participant's level of self-efficacy. "...people with high self-efficacy set higher goals than do people with lower self-efficacy. They are also more committed to assigned goals, find and use better task strategies to attain the goals, and respond more positively to negative feedback than do people with low self-efficacy (Locke & Latham, 1990; Seijts & Latham, 2001)."

“...self-efficacy is defined as people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives.” *Bandura (1994)*.

4. 1) *I prefer to make a to-do list that I can complete each day.* 2) *I prefer to deal with tasks as they come up each day.*

This question provides insight into the participant’s approach to dealing with daily tasks. Are they are guided by goals or guided by the ad hoc situations that take place each day?

5. 1) *If something is meant to happen, it will; there is little I can do to change it.* 2) *My future is in my control and depends on the decisions I make.*

This question provides insight into the participant’s level of self-efficacy. “...people with high self-efficacy set higher goals than do people with lower self-efficacy. They also are more committed to assigned goals, find and use better task strategies to attain the goals, and respond more positively to negative feedback than do people with low self-efficacy (*Locke & Latham, 1990; Seijts & Latham, 2001*).”

“...self-efficacy is defined as people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives.” *Bandura (1994)*.

## **Risk**

1. 1) *I enjoy adventures and surprises.* 2) *I prefer safe areas that are familiar to me.*

This question will provide insight into the participant’s appetite for unfamiliar and risky environments.

2. *Assume that if you buy a lottery ticket, you will have a 10% chance of winning \$1,000 USD. If you had exactly \$1,000 USD in your savings account, how much would you be willing to pay for the lottery ticket?*

This question will provide insight into the participant's ability to perceive risk-reward opportunities, and their appetite for risk in a purely monetary situation.

3. *Your family member wants to start a business and needs a total of \$1,000 USD to start. They are asking for your help and have promised to pay you back in 6 months. Assuming you had exactly \$1,000 USD in your savings account, how much money would you be willing to lend your family member?*

This question will provide insight into the participant's ability to perceive risk-reward opportunities, and their appetite for risk when close personal relationships are involved.

4. *1) I believe that saving my money and keeping it safe is best for me. 2) I believe that investing my money in a new business or in the stock market is best for me.*

This question will provide insight into the participant's ability to perceive long-term risk-reward opportunities, and their perception of risky investments.

5. *Assume one of your long-time customers' needs a new order worth \$500 USD and has asked you to ship it today if possible. This customer has not yet paid the invoice from the last order worth \$500 USD that you shipped them four weeks ago, but they promise that they will pay both invoices in full in 30 days. Would you be willing to ship the new order today?*

This question will provide insight into the participant's ability to perceive risk-reward opportunities, and their appetite for risk when close business relationships are involved.

## **Delegation**

1. *1) I prefer to complete daily tasks myself. 2) I trust others to complete daily tasks.*

This question provides insight into the participant's willingness to trust others to complete necessary tasks. In a set of cross-country regressions, *Bjørnskov & Gur (2017)* show a strong association between trust and delegation.

2. 1) *People describe me as strong and independent.* 2) *People describe me as collaborative and trusting.*

This question provides insight into the participant's belief about how others perceive them when it comes to the participant's ability to work with others.

3. 1) *I enjoy working on my own.* 2) *I enjoy working with others.*

This question provides insight into the participant's own perception of their ability to work with others

4. 1) *I like to share my ideas.* 2) *I like to keep my ideas to myself.*

This question provides insight into the participant's own perception of their willingness to share ideas with others

5. 1) *Power and respect are the most important attributes of a leader.* 2) *Empathy and teamwork are the most important attributes of a leader.*

This question provides insight into the participant's belief of important leadership qualities. This may reflect the participant's personal leadership style. The question is structured to specifically provide insight into the participant's view of manager/subordinate relationships. Delegation and teamwork have been found to be highly correlated [Flores-Fillol, Iranzo, Mane, 2017].

### **Adoption of New Processes**

1. 1) *I usually know the best way to do things.* 2) *I like to understand how other people do things.*

This question provides insight into the participant's willingness to look beyond their own knowledge and see how other people are accomplishing the same tasks. We hypothesize that those participants who seek to understand other ways of doing, are more likely to be adopters of new technology and processes.

2. 1) *New technology is bad for society and people.* 2) *New technology is good for society and people.*

This question provides insight into the participant's beliefs about new technology and its impact on society. We hypothesize that those participants who believe that technology is good for society, are more likely to be adopters of new technology and processes.

3. *1) Consistency is the key to business success. 2) Change is the key to business success.*

This question provides insight into the participant's beliefs about business success. We hypothesize that those participants who believe business success is driven by change, are more likely to be adopters of new technology and processes.

4. *1) I prefer to go to the restaurants that I know and trust. 2) I prefer to try new restaurants frequently.*

This question provides insight into the participant's appetite (no pun intended) for exploration of new options. We hypothesize that those participants who are more willing to explore, are more likely to be adopters of new technology and processes.

5. *1) My business will look the same in 5 years. 2) My business will look completely different in 5 years.*

This question provides insight into the participant's vision of the future state of their business. We hypothesize that those participants who believe their business will look different, are more likely to be adopters of new technology and processes.

Exhibit C – Research Methodology Diagram

