

## Looking to the Future While Grounded in the Past: Internalization among Technology Entrepreneurs

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### Abstract

*The dynamic knowledge creation process, traditionally described and applied in the context of large firms, is receiving growing attention in entrepreneurship research as a model to identify ways to decrease mortality rates in the “valley of death,” the stage of entrepreneurship infamously known for the high percentage of startup failures. Prior innovation literature associates entrepreneurship activities with the socialization phase of Nonaka’s dynamic theory of knowledge creation (also known as the SECI model). However, linguistic analysis of interviews with entrepreneurs indicates that internalization (i.e., the creation of tacit knowledge from explicit assets) plays an important role in new ventures activities.*

*In this study, we distinguish between internalization in the current venture from internalization during the entrepreneur’s prior employment. We find a strong relationship between references to the past and internalization that is mediated by negative emotions, which may have motivated the entrepreneur to leave prior employment and launch a new venture. We also find a strong relationship between an entrepreneur’s references to the past and the number of employees in the venture, indicative of the importance of an entrepreneur’s prior knowledge internalization to the current venture.*

*This research contributes to the growing field of entrepreneurial knowledge management by extending the role of the entrepreneur’s past knowledge creation activities to those of her/his new venture. It underscores the common tagline that we can learn more from our failures (negative emotions).*

### 1. Introduction

Knowledge management as a discipline has evolved since the mid-nineties to encompass epistemological questions on the nature of knowledge; pragmatic questions on processes and technology that enable better know-how and information management; and strategies for knowledge creation, accumulation, transfer and reuse. A well-known theory that explains the dynamic process of knowledge creation (a prerequisite for its accumulation and reuse) is Nonaka’s SECI model, which is famous for its articulation of a cyclical flow of knowledge that augments at each cycle (the so-called knowledge spiral) [1].

The knowledge spiral starts from the socialization of existing knowledge, in a context of shared understanding or “ba”, and then moves towards a process of codification, combination and internalization of the collectively shared knowledge. This leads to higher level of overall individual and organizational knowledge. Individuals have tacit knowledge in their heads but they share it within groups and, consequently with broader levels of the organization. As knowledge moves from the individual to the organization, it slowly becomes more codified and made explicit, for example through standard operating procedures.

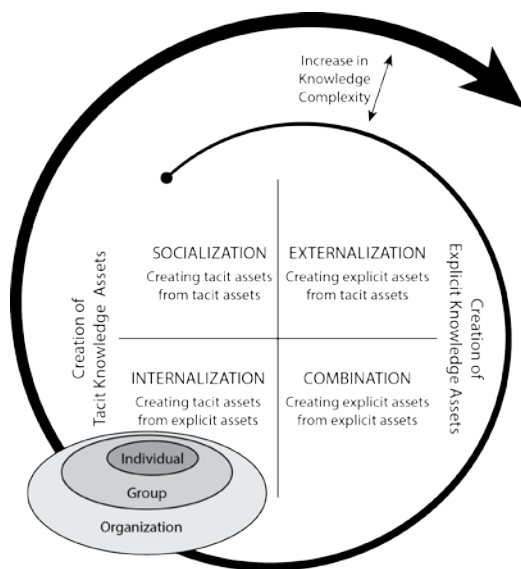
The knowledge creation process has been described as a transformation from tacit to explicit, and back to tacit, moving clockwise in the spiral (see Figure 1). Each iteration expands and elicits knowledge further, beginning with knowledge creation at the individual and subsequently at the group and ultimately across the entire organization. A virtuous knowledge cycle

brings increasing returns from knowledge assets; a vicious cycle treats existing knowledge as a liability, leading to a lack of innovation and repeating unproductive behaviors and outcomes [2].

The above is how knowledge has been found to flow in large successful organizations. It is reasonable to expect that in a small business, entrepreneurial knowledge creation could function with the same intensity and flow as in larger organizations.

*What if this flow is different?*

The goal of this study is to investigate the flows (socialization to externalization, combination and internalization) of the SECI model, i.e., the progression of knowledge creation across the four quadrants, in the context of highly dynamic micro and small firms operating within a startup incubator.



**Figure 1. SECI knowledge creation model (adapted from Tammets [2])**

## 2. Literature Review, Framework and Hypotheses

In an effort to understand the application of the dynamic theory of knowledge creation, and particularly its applications to training and learning, Tammets [2] conducted a comprehensive qualitative analysis of various studies about Nonaka's SECI model [3] and mapped the context and outcomes through cognitive maps. While the value of the model is confirmed as a solid framework for the analysis of learning and knowledge growth, some of its limitations are also

described. For example, some studies show that it is hard to examine the outcomes of internalization [4], and the transfer of knowledge from individuals to groups and to the organization is difficult to accomplish smoothly.

Studies show that moving beyond individual learning is difficult and influenced by many motivational factors of the group [2, 5]. That is, moving across the concentric circles in the internalization process is not easily achievable unless the learners are ready to leverage past experiences and develop different levels of understanding.

To better capture the behavioral interplay between tacit and explicit knowledge creation in the context of individual learning, we used a linguistic analysis approach that is focused on understanding and extrapolating perceptions, emotions, and orientation of entrepreneurs. Such approach was applied to better capture the affective and personal aspects of the entrepreneur and the underlying motivations that may influence their interest in learning and creating new knowledge.

We conducted interviews (Appendix A) with twenty-seven practicing entrepreneurs in a northeast university technology business incubator (Appendix B). The interview questions addressed aspects of the new venture and the participant's prior experience, and participants were allowed to discuss additional topics. The questions also included some closed-ended questions, including the pre/post revenue status of the firm, number of employees, and agreement (measured on a five-point Likert scale) with phrases intended to measure cognitive biases and concepts belonging to the theory of planned behavior [6].

### 2.1. Linguistic Analysis

The interviews were transcribed by the authors and then analyzed with a psycholinguistics software tool called Linguistic Inquiry and Word Count (LIWC) that reads a given text and computes the frequency of words that reflect different social concerns, thinking styles, emotions, and parts of speech. LIWC uses a dictionary composed of roughly 6,400 words, word stems and selected emoticons. The dictionary labels each entry with psycholinguistic categories [7]. A LIWC text analysis module compares each word in the given text against this dictionary, and determines which words correlate with psychologically-relevant categories. LIWC then computes the percentage of total words that match each of the categories.

As an example, suppose that the given text in this paper is a single reply from an individual entrepreneur, and contains a total of 2,000 words. LIWC will compare the interview transcript against its dictionary

and may find 200 pronouns and 134 positive emotion words in the transcript. LIWC converts these numbers to percentages based on the total number of words, in this example 10% pronouns and 6.7% positive emotion words.

LIWC also identifies the categories of each word. For example, the word *cried* is part of five word categories: 1) Sadness, 2) Negative Emotion, 3) Overall Affect, 5) Verb, and 5) Past Focus. Therefore, if the word *cried* was found, each of these five sub-dictionary scale scores would be incremented [8].

There are four main summary variables in LIWC that represent a combination of categories and a larger set of related variables:

- Analytical Thinking: A high number reflects formal, logical, and hierarchical thinking; lower numbers reflect more informal, personal, here-and-now, and narrative thinking.
- Clout: A high number suggests that the author is speaking from the perspective of high expertise and is confident; low clout numbers suggest a more tentative, humble, even anxious style.
- Authentic: Higher numbers are associated with a more honest, personal, and disclosing text; lower numbers suggest a more guarded, distanced form of discourse.
- Emotional Tone: A high number is associated with a more positive, upbeat style; a low number reveals greater anxiety, sadness, or hostility. A value of 50 suggests either a lack of emotionality or different levels of ambivalence.

In this study, we conducted a text-mining analysis with LIWC because it was particularly suited to an exploratory study of the intersection between entrepreneurship and the SECI model, an emerging area of knowledge management research. In addition, because LIWC focuses on identifying temporal orientation, drivers and affective variables of each participant, this type of analysis appeared more suited to ascertaining the individual entrepreneurial mindset. Finally, since this study is exploratory, we opted against using a structured survey approach but rather used the interview questions as a way to identify important affective components of knowledge elicitation processes that may be overlooked by deductive research approaches.

Because the dynamic theory of knowledge creation and the knowledge spiral have a temporal orientation, we focused this analysis on three LIWC variable that can be considered a proxy for the temporal mindset of the entrepreneur:

- *Past orientation* refers to a mix of past tense verbs and references to past events/times
- *Present orientation* presents tense verbs and references to present events/times

- *Future orientation* presents future tense verbs and references to future events/times

Affect processes represent the emotional tone of individuals and may play a role of personal participation in knowledge sharing. Affect processes have the following sub categories:

- *Affect* refers to happy, cried, abandon, etc.
- *Positive Emotion* refers to love, sweet, nice
- *Negative Emotion* refers to hurt, ugly, nasty. Associated labels include anxiety (worried, fearful, nervous), anger (hate, kill, annoyed), and sadness (sad, crying, grief).

We considered both temporal and affective processes among the relevant variables in the study to understand which stages of the SECI model would be more frequently in the mind (and hence in the narrative of the interview) of the participating entrepreneurs. Moreover, because knowledge management requires more formalized processes and structure – an indication that a venture has matured and increased in size – we used the number of employees as a control variable to investigate the impact of company maturity on the stage of the SECI model ultimately identified as the most recurrent.

### 2.3. Hypothesis Development

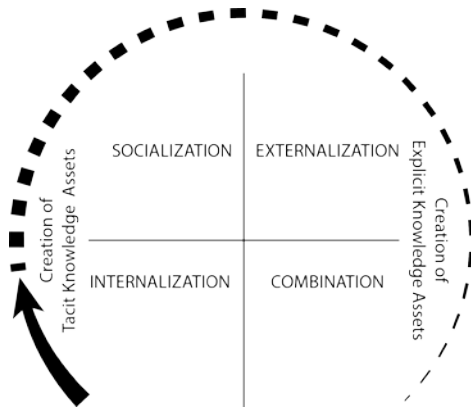
An entrepreneur discussing her or his new venture may present prior experiences that influenced the decision to launch the venture and lay out the strategy going forward. We consider five attributes of these prior experiences. First, they can include education, prior employment, and other activities that contributed to opportunity recognition and the cognitive biases of entrepreneurship [9, 10]. Second, they can involve the creation of tacit knowledge from explicit knowledge assets such as textbooks, manuals, and social media (new learning). Third, the knowledge creation activity of these prior experiences maps to the internalization stage of the SECI model. Fourth, prior experiences can span a period of time that is greater than (and precedes) the duration of operation of the new venture. Fifth, because of their long duration, these prior experiences can be more numerous than activities at the new venture itself.

When mapping the activities in a startup to the stages of the SECI knowledge creation model, extant literature [11, 12] argues that the most frequent activity will be socialization rather than externalization, combination, or internalization. Moreover, since each stage is a prerequisite of the next stage, the amount of the activity, as reported by the narrative descriptions of the entrepreneurs, conducted at each stage will be progressively less, i.e., S>E>C>I (Figure 1). However, the activities expressed by an entrepreneur will

necessarily include prior experiences since without internalized learned experiences the nascent entrepreneur may have nothing to socialize. If this is the case, we could as well find that the SECI model starting point is not socialization, but rather internalization of explicit know-how that can later be used for the next cycle of knowledge creation. This question can be studied through the following hypothesis:

*H1: Entrepreneurs' internalization activity is the highest*

Hypothesis H1 can be expressed as  $I>S>E>C$  and is illustrated in Figure 2. The difference between the ranking of SECI stages by H1 and extant literature is that the former includes the contribution of prior internalization activities as a prerequisite to the creation of knowledge in the current firm.



**Figure 2. Expected allocation of activity recalled by an entrepreneur ( $I>S>E>C$ )**

We expect that past knowledge will play a significant role in the SECI cycle because the entrepreneurs has internalized prior experiences, especially the negative experiences that might have led to the loss of employment or the failure in a prior venture. Therefore, in addition to a temporal dimension, emotional tone (as represented by the variables earlier listed under affective processes) may impact internalization. We expand H1 to identify whether

*H1a: Past orientation, mediated by emotional tone, impacts internalization*

Finally, the complexity of the knowledge sharing channels in an organization could also impact the volume of knowledge assets created and the

opportunity to internalize new knowledge. In a network structure (from individuals, to the group and the organization as depicted in Fig. 1), the number of lines of communication generally increase when an additional person is added to the network. In the case of completely connected networks, this number of lines is  $n(n-1)/2$ , where  $n$  is the number of people in the network. We anticipate that the number of employees in a venture will impact the network communication process (individuals→group→organization), and ultimately the internalizations process. We expand H1 to also identify whether

*H1b: Past orientation, mediated by number of employees, impacts internalization.*

### 3. Methods

The authors conducted interviews with practicing entrepreneurs in a northeast university business incubator that hosts ninety technology startups predominantly in biomedical and telecommunications industries. These startups are headquartered within the incubator (i.e., their offices and laboratories are located within the incubator), and range in size from sole proprietor to 40 employees. Unlike most university incubators whose companies are formed by students or faculty, the companies in this incubator are formed by entrepreneurs with prior industry and entrepreneurial experience.

Each interview included open-ended questions (see Appendix A) addressing aspects of the new venture and the participant's prior experience, and participants were allowed to discuss additional topics. The interview also included closed-ended survey questions, including the pre/post revenue status of the firm, number of employees, and agreement (measured on a five-point Likert scale) with phrases intended to measure cognitive biases and concepts in the theory of planned behavior [6].

We used LIWC to measure the psychometric properties of each interview transcript. Because LIWC defines different variables with different scales, to facilitate the interpretation of LIWC results we normalized each measurement of each transcript by the value of the same measurement from a broad collection of public reference content [13]. For example, a normalized value of 1.25 for the LIWC variable "focus on future" indicates that entrepreneur was 25% more focused on the future than the public reference content.

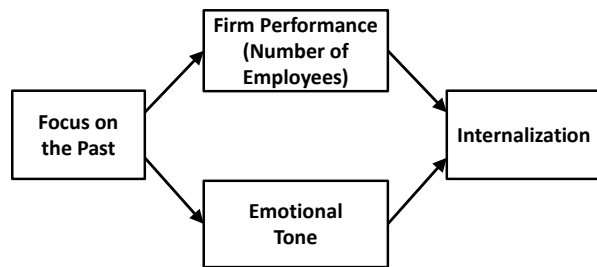
The authors voted on the association between thirty variables computed by LIWC and the stages of the SECI model. The association is binary and not mutually exclusive, allowing authors to associate a

LIWC variable with more than one SECI stage. The degree of activity discussed in the  $n$ 'th interview mapping to the  $j$ 'th stage of the SECI model was then calculated as

$$Q_{j,n} = \sum_{i=1}^{30} \Delta_{i,n} \times w_{i,j}$$

where  $w_{i,j}$  is the number of votes associating the  $i$ 'th LIWC variable to the  $j$ 'th stage of the SECI model, and  $\Delta_{i,n}$  is the normalized value of the  $i$ 'th LIWC variable calculated from the  $n$ 'th interview. We test hypothesis H1 by comparing the values of  $Q_{j,n}$  between different values of  $j$ .

To determine if discussions of past activities impact the internalization score, we analyze the relationship between this score and the normalized LIWC values that have temporal significance. In particular, we focus on the relationship between the internalization score and the LIWC variable "focuspast" which is a measure of the extent by which the entrepreneur dwelled on the past during the interview.



**Figure 3. Model of hypotheses H1a and H1b**

We test hypotheses H1a and H1b with a structural equation model that moderates the effect between focuspast and internalization with number of employees (representing maturity of the new venture) and the entrepreneur's emotional tone (Figure 3). We introduce emotional tone because the extant literature identifies it as a component of the decision to launch a new venture [6, 14]. LIWC measures affective processes using five psychometric parameters associated with emotional tone: risk, negative emotion, positive emotion, anxiety, and affect. Using a five-point Likert scale, the survey also measures two affective processes common in entrepreneurial intention models: social norms (how supportive are friends and family of the decision to become an entrepreneur) and self-efficacy (one's belief in her/his ability to succeed in specific situations or accomplish a task) [15]. We explore the effect of these seven

effective processes and emotional tone variables on Figure 3. Table 1 summarizes the variables used in the model; the description of LIWC variables includes words from the dictionary used to calculate the variable.

**Table 1. Variables used in assessing H1a and H1b**

Variable Name	Source	Description
Number of Employees	Questionnaire	Integer
Revenue	Questionnaire	Binary (pre-revenue or post-revenue)
focuspast	LIWC	"ago, did, talked"
risk	LIWC	"danger, doubt"
negemo	LIWC	"hurt, ugly, nasty"
posemo	LIWC	"love, nice, sweet"
anx	LIWC	"worried, fearful"
affect	LIWC	"happy, cried"
Support	Questionnaire	5 pt. Likert agreement with "My family and friends will support me if I choose to be an entrepreneur."
Shape Environment	Questionnaire	5 pt. Likert agreement with "I can shape whatever environment I find myself operating in"
Internalization	LIWC, Author Mapping	$Q_{4,n}$

## 4. Results

The authors conducted interviews with twenty-seven practicing entrepreneurs in the incubator (30% of the overall roster of incubator tenants). The majority of the respondents identified themselves as CEO of their respective venture. Firm and interviewee demographics are presented in Appendix B. Each interview lasted between 30 and 45 minutes.

The summary statistics of the SECI scores  $Q_{j,n}$  are presented in Table 2. The average score for internalization across all entrepreneurs is the highest among all four SECI stages; the second highest average score is socialization, the third highest is by externalization, and the smallest is combination. A t-test shows that internalization values are greater than the values of the remaining three stages with statistical significance ( $p < 0.05$ ). These findings support H1.

Interestingly, all SECI values, with the exception of externalization, differed significantly between the interview transcripts and the reference content, indicating possible psychometric differences between entrepreneurs and the "average person." An ANOVA test comparing all four stages reveals they do not differ by a statistically significant amount. However, externalization, combination, and internalization do differ significantly ( $p < 0.05$ )

**Table 2. Summary statistics of SECI scores**

Stage ( <i>i</i> )	S	E	C	I
Average $Q_{i,n}$ across all entrepreneurs	66.34	63.22	52.60	70.14
Standard Dev of $Q_{i,n}$	6.06	5.20	4.72	7.24
Difference from Ref	0.948*	1.020	1.074**	0.935**

\*  $p < 0.005$  \*\*  $p < 0.001$

The cross-correlations between the variables used in assessing H1a and H1b are presented in Table 3. The heat map (red=larger correlation, green=smaller correlation) is based on the magnitude of the correlation, ignoring correlation direction (positive or negative). LIWC variable focuspast is correlated with the number of employees in the firm, and internalization is strongly correlated with negative emotions and anxiety.

The results of a structural equation model of the relationship between focuspast and internalization, mediated by number of employees and negative emotions is illustrated in Figure 4. We see that the focuspast→negemo→internalization path is strong (standardized coefficients of .27 and .86) and statistically significant ( $p < 0.05$ ). In contrast, the focuspast→Employees→internalization path is neither,

with the last effect having a weak standardized coefficient of only 0.038. Thus, while an entrepreneur’s focus on the past is correlated with the maturity of her/his venture, the effect of this mediation does not extend to internalization. These findings support H1a but not H1b.

In an exploratory effort apart from hypothesis testing, the model in Figure 4 was repeated twice, first replacing focuspast with focuspresent and then with focusfuture. These LIWC variables measure the entrepreneur’s reference to the present and the future, respectively. In neither case was the model statistically significant.

**Figure 4. SEM of mediated relationship between focus on past and internalization**



**Table 3. Cross-Correlation of LIWC and Interview Variables with Internalization**

	risk	negemo	anx	affect	Support	Employees	focuspast	Revenue	ShapeEnv
negemo	0.6872	1.0000							
anx	0.3608	0.6964	1.0000						
affect	0.2499	0.5511	0.5366	1.0000					
Support	-0.1968	-0.1067	-0.0313	0.1184	1.0000				
Employees	0.0234	0.0961	-0.0865	0.1740	0.1163	1.0000			
focuspast	0.2438	0.2620	-0.1465	0.1334	-0.1062	0.4024	1.0000		
Revenue	-0.0389	-0.0235	-0.1354	0.0592	0.1103	0.4164	0.0368	1.0000	
ShapeEnv	-0.2481	-0.2431	-0.3394	-0.2974	0.0339	0.0250	-0.2946	0.0118	1.0000
Internalization	0.5393	0.8589	0.6119	0.5389	-0.2746	0.1139	0.2452	0.1355	-0.3389

## 5. Discussion and Conclusions

Studies found that the tense of common verbs can provide us with information about the temporal focus. In a study of political ads, the researchers found that positive ads used more present and future tense verbs, and negative ads used more past tense verbs [16]. Others also found that greater past focus (tense) belonged to participants discussing a disclosed event and greater present tense in discussing an undisclosed event [17]. Based on these studies, verb tense differences could indicate increased psychological distance and a higher degree of resolution for disclosed events compared with undisclosed events.

Similar findings emerge from our study of entrepreneur interviews. From the focus of the past

verbs (past focus) and negative emotions, we can conclude that the negative aspects in the transcripts of entrepreneur interviews is most likely focused on past actions. Moreover, the formative aspects of these prior experiences form a part of the overall internalization history of the entrepreneur that can pre-date her/his current venture, even if the venture is sufficiently mature to have employees. Similar to negative emotions and past focus, our findings show that there are close correlations between past focus and risk, affect, and anxiety. The last two (affect and anxiety) and negative emotions are interesting because these dimensions belong to the *affect* dimension in LIWC.

This study shows that entrepreneurs that have dealt with negative emotions tend to significantly internalize lessons learned. That is, we continue to learn more

from failure than successes and, therefore, we should perhaps welcome negative emotions as the opportunity to effectively define future, and hopefully more fruitful, directions. Since negative emotions are correlated to the past, further research could explore whether positive emotions are correlated to future. While this research did not study nor find such relations, behavioral research has already shown that individuals are generally optimistic about their future abilities, regardless of the data they have accumulated to the contrary [18].

The study also finds that an entrepreneur's focus on the past is strongly associated with the size of her/his venture (i.e., number of employees), but venture size is not associated with internalization. The KM processes in the current venture may indeed be contributing to internalization, but this effect is small when compared with the internalization from a difficult past. The implication seems to be a reconciliation of Figures 1 and 2; Figure 1 continues to represent the KM processes in a new venture (S>E>C>I), whereas Figure 2 is the entrepreneur's composite KM experience over her/his career (I>S>E>C).

This research contributes to the growing field of entrepreneurial knowledge management by clarifying the relationship between the entrepreneur's past knowledge creation activities and those of her/his new venture. While prior entrepreneurial experience has often been associated with future startup success, this research uses the SECI model and linguistic analysis to describe this association in greater detail. We show that tacit knowledge attained from prior internalization of experiences contributes to future cycles of startup knowledge creation, thereby helping entrepreneurs build a future that leverages lessons that are well grounded in the past.

## Appendix A: Interview Questionnaire

### Header Data

- Timestamp.
- Interviewer
- Interview Location
- Name of Interviewee
- Interviewee Contact Information
- Interviewee Gender

### About the Firm (General)

- Can you talk about your firm?
- Name of Firm
- What industry is your firm in?
- Do you provide a product or service, or do you license intellectual property?
- What is your product or service?
- How many employees do you have?
- What is the age range of your employees?
- What is the management structure of your company? Are different people in charge of different things?

- What is the current stage of development in your company?
- How long have you been in this stage?
- What is the source of your funding?
- What is your current geographic distribution of sales?
- What is your annual growth percentage?
- How do you expect your company to grow? In what areas?

### About the Firm (Technology)

- What technologies (hardware and software) do you use to operate your business
- How does technology play a role in your company and in the creation of your product?
- Is technology used to support your growth aspirations? If yes, how? If not, do you expect to use it future? How so?
- Do you develop your own software or outsource the development of custom software? If yes, do you use other technologies besides computers and cell phones?
- How often do you use cloud based applications?
- How often do you use mobile computing?
- Do you use social media applications?
- Do you use big data?
- How often do you collect analytics?

### Participant Demographics

- What is your position in the company?
- What are your responsibilities in the company?
- Have you ever had past managerial experience
- Can you elaborate on your past managerial experience?
- Have you ever had any startup experience?
- Was it a successful start-up endeavor?
- What level of education have you had?
- What were your degrees in?
- Describe your IT & Business background
- When did start your business?
- At what age did you start your company?

### Likert Questionnaire (strongly disagree, disagree, neutral, agree, strongly agree)

- I can shape whatever environment I find myself operating in
- I believe that I can grow in positive ways by dealing with difficult situations.
- I am creative when asked to work with limited resources.
- I often make novel connections and perceive new relationships between various pieces of information.
- My family and friends will support me if I choose to be an entrepreneur.
- I do not fear risk in order to potentially increase the success of your company.
- I have certain leadership qualities and understandings that aid the success of my company.
- Based on previous education, I feel I am knowledgeable on the subject matters my company entails.
- I exert more energy and thought into the growth of my company than required?

### Participant Strategy

- How do you measure the success of your company?
- Do you consider your company successful?
- What motivates you to develop and expand your company?
- Rank these three motivators in terms of increasing importance: Responding to a challenge, independence, and then wealth.
- In your opinion, what makes a good entrepreneur?
- What makes your company a great company?
- What is your management style? How do you manage employees, customers, products/services, or the company?



## Appendix B: Demographics of Participating Startups

# of Employees	Pre/Post Revenue	Founder's Degree	Age of Business	Primary Customer Industry
2	Pre	Masters	0.5	Project Management Services
2	Pre	Masters	2	Project Management Services
25	Post	Bachelors	17	Project Management Services
6	Pre	Bachelors	30	Telecommunications
1	Post	Bachelors	1	Manufacturing Equipment
9	Pre	Masters	11	Biomedical
4	Pre	Masters	11	Biomedical
8	Post	Masters	8	Financial Services
8	Post	Bachelors	7	Real Estate
4	Post	Masters	4	Nutritional Products
5	Post	Masters	9	Biomedical
1	Pre	Masters	2	Financial Services
10	Post	Masters	2	Commercial Construction
3	Pre	Bachelors	3	Biomedical
4	Pre	Bachelors	0.5	Business IT Services
1	Pre	Masters	2	Financial Services
1	Pre	Masters	5	Distance Learning
9	Post	Bachelors	1	Commercial Construction
18	Pre	Masters	2	Medical Business Services
18	Pre	Bachelors	1	Medical Business Services
30	Post	Masters	5	Telecommunications
10	Post	PhD	6	Biomedical
10	Post	PhD	8	Business IT Services
40	Post	PhD	12	Office Support
8	Pre	PhD	8	Biomedical
20	Post	Masters	19	Office Support
2	Pre	Bachelors	1	Medical Business Services

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