

The dynamics of forming a technology based start-up: How founders use external advice to improve their firm's chance of succeeding

by

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B.S. Mechanical Engineering
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Submitted to the System Design and Management Program
in Partial Fulfillment of the Requirements for the Degree of

Master of Science in Engineering and Management

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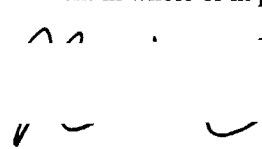
Massachusetts Institute of Technology

[June 2007]
May 2007

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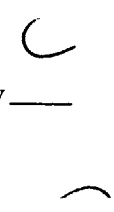
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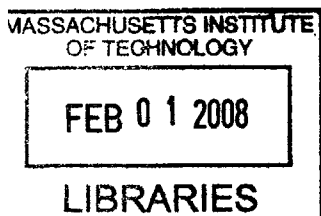


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Submitted to the System Design and Management Program on May 11, 2007 in Partial Fulfillment of the Requirements for the Degree of Master of Science in Engineering and Management

Abstract

External advice can be a valuable resource for founders of high technology startup companies. As with any resource, the pursuit and efficient use of the external advice resource is one of the greatest challenges for founders. This thesis examines how the founders of eleven US venture-backed high-tech companies leveraged external advice to their advantage.

By aggregating data extracted from case-based interviews, the characteristics of advice are fully understood. In particular, insights are made into the types of advice these business focused founders received, the types of advisors they selected and considered influential to the development of their company and the way they were connected to these influential advisors. Organizing the data by companies' business characteristics enabled further insights to be drawn. Notably, there was a significant difference in a variety of the advice sought by first time founders compared with that of more experienced founding teams. First time founders received broader and more tactical advice than did experienced founders. Furthermore, first time founder's advisors were much more likely to act as coaches, instilling confidence and expending effort to mentor these first-timers into successful CEOs. Silicon Valley advisors and others affiliated with Silicon Valley companies were much more likely to introduce the founders to their influential network, which illustrates the rich entrepreneurial nature of Silicon Valley. There was no statistically significant difference in advice characteristics based on the size of their founding team or on type of their industry.

Since the eleven companies are private and thriving, the selected performance metric was the amount of venture capital raised per year of existence. This less than ideal performance data clearly shows a positive correlation between the size and experience of the founding team with company performance. However, no correlation between company performance and industry and geography could be determined. Since the advice characteristics that were correlated with performance were similar to those of large experienced teams, it is reasonable to conclude that none of the advice characteristics are predictors of success. It follows rather that advice characteristics are more a reflection of the companies' business characteristics than itself a predictor of venture success.

Thesis Supervisor: M. Diane Burton

Title: Fred Kayne Career Development Associate Professor Behavioral and Policy Sciences

Acknowledgements

First, I want to extend my gratitude to all the startup founders that were interviewed for this thesis. You graciously donated a portion of your limited and very valuable free time to share your experiences and insights with me. I only hope that some of the conclusions I drew based on your aggregated experiences will help future entrepreneurs build successful enterprises. A case based thesis, like this one, is only as good as its subjects. Upon reflection, I don't think I could have selected better business founders for my cases. I look forward to following your companies as they grow and positively impact our future world.

If this thesis has taught me anything, it is that good advice is a treasured resource. My thesis advisor, Diane Burton, gave me valuable advice not only about this thesis but also about my career path. You were my advisor, Diane, but you were also my coach. And like any successful coach, you made yourself available when I needed you but also gave me the freedom to create my own framework. Furthermore, you gave me confidence when things looked bleak. In short, you represented everything one would want from an advisor.

The System Design and Management (SDM) program has exceeded my expectations. What I have learned in and out of the classroom during my time here gives me confidence that I will be able to add value to any technology based company. In particular I want to thank Pat Hale, the SDM director, who puts his heart and soul into the program to make it world-class. Pat always listened to my needs regardless of how outrageous they might have been. In addition, Pat helped me design a set of electives that enabled me to focus on my newly found passion of entrepreneurship.

I want to thank the new close friends that I have made at MIT and my lifelong friends back in the San Francisco Bay Area. For the last year you guys had to listen to me talk about every excruciating minute detail of this thesis. Now, we can talk about more important things in life like Giants baseball and Cal football.

A special thanks goes to Bill Burns, my Dad's best friend and a maestro of the English language. I sincerely appreciate the valuable and thoughtful feedback you gave me on this thesis as well as other documents I have written throughout the years. More importantly, your friendship to my Dad is a model that we should all strive to match. He is lucky to have such a caring, loyal and supportive person to call his best friend.

Finally, I want to thank my parents. For if it wasn't for your encouragement and belief in me, I wouldn't be where I am at today. Although you were 3000 miles away when I wrote this thesis, I felt like you were always by my side cheering me along like you did when I was a kid on the baseball field. You guys are simply the best.

Table of Contents

1	Introduction.....	7
2	Data Methodology	9
3	Data	15
4	Analysis Methodology	18
4.1	Type of Advice	20
4.2	Type of Advisor	22
4.3	Advisor Connection	24
5	Analysis.....	25
5.1	Type of Advice	25
5.2	Advisor Type	27
5.3	Advisor Connection	29
5.4	2-Ways: Advisor Type versus Advice Type	31
5.5	Founding Team Experience	31
5.6	Founding Team Size	35
5.7	Geography.....	37
5.8	Industry	39
5.9	Advisor Engagement.....	40
5.10	Compensation	41
5.11	Full-Time Employment Offered	42
5.12	Performance	43
6	Conclusions.....	48
7	Future Work.....	52
	Appendix A: Interview Guide.....	55
	Appendix B: A123 Systems.....	60
	Appendix C: Espresso Fitness	68
	Appendix D: Heliovolt.....	75
	Appendix E: Kiva Systems	83
	Appendix F: Konarka.....	94
	Appendix G: Miasolé.....	103
	Appendix H: QD Vision	112
	Appendix I: Seahorse Power.....	119
	Appendix J: Stion.....	127
	Appendix K: Surface Logix.....	135
	Appendix L: Tropos Networks	145
	Appendix M: Thesis Timeline	159
	Bibliography	161

List of Tables

Table 1. Case Interview Selection Criteria.	10
Table 2. Required Company Characteristics.	11
Table 3. Represented Companies Summary.	15
Table 4. Number Of Founders For Each Represented Company.	16
Table 5. Interview Summary.....	17
Table 6. Founder Experience.....	17
Table 7. Geographic Summary.	18
Table 8. Industry Breakdown.....	18
Table 9. Advice Type for Each Case Company.....	26
Table 10. Advisor Type For Each Case Company.	28
Table 11. Advisor Connections For Each Case Company.....	29
Table 12. Advice Type Versus Advisor Type.	31
Table 13. The Type Of Advice Received For Different Levels Of Founder Experience.....	33
Table 14. Founding Team Size & The Type Of Advice Received.....	36
Table 15. Founding Team Size & Advisor Connection.....	36
Table 16. When Advice Commenced Versus The Type Of Advice Received.....	41
Table 17. Compensation Broken Down By Each Type Of Advisor.....	42
Table 18. Full-Time Employment Offers By Each Advisor Type.....	43
Table 19. Company Performance.	44
Table 20. Geography Versus Performance.	45
Table 21. Team Size Versus Performance.	45
Table 22. Experience Versus Performance.....	45
Table 23. Industry Versus Performance.....	45
Table 24. Performance Versus The Type Of Advice Received.....	46
Table 25. Performance Versus The Type Of Advisor.	46
Table 26. Performance Versus Advisor Connections.	47

List of Figures

Figure 1. Founder Experience Versus The Type Of Advice Received.....	32
Figure 2. Founding Team Experience Versus How The Advisor Was Found.	34
Figure 3. Geography Versus Advice Type.	38
Figure 4. Geography Versus Advisor Connections.	38
Figure 5. The Type Of Industry Versus The Type Of Advice Received.....	40
Figure 6. Performance Ranking Versus The Number Of Identified Core Advisors.....	47
Figure 7. Performance Ranking Versus The Breadth Of Advice.	48
Figure 8. Espresso Fitness' First Product. (Boehret, 2006)	69
Figure 9. ItemFetch (Left) & CaseFetch (Right)	84
Figure 10. Kiva Systems Team with the 1st Prototype (July 2004).	87
Figure 11. Raff D'Andrea, Mick Mountz & Pete Wurman (Left to Right) on top of second prototype	88
Figure 12. Konarka's Flexible Solar Cell (Konarka, 2007-2)	95
Figure 13. Dave Pearce, CEO & Co-founder, Next To Prototypes of Miasolé's Thin-Film Solar Cells (Left) and The manufacturing Equipment Used To Produce Them (right). (Baker, 2007)	104
Figure 14. Boston Mayor Menino (Left) with Big Belly & Big Belly @ Baltimore's Harbor. (Seahorse, 2007-2)	120

1 Introduction

*“The way of a fool is right in his own eyes, but a wise man is he who listens to counsel.”
Proverbs 12:15*

The path to high technology startup success is long, arduous and filled with many unforeseen obstacles that the founding team must successfully navigate. The typical founding team has the barest of resources at its disposal to survive the journey. Rarely does a founding team have the human and financial capital required to take their innovative solution to market in the time they desire. With their small team, they are required to make complex decisions that determine the fate of the company. Occasionally the team will possess the required knowledge to make timely and informed decisions. However, when they don't possess the required knowledge, the team must either make an uninformed decision or consult an external source in order to acquire that knowledge. These external advisors are potentially valuable resources to the founding team. If identified and used properly, external advisors can help the founding team navigate the path with higher quality information and allow the team to make better decisions. Thus, it is the aim of this thesis to understand if, when and how founders use external advice resources when developing their company. Additionally, this thesis will attempt to correlate the success of a firm with its use of external advisors.

After a comprehensive literature review, no academic publications were found that specifically correlated the success of high technology companies with the use of external advisors. There is ample research on other business characteristics and the success of a company, but none looking at external advice. For example, there are multiple studies that correlated success with the size of the founding team (Roberts, 1991,

Eisenhardt and Schoonhoven, 1990, Cooper and Bruno, 1977) and the amount of experience of the founding team (Delmar and Shane, 2006). Furthermore, much has been written on the value of the founding team's personal and professional network and its likelihood of success (Zhao & Aram 1995). Vesper, in his classic text "New Venture Strategies," noted that the founders' personal contacts are the third of five key ingredients for startup success (Vesper 1990). Furthermore, Aldrich has written much on the value of social capital, specifically the role of network brokers and weak and strong network ties plays in building a new company (Aldrich & Martiniez 2001, Aldrich 1996). Finally, most literature on new venture advice has been descriptive (Leonard & Swap 2000) and itself a form of advice (Stevenson & Sahlman, 1998).

In order to understand when and how founders use external advice when developing their company, one must go straight to the source. The information about how founders started their firms is seldom documented and thus must be extracted from those directly involved, namely the business focused founders. By interviewing multiple founders from high technology venture backed United States companies, the author will gain a better understanding of the type of advice received, the type of advisors used and understand how entrepreneurs connect to advisors. By examining the relationship between advice and advisors and firm performance, the author can test his underlying theory that those that best utilize their external advice resources will have a high likelihood of success. The findings in this thesis will contribute to the existing literature on the factors of success of new high technology firms.

2 Data Methodology

The purpose of this research is to understand if, when and how founders seek and use external advisors in the formation of their venture. Because the author is interested in both the content of the advice and the process by which it is obtained, his research necessarily takes him to the field to gather data from actual entrepreneurs who are in various stages of starting companies.

It would be impossible to understand how advice is received and incorporated in start-ups from the limited public information available on start-up companies. The author relied on a multiple case study design to generate a theory on how high technology founders can use external advice to improve their probability of success (Yin 2002).¹

The first step in case method research is to determine the scope of the investigation. Selecting a scope that is too broad runs the risk of not having meaningful conclusions because there are not enough common characteristics between the cases. On the other hand, selecting a scope that is too narrow reduces the potential audience that can benefit from the research. Therefore, a scope must be selected such that it maximizes the potential audience, while at the same time allows relevant conclusions to be drawn. The author has chosen to limit this thesis to external advice in high technology product based venture backed companies founded in the United States.

Product based companies were selected because they require collaboration among multiple entities and the understanding of complex processes in order to get to market. Thus they are expected to require a greater amount of external advice to succeed than other types of start-ups. The investigation was limited to only venture backed companies

¹ Besides used to generate a theory, the case method can also be used to test a theory or provide a description of a particular situation. (Eisenhardt, 1989)

as a quality screen. In essence, the venture capitalists have already done the background research and have concluded that these firms are worthy of investment. Furthermore, only United States firms were considered in order to eliminate any international dynamics. Finally, companies between two and seven years old were considered. It was believed that the founders of companies older than seven years would have a difficult time recalling the details of the founding process. Likewise, companies younger than two years old were discarded because it was surmised that they were still in the process of acquiring influential external advisors and were too young to properly gauge performance. Each one of the companies selected for the case study meets the required criteria listed in the table below. Therefore, the conclusions made from this thesis are applicable to this specific subset of start-up companies. However, it is expected that the entrepreneurs with companies outside of this scope will be able to apply most of the conclusions drawn from this thesis.

Table 1. Case Interview Selection Criteria.

Industry	Technology Based
Focus	Product
Financing	Venture Capital (Minimum Series A)
Age	Less 7 but greater than 2 years
Geography	Headquartered in the United States

Although each case selected must meet the general requirements outlined above, varying certain company characteristics across the selected cases will enable more meaningful cross-case comparisons and conclusions. The effects of geography, industry, advisor characteristics, number of founders and founder experience will be studied. Therefore, cases were selected systematically such that there were greater than three companies representing each company characteristic. For example, to examine if there is

a difference in the type or quantity of advice received in different geographies, cases were selected such that at least three companies were headquarter in the San Francisco Bay Area and at least three companies were headquartered in the Boston Metro area. Another example, cases were selected such that at least three of the companies were founded by first time founders and the at least three of the companies were founded by experienced founders (4 or more companies founded) in an effort to determine if the advice requested or incorporated varied based on the experience of the founder. The table below shows the company characteristic (henceforth referred to as company parameters) and their associated values.

Table 2. Required Company Characteristics.

<i>Parameters</i>	<i>Values</i>
Geography	Boston Metro Vs Silicon Valley
Number of Founders	Sole Vs Partnership
Industry	Solar Vs Non-Solar
Founder Experience	1 st Time Founder Vs Experienced Founder

After the scope had been defined and the cross-case parameters and values determined, the next step was to establish how many cases were required. The underlying philosophy is to go deep and explore few cases rather than broadly cover numerous cases (Kawakita, 1977). At a minimum at least three cases for each of the values in the cross-case parameter must be selected. Since there are only two values for each parameter, the minimum number of cases is six. However, it is very unlikely that the cases can be selected such that the minimum number of cases is reached because the sample size of the potential cases is small. Therefore, the true minimum number of cases selected is such that the requirement of having three cases for each value in each cross-case parameter must be met. Furthermore, the sample size for the general segment of companies must be sufficiently large to draw meaningful conclusions. Eisenhardt in her

paper "Building Theories from Case Study Research" (1989) states that it is difficult to put a number on the required cases before starting the case interviews. Only after one reaches what she calls the "saturation point," the point where only marginal gains in knowledge can be gained by conducting another interview, can one confidently conclude one's interviews (Eisenhardt, 1989). Based on her experience she believes that it takes between four and ten cases to reach the saturation point. For another reference point, Griffith and Hauser (Griffen, 1991) for customer based cases suggest between ten and twenty cases. Initial cases for this thesis were selected such that they met the true minimum, then two cases at a time were added until the author believed the saturation point was reached. The saturation point for this thesis was reached after the eleventh case.

Once the companies for the cases were identified, the next task was to determine who to interview for each case. Since this thesis is focused primarily on advice in the early stages of the company, the logical choice was to interview the founder of the company. For companies that have multiple founders, the founder whose primary responsibility was developing the business was selected since they are responsible for the largest set of activities in setting up the venture and thus require the most external advice. Even though they might not be directly responsible for the other areas of the company, it is expected that they would have at least a general understanding of everyone's actions. In contrast, if a technical founder was selected they wouldn't be as likely to know the details at every level of the company because they are focused mostly on their specific technical problems and opportunities. It is important to note that by interviewing only the "business" founder there is a bias in the data toward the business advice received.

A list of over forty target companies was created based on an initial screening using the criteria discussed above. Since company founders were difficult to get a hold of and were extremely busy, a targeted approach was used. Any connection the author had with these targeted companies was used. These connections included prior working experience - be it as an intern or on a class project, MIT database and faculty connections and Harvard Business School class connections. These connections got the author eight of the eleven total interviews. The other three interviews were based on unsolicited invites. Where the author had a connection, the probability of securing the interview was 100%. However, where there was no connection, the probability of securing the interview was below twenty five percent.

For case based theses, the interviews are the data that will be used for analysis and theory generation. It is imperative that the interview be as comprehensive as possible given the interviewee's limited time available. It was determined that the founders could not afford more than one hour for their interview. Therefore, an interview guide was created (See Appendix A: Interview Guide) in order to extract as much information about the topic as possible during the one hour interview. Furthermore, the guide was designed to ensure consistency in data collection across the companies. After a pilot interview was conducted, the interview guide was slightly tweaked based on the feedback from the interview. After that first interview, the interview guide did not change and thus the same basic questions were asked to each founder. The guide itself was broken into three main sections: the first section focused on company formation, the second section was about specific external advisors that were instrumental in the developing of the business and the last section was concerning lessons learned. In addition, at the end of the

interview detailed questions about the company timeline and current state of their development were asked if the information was not publicly available.

Prior to the interview the author would research the company in question by typically reading every piece of public information about the company. General company information was found on the company website and through a Google web search. Financial information was found through a combination of company press releases and Venture Source database mining. Typically, the author would review five to twenty company specific articles before each interview to assure he was adequately prepared. The preparation saved time in the interview since basic questions could be skipped which allowed for more time on the external advice related questions.

During the interview, the author voice recorded the interview after permission was granted and scribed during the interview.^{2,3} After the interview was completed the interview was transcribed in electronic format with direct quotes taken from the voice recording and sent it to the companies for error checking. Once the case facts were approved a case narrative was created based solely on the case facts and the public research conducted. Furthermore, the verified case facts were used in the cross-case analysis. All case facts, company research and voice recordings were backed up on a case database (Yin, 2002) so future researchers could use the raw data for their own research.

² There were technical difficulties with the recording and file transfer for three of the eleven companies. The interview was lost and thus the author had to rely on his transcribed notes. The other eight recordings were successful and are backed up on a case database.

³ Ideally, two people should have conducted the interview – one to ask the questions and another to transcribe. However, this was not an option for the author.

3 Data

Eleven high technology business-oriented founders and one non-founder CEO were interviewed for this thesis. The interviews were conducted between November 2006 and January 2007 and each interview lasted between forty and eighty minutes. The interviewees represented eleven high technology companies. Two interviews were conducted at Tropos, one with the founder and one with the current CEO, in order to determine if type and quality of advice changes as the company develops. A summary of the represented companies is shown below. For a comprehensive summary of each interview and for their represented company overview, please refer to Appendix B- L.

Table 3. Represented Companies Summary.

Company Name	Industry	Location	Year Founded	Stage of Development	Number of Founders	Capital Raised	# of Employees
A123	Battery Manufacturing	Watertown, MA	2001	Shipping Products	3	\$102M	250
Expresso Fitness	Fitness Equipment	Sunnyvale, CA	2003	Shipping Products	6	\$19M	35
Heliovolt	Solar Energy	Austin, TX	2001	Product in Development	1	\$10M	22
Kiva Systems	Warehouse Automation	Woburn, MA	2003	Shipping Products	1	\$26M	54
Konarka	Solar Energy	Lowell, MA	2001	Product in Development	5	\$52.5M	50
Miasolé	Solar Energy	Santa Clara, CA	2001	In Beta Test	6	\$59M	90
QD Vision	Display Manufacturing	Watertown, MA	2004	Product in Development	5	\$6M	21
Seahorse Power	Waste Management	Needham, MA	2003	In Beta Test	1	\$2.2M	13
Stion	Solar Energy	Menlo Park, CA	2005	Product in Development	3	\$6.3M	12
Surface Logix	Pharmaceuticals	Brighton, MA	1999	Product in Development	4	\$82.M	50
Tropos	Wireless Networking	Sunnyvale, CA	2000	Shipping Products	4	\$65.3M	103

The eleven participating companies are between two and eight years old with the average age being five years old. Furthermore, the represented companies are at different

stages of development. Five companies are still developing their first product, two of the companies are testing their product at beta sites and the remaining four companies are currently shipping products. Not surprising, the amount of capital raised and number of employees also varies significantly. Stion has the fewest employees with twelve and Seahorse Power raised the least amount of capital; whereas, A123 has the most employees with 250 and has also raised the most capital, having raised 102 million dollars over the course of their six year history. For the data set, the average number of employees is sixty three and the average amount of capital raised is 37 million dollars. Finally, the number of founders for each represented company varied from one to six with an average of 3.5. The table below breaks down the number of companies in each founding size “bucket.”

Table 4. Number Of Founders For Each Represented Company.

# of Founders	Companies	Total Advisors
1	3	15
2-3	2	5
4-5	4	16
6+	2	6

All the interviewees were either the sole founder or the business focused founder of their company.⁴ They either went on to become the company CEO or head of their business development group.⁵ Therefore, all were able to comment on the early stages of development and the external advice they received. As of March 2007 all of the companies are still in operation. However, two the founders interviewed, Tropos’ Christian Dubiel and Surface Logix’s Carmichael Roberts, left the discussed company

⁴ Technically Stion had three founders and the technical founder was interviewed for this thesis. However, the technical founder acted as the sole founder for the first few months of the venture. Thus the interviewee can be considered a business focused founder because he was responsible for the business operations in the early stages of development.

⁵ With the exception of Howard Lee who became the company CTO. See note above.

prior to the interview. Both subsequently started their second company.⁶ Seven of the founders were first time founders. The other founders had experience varying from their second startup to their thirteenth startup founded (See summary table below). Finally, the number of advisors the interviewees identified as influential varied from two to seven with an average of 3.8.

Table 5. Interview Summary.

Company Name	Interviewee Name	Title	# of Companies Founded ⁷	Core Advisors
A123	Ric Fulop	Co-Founder & VP of Business Development	6	2
Espresso Fitness	Brian Button	Co-founder & CEO	1	3
Heliovolt	Dr. Stanbery	Founder, President & CEO	1	4
Kiva Systems	Mick Mountz	Founder & CEO	1	7
Konarka	Howard Berke	Co-Founder, Chairman & CEO	13	4
Miasolé	Dave Pearce	Co-Founder, President & CEO	4	3
QD Vision	Greg Moeller	Co-Founder & Director of Business Development	3	3
Seahorse Power	Jim Poss	Founder & CEO	1	4
Stion	Howard Lee	Co-founder & CTO	2	3
Surface Logix	Carmichael Roberts	Co-founder & CEO	1	5
Tropos	Christian Dubiel	Co-Founder & VP of Business Development	1	4

Table 6. Founder Experience.

Founder Experience	Companies	Advisors
1st	6	27
2 nd – 3rd	2	6
4th +	3	9

Further decomposing the data, the companies can be grouped by geography and by industry. Four of the companies were from the San Francisco Bay Area, six were from the Boston Metro Area and one was from Austin, Texas. Finally, four of the

⁶ Carmichael Roberts founded WMR Biomedical and Christian Dubiel founded Kingfish.

⁷ Including the represented company.

companies were developing products for the solar industry. The remaining companies represented a diverse set of high technology industries from wireless networking to battery manufacturing (see Table 3 for the companies' industries and Table 8 for an industry breakdown).

Table 7. Geographic Summary.

Headquarters	Companies	Advisors
SF Bay Area	4	13
Boston	6	25
Other	1	4

Table 8. Industry Breakdown.

Industries	Companies	Advisors
Solar	4	14
Non-Solar	7	28

4 Analysis Methodology

After completing a narrative for each case, the author was left with a plethora of quotes and insights into external advice. The fragmented insights needed to be structured such that conclusions could be drawn from a quantitative analysis rather than from a qualitative reflection. The first step to quantify the interviews was to determine what topics were common across all cases. After carefully reviewing the case facts, the author observed that the type of advice given (advice type), the type of advisor (advisor type) and how the founder was connected to the advisor (advisor connection) were all topics that each founder addressed in great detail when describing his most influential advisors. These topics were further decomposed so a more comprehensive analysis could be performed. In addition, how the influential advisors were compensated for their advice as well as if they were asked to join the company full-time were either explicitly or implicitly determined from the case interviews. Moreover, relevant company characteristics were extracted from public information and from the interviews. For

example, the number of founders, the founders experience, the company headquarters, year founded, and current stage of development were determined for each case.

The next step in quantifying the case interviews was to create a database in Excel. The database listed the influential advisors for each case in the rows and had the decomposed topics along the columns. Next, the author read through each case narrative and interview case facts and determined for each identified influential advisor what type of advice of was given, the advisor type, the advisor connection, how that advisor was compensated, and if that advisor was asked to join the company full-time. For each “true” statement the author would put a “1” in the “true” column for the respective advisor (row). In total, the database was 42 (number of advisors) X 43 (number of decomposed categories) in total size.

After the database was complete, the analysis began. Using this comprehensive database with database filtering tools, the author could quickly explore multiple one dimensional and two dimensional comparisons. For example, a one way table would look at the type of advice received for each company, whereas a two way table would look at the type of advice received for each advisor type. In total, over 40 tables were created in order to aid in drawing conclusions. Some of the tables clearly showed a correlation between two variables whereas other tables showed that there was no correlation. The dataset was manageable so no regression testing was necessary to determine variable significance.

The most important step in the process was properly decomposing the three main topics into mutually exclusive subcategories. If this was not done properly, the conclusions drawn would be meaningless and disputed. Thus to avoid any confusion, the

decomposed subtopics for the three main topics are shown below. These definitions were reviewed by the author's thesis advisor and consulted frequently when going through the laborious task of filling in the database.

4.1 Type of Advice

In total, there were eight subcategories for the type of advice received from the influential advisors. It is possible for a single advisor to give advice on multiple types of advice. In fact, in most cases advisors gave advice that fell within two or three of the categories defined below.

- Business Tactics
 - General advice on how to run the company. The advice is much more short term in nature (less than two years). Examples are who to hire, where to locate, what professional service firm to use, etc. It also includes advice that is unique to starting up the company (where to incorporate, paperwork, etc.).
- Business Strategy
 - Advice on the long term (greater than two year) strategic direction on the company. Advice could be on marketing strategy (what products, what customers, how to price), operations strategy (where to locate the manufacturing plants, the need to partner), financial strategy (how to structure the company, equity vs debt considerations) as well as general business strategy (vision of company, business model, etc.). It doesn't include technology strategy (covered in "technical" below) or intellectual property strategy (covered in "highly specialized" below).

- Fund Raising
 - Advice on how to raise money for the new venture. This includes advice on who to approach, how much to ask for, how to structure the deal, how to put together a winning pitch, etc.
- Industry Specific
 - Advice on industry trends, customer needs, competitive landscape and key suppliers.
- Highly Specialized (Expert Advice)
 - This is advice that only a few people (experts) are qualified to offer. These are topics that are not taught at business school and thus the business founders are not expected to know. This includes any advice on the law (IP, contracts, etc.), lobbying, etc. This does not include fundraising or technical issues since those are covered in other categories.
- Technical
 - Advice on the underlying technology of the product. The advisor could help point out what technology to use, identify technology risks, advise on technology and product strategy or could give a technology assessment.
- Coaching
 - A coach's primary responsibility is to develop the players on his team. He cares not only about how the team performs but also how the individuals on the team are improving their skills. He identifies weakness and helps his players overcome their weaknesses. Furthermore, a coach offers encouragement to his team, which instills confidence in them. A good

coach is one who believes in his players and carefully balances between pushing them to their limits and coddling them when they have lost hope.

- Networking Broker
 - An advisor can act as a broker. In the networking terminology, a broker is one who connects people (Aldrich 1996). The advisor will “open his rolodex” to the founding team and introduce the founders to his personal and or professional network. Often the introductions will save the founding team significant time getting the information they so desperately desire.

The decomposed groups can be aggregated into the following super categories:

- Tactical: Includes business tactics, fundraising, & highly specialized.
- Strategic: Includes business strategy, Industry Specific & Technical
- Personal Investment: Includes Coaching & Networking Broker
 - The idea here is that advisors that engage in coaching and network brokering are putting their personal time and reputation on the line and thus are making more of a personal investment in the company.

4.2 Type of Advisor

An advisor can come from many sources. The author identified eight types of advisors. Although these categories are mutually exclusive, it is possible for a single advisor to have more than one affiliation. The most common example is an advisor that when giving advice was both an investor in the company as well as a member of the Board of Directors.

- Friend
 - Prior to starting the venture one or all of the founders were friends with the advisor.
- Family
 - Prior to starting the venture one or all of the founders were related to the advisor either by bloodline or through marriage.
- Professional Consultant
 - The advisor is a professional consultant and his primary role at the company was as a consultant. The advisor must have received some type of consideration for his time spent at the firm.
- Venture Capitalist
 - The advisor is a practicing venture capitalist. He is either an associate, analyst, partner or general partner at an accredited venture capital firm.
- Venture Capital Advisor
 - Brought in by the venture firm to advise the startup and or perform due diligence on the venture. Some VC firms call this position a venture partner.
- Investor
 - The advisor invested his own personal money into the firm (NOTE: this does not include venture capitalists that invest in the venture on behalf of their LPs or any other agent relationships)
- Board Member
 - At the time of given the advice, the advisor sat on the Board of Directors

- Customer
 - Can be a current or potential customer of the new venture at the time the advice was given.

4.3 Advisor Connection

Founders of companies can find their influential advisors from a variety of sources. In total eight subcategories were identified.

- Existing Founder Social Network
 - One of the founders knew the advisor directly through his social network. The advisor could be his family, friend or classmate.
- One Degree of Separation from Founder's Social Network
 - Someone in a founder's social network introduced the founders to the advisor.
- Existing Founder Professional Network
 - One of the founders knew the advisor directly through his professional network. The advisor could be a former colleague at the founder's previous company or member of a professional organization.
- One Degree of Separation from Founder's Professional Network
 - Someone in a founder's professional network introduced the founders to the advisor.
- Venture Capital Connection
 - Someone affiliated with the VC introduced the founders to the advisor.

- Professional Consultants
 - One of the professional consultants in the company introduced the founders to the advisor.
- Core Advisor
 - An advisor that was identified by the founder as one of the “core advisors” introduced the founders to another one of the “core advisors.”
- Blind
 - There was no previous relationship or an introduction to the advisor. The founders could have found the advisor by an internet search, networking event, at a conference or by any other random method.

5 Analysis

The following sections explore the characteristics of external advice for each company and company characteristics groupings defined in the data section above. The aim of these sections is to illustrate how external advice is used in today’s high technology firms. The final section attempts to correlate firm level performance with certain external advice characteristics and company characteristics.

5.1 *Type of Advice*

In aggregate, the interviewed founders identified 42 influential advisors. Those 42 advisors gave a total of 110 types of advice.⁸ Therefore, on average, each advisor gave advice on 2.6 topics identified by the author of this thesis. Some types of advice were on average given more frequently. Business strategy advice was the most prevalent

⁸ The correct unit is type-advisor. For example, if 3 advisors each gave 3 types of advice (could be the same or different type), then there were a total of 9 types-advisor advice. For simplicity reasons, this unit will be referred to as types.

with 21 total types of advice received. Both industry specific and highly specialized advice was given the least frequent, having only eight total types or 0.7 advice per firm. A summary of the type of advice given to each case study company is shown in the table below.

Table 9. Advice Type for Each Case Company.

Company	Business Tactics	Business Strategy	Fund Raising	Industry Specific	Highly Specialized	Technical	Coach	Network Broker	Total	# of Advisors	Advice/Advisor
Expresso Fitness	1	0	0	3	2	1	1	2	10	3	3.3
Miasolé	0	0	1	0	2	1	1	2	7	3	2.3
A123	0	2	1	0	0	0	0	1	4	2	2.0
Heliovolt	2	3	3	0	1	1	0	2	12	4	3.0
Kiva Systems	3	1	2	2	1	2	5	2	18	7	2.6
Konarka	0	2	0	1	0	4	0	0	7	4	1.8
QD Vision	2	1	0	0	0	1	1	2	7	3	2.3
Seahorse Power	2	3	1	0	1	0	1	1	9	4	2.3
Stion	2	2	1	1	1	0	1	3	11	3	3.7
Surface Logix	2	4	3	1	0	0	4	0	14	5	2.8
Tropos	2	3	1	0	0	1	2	2	11	4	2.8
Total	16	21	13	8	8	11	16	17	110	42	2.6
Average	1.5	1.9	1.2	0.7	0.7	1.0	1.5	1.5	10.0	3.8	2.6

A few observations regarding the quantity and breadth of advice can be made by examining the type of advice each company received. First, the amount of total types of advice for each company varied from 4 (A123 System) to 18 (Kiva Systems) with the average being 10. Furthermore, the breadth of advice (number of types of advice per advisor) varied from 1.8 (Konarka) to 3.7 (Stion). This means that Konarka's advisors covered half the advice categories compared to Stion's advisors. Put another way, Konarka's advisors gave more specific advice than Stion's advisors. Another way of looking at total breadth of advice for the company is to see how many of the eight categories were covered by at least one advisor. Only Kiva Systems' advisors covered all eight categories. Both A123 Systems and Konarka only covered three of the eight

categories. One reason could be that both A123 Systems and Konarka were founded by experienced founders and had a large founding team whereas Kiva Systems was founded by a first time sole founder. Another interesting observation is the amount of redundant advice received. For example, five of Kiva's seven influential advisors give coaching advice, all four of Konarka's advisors gave technical advice and four out of the five advisors to Surface Logix gave both coaching and business strategy advice. These topics must have been of critical importance to the founders as well as must have been an area outside their level of expertise.

5.2 Advisor Type

Out of the eight types of advisors identified by the author, the most common was the professional consultant (14 of the 42 advisors or 33%). The next most common was the investors and Board of Directors (28% each). The least common type of advisor was the customer (5%). This could be because five of the eleven case companies were in the research and development stage and thus have yet to significantly interact with customers. As mentioned in the analysis methodology section, it is possible for one advisor to have multiple affiliations. For example, they could be a Board of Directors member as well as a personal investor in the company. Since there were a total of 55 advisor types and 42 advisors, then on average each advisor had 1.3 affiliations. The table below summarizes the types of advisors for each company.

Table 10. Advisor Type For Each Case Company.

Company	Friend	Family	Professional Consultant	VC	VC Advisor	Investor	Board Member	Customer	Total	# of Advisors	Advice/ Advisor
Expresso Fitness	0	0	0	0	0	1	2	1	4	3	1.3
Miasolé	0	0	0	1	0	1	3	0	5	3	1.7
A123	0	0	0	1	0	1	2	0	4	2	2.0
Heliovolt	0	0	2	0	2	0	1	0	5	4	1.3
Kiva Systems	5	2	0	0	0	2	0	1	10	7	1.4
Konarka	0	0	3	0	0	0	1	0	4	4	1.0
QD Vision	1	0	0	1	1	0	0	0	3	3	1.0
Seahorse Power	0	0	2	0	0	2	1	0	5	4	1.3
Stion	0	0	3	0	0	0	0	0	3	3	1.0
Surface Logix	0	0	0	1	0	5	2	0	8	5	1.6
Tropos	0	0	4	0	0	0	0	0	4	4	1.0
Total	6	2	14	4	3	12	12	2	55	42	1.3

From examining the advisor type table it is clear that some companies relied heavily on one type of advisor. For example, all of Kiva’s advisors were family or friends, all of Stion’s and Tropos’ advisors were professional consultants, all of Miasolé’s advisors were on their Board of Directors and all of Surface Logix’s advisors were investors in the company. Although these companies had “sole source” advisors, it did not translate into less breadth of advice. “Sole sourcing” advisors could have had an impact on the quality of advice received since it is surmised that certain types of advisors are better at given certain types of advice. However, the quality of advice received was not quantified in this thesis so it is pure speculation.

When pitching the advantages of using a venture capital firm in lieu of other financing sources, venture capitalists often stress their powerful advising capabilities. However, only 10% of the influential advisors identified in the case studies of venture backed companies were venture capitalists. Venture capitalists would argue that not only do they personally offer advice, but they also enlist an army of advisors to help their portfolio companies. This might be true, but only 7% of the influential advisors were VC

advisors. Thus, in total only 17% of influential advisors were affiliated with a venture capital firm.

5.3 Advisor Connection

Where does a founder find a quality advisor? Out of the 42 advisors studied in this thesis, the plurality of them came from the founder’s own social network (36%). Both Kiva Systems and Surface Logix found all their advisors from the founders’ social network (see table below). If you include the founder’s professional network and one degree of separation from both the social and professional network as part of the founders “network”, then over half of the advisors (55%) were found from the founder’s network. The founder’s venture capitalists and professional consults introduced the founders to 10 and 5 percent of the total advisors respectively. Although venture capitalists were a small percent of the advisors, they were perhaps more valuable as network brokers introducing the founders to valued advisors.

Table 11. Advisor Connections For Each Case Company.

Company	Existing Founder Social Network	1 Deg Separation from Founder's Social Network	Existing Founder Professional Network	1 Deg of Separation From Professional Network	VC Connection	Professional Consultants	Core Advisor	Blind	Total
Espresso Fitness	1	0	0	0	0	1	0	1	3
Miasolé	0	0	0	0	1	1	1	0	3
A123	0	0	2	0	0	0	0	0	2
Heliovolt	0	0	0	0	1	0	0	3	4
Kiva Systems	7	0	0	0	0	0	0	0	7
Konarka	0	1	0	2	0	0	1	0	4
QD Vision	1	0	0	0	1	0	0	1	3
Seahorse Power	1	0	0	0	0	0	0	3	4
Stion	0	0	1	0	0	0	2	0	3
Surface Logix	5	0	0	0	0	0	0	0	5
Tropos	0	1	1	0	1	0	1	0	4
Total	15	2	4	2	4	2	5	8	42

Even more surprising is the role of the identified influential advisor. These “core advisors” introduced the case founders to five other core advisors. Since a core advisor couldn’t introduced himself, then the “core advisors” represent 13% ($5/(42-5)$) of the total advisor connections. This clearly illustrates an advisors network effect. In addition to bestowing advice, advisors can act as network brokers introducing the founders to other valued advisors. The more advisors a firm has the more likely that those advisors would introduce the founder to other valued advisors. Thus, the network of advisors becomes more valuable with the each additional advisor added to the network.

Not all advisors are found from one’s network or by recommendations from those affiliated with the firm. In fact, nineteen percent of the advisors were found without any connection (“blind”). These advisors were found at trade shows, through an internet searches, general networking events and other random ways. Founders of companies with “blind” connections knew that they needed advice, but didn’t have anyone close to them that could recommend a quality advisor. Without a recommendation, the founders would have to blindly select someone and hope that they could trust them and that the person would provide worthwhile advice. Both Seahorse Power and Heliovolt found 75% of their advisors without any direct connections. Perhaps both of these companies had to resort to “blind” connections because they were both first time founders and sole founders. As inexperienced first time founders, they didn’t have an established entrepreneurial network. Furthermore, they couldn’t leverage an extended network that one would have if one was part of a diverse founding team.

5.4 2-Ways: Advisor Type versus Advice Type

Additional conclusions about advice type and advisor type can be drawn by looking at them in a two dimensional matrix (See the table below). The primary conclusion is that each advisor type offers broad advice as evidence that 78% of the cells in the matrix have non-zero entries. There is not one advice category that exceeds 40 percent of the total advice given by any advisor type. Conversely, there is not one advisor type that exceeds 40 percent of total advice received in any advice category.

Table 12. Advice Type Versus Advisor Type.

Advisor Type	Business Tactics	Business Strategy	Fund Raising	Industry Specific	Highly Specialized	Technical	Coach	Network Broker	Total	# of Advisors	Advice/ Advisor
Friend	3	2	1	1	0	2	5	1	15	6	2.5
Family	1	0	1	1	1	0	1	1	6	2	3.0
Professional Consultant	7	9	4	2	3	4	3	7	39	14	2.8
VC	1	1	2	0	1	0	1	3	9	4	2.3
VC Advisor	0	1	1	0	0	2	0	1	5	3	1.7
Investor	5	7	7	4	1	0	8	5	37	12	3.1
Board Member	2	6	3	2	4	3	5	5	30	12	2.5
Customer	1	0	0	2	0	0	1	0	4	2	2.0
Total	20	26	19	12	10	11	24	23	145	55	2.6

Investors on average give almost two times as much breadth of advice compared to VC advisors (3.1 advice type/advisor versus 1.7). This makes sense. VC advisors are typically brought in by the VCs to help with a specific problem and thus offer much more specialized advice; whereas, investors typically are protecting their investment and thus are willing to give advice on any and every topic that will potentially help the founding team.

5.5 Founding Team Experience

The type of advice received and how founders find their advisors varies considerably between first time founders and experienced founders. The figure below compares first time founders to founders that have founded at least four ventures. First

time founders are much more likely to get coaching advice (48% of the advisors) and business tactics (44%) compared to experienced founders (11% and 0% respectively). This is not surprising since experienced founders through their previous startups have learned the necessary tactics and no longer need the encouragement because they have a proven track record.

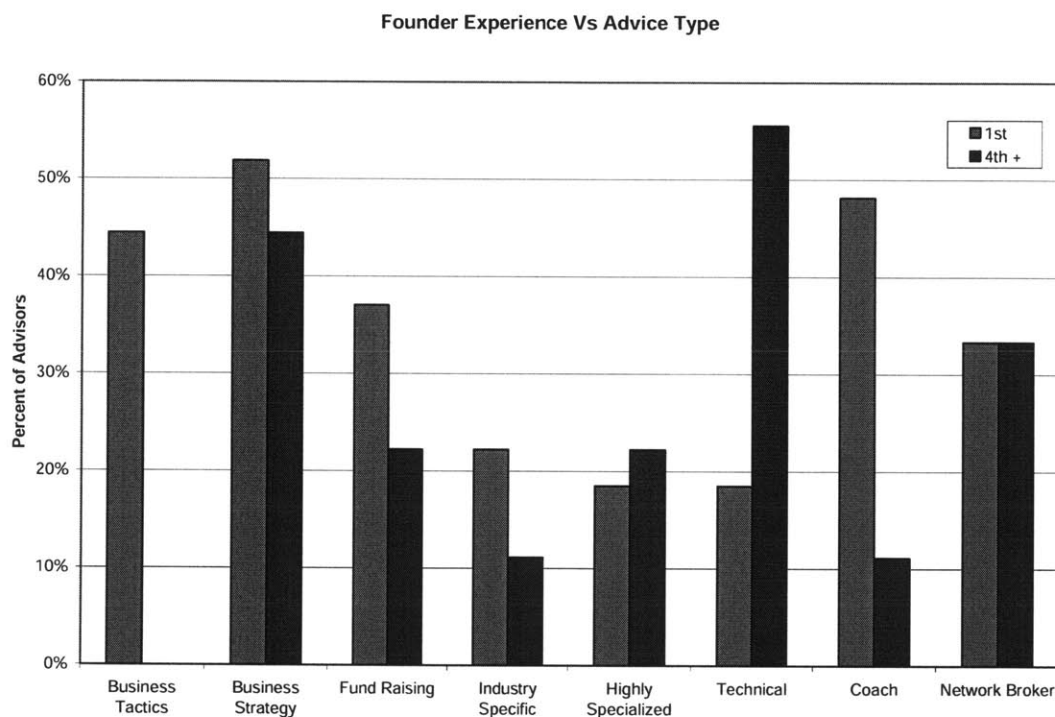


Figure 1. Founder Experience Versus The Type Of Advice Received.

Experienced founders are much more likely to get strategic advice⁹ (56%) than first time founders (34%). Furthermore, the advisors of experience founders on average tend to give more specific advice (2.0 advice types per advisor) compared to first time founders (2.7).

⁹ See definition in analysis methodology section

Table 13. The Type Of Advice Received For Different Levels Of Founder Experience.

Founder Experience	Tactical	Strategic	Personal Investment	Total	# of Advisors	Advice/Advisor
1st	27	25	22	74	27	2.7
2nd - 3rd	6	5	7	18	6	3.0
4th +	4	10	4	18	9	2.0
Total	37	40	33	110	42	2.6

How founders find their advisors also depends on the level of experience of the founding team (see Figure 2). First time founders of companies in this thesis find 78% of their advisors either from their existing social network or blindly. This compares to experience founders who found none of their advisors from these two sources. The reason for this difference could be that first time founders are much less likely to have an entrepreneurial professional network that will be able to offer advice. Thus, they have to go those closest to them (their friends, family or classmates), even if they are not as qualified. If they don't have a strong social network, then they have to reach out blindly to other sources of advice. On the other hand, experienced founders have built through the years a large entrepreneurial professional network that they can leverage for advice or for references for quality advisors. In addition, experienced advisors are seven times more likely to have their core advisors connect them to other core advisors compared to first time founders. Thus, experienced founders not only have a larger professional network, but also their core advisors have a much larger network of potential advisors.

Founder Experience Vs Advisor Connection

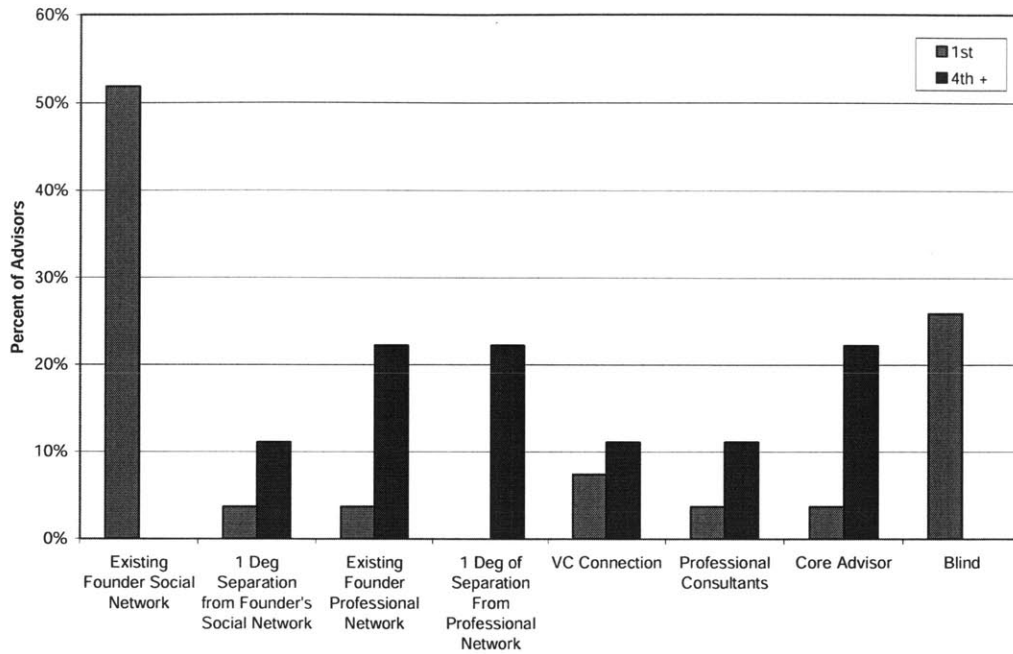


Figure 2. Founding Team Experience Versus How The Advisor Was Found.

The comments from the interviews regarding founding team experience echoed some of the quantitative results from the aggregated data. Experienced founders mentioned that for their first few startups that they relied heavily on advice and took advice from any source that would give it. Ric Fulop, the co-founder and VP of Business Development at A123 systems, said, “for my first three companies I relied on a lot of advice...I didn’t know how to negotiate a term sheet or how to raise money...I didn’t know how to do anything...by the time I was in the fourth one, I was more autonomous and for the fifth and sixth ones it was more auto pilot (Fulop, 2007).” Similarly, Howard Berke, the CEO and co-founder of Konarka, mentioned that “when I was first starting, (I) didn’t know that much and (I sought) advice on everything including some very mundane subjects.” Like Ric, when Howard gained experience the advice he requested moved

from general to specific, “(I now seek) out on a more focused basis individuals with precise expertise in the area that you need their assistance. (Whereas) when you are younger just starting out you are happy just to get general business advice and counsel (Berke, 2007).” Finally, Christian Dubiel, the co-founder and former Director of Business Development for Tropos Networks, mentioned the coaching benefits for a first founder, “when you are a first time entrepreneur there is so much that is new that having someone that has been there before saying, ‘hey, it is always this messy. I found it very helpful (Dubiel, 2007).”

5.6 Founding Team Size

All three of the companies that were founded by just one person also happened to be founded by first time founders. It is interesting that all experienced founders started their latest venture with a team of founders rather than by themselves. These experience founders were more capable of starting a company by themselves but decided not to. It is possible that they either read entrepreneurial literature (Roberts, 1991, Eisenhardt and Schoonhoven, 1990, Cooper and Bruno, 1977) or they realized by first hand experience that a venture was more likely to succeed with a large founding team than by a single founder. Unfortunately, since all the sole founders were first time founders, aggregating all the data is not useful since no conclusions can be made about sole founders. However, if a subset of the data is used then it is possible to make some meaningful conclusions. In this case, only data from first time founders was examined and the data from experienced founders was disregarded.

There is not a significant difference between sole founders and large founding teams when exploring the type of advice they received, the type of advisors and how they

found their advisors. The single biggest difference is highlighted in the table below. Sole founders are more likely to get tactical advice (41% of advice received) compared to experienced founders (31%). Conversely, experienced founders are more likely to seek strategic advice compared to first time founders (37% versus 31%). Although these differences are marginally significant, they do seem to make sense. A larger founding team has more resources and expertise to handle tactical issues. However, strategic advice is universally sought by experienced firms presumably since the topic has a greater impact on the success of the company and there is not a definitive answer. Therefore, obtaining as many perspectives helps the founder determine all of his options.

Table 14. Founding Team Size & The Type Of Advice Received.

Founding Team Size	Tactical	Strategic	Personal Investment	Total	# of Advisors	Advice/Advisor
1	16	12	11	39	15	2.6
4+	11	13	11	35	12	2.9
Total	27	25	22	74	27	2.7

The second finding is that 40% of the sole founders' advisors were blind connections compared to 8% of the large founding team's advisors. Furthermore, both sole founders and large founding teams were just as likely to find their advisors from their existing social network. Comparing this finding to the findings in the founding team experience section above, the author can conclude that using their existing social network to find core advisors is more dependent on the experience of the foundering team than on the size of the team. However, the author can not conclude what has a bigger effect on the use of blind connections, founding team size or founding team experience.

Table 15. Founding Team Size & Advisor Connection.

Founding Team Size	Existing Founder Social Network	Blind
1	53%	40%
4+	50%	8%

5.7 Geography

Much has been written on the differences between the Silicon Valley and other parts of the United States in terms of the entrepreneurial activity and networks (Saxenian, 1994). In addition, in the case interviews for this thesis, the founders of Tropos, Konarka and Kiva Systems all mentioned the network advantages of the Silicon Valley even though the question was not directly asked. Tropos' co-founder, Narasimha Chari, commented on why Tropos moved from Boston to Silicon Valley, "we saw the West Coast as being the nexus of innovation. It offered access to venture capital, engineering talent, other entrepreneurs, and other technology companies" (Lassiter, 2006). Furthermore, the CEO and co-founder of Konarka, Howard Berke, believes that with the denser entrepreneurial network in Silicon Valley startup companies are more likely to succeed. He drew the following analogy, "if you randomly dropped a seed pod onto fertile soil (Silicon Valley) its more likely to take root and sprout than if you dropped it onto barren soil (other regions of the US) (Berke, 2007)."

The question is will the data from the case interviews for this thesis shed any light on this topic. The answer is yes. From Figure 3, advisors in the San Francisco Bay Area are almost three times as likely to act as a network broker. Since there is a denser entrepreneurial network in the Bay Area, then it is not surprising that the advisors would be more likely to introduce the founders to people within their network. In addition, the results from Figure 4 below show that 62% of the SF Bay Area core advisors were found from VC, professional service, or other core advisors compared to only 8% for the Boston area. This is yet additional evidence of the strength of the Silicon Valley entrepreneurial network.

Geography Vs Advice Type

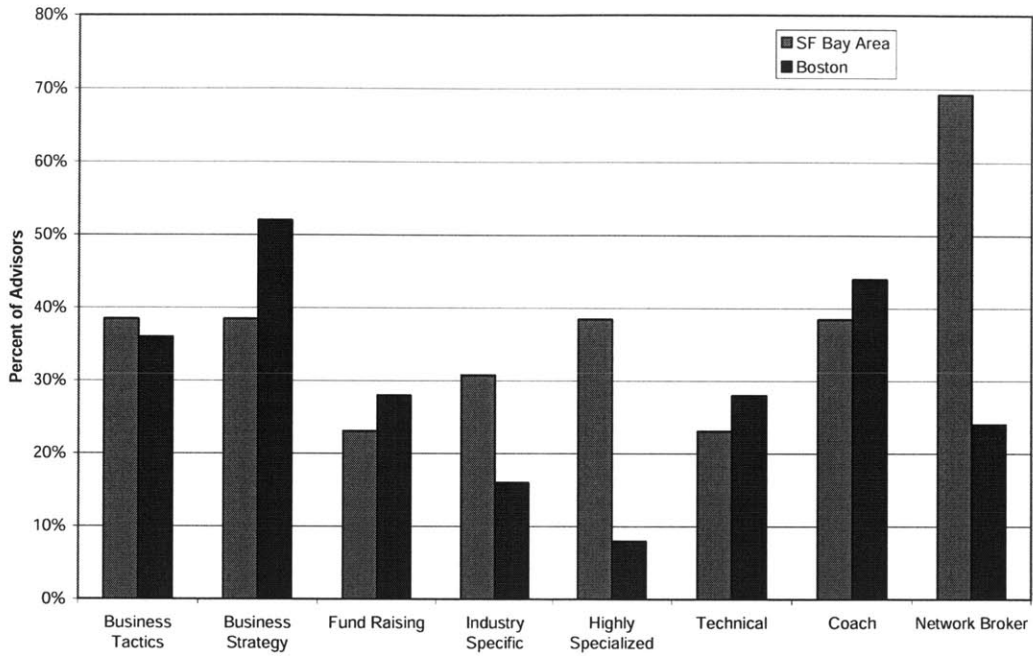


Figure 3. Geography Versus Advice Type.

Geography V Advisor Connections

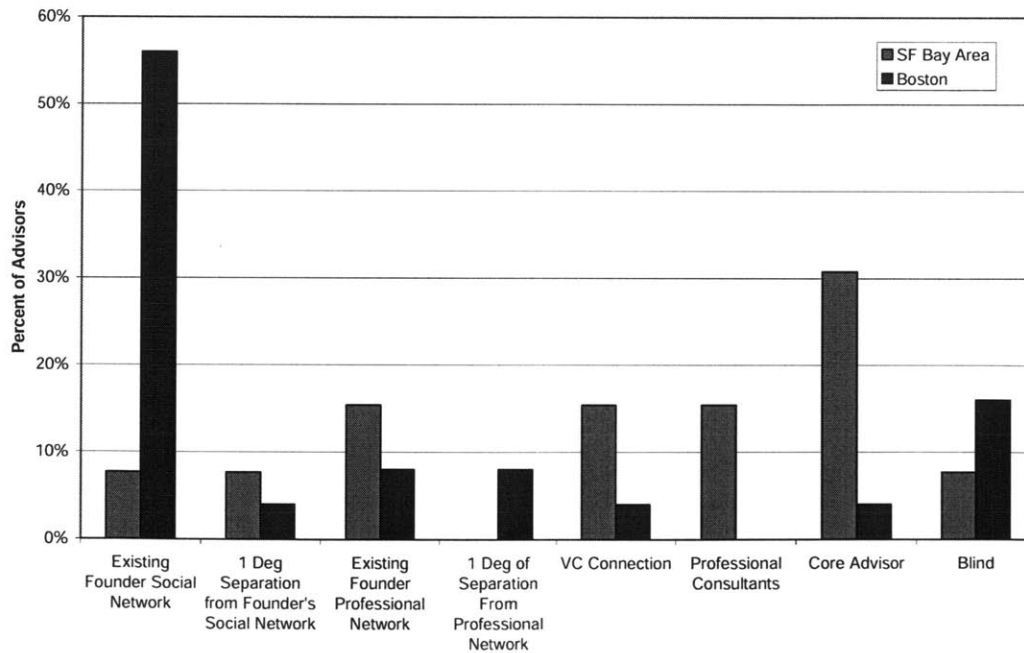


Figure 4. Geography Versus Advisor Connections.

5.8 Industry

Four of the eleven case companies were in the solar energy industry. Furthermore, the four solar energy companies had a diverse set of company attributes. There was at least one company in each of the founding team size, founding team experience and geography groupings. Therefore, an industry comparison could be made between the solar companies and the companies in “other” non-solar industries.

There was not a significant difference in external advice characteristics between solar energy companies and non-solar energy companies. The solar energy companies received virtually the same breadth of advice from each advisor (2.64 vs 2.61 for non-solar) and received similar advice from their advisors compared to non-solar energy companies. The biggest difference was that solar companies got on average 2.4 times as much technical advice and 2 times as much highly specialized advice. This could be primarily because of the advanced nature of the technology that they are developing.

Surface Logix and Kiva Systems represented 80% of the total coaching advice and were both in the non-solar industry category. That is why it seems that non-solar companies received so much more coaching advice. If you filter out the coaching advice data from Surface Logix and Kiva Systems then there is basically no difference in coaching advice between solar and non-solar industries.

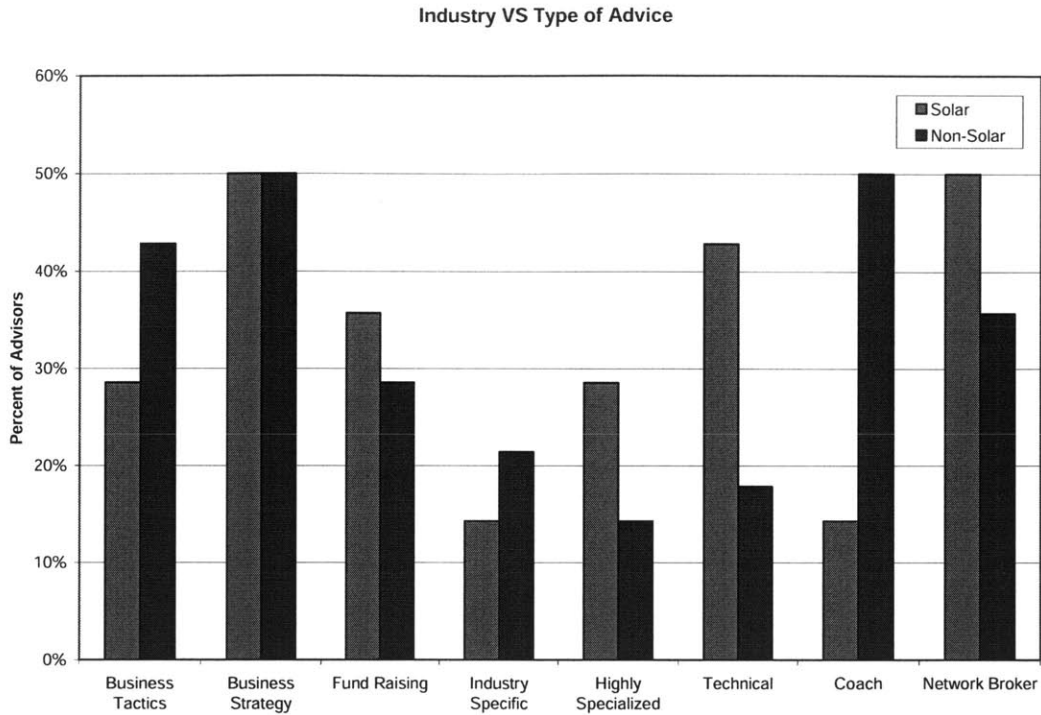


Figure 5. The Type Of Industry Versus The Type Of Advice Received.

5.9 Advisor Engagement

When in the case companies' history did the identified influential advisors begin giving advice? The answer: early. Two thirds of the advisors first gave advice within the first six months of the case companies' history (see table below). In fact, 29% of the advisors starting giving advice before the companies were formally founded. Not surprising, these early advisors tended to give more broad advice (2.75 advice-types per advisor when the advisor was engaged during the first six months of the company's formation versus 2.4 if engaged after six months). When the advisors were engaged within the first year, the advice received was spread almost equally between tactical, strategic and personal investment (coaching and networking). However, if the advisor entered after the company celebrated its first anniversary, then advisors were 2-3 times more likely to give strategic advice. This is not surprising since after a year the company

has internal resources that can advise the founder on tactical issues. Furthermore, after a year the founder has already extended his network and built his confidence so he would be less likely to need advisors to make “personal investments (coaching and network brokering).”

Table 16. When Advice Commenced Versus The Type Of Advice Received.

Engagement	Tactical	Strategic	Personal Investment	Total	# of Advisors	Advice/Advisor
At Beginning	9	11	10	30	12	2.5
Within 1st 6 Months	18	14	15	47	16	2.9
6 months - 1 year	4	4	4	12	5	2.4
1-3 year	2	5	2	9	4	2.3
After 3 years	4	6	2	12	5	2.4
Total	37	40	33	110	42	2.6

5.10 Compensation

As with most resources, the advice resource normally comes at a cost. Only 16% of the advisors gave free advice and all of those advisors were either friends or family members of the founder (see table below). Paid advice came in three forms: 1) an up front cash payment, 2) stock options in lieu of cash and 3) a combination of stock options and cash.¹⁰ Of the 19% of advisors that received cash, 87.5% were consultants and the other was a Board of Director¹¹. Of the 23% of advisors that received stock options for their advice, 80% of them were professional consultants. In total 33% of the advisors received stock options and or cash for their advice. The remaining 50% of advisors did not receive any compensation because they gave their advice either as an investor, potential investor or as a Board of Director. Since these advisors had a vested interest in the company and thus had the power to remove the advisee, then these advisors were not

¹⁰ Typically stock options first then once the company was properly financed, they started to receive cash

¹¹ The Board of Director was paid in cash and options before he became a member of the Board of Directors.

giving true independent advice. As a consequence, advisees could be more reserved in the type of advice sought. For example, they might be interested in getting advice on a certain topic from a Board of Director advisor; however, they might refrain from asking because it might make them look like a less competent leader. On the other hand, if the advisor had no ties to the company (either friend or paid consultant), then the advisee would feel more comfortable asking for any type of advice.

Table 17. Compensation Broken Down By Each Type Of Advisor.

Compensation	Friend	Family	Professional Consultant	VC	VC Advisor	Investor	Board Member	Customer	Total	# of Advisors	Advice/ Advisor
Cash	0	0	7	0	0	0	1	0	8	8	1.0
Free	6	1	0	0	0	1	0	1	9	7	1.3
Stock Options	0	0	8	0	0	0	1	1	10	10	1.0
N/A Vested Interest (Board/Investor)	0	1	2	4	3	11	11	0	32	21	1.5
Total	6	2	17	4	3	12	13	2	59	46	1.3

5.11 Full-Time Employment Offered

One measure on whether the founder valued the advisor's advice is if the founder offered full-time employment to the advisor. Now, not all of the advisors in this study were eligible for this offer. A founder would most likely only offer a full-time position to friends and family as well as to a professional consultant. In total, over nine (21% of total & 41% of eligible) offers were made and of those offers, only four accepted. Of the eight friends and family advisors, six were eventually offered full-time work and of the fourteen professional consultant advisors, only two were offered full-time work. The one Board Member who was offered full-time position represented a special case. The scientific founder for Konarka tragically died before the company was formally launched. Konarka's CEO, Howard Berke, reached out one of his technical advisors, Alan Heeger, to take over as a scientific founder and join the Board of Directors. In most all cases,

investors and Board of Directors would not be asked to join the company as a full-time employee.

Table 18. Full-Time Employment Offers By Each Advisor Type.

Full-Time Employment	Friend	Family	Professional Consultant	VC	VC Advisor	Investor	Board Member	Customer	Total	# of Advisors
Offered	5	1	2	0	0	0	1	0	9	9
Accepted	1	1	1	0	0	0	1	0	4	4

5.12 Performance

The ultimate objective of this thesis is to correlate firm performance with characteristics of external advice. Unfortunately, since all of the firms are by their own accounts “doing well” and all are still private, it is difficult to get accurate performance data.

The best measure of success can be determined by examining each companies revenue and profit statements. Although this information was requested, not one firm felt comfortable sharing their financial status. The next best method of valuing a firm’s performance would be to look at the market capitalization of the company. Again, the companies did not feel comfortable sharing their most recent venture funding capitalization (post-money valuation). Thus, the only possible performance data the author could get from public sources was the cumulative capital raised. Admittedly, this is not the best measure since it represents only a fraction of the value of the company¹² and reflects the value only at the last funding round, which could be two years ago. The assumption is that the cumulative capital raised to the true value of the company fraction is relatively constant for all the companies. Thus, this measure is a rough approximate to the true value of the company. To account for the fact that the companies in this thesis were founded at different times, the cumulative capital raised is divided by the years in

¹² Assuming most of all rounds are “up-rounds”

operation. This yields a rate of capital raised (capital raised per year), which the author will use for the remainder of the paper as the performance variable. The list of the companies ranked by their performance is shown in the table below.^{13,14} Each company was ranked and put either into the upper, middle or bottom performance group. It is important to note that the historical performance listed below does not indicate future performance and is not a sign of the investment worthiness of the companies.

Table 19. Company Performance.

	Company Name	Capital Raised (\$m)	Cap/Year	Ranking
Upper	A123	\$102	\$17	1
	Surface Logix	\$82.00	\$10.25	2
	Miasolé	\$59	\$10	3
Middle	Tropos	\$65.30	\$9.33	4
	Konarka	\$52.50	\$8.75	5
	Kiva Systems	\$26	\$7	6
	Expresso Fitness	\$19	\$5	7
Bottom	Stion	\$6.30	\$3.15	8
	OD Vision	\$6	\$2	9
	Heliolt	\$10	\$2	10
	Seahorse Power	\$2.20	\$0.55	11

Company Characteristics

By placing the performance data into the company characteristics categories defined in the data section, an average performance ranking per category is calculated. The results are summarized in the four tables below.

¹³ Based on all company public announcements as of March 23, 2007.

¹⁴ If a company came out on the 24th of March with a huge financing round, it would greatly affect the performance ranking and thus some of the conclusions.

Table 20. Geography Versus Performance.

Geography	Average Ranking
Boston	5.7
SF Bay Area	5.5

Table 21. Team Size Versus Performance.

Founding Team Size	Average Ranking
1	9
2-3	8
4-5	5
6+	5

Table 22. Experience Versus Performance.

Founding Team Experience	Average Ranking
1st	6.7
2nd - 3rd	8.5
4th +	3

Table 23. Industry Versus Performance.

Industry	Average Ranking
Solar	6.5
Other	5.7

There is significant correlation between performance and the founding team size as well as the founding team's experience. The correlation between founding team size and performance matches the results from multiple entrepreneurial studies (Roberts, 1991, Eisenhardt and Schoonhoven, 1990, Cooper and Bruno, 1977) as well as the strong views of one of the case interviewees. Ric Fulop, the co-founder and VP of Business Development at A123 Systems, mentioned at the onset of the interview, before even the introductory statement was read, that "the number of founders in the company has a huge impact on the success (of the company)" (Fulop, 2007) In addition, the correlation between founding team experience and company performance matches the finding from Delmar and Shane's study (Delmar and Shane, 2006). It is interesting to note that the three first time founders who were also sole founders had an average ranking of 9 (6th, 10th and last). Experience and founding team size does matter.

There was no correlation found between performance and the company geography and industry. The regional advantage of the Silicon Valley (Saxenian, 1994) in this sample did not yield a performance advantage. Also as expected, there is not a significant advantage from being in one industry compared to another.

External Advice Characteristics

Since the top performing firms tended to have larger founding teams and more experience compared to the poor performers, then it is difficult to determine if the performance was due to certain advice characteristics or the company characteristics. However, by comparing the top performers with the bottom tier performers, some conclusions can be made about the type of advice and the type of advisors of top performing firms (see Table 24 - Table 26).

Compared to bottom performing companies, top performing companies are:

- ½ as likely to seek business tactics advice
- ~½ as likely to have advisors act as a network broker
- Over 2 times more likely to have their advisor act as a coach
- Over 3 times more likely to have an influential advisor be an investor & Board of Director member
- 3 times more likely to find their influential advisor from their own personal network (0 influential advisors were found blindly compared to 50% for bottom performing companies)

Table 24. Performance Versus The Type Of Advice Received.

Performance Rank	Business Tactics	Business Strategy	Fund Raising	Industry Specific	Highly Specialized	Technical	Coach	Network Broker	Total	# of Advisors	Advice/ Advisor
TOP	4	9	6	1	2	2	7	5	36	14	2.6
MIDDLE	4	3	2	6	3	7	6	4	35	14	2.5
BOTTOM	8	9	5	1	3	2	3	8	39	14	2.8
Total	16	21	13	8	8	11	16	17	110	42	2.6

Table 25. Performance Versus The Type Of Advisor.

Performance Ranking	Friend	Family	Professional Consultant	VC	VC Advisor	Investor	Board Member	Customer	Total	# of Advisors	Advice/ Advisor
TOP	0	0	4	3	0	7	7	0	21	14	1.5
MIDDLE	5	2	3	0	0	3	3	2	18	14	1.3
BOTTOM	1	0	7	1	3	2	2	0	16	14	1.1
Total	6	2	14	4	3	12	12	2	55	42	1.3

Table 26. Performance Versus Advisor Connections.

Performance Ranking	Existing Founder Social Network	1 Deg Separation from Founder's Social Network	Existing Founder Professional Network	1 Deg of Separation From Professional Network	VC Connection	Professional Consultants	Core Advisor	Blind
TOP	5	1	3	0	2	1	2	0
MIDDLE	8	1	0	2	0	1	1	1
BOTTOM	2	0	1	0	2	0	2	7
Total	15	2	4	2	4	2	5	8

The performance ranking versus the number of core advisors identified by each company and the average breadth of advice for each company advisor are shown in Figure 6 and Figure 7 below. The results reveal that there is no correlation between company performance and the breadth of advice. This finding is unfortunate since these parameters were one of the few that a founder could control.

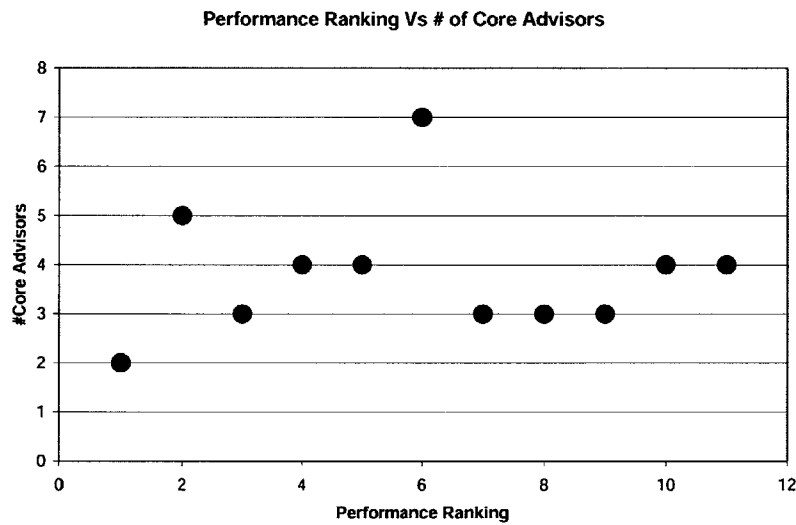


Figure 6. Performance Ranking Versus The Number Of Identified Core Advisors.

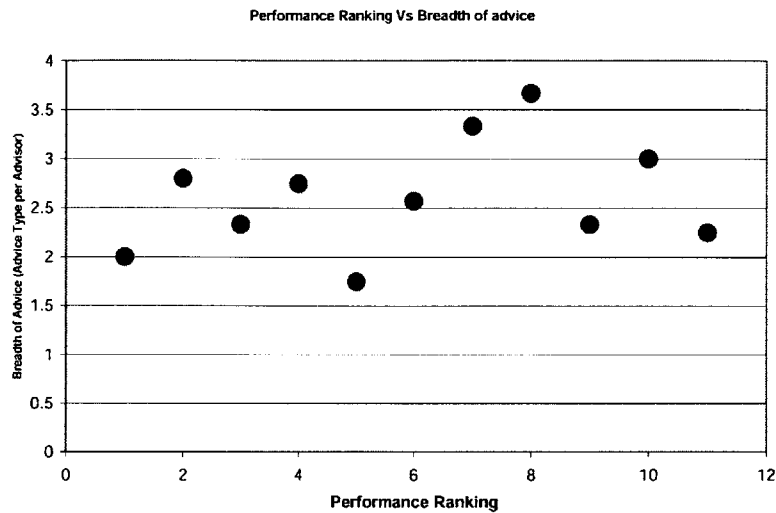


Figure 7. Performance Ranking Versus The Breadth Of Advice.

6 Conclusions

Although the characteristics of the companies selected for this thesis varied, the founders of the companies all had one thing in common; they all actively sought external advice. In aggregate, the advice the founders received was broad covering topics from strategy to tactics. Nine out of the eleven companies received advice from their core advisors in at least five of the eight advice type categories identified. In addition, on average each core advisor gave advice on two to three advice categories. This does not indicate that every advisor to the company gave broad advice. However, one possible reason why the advisor was identified as core by the founder was because of the breadth of advice given. Another reason why the advisors could have been identified as core was because of their length of tenure with the firm. Over seventy percent of the core advisors are still advising the company and two thirds of the total advisors started giving advice within the firms first six months. Yet another reason why the advisors could be valued was that the core advisor made a personal investment in the company. Sixty-four percent of the advisors gave either coaching advice or acted as a network broker giving vital

contacts to the company. In both of these roles the advisor is going above the standard role of an advisor and putting his reputation on the line for the betterment of the founder and company. The advisor is making a personal commitment (or investment) that far exceeds what is necessary and consequently is more likely to assure his investment pays off by issuing valuable advice. Thus, one can conclude that core advisors are valued in part because of their breadth of advice, their tenure with the company and their personal investment made in the company.

There was not a typical type of advisor. Advisors ranged from company independent sources like friends and family and consultants to those tied to the success of the company like Board of Directors, investors and venture capitalists. It was an equal split between those with a vested interest in the company and those that did not have one. Those without a vested interest either gave the advice for free (typically friends or family members) or were compensated for their advice with stock options or cold hard cash. Given the fact that all of these firms were venture backed and that venture capitalists often stress value of their advising network, it was surprising that only 17 percent of the advisors were affiliated with a venture capital firm.

The majority (55%) of the core advisors were found by leveraging the founding team's personal and professional network. The remaining advisors were found either by connections from those affiliated with the company or without any prior connection (blindly). An interesting finding is that core advisors introduced the founders to thirteen percent of the other core advisors. This clearly shows the network effect of selecting quality advisors - the value of the advisory network increases with the addition of each additional advisor. The more quality advisors a founder has the more likely the founder

will be able to connect to other quality advisors. Surprisingly, only 19 percent of the advisors were found without any connection. Again this illustrates how valuable the founding team's network is and how important it is to have well connected people affiliated with the company.

Out of the four business characteristics examined, only the founding team experience showed a significant difference in advice characteristics. First time founders were significantly more likely to get coaching advice and tactical advice compared to experienced advisors. Going through the first few years of a startup can be an emotional experience filled with many unknowns. Thus, having advisors that can give words of encouragement and help with some of the daily decisions is extremely helpful for first time founders. Contrary, experienced founders have "been there and done that," so they do not need as much encouragement and tactical advice. Rather, they reach out for more strategic advice since having many opinions on strategic direction is always helpful. Moreover, first time founders get much more broad advice compared to their experienced brethren. Again, this is expected since experienced founders through their years of experience have a better grasp on how to run a startup and thus seek advice for highly specialized topics. This point is made clear by the fact that A123 and Konarka which were founded by the two most experienced founders in this case study only sought advice from three of the eight advice categories identified, where all other founders sought advice on at least five of the eight categories.

In her book, "Regional Advantage," Saxenian (1994) suggests that there is a larger entrepreneurial network in the Silicon Valley compared to that of Boston's Route 128. The findings in this thesis agree with the author's assessment. In particular, core

advisors from the Silicon Valley in this thesis were more than three times more likely to act as networking brokers. In addition, sixty eight percent of the core advisors from Silicon Valley firms were connected by those affiliated with the company compared to only eight percent of Route 128's advisors. It is presumed that the Silicon Valley advisors are connecting more people because of the higher density entrepreneurial minded people in the area. They simple have more people to choose from and those advising candidates that they recommend are more willing to work with the firm since they are in the same geographic area.

External advice does not seem to be a predictor of success, but rather it is more of a reflection of the characteristics of the company. The performance data clearly shows that there was a strong correlation between the founding team size and founding team experience and company performance. The findings agree with existing literature that a firm has a higher probability to succeed if the founding team is sufficiently large (Roberts, 1991, Eisenhardt and Schoonhoven, 1990, Cooper and Bruno, 1977). Furthermore, the data agrees with the literature that the more experience the founding team has the more likely the firm will succeed (Delmar and Shane, 2006). The data in this thesis did not show any statistical significance in the type of industry or geographic location and firm performance.

Looking at the advice characteristics and company performance, there was only one notable difference than what would be expected by looking at the advice characteristics of a large and experienced founding team. The one exception was that successful companies were two times more likely to have an advisor take the role of a

coach.¹⁵ This surprising correlation shows the value of coaching in a startup regardless of the founding team's experience. Excluding this exception, the author is unable to correlate the quantity and type of advice with the firm's performance. The performance is governed primarily by business characteristics rather than advice characteristics. In order to improve the founders company's probability of success, a founder is better off creating a large and experienced team. A larger and experienced team will help the founder get better advisors because of the network effect of advisors.

7 Future Work

This thesis just scratched the surface on startup companies' use of external advice. The focus was narrow so valid conclusions could be reached. Unfortunately, the ramifications of the narrow scope means that the conclusions reached are directly applicable to only high technology product based firms. Furthermore, with only eleven cases the statistical significance of the data is less than desirable. Therefore, a future study could use the frameworks created in this thesis to study additional high technology companies that have the same business characteristics as what was presented in this thesis. This would verify the data collected in this thesis and would strengthen the baseline for exploring external advice for other business characteristics.

Other future studies could explore how external advice is used for companies outside the Boston and Silicon Valley area or how external advice is used by high technology software services companies. In addition, a future study could explore how external advice is used for less complex non-technology companies. The possibilities are limitless. By using the advice characteristic categories created for this thesis, a large

¹⁵ Only 11 percent of experienced teams used coaches compared to 50 percent of inexperienced teams.

database could be created that would paint a better picture of the use and value of external advice. To get the relevant information for the database, a case-based approach could be utilized like what was used in this thesis. However, since the external advice categories are now well defined, a survey could be incorporated that would enable a much larger and richer dataset.

Since all of the companies selected for this thesis are still in business and in their view doing well, it was difficult to find an accurate performance measure. The optimal performance measure is one that looks at the success of the company over time. Thus, a future study would be to track the use of external advice and firm performance for the eleven companies studied in this thesis over a five year period. Doing this would clearly illustrate how external advice changes with the development of the company and would more accurately show if there is a correlation between external advice and the firm's performance. The study should include semiyearly interviews with the founding team and close monitoring of public information released by the firms.

Finally, this thesis has focused on the founder's perspective of external advice. Future studies should look at external advice from the perspective of the advice giver. Better understanding why advisors give advice would help founders and others find the right advisor and improve their relationship with them. In particular interest is the advisors that give "personal investment" advice (coaching or act as network broker). These individuals go beyond their requested scope of advice and give their time and energy to help founders and companies succeed. Understanding their motives and characterizing their interactions with the firm is of great interest to those that either want

to become a “personal investment” advisor or want to find and benefit from a “personal investment” advisor.

Appendix A: Interview Guide

Firm _____ Interviewer _____

Interviewee Name _____ Date _____

Interviewee Title _____ Location _____

Interview Introduction

Thank you for meeting with me today. This interview should last about one hour. The questions are open-ended and are primarily focused on how you incorporated advice from key people over the first few years of your company's history.

General Open-Ended Questions

Company Formation

I'd like to begin with a bit of background information about the firm's earliest days.

Where did the idea for the company come from?

[# Founders]

[University Connections]

[Corporate connections]

What did you do to validate the idea?

[early customer/investor/advisor communication]

[early prototype]

What did you do after the idea was validated to make the idea into a "real" product and business? (Market Acceptance)

[hire key employees]

[Pilot]

[Visionary Customer]

[patent protection]

Communication Feedback

The next series of questions will focus on the advice that you received and how you incorporated the advice.

Were there any people, not on the founding team, who gave advice that was important in developing the business? If so, who were they and what was their role. For now, please just list their names and roles.

[names]

[roll]

Please rank the people just mentioned by the value of their contributions. People whose advice contributed the most to the development of the company go on top of the list.

For each person mentioned: NAME:

What is your connection to this person?

[Friend]

[School]

[Network]

What kind of advice was provided?

[strategy]

[product design]

[organizational structure]

Was the advice requested or unsolicited?

What impact did the advice have in the development of the company?

[strategy]

[Disregard]

[product design]

[organizational structure]

At what points in the development of the company did the person give advice?

[Beginning]

[Throughout]

[Continuing today]

After we go through the entire list of names

Is there anyone missing from the original list? (If so, repeat the questions listed above)

Did you offer full-time employment to any of these advisors?

[who]

[Why]

If you had to do it all over again...

Would you request more or less advice from these people?

Would you have incorporated more or less of their advice?

Would you seek additional advisors? If so, what type of people?

People not on the list

I noticed that [investors, customers or former colleagues] were not on this list.

Why?

[Didn't think about it]

[Did ask, but info not valuable]

Required Company DNA data

Walk me through the timeline of the company's major milestones from inception to incorporation to 1st prototype?

[DATES!]

[Inception]

[Incorporation]

[Angel Funding]

[VC Funding]

[First Prototype]

[First Employee]

[First Customer]

I was able to get a lot of your "company DNA" from news sources and your website. However, I wasn't able to get the following information.

- Key Dates (most answers should come from first set of questions)
 - Idea for the company
 - Company incorporated
 - Funding Dates (Angel, Series A/B/C)
 - First Pilot or Paying Customer
 - First employee hired
- # of Founders
- Primary Investors (VCs)
- Primary Industry
- Present Day Information
 - # of Current Employees
 - Annual Revenue
 - When profitable

Concluding Remarks

- *Thank interviewee once again*
- *Stress how important the interview is to the success of the thesis*
- *Mentioned that you will send a follow up email for fact and name verification.*
- *Ask if there are founders of other companies that I should talk to for my thesis*
- *Ask if the founder would like to receive a copy of the thesis*

Appendix B: A123 Systems



Company Snapshot

Industry	Stage	Founded	# of Founders	Headquartered	Total Capital Investment	Current # of Employees
Battery Manufacturing	Shipping Product	2001	3	Watertown, MA	\$102 M	250

Interview Snapshot

Interviewee	Title	Experience	Interview Date
Ric Fulop	VP of Business Development & co-founder	6 th Company Founded	1/24/07

Company Overview

The world has freed itself from the shackles of the wired infrastructure. Devices that once required a hard-wired connection (telephones, entertainment systems, computers), now can be used anywhere, anytime. That is, if you have stored energy at your disposal. Unfortunately, innovations in battery technology have lagged that of their electrical component brethren. The battery industry hasn't seen a major technological advance since lithium-ion batteries were introduced in the 1990s. Using nano-technology, A123 Systems has developed the breakthrough battery that the industry has longed for. Their solution, which got its roots from the labs at MIT, is capable of lasting 10 times longer, offers five times as much power, and recharges in only 5 minutes (A123 Fact Sheet).

Operating in stealth mode for the first four years while they perfected their technology, A123 is now one of the most watched rechargeable battery manufacturers in the world. Black and Decker was the first to commercialize their technology by

incorporating A123's battery technology in their DeWalt power tools line starting in 2005 (Viscarolasaga, 2005). At the beginning of this year, A123 Systems entered the lucrative automotive battery market and subsequently signed a deal to supply batteries for plug-in hybrid vehicles for General Motors (Woodyard, 2007). Producing an estimated 20 million batteries this year (Moore, 2007) alone with a staff of 250, A123 is no longer a small development company, but rather a major player in the 5.2 billion dollar rechargeable battery market (Bowen, Morse, Cannon, 2006).

Company Formation¹⁶

"You've got to be a little crazy to be an entrepreneur." – Ric Fulop, 2007

Sitting at his desk in Howard Anderson's YankeeTek's office Ric Fulop contemplated his next move. Although Howard had lost \$10 million dollars in Ric's last two ventures, he thought highly of him and offered Ric "entrepreneur in residence" status and temporary office space after Ric's last startup attempt. At this time Ric, a Babson College dropout (Kedrosky, 2005), was 27 years old and already had founded five companies in various high technology industries. These were no small "mom and pop" operations. In total he raised \$170 million of venture capital. Ric was a serial entrepreneur and was itching for his next fix.

Ric had two major requirements for his next venture that were based on lessons learned from his last few ventures; namely, that the new company has "real technology" and that it is in an industry with high barriers to entry. He quickly narrowed down his field of view to the portable power field where the two primary options were fuel cells and batteries. After an exhaustive research effort, Ric concluded that "fuels cells would

¹⁶ Unless explicated stated, all quotes and data for this section were taken directly from Nick Cravalho's interview with Ric Fulop (Fulop, 2007).

never get to the volumetric power density that would make the product commercially valid. I just didn't want to do science fiction." That left batteries.

One day in 2001, the confident entrepreneur walked into MIT Professor Yet-Ming Chiang's inorganic devices laboratory and said that he wanted to start a battery company. Ric was excited to learn more about Professor Chiang's "self organizing" battery concept and development progress. The two hit it off and decided to start a company based on Professor Chiang's research. In order to be successful, both Ric and Professor Chiang knew that they needed to first find an R&D leader to complete the founding team. They found that leader in Bart Riley, whom Professor Chiang had co-founded American Superconductor with in 1987. With over 40 patents in the filed of advanced materials and senior manager experience at American Superconductor, Bart made a nice addition to the team. The three, Ric, Bart and Professor Chiang, founded and incorporated A123 Systems in 2001.

The first thing that Ric did after forming the company was to better understand the rechargeable battery market. He wanted to find out where the competitors were going and how much capital was required to get them in a market position he desired. He learned about the market not only by reading industry reports but also by talking to key people in the field and by visiting competitor's factories. He concluded that "the market forces were going to happen in such a way that if we did things right we could end up in a tornado." After convincing himself that he had the right technology in the right market, the next major task for Ric to do while his other two co-founders were developing the technology was to raise capital. In 2002 he closed on an 8.3 million dollar Series A

round that was led by Northbridge but also included Sequoia, YankeeTek, Desh Deshpande and a “guy who founded Google.”

In March of 2002 A123 moved into the Boston University Photonics Center, a facility that they would stay for the next three years. The \$86 million dollar facility had 10 floors with state of the art labs, classrooms, offices and business accelerator space (Bowen, Morse, Cannon, 2006). The primary purpose of the facility was to act as an incubator where startups in the building could collaborate and share resources. A123 wasn't looking for a collaborative environment rather they were “just looking for office space.” Personally Ric is not a believer in the incubator model but found that sharing facility resources, including the lab, was beneficial. It allowed the company to focus its capital developing the technology rather than investing in real-estate.

Although the founders knew that they were getting into an R&D effort initially, they didn't think it would take four years to come to market. The biggest reason for the delay was that in 2003 the company decided to switch technology from “self organizing” to the “nano-phosphate” based lithium-ion battery technology also from the Professor Chiang's laboratory at MIT. The nano-phosphate was a better performing battery, but changing directions set the company back at least a year.

Ric had confidence all along that A123 would be successful. With each new hire and each series of venture funding the concept became more validated in his eyes. However, the signing of the Black & Decker contract in 2005 was “great validation” and a sign that he had a “real” business with great future prospects. With the monumental contract, A123 Systems moved from a R&D company to a manufacturing company almost overnight.

External Advice¹⁷

Ric did not seek many external advisors when starting A123. Explaining why he didn't, he pointed to his startup experience and the size of his founding team. In terms of the founding team, Ric believes that "there is a (negative) correlation between the number of founders and the required advice." With a large founding team Ric believes that most problems can be solved internally especially if the team has diverse backgrounds and skill sets. Not only does he believe that with a larger founding team less external advice is required, he also believes that "the number of founders in the company has a huge impact on the success (of the company)." Based on his previous startup experiences he felt that he had a higher chance of success when the team was sufficiently large (typically 3 or 4).

In Ric's first few startups he sought advice from many external sources. "For my first three companies I relied on a lot of advice," commented the seasoned entrepreneur. He sought advice from other entrepreneurs, board members, VCs and other people he looked up to. He found these people through his relatively small network. The quality of the advisors wasn't ideal, but "you work with what you have." He typically gave equity in exchange for advice but "is not so sure it helps." Commenting on just how inexperienced he was, "I didn't know how to negotiate a term sheet or how to raise money...I didn't know how to do anything." He learned these general business skills from trial and error and from advice from his advisors. As he learned and thus became more experienced, he didn't need as much general advice and "by the time I was in the

¹⁷ Unless explicated stated, all quotes and data for this section were taken directly from Nick Cravalho's interview with Ric Fulop (Fulop, 2007).

fourth one, I was more autonomous and for the fifth and sixth ones it was more auto pilot.”

Although he does not believe that he requires many external advisors, he did and still does seek advice from two highly regarded individuals, Howard Anderson and Desh Deshpande. Both Howard and Desh are on A123 Systems board and actively give valued advice.

Howard Anderson is currently a Senior Lecturer at the MIT Sloan School of Management and an experienced venture capitalist. Howard invested in Ric’s last two companies which ended in a net loss for Howard. Ric “respected him and wanted him to be an investor in A123 when we got started.” Howard provided advice from very early on since Ric conceived the idea when in his “entrepreneur in residence” with Howard. They use to meet daily where Howard would discuss strategies for putting together a round of financing, talk about the business model and give his thoughts on what other investors were thinking. Besides bestowing business advice, Howard also introduced Ric to key members of his personal network including a Black & Decker board member. In A123 board of directors meetings “we listen when (Howard) talks” and “he has been right when he has had an opinion.” Today Howard and Ric about once a month and Howard still gives advice that Ric takes to heart.

Ric met Desh Deshpande at an award ceremony in 1999 where both Rich and Desh were honored as one of the Red Herring’s top 10 entrepreneurs of the year. Having founded two of the successful companies in the New England area, Syamore Networks and Cascade Communications, Desh is an entrepreneurial legend in the New England area. When Ric started A123 he sent an email to Desh to inform him of his new venture.

Desh was intrigued by the idea and requested a meeting to learn more about the new company. Ric was thrilled that Desh took an interest because Ric viewed Desh as “an industry father for us younger entrepreneurs.” Shortly after their meeting Desh joined the company as chairman of the board. Although they only spoke biweekly, Desh had a major impact on the development of the company. He “helped shape the company and we are very lucky to have him,” said Ric when reflecting on Desh’s impact.

Ric reconfirmed that only Desh and Howard were his influential advisors. He didn’t cite any customers, investors or professional service firms that contributed advice that had a positive impact on the development of the company. Ric attributes the lack of total advisors to his belief that with a large diverse founding team and an experienced founder that external advice is not as useful and thus should not be actively sought.

Ric Fulop’s Biography¹⁸

Ric Fulop co-Founded A123systems in 2001 to commercialize novel technology developed at the material sciences department at MIT and is Vice President of Business Development and Marketing for the company. One of Ric’s greater goals for A123 Systems is to help improve the world’s carbon cycle by providing superior price performance solutions to the HEV, transportation, and energy storage markets.

His experience in entrepreneurship includes founding six technology companies that have raised over \$170M in industries as varied as energy storage, software, semiconductors and wireless communications. Ric has an MBA from the MIT Sloan School of Management where he was a Sloan Fellow.

¹⁸ Taken verbatim from A123 Systems’ website (A123, 2007)

Timeline¹⁹

2001

October – Company incorporated

2002

March – Moved in Boston University Photonics Center

December – Closed Series A funding [\$8.3M led by Northbridge] (Bowen, Morse, Cannon, 2006)

2003

March – Closed Series B funding [\$4M from corporate investors Motorola & Qualcomm] (Bowen, Morse, Cannon, 2006)

2005

January – Moved into the site in Watertown, MA (current residence)

November – 1st Public Announcement (Stealth for 4 years)

November – Announce Black & Decker deal [first customer] (Viscarolasaga, 2005)

2006

February 6th – Closed 3rd round of founding [\$30M from Private Equity] (A123 PR, 2006)

December 8th – Awarded \$15M technology development contract from the United States Advanced Battery Consortium (USCAR, 2006)

2007

January 3rd – Cobasys & A123 create a partnership to develop energy storage for HEV applications (Woodyard, 2007)

January 4th – Deal with General Motors announced (Woodyard, 2007)

January 25th – Closed 4th round of funding [\$40M led by General Electric Commercial Finance] (Woodyard, 2007)

¹⁹ Constructed from the interview as well as other public documents

Appendix C: Espresso Fitness



Company Snapshot

Industry	Stage	Founded	# of Founders	Headquartered	Total Capital Investment	Current # of Employees
Fitness Equipment	Shipping Products	2003	6	Sunnyvale, CA	\$19M	35

Interview Snapshot

Interviewee	Title	Experience	Interview Date
Brian Button	Co-founder & CEO	1 st Time Founder	1/12/07

Company Overview

Imagine riding your bike in the Napa Valley with your fellow biking riding enthusiasts pushing you to go faster and farther than what you thought was possible. Now imagine doing this without leaving the confines of your local gym. Espresso Fitness' reality is this virtual reality. The San Francisco Bay Area startup's goal is to bring life to the stationary cardio equipment by making it interactive and most importantly, fun. The thought is that with a fun and interactive experience users will workout longer, harder and more frequent.

Their first product is a stationary bike with a built in LCD screen and computer (Boehret & Mossberg, 2006). Users of the bike can select from multiple courses and can race against others or even against their personal best. After the intense workout, a user can login to Espresso Fitness' website and review analyses of any of his workouts and monitor his overall performance. The target market for the bike is fitness centers, like 24

Hour fitness. However, Espresso Fitness also offers secondary services directly to the user of the bike for a nominal monthly fee. With their bikes installed in over 150 clubs across the United States (Espresso Fitness, 2007-2), Espresso Fitness is well along the way of making their goal become a reality.



Figure 8. Espresso Fitness' First Product. (Boehret, 2006)

Company Formation²⁰

Brian Button contemplated his next move after his last “company went down with the dotcom bust.” As a professional CEO who was typically brought in to help commercialize ventures, Brian looked for executive positions at local startups. During his search his colleague at his last firm, John Fisher, presented Brian with a unique opportunity to start company based on interactive cardio equipment designed by John. The possibility of founding a company never crossed Brian’s mind. However, after thinking about the proposal for a few days, he called up John and agreed to be the firm’s CEO.

Neither Brian nor John had ever founded a company. However, both had startup experience. Brian had previously worked at three other startups as a CEO, VP of Sales

²⁰ Unless explicated stated, all quotes and data for this section were taken directly from Nick Cravalho’s interview with Brian Button (Button, 2007).

and product marketer. None of his experience however was in the fitness equipment or games industries. To gain the experience he and his team read about the industries, talked to users and customers, and went to tradeshow. More importantly, Brian either hired or brought in industry experts as advisors to round out the team. Very early on he identified the need for industry expertise and actively sought the best talent.

The first priority for the newly founded company was to build a working prototype. Brian believed that it was necessary to demonstrate the product concept to potential customers, investors and prospective employees. He thought that they needed to experience the bike before they would make a commitment. John and Brian “hired” four employees to design and build the first prototype. Brian considers these four employees in addition to him and John as the founders of the company “because they worked without salary for a couple of months.” Most of the 100,000 dollars that the founders put into the company went directly to software development in which they outsourced to a local game development company. The founders focused their efforts on designing the hardware.

With a working prototype Brian was able to secure 1.5 million dollars from angel investors in May of 2004. Espresso Fitness used this money to build their first production units and hire a small staff. Seven months later Espresso Fitness got their first paying customer, which helped them close their first round of venture capital from Enterprise Partners in July of 2005. At this time with cash in the bank, a strong team and paying customers Espresso Fitness considered itself a sustainable enterprise with a bright future.

External Advice²¹

Having worked for three previous startups, Brian didn't seek "startup advice," elaborating that "it was second nature to me." Most external advice was focused on better understanding Espresso Fitness' industry and its target customers. He identified his customer advisory board, a game industry retired executive and a fitness equipment industry retired CEO as the most external advisors that had the biggest impact on the development of Espresso Fitness. In addition, he did mention that his law firm, Perkins Coie, was helpful especially in making useful introductions but didn't consider them as having the same impact as the others mentioned above.

For a three month span in 2004 while the team was designing and building the first prototype, Brian constructed a customer advisory board. The board consisted of three club owners (two from the Bay Area and one from Oregon) and was compensated with stock options. Having no personal connections to fitness club owners, Brian had to cold call potential advisors. Describing the process Brian said, "I just called them up, introduced myself and told them we were doing something interesting. I just tried to get them curious...I am not trying to sell you anything. I have no intentions of selling you anything but I would like to get your views on this (design)." He called dozens of owners before he got a board he felt comfortable with. Brian never assembled all of the owners together for group meetings. Rather, he would call each one and solicit advice. The customer advisory board gave advice on club "environmentals,"²² reasonable pricing, buying frequency and criteria and relationships with suppliers. In particular Brian wanted to determine if there was a dominate supplier that had a "strong hold" on the

²¹ Unless explicated stated, all quotes and data for this section were taken directly from Nick Cravalho's interview with Brian Button (Button, 2007).

²² Environmentals include: Size, weight & space limitations as well as the AC outlet location & Internet access points.

industry. The impact of the board was significant. They helped Brian determine if his company's concept "was going to fly or not" and "some of the criteria for the design." These advisors not only gave advice, but two of the three ended up being early stage customers.

Brian's law firm introduced him to Bill Potts, a retired CEO of a fitness equipment company, in November of 2006. Brian and Bill "gelled right away" and Brian shortly thereafter asked Bill to join the Board of Directors. Brian believes that Bill is a perfect fit to advise Expresso Fitness. As the CEO of a fitness equipment company that went from \$25 million to \$150 million under his watch, Bill is expected to not only give industry advice but also general management advice on how to grow quickly. In addition, since "he is a product oriented guy," he has and will continue to give advice on product design, production, product life cycle and how to get around IP minefields. Summing up his potential impact, Brian commented that he will "help us out on stuff that we would take much longer to figure out and would make mistakes on." As of February 2007, Bill has yet to officially join the board, but "the board can't wait for him to join."

The final influential advisor identified by Brian was Dave Genewetzki. Brian was introduced to the former gaming industry executive through one of Express Fitness' co-founders. After listening to Brian's initial pitch in early 2004, six weeks later Dave invested in the company and joined the newly created Board of Directors. Brian used Dave as a sounding board on general management issues, commenting that "in the early days I didn't have anyone to bounce ideas off of. As a CEO you don't go around and ask people in the company, 'what do you think I should do here.' If you do that too often you will ruin your image." In addition to the general management advice, Dave also

bestowed “wisdom about the games industry.” It was important for Brian to understand the games industry since he believes his company’s product is a mix between standard fitness equipment and a video gaming experience. Commentating on the difference between these two industries Brian mentioned that “you can’t imagine two industries that are more different than the fitness equipment industry – bent metal and weighs 10,000 pounds and the wild and wacky games industry.” Dave was Brian’s go-to-guy to understand the much faster pace gaming industry. Brian believes that Dave had a positive and lasting impact on the company and on him personally. He was a coach offering encouragement and advice and as a sounding board he “kept me from going insane.”

Reflecting on his use of external advisors, Brian mentioned that he was satisfied with the amount of advice requested from his key advisors as well as the number of advisors he had. He did however point out that there were some cases when he should have incorporated advice instead of dismissing it. He ended up losing nine months of sales because he didn’t listen to a customer advisor who stressed that people buy on relationships in the fitness equipment industry. Had he taken the advice to heart, he would have hired a VP of sales much earlier.

Brian Button’s Biography²³

Brian is a serial entrepreneur with a depth of executive management experience in Bay Area start-ups. Prior to Expresso, he served as CEO of Alvesta, where he managed the telecom subsystems start-up through a challenging market environment. As Vice President of Worldwide Sales at Proxim, Brian led a 75-person team that launched a

²³ Taken verbatim from Expresso Fitness’ website (Expresso Fitness, 2007-1)

disruptive wireless networking technology for the home consumer market and fueled a double-digit growth in revenue. Prior to Proxim he directed product marketing for StrataCom, launching 22 new products with his team and creating the market for Frame Relay, one of the most profitable data services of all time. Brian began his career in engineering and management at Hewlett Packard. He earned a BS in Electrical Engineering and Computer Science at the University of California, Berkeley. Brian is a keen tennis player and stationary bike enthusiast.

Timeline²⁴

2003

3rd Quarter – Idea for the company presented to Brian by John Fisher
November – Company incorporated

2004

January – Dave Grenewetzki started giving advice
May – Series A Funding Received (1.5M from Angels)
June – First employee hired

2005

January – 1st paying customer
March – Introduced 1st version (Spark)
July – Series B Funding [\$4.5M Enterprise Partners] (Primack, 2005)
July – Hired VP of Sales & VP of Marketing

2006

September – Series C Funding [\$4M Enterprise Partners] (SJJ, 2006)
November 13 – Released next generation product
November – Retired CEO started giving advice

2007

March 15 – Series D Funding [\$9M Led by Sierra Ventures] (Takahashi, 2007)

²⁴ Constructed from the interview as well as other public documents

Appendix D: Heliovolt



Company Snapshot

Industry	Stage	Founded	# of Founders	Headquartered	Total Capital Investment	Current # of Employees
Solar Energy	Product in Development	2001	1	Austin, TX	\$10M	22

Interview Snapshot

Interviewee	Title	Experience	Interview Date
Dr. Billy J. Stanbery	President, CEO and Founder	1 st Time Founder	1/9/07

Company Overview

Heliovolt is striving to change how residential homes and commercial buildings capture energy from the sun. Today, large silicon-based solar panels are installed on the roof of homes and commercial buildings. These panels are expensive, unattractive and inefficient. Heliovolt is attempting to solve these inherent problems by manufacturing a thin-layer of copper indium gallium selenide (CIGS) based solar cells and integrating them into building materials like metal roofs, skylights, and exterior glass. The hope is that with these aesthetically pleasing cost effective materials that solar energy will be appealing to the mainstream consumer. Heliovolt is still a few years away from making this vision a reality. However, they have already produced some prototype CIGS-based solar cells using their patented FASST™ manufacturing process and have recently received their first purchase order.

Company Formation²⁵

Dr. Billy J Stanbery (BJ) started Heliovolta without a team, solution or intellectual property. Rather, as Dr. Stanbery says, “the reason I founded the company was to fulfill my personal career goal over the last 30 years, which is to make solar electricity cheap and ubiquitous.” Dr. Stanbery spent almost his entire career improving the design of solar cells. While at graduate school at the University of Washington in 1978, Dr. Stanbery went to an event hosted by Boeing regarding solar cells in space applications (World Talk Radio, 2005). He was so fascinated by the subject that he joined Boeing’s solar division as a research engineer. Originally his focus was on silicon based cells but shifted over to an emerging field, thin-film solar, in 1983. Before leaving Boeing in 1995 to get his PhD, he set the still-standing world record for thin-film efficiency. Although Dr. Stanbery did not have the specific product idea or technology when forming Heliovolta, he had the experience and confidence to make his lifelong goal a reality.

The only thing that this first time founder knew when he formed the company was that the technology was going to be based on copper indium gallium selenide (CIGS) and that it would be headquartered in Austin, Texas. CIGS were selected because they were the most efficient thin-film, inherently stable, and good absorbers of light. From Dr. Stanbery’s past experience with the thin-film, he knew that the only way to make CIGS-based solar cells commercially viable was to create a manufacturing method that significantly improved the throughput of the cells (amount of cells manufactured per machine per hour). Initially tackling this problem alone and without much capital, Dr. Stanbery looked for creative ways of developing his technology. Early in the

²⁵ Unless explicated stated, all quotes and data for this section were taken directly from Nick Cravalho’s interview with Dr. Stanbery (Stanbery, 2007).

development of the company he created a cooperative research and development agreement (CRADA) with the Nation Renewable Research Lab in Colorado. By jointly engaging in basic research with this renowned government research lab, Dr. Stanbery was able to spend his money building the company's patent portfolio rather than acquiring capital equipment. Throughout the idea generation and validation stage Dr. Stanbery did not have a working prototype and had to believe in himself and in the underlying technology, as he kept on thinking to himself, "It has to work. The physics is all there. The science is all right. I can't think of any way that it can't work. In the end, it did."

When he wasn't in the laboratory developing the technology, Dr. Stanbery was networking and raising money. His father put up most of the initial money and he put up the balance. Although he was cautious with the initial investment, it wasn't enough to cover most of the expenses. Over a four year period Dr. Stanbery raised a total of one million dollars from angel investors. For the first year Dr. Stanbery didn't have a staff and was even doing the books himself. However, he soon realized that he needed to offload some tasks so he could remain focused on building the company. His mantra became, "what have I done, or what I am going to do, to increase the value of the company today?" He would ask himself this question almost everyday when deciding where he should focus his limited time. This led him to hire some key staff starting in late 2002 including a VP of Engineering, Bob Oswald, and a VP of Marketing, John Langdon. John was pivotal in determining the market needs and Bob was helpful in developing the technology.

In order to make the idea into a "real" business Dr. Stanbery believed that he needed to "raise a significant amount of capital and build a team that could execute."

The significant amount of capital arrived in June of 2005 when Dr. Stanbery completed the Series A financing round of nine million dollars led by New Enterprise Associates (NEA). In commenting on how he would spend the money Dr. Stanbery said, “(I) was never raised in the (Silicon) Valley culture of receiving and dispersing gigantic quantities of money without being, very, very cautious about it.” Indeed, a year and half later, and with a much larger team, Heliovolt is still using money from the initial VC investment when the two other major CIGS based solar manufacturers, Miasolé and Nanosolar have raised sixty and one hundred million dollars respectively. Although cautious with his money, Dr. Stanbery does plan on a much larger Series B round to build out a manufacturing plant. Though he started slowly, Dr. Stanbery believes as of June 2006 that he has a “real” business with good prospects for success.

External Advice²⁶

Dr. Stanbery received external advice from various sources when developing his company. His advisors can be put into three categories: paid consultants, venture capital advisors (referred to as partners) and friends and family. In the friends and family category, his father, a retired executive, was present from the beginning and taught his son the value of advisors and how to build relationships with them. In addition, two of his good friends initially served as advisors until Dr. Stanbery brought them on to work full-time as the VP of Business Development in the middle of 2002 and the VP of Marketing in late 2002. He would get their opinion on a subject every few weeks, but what he was really doing was “testing them before (bringing) them in.” When selecting

²⁶ Unless explicated stated, all quotes and data for this section were taken directly from Nick Cravalho’s interview with Dr. Stanbery (Stanbery, 2007).

the most influential advisors to his company, Dr. Stanbery selected his corporate attorney, outsourced financial advisor and the venture advisors.

Shortly after the company was founded, Dr. Stanbery knew that he needed legal advice but he didn't have any prior relationships with local lawyers or recommendations from friends so he went "shopping" for a corporate counselor. After talking with roughly twelve lawyers from six law firms he chose Paul Hurdlow, the co-founding partner of the Austin branch of Gray Cary. When asked why he selected Paul, Dr. Stanbery concisely said, "I liked him best." Strapped for cash, Dr. Stanbery deferred payment in exchange for warrants. Besides offering the typical advice of a corporate counselor, Paul also advised Dr. Stanbery on financing strategies and investor pitches. In addition, Paul introduced Dr. Stanbery to many local angel investors some of whom invested in the company. However, the biggest impact Paul had was the strong financial foundation he helped create for the company. Dr. Stanbery commented, "When we got funded by NEA that (financial) foundation turned out to be extremely efficient and very effective. There were no obstacles in financial due diligence. It flew right through."

For the first year and half Dr. Stanbery did almost everything at the company including the books and filing for taxes. After realizing the need to offload some of the financial administrative load, Dr. Stanbery went looking for a financial service provider. He found Gerry Bula, a partner at Bridgepoint Consulting, at a networking event. Dr. Stanbery believes that you must genuinely like your advisors. Not only did he believe Gerry had the necessary skills and work ethic but he also "liked him, so (he) hired him." Like Paul, Gerry received warrants until Heliovolt get financed. In addition to his responsibilities of keeping the books and filing taxes, Gerry also advised Dr. Stanbery on

financial strategy and operations and the mindset of potential investors. Perhaps his biggest contribution was networking Dr. Stanbery into the local angel community. Both Paul and Gerry still serve as consultants in the company but now get paid their more typical hourly fees.

A major influx of advice came in early 2005 when NEA conducted their due diligence. NEA had their two Venture Partners²⁷, Jimmy Trebig and Arno Pezias, determine if Heliovolt was investment worthy and if Dr. Stanbery was the right person to lead the company. Dr. Stanbery made the most of this seemingly one-sided evaluation by soliciting high level advice from these professionals. From Jimmy Trebig, the former CEO of Tandem Computers, Dr. Stanbery sought business-related advice. From Arno Pezias, the former Chief Scientist at Bell Labs, he sought mostly technical advice. In fact, it was Arno who introduced NEA to Heliovolt. After listening to Dr. Stanbery give a seven minute speech at a conference in early 2005, Arno requested a meeting with Dr. Stanbery. Arno liked what he heard in the two and a half hour meeting and recommended that NEA look into this Austin-based solar cell manufacturer. Not only did Arno give technical advice, but he also shared his insights on “how to think about different options from an investor’s point of view.” Commenting on both Arno and Jimmy’s “dramatic” impact, Dr. Stanbery said that they “both contributed significantly to developing the vision of how to create a big company using a sophisticated strategy.” Both Arno and Jimmy worked closely with Dr. Stanbery to shape Heliovolt’s business strategy. They helped Dr. Stanbery realize that integrating his technology with building integrated materials would be a better long term strategy rather than just producing

²⁷ NEA Venture Partners are typically industry experts that help with the due diligence and sit on the board of directors or technical advisory committees. They are not partners in the firm.

standard modules. Although these individuals were instrumental in redefining Heliovolt's core strategy, they also helped reconfirm Dr. Stanbery's vision for the company which instilled confidence in him. Commenting on this, Dr. Stanberry said "sometimes you don't realize your own business models." Both Arno and Jimmy still give advice directly to Dr. Stanbery but now Arno does it as a member of the technical advisory board and Jimmy does it as a member of the board of directors.

Dr. Stanbery was content with the amount of advice requested from these core advisors as well as the number of advisors he had. Discussing the amount of advice that was given to him, Dr. Stanbery mentioned, "I took all the advice that was given. I didn't use it all. Didn't agree with it all, but I listened to everything everyone told me." Dr. Stanbery was quick to mention that it is up to the advisee to either accept or reject the advice and must accept responsibility for the final decision. The advisee can not accept advice blindly. Although Dr. Stanbery received and incorporated advice from external parties that was instrumental in building the foundation of the company and setting the strategy, in the end Dr. Stanbery will "accept responsibility for making the right or wrong decisions."

Dr. Stanbery's Biography²⁸

Dr. Stanbery has had 25 years experience in both the technical and business aspects of photovoltaics. The latter includes leading a PV group while at Boeing and being responsible for efforts to spin it off in a corporate joint venture. While employed at Boeing, he registered seven patents in thin film PV device technology, designed, manufactured and successfully deployed photovoltaic devices for spacecraft, and has

²⁸ Taken verbatim from Heliovolts's website (Heliovolt, 2007)

achieved and held since 1990 the world record in multi-junction thin film cell efficiency. Dr. Stanbery is an eminently recognized expert within the international PV community in the materials science of CIS and related compound semiconductors.

Timeline²⁹

2001

July – Company Incorporated.

Late – Hired corporate counselor Paul Hurdlow

2002

Early – Financial Services advisor, Gerry Bula, begins advising the company

Mid – 1st hire, VP Business Development, joins the company full time

August – Receive grant of \$100k from the US department of Energy (Higginbotham, 2002)

Late – John Langdon (VP Marketing) joined the company (key hire)

2003

November – Announces the NREL deal

2004

May – Award Phase I SBIR contract by the Missile Defense Agency (Press Release, 2004)

June – Complete Angel round of financing

2005

Early – Venture Partners start advising the company

June 20, 2005 – Complete \$9M Series A funding with NEA³⁰ (Bole, 2005 & Stanbery, 2007)

September – Moved to new location in Austin, TX

December – Bob Oswald joined Heliovolt as VP Engineering³¹ (Kanellos, 2005)

2006

June – Got to a point where Dr. Stanbery believes he has a “real” business.

October – Iga Hallberg joined as VP of business development (Press Release, 2006)

²⁹ Constructed from the interview as well as other public documents

³⁰ All public articles had the series A investment at \$8 million, but Dr. Stanbery in the interview mentioned that it was \$9 million.

³¹ CNET article mentioned that Oswald would be the CTO. Dr. Stanbery corrected this misprint.

Appendix E: Kiva Systems



Company Snapshot

Industry	Stage	Founded	# of Founders	Headquartered	Total Capital Investment	Current # of Employees
Warehouse Automation	Shipping Products	2003	1	Woburn, MA	\$26M	54

Interview Snapshot

Interviewee	Title	Experience	Interview Date
Mick Mountz	Founder & CEO	1 st Time Founder	11/19/06

Company Overview

Mick Mountz and his team at Kiva Systems have enlisted an army of orange robots to dethrone the current order fulfillment equipment suppliers. Their underlying approach is simple. Instead of having employees walk around a warehouse searching for items to fulfill an order as most of the industry does today, why not bring the items directly to the employees? Kiva Systems accomplishes this task by having numerous small autonomous robots moving around the warehouse floor picking up movable shelves when commanded by a centralized system. The necessary shelves are then brought to a work station where a laser points to the item that an employee picks and places into the proper box. After the item is removed from the shelf, the robot returns the shelf to an optimized vacant location. This patented Mobile Fulfillment System has demonstrated three times improvement in employee productivity and a significant improvement in order fulfillment accuracy. With the operational and efficiency savings, the system will pay for itself in less than two years. Staples, the office supply giant, is a believer. Not only were they Kiva Systems' first paying customer, but Staples recently announced that

their new Denver distribution center will be the second site to incorporate the Mobile Fulfillment System (Berman, 2007). Additionally, Kiva Systems recently announced two product extensions that would enable them to address most all of the warehouse order fulfillment market needs – from handling merchandise received from the supplier to delivering customer orders to the shipping dock (Kiva Systems 2006,2007-2). With this wall-to-wall solution Kiva Systems and its robot army are ready to battle for the hearts and wallets of the retail distribution industry.



Figure 9. ItemFetch (Left) & CaseFetch (Right)

Company Formation³²

While working at Webvan, a defunct online grocery store, at the turn of the century, Mick Mountz was tasked with solving their distribution problem. To be profitable Webvan needed to reduce the cost to fulfill an order from 30 dollars to 10 dollars. Mick and his team implemented many changes but couldn't get to the target order cost. Although he left Webvan, the problem of improving warehouse order fulfillment never left his head.

In the spring of 2002, a year after leaving Webvan, Mick decided that he wanted to start his own company. Mick explored many startup ideas he had been considering

³² Unless explicated stated, all quotes and data for this section were taken directly from Nick Cravalho's interview with Mick Mountz (Mountz, 2006).

for the last few years. One of his startup ideas that he believed had commercial potential was a peer-to-peer GPS based network that would be used to give its users real time traffic information. After discussing the idea with his fellow northern California Harvard Business School (HBS) alumni, it was clear to Mick that it wasn't the right idea to take to market. The idea that did get traction amongst his network was his recently created solution to the order fulfillment problem that plagued retailers like Webvan. He and his network liked the fact that there was a large existing market that had a well-defined problem. Furthermore, with recent advances in mobile robot technology and costs, it was thought that the technology was commercially feasible. With that confirmation, Mick got to work on detailing the mobile order fulfillment business concept.

One of the first things Mick did when starting Kiva Systems was to protect his novel idea. He immediately hired a patent attorney and filed his first patent in July of 2002. Next, Mick wanted to get customer feedback. He wanted to make sure he was developing something they valued as well as elicit their requirements for an order fulfillment system. Leveraging his HBS, MIT and friends and family network, Mick was able to meet with eight companies. The feedback he received was encouraging. In fact, three of the companies said they would consider investing in the startup.

After initial meetings with customers and some initial potential investors it became clear to Mick that he needed to demonstrate the benefits of the system. He first tried to do this with a simulation model. His friend built the first simulation model using existing flash technology. Though helpful at showing how the robots would move inventory around the warehouse, it proved insufficient for demonstrations and internal analyses. Searching for an expert in simulation, Mick landed at the doorstep of Dan

Brunner. Dan built the model that is still used today. Simulation alone wasn't enough. The customers and investors wanted to see what the hardware would look like. Leveraging his MIT degree in mechanical engineering, Mick created the first 3D CAD model of the system. With the simulation model and the 3D model the potential customers and investors could visualize the system; however, they were still skeptical of the system efficiency saving. Mick knew that he needed to create a working demonstration to prove the theoretical three times efficiency savings. After securing a few hundred thousand dollars in seed capital from friends and family, Mick had enough capital to build the first prototype. In the first part of 2004, Mick contracted the design and manufacturing work to Reciprocal Designs, a firm owned by two of his MIT fraternity brothers. He paid them 30,000 dollars for 30 days of work. Now, when pitching customers, Mick could either show them a video of the robots in action or, better yet, bring the customers or potential investors to Kiva Systems' headquarters for an onsite demonstration.

For all of 2003, Mick worked from his apartment in Palo Alto, California. He preferred to keep the company in the Bay Area because of the plentiful business and software resources. However, after getting rejected from every major venture capital firm on Sand Hill Road³³ and realizing that his key advisors (and possible future hires) were in the Boston area he reconsidered his plan. After he received 1.6 million dollars in angel investments in late 2003, he decided to move to a small warehouse in Burlington, MA.

With the new facility and an influx in capital, he quickly built a team. A key initial hire was Raff D'Andrea, a Mechanical Engineering Professor at Cornell. Raff was

³³ Sand Hill is a road in Palo Alto in which many of the nations top tier venture capital firms reside.

responsible for the hardware and controls and Pete Wurman (discussed later) was responsible for the software architecture. Out of the fifteen initial hires, five were direct contacts of Raff, two were Mick's fraternity brothers and one was Mick's brother-in-law. By the beginning of 2005, the company secured 6.5 million dollars of venture financing from Bain Capital and changed its name from Distrobot to Kiva Systems. At this point, with a staff of 15, a cash reserve in the bank and some customer traction, Kiva Systems was a full-fledged company ready to capture its share of the 5 billion dollar material handling market.

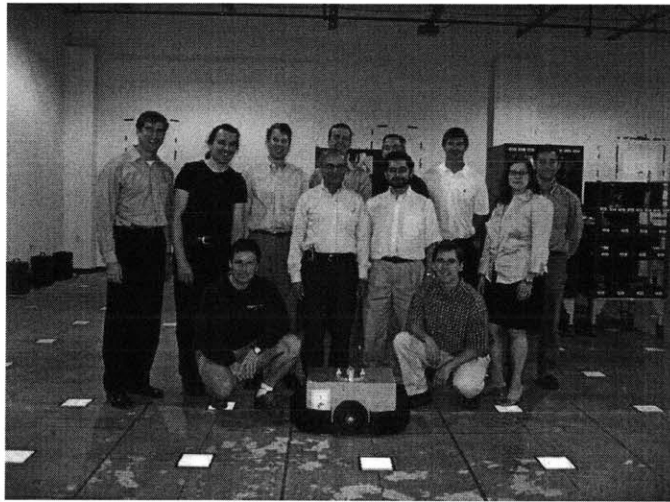
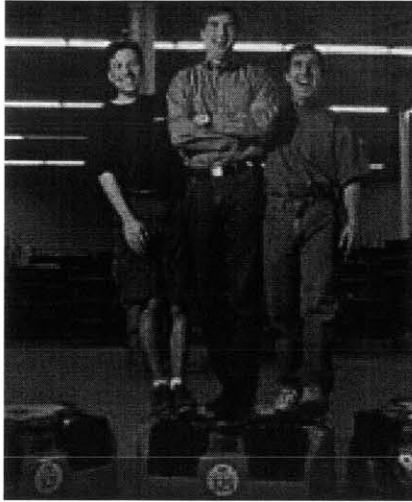


Figure 10. Kiva Systems Team with the 1st Prototype (July 2004).
BACK ROW: Mick Mountz, Dennis Polic, Michael Barbehenn, Jason Reneau, Mike Decker, Dave Becker (board member, also angel investor), Amy Buntel, Andrew Hoffman
FRONT ROW: Raff D'Andrea, Harry Mankodi (board members, pre-bain), Edgar Sivelte (contractor to Dan Brunner on site that day), Pete Wurman (Source: Kiva Systems)



**Figure 11. Raff D'Andrea, Mick Mountz & Pete Wurman (Left to Right) on top of second prototype
PHOTO BY ERIK JACOBS/BOSTON GLOBE**

External Advice³⁴

During the development of his company, Mick reached out primarily to his close friends and family for advice. Out of the seven advisors that Mick identified as being instrumental in the development of the company, two were his MIT fraternity brothers (Pete Wurman and Burl Amsbury), three were HBS connections (Matt Diamond, Colin Beuchler and Gerald Hwasta) and two were from his immediate family (Bob Mountz and George Fisher). Mick also mentioned that he did get valuable input and advice from the initial customers he visited, including JCrew, Gap, Amazon, Motorola and Dell. Also valued, but not put into the same category as the “key” advisors, were Sam Kinney and Dave Becker both of who were former Freemarkets executives and angel investors in Kiva Systems. Absent from first time founder’s list were professional services companies and professional venture capitalists.

Pete Wurman and Mick met when pledging the Sigma Alpha Epsilon (SAE) fraternity at MIT. Both were athlete scholars. Mick was the captain of the baseball team

³⁴ Unless explicated stated, all quotes and data for this section were taken directly from Nick Cravalho’s interview with Mick Mountz (Mountz, 2006).

and Pete was the captain of the wrestling team. Pete went on to become an Associate Professor in the computer science department at North Carolina. Whenever Mick would come to North Carolina to visit two of the potential customers for his new company, he would “crash” at Pete’s house for a few days. During these visits Pete, an expert in agent based planning, and Mick would discuss different software approaches for Mick’s proposed system. Pete offered a different software architecture based on his research to what Mick had. After reviewing the benefits of the new approach Mick agreed that Pete’s approach was more elegant than his. Pete offered considerable amount of assistance during the early stages of development because “he thought (what Mick was doing) was cool.” Not only did Pete offer advice, he also instilled confidence in Mick. When Mick doubted himself and the approach, Pete would say “not to worry” and that the approach was “completely do-able.” Mick thought so highly of Pete that he hired him as Kiva’s first employee.

Burl Amsbury, another pledge brother and MIT wrestler, left DEKA to join Thought Equity in Colorado at the time Mick was forming his new venture. At the very early stages of the company, Burl and Mick together wrote the hardware specification. Burl and Mick were a good team. Not only were they good friends, but also their backgrounds were complimentary. Mick had a Mechanical Engineering degree and Burl an Electrical Engineer Masters and a Masters in Management and Engineering from MIT (SDM Fellow³⁵). The team produced a quality document that was the basis for the first prototype. Burl turned down Mick’s full-time offer because he didn’t want leave Colorado, but did receive stock options for his effort.

³⁵ The author is also enrolled in the System Design and Management (SDM) program

It is nice to have an advisor that is the former CEO of Motorola and Kodak and who has first hand experience with warehouse automation equipment. It is even nicer if that advisor is required to come over for holiday dinners. George Fisher, Mick's uncle and advisor, gave general business advice to the first time founder. In addition to being the first investor in the company, George also opened up his rolodex to his nephew. He introduced him to Jeff Bezos, the CEO of Amazon, and Harry Mankodi, the VP of Supply Chain at Motorola³⁶. Finally, George also gave business encouragement to Mick. Mick understood how valuable George's advice was, but only called him about once a quarter so not to abuse their relationship.

Matt Diamond and Mick were roommates when they both attended Harvard Business School. While most of Matt's peers were getting jobs in investment banking, private equity and management consulting, Matt was already working on starting his own company. Initially his company, Alloy, sold winter cloths online to the Japanese market. However, when he found out that American girls were buying his merchandise in droves, he quickly changed his business strategy. That moved paid off, he took his company public and the company now pulls in over 500 million dollars annually. Mick reached out to the successful entrepreneur back in 2002 when he was filing for the patents. Matt gave Mick useful advice on the entrepreneurial process and instilled the entrepreneurial spirit in Mick. In addition, Matt gave "good insights into what the customers and investors were looking for." Later, Matt became the second investor in Kiva and was the first to provide customer feedback.

Gerald Hwasta was another HBS classmate that provided valuable advice in the early stages of the company's development. Gerald was living in the San Francisco Bay

³⁶ Harry subsequently joined Kiva Systems Board of Directors.

Area at the same time as Mick and was “between gigs.” He advised Mick on financing and helped create and give investor pitches in the summer of 2003. Furthermore, Gerald “provided energy (with a) yes we can do it attitude.” Mick asked Gerald to be his business partner, but Gerald declined because “it wasn’t his thing.”

Mick met Colin Beuchler through the HBS northern California alumni network. Colin, Mick, Gerald and a few others in the network would meet frequently for dinner and share the current status of their professional and personal lives. The group was very close and supportive of each other. Colin had a knack for drawing ideas out of Mick. In fact, it was Colin who persuaded Mick to pursue the Mobile Order fulfillment business concept. Colin’s passion was for business strategy. He typically gave Mick advice on general strategy as well as helped him with customer presentations. Mick tried to get Colin to join the company, but Colin was more interested in the strategy position offered by Dell.

As the old saying goes, “fathers know best.” What better source of advice than from your own father. In the army Bob Mountz spent most of his time in procurement. He became an expert in contracts and negotiations. He helped his son write contracts with the vendors and suppliers that “made the company seem more professional and bigger than it was.” In addition to the contract work, Bob also gave his son operations based advice that Mick took to heart. Mick later convinced his father to come out of retirement and work full-time as the Director of Supply Chain Management.

Looking back at his use of external advisors in the development of the company, Mick felt like he “struck the right balance” in the amount of advice requested from these core advisors. However, he said that he would have benefited by having additional

advisors with industry experience. Initially, he believed that warehouse equipment vendors couldn't help with such a radical idea. In retrospect, he believed that he could have benefited by engaging industry consultants. In his opinion, it could have helped him better understand the sales process, which would have saved him many months of frustration.

Mick Mountz's Biography³⁷

Mick founded Kiva Systems in January 2003 after spending thirteen years in high tech product development, manufacturing, operations and marketing. Prior to Kiva, Mick worked on a business process team at Webvan designing a next generation distribution strategy for grocery home delivery, during which he experienced first-hand the high cost of order fulfillment and the inflexibility of existing technologies. Prior to joining Webvan, Mick spent three years in product marketing at Apple Computer as a product manager where he helped move many new technologies into the standard desktop platform including FireWire, DVD, Fast Ethernet, and 3D graphics acceleration. He began his career at Motorola, where he spent seven years working as both a mechanical and a manufacturing engineer. Mick holds five United States technology patents. He earned a Bachelor of Science in mechanical engineering from the Massachusetts Institute of Technology and a Master of Business Administration degree from Harvard Business School.

³⁷ Taken verbatim from Kiva Systems' website (Kiva Systems, 2007)

Timeline³⁸

2002

Spring – Mick explored many potential ideas for a startup.

July – Filed 1st patents for the mobile order fulfillment system

Fall – Mick launches Distrobot Systems (original name) from his Palo Alto, CA apartment

2003

January – Distrobot Systems, Incorporated

Late – Raised 1.6 million dollars from angel investors

2004

January – Company moves to Burlington, MA

Summer – Prototype Hardware (P1 version) completed

December – 2 companies sign up for Pilots (Genco & Staples)

2005

January – Company name changes to Kiva Systems (New Logo Launched)

March 29th – Series B funding announced³⁹ (\$6.5M led by Bain Capital)

Spring – 2nd Generation of Hardware (E version) released

Summer – Completed 2 successful pilots

September – Company moves to Woburn, MA bigger demo facility

November – Signed first customer contract (Staples)

2006

May 24th – Series C funding announced (\$10M led by Bain Capital)

June – 3rd Generation of Hardware (F version) released

August – Go live @ Staples

November – Launch OrderFetech [Product Extension] (Kiva Systems, 2006)

2007

January – Launch CaseFetch [Product Extension] (Kiva Systems, 2007-2)

January – Staples to incorporate the Kiva Mobile Order Fulfillment System in their new Denver distribution center

³⁸ Constructed from the interview as well as other public documents

³⁹ Closed at end of 2004, but kept silent for 3 months.

Appendix F: Konarka



Company Snapshot

Industry	Stage	Founded	# of Founders	Headquartered	Total Capital Investment	Current # of Employees
Solar Energy	Product in Development	2001	5	Lowell, MA	\$52.5M	50

Interview Snapshot

Interviewee	Title	Experience	Interview Date
Howard Berke	Co-Founder, Chairman & CEO	13 th Company Founded	1/25/07

Company Overview

Konarka has a vision for solar energy that extends far beyond the rooftops of residential and commercial buildings. With their flexible and low cost polymer-based solar cells, Konarka is searching for new applications and markets that the significantly more expensive and rigid base-silicon cells could never penetrate. For example, Konarka is exploring integrating solar cells into everyday use products like electronic devices and clothing. With seamless integration, customers will be able to charge their batteries when they are away from the power grid. This is particularly useful for the armed forces as well as heavy electronic device using consumers that spend most of the time outside. Konarka can enable these new markets because of their patented conducting polymer based cell design and their roll-2-roll manufacturing process. They have partnered with a printing press company and in a few years when they are ready for production, solar cells will be flying off the presses.



Figure 12. Konarka's Flexible Solar Cell (Konarka, 2007-2)

Company Formation⁴⁰

Howard Berke, just off of his twelfth startup, was consulting for the University of Massachusetts system on possible technology transfer opportunities. During this exploration, Howard met the inspiration for Konarka, Sukant Tripathy. Sukant was a chemistry professor and the founder of the Center for Advanced Materials at the University of Massachusetts, Lowell. For two and a half years Howard and Sukant discussed technologies that Sukant believed worthy of commercialization. Although they were always interesting ideas, Howard didn't believe that any of Sukant's initial ideas were worthy of Howard personally "sinking his teeth into." However, when Sukant mentioned his work with organic solar cells, Howard thought that it "seemed to be very exciting and potentially a breakthrough technology." Howard not only recommend to the University of Massachusetts that Sukant's solar cells be eligible for technology transfer, but also said that he would take responsibility to commercialize it. As Howard explained, "the genesis of the idea was use of organic materials, be that of small molecules or polymers, for the coating in a roll-2-roll process on plastics, on foils for light weight flexible photovoltaic material."

Tragically, Sukant died before the company was formally founded. Howard had a difficult decision to make. He had to decide either give up this unique opportunity or

⁴⁰ Unless explicated stated, all quotes and data for this section were taken directly from Nick Cravalho's interview with Howard Berke (Berke, 2007).

continue without the technical visionary. Howard reached out to Alan Heeger whom he recently brought in as a technology advisor to the company. He asked the University of California, Santa Barbara professor and Nobel laureate if he would assume Sukant's role as the chief scientist and co-found the company with him. Alan agreed and so Howard decided to continue on and founded the company in July 2001. In honor of his fallen friend and co-founder, Howard named the company Konarka.⁴¹

Not having any direct solar experience, Howard wanted to better understand the market so he "brought in advisors who were traditionally from the solar industry who told us about the market, how one might penetrate the market, about other advisors involved from a technology standpoint." These advisors helped substantiate that the underlying science had merit. After he felt confident about the underlying technology Howard raised a one million dollar seed round. This enabled Howard to bring in key hires like Russell Gaudiana, former director of chemical research at Polaroid, who would help design and make the first prototype. In Howard's opinion it was the combination of technology progress and key hires that helped validate the idea, "it was both convincing yourself that the technology has legs because the right people and well respected people both in academia and industry thought it had potential. Easier said than done. Reducing it to a rudimentary prototype and process to demonstrate that the materials could be laid down with coating multilayer process was important to convince ourselves that the process technology could be developed and scaled."

In order to transform the idea into a real business, Howard expanded both the technical and management team. In addition, in October 2002, Howard raised 13.5

⁴¹ Konarka is a 13th century Hindu temple located outside Orissa, India and was one of Sukant's favorite places (Indhistory, 2007). The company name has added significance because the temple is dedicated to the Hindu sun goddess Surya, which is fitting for a solar company.

million dollars, which was led by Draper Fisher Jurvetson (DFJ). This investment was significant because it was one of the first major solar energy investments by a top tier venture capital firm. Howard used some of the initial capital to broaden Konarka's patent portfolio. He purchased patents from Switzerland's EPFL, Austria's JKU and Germany's Siemens. Armed with a world class team of employees and advisors as well as a broad patent portfolio and money in the bank, Howard believed that his 13th company was well positioned to further develop the technology and prepare to bring the product to market.

External Advice⁴²

"Early on in the first couple of years of a company where you can't afford the headcount, the way to get the expertise from individuals without the necessity of the cost of engaging them on a full-time basis or under an income compensation arrangement...you create a committee, you give them options, equity and expect them to be there to come to meetings once a quarter or a few times a year and always be there when you phone with a question." - Howard Berke, 2007

Howard Berke has a large portfolio of advisors that he taps into frequently. Even before he officially launched Konarka, Howard actively sought advice. During this time he received advice on the worthiness of the venture both from a technical and business standpoint. Once the business was officially founded, he created technical and business advisory committees. "In the first two years the advisory committees were very active. We only had 12 people inside the company, but had 12-15 advisors. It was a way to gain leverage without having a significant budget," commented the experienced founder. In addition to his formal advisory committees, Howard also received valuable advice from professional service providers and his Board of Directors. Although most of the technical and business advisors were first time advisors to Howard, half of the professional service providers had preexisting and longstanding relationships with Howard, including his

⁴² Unless explicated stated, all quotes and data for this section were taken directly from Nick Cravalho's interview with Howard Berke (Berke, 2007).

executive search firm, audit firm and chief counselor. In fact, his chief counselor had worked with Howard over the last seven startups even though the lawyer moved law firms.

Howard's technology advisory committee consisted of industry scientists and faculty from campuses in which Konarka licensed technology. In looking for a member of his committee, he would "seek those that were nationally and internationally recognized for their expertise and leadership in this (photo chemistry) area of science." He got to the members of his technology committee mostly by networking with his existing network and the network of his initial advisors, "one advisors credibility enhances the prospects of securing the support of another key advisor in a different field of science because they have mutual respect for one another." After a meeting or two with the potential advisor, Howard would determine if the person was worth adding to the advisory committee. Most of the offers to join the advisory committee were accepted partly because Howard's reflective credibility.

Howard identified Alan Heeger, Michael Grätzel, and Allen Bard as being influential technology advisors. When Howard brought them into the company, Michael Grätzel was an EPFL chemistry professor and Allen Bard was a UT Austin professor who won the silver medal in chemistry.

The business advisory committee was formed "because the company was new and not started by someone that came out of the solar photovoltaic industry." His business advisors helped him better understand the dynamics of the solar market including the value chain as well as customers' and suppliers' needs. His business advisory committee allowed Howard to quickly come up to speed and introduced him to key industry leaders.

Howard identified Charlie Gay as an influential member of the business advisory team. Charley was the CEO of three solar companies and was the former director of National Renewable Energy Laboratory (NREL) when Bill Clinton was president. Unfortunately, Charlie took a job at Applied Materials in their solar division so he had to step down as a formal advisor to Konarka after three years in that role.

Insights from an Experienced Entrepreneur

Having founded companies in the Silicon Valley and Boston's Route 128, Howard has a unique perspective on the "significant differences" between the two regions. In the seventeen years that he spent in the Silicon Valley (mostly during the 80 and early 90s) and the twelve years that he spent in the New England area, Howard observed that "Silicon Valley is much more aggressive about not only succeeding, but succeeding at the detriment of your competitors, as opposed to a more amicable style of competition in route 128 companies." In addition, he sees that "people seem to need to be more energetic in Silicon Valley. There is a reason why you have a Google in the Silicon Valley and you do not have a similar cultured company out here (in route 128)." It is not surprising that the more energetic and competitive Silicon Valley culture would lead to much longer working days compared to Route 128. Furthermore, Howard believes that the entrepreneurial network has a much higher density in the Silicon Valley, "that is why a company can spin out and form itself two blocks away from the nexus of its own cluster. You don't have that here (in route 128)." Howard believes that with this denser network, companies are more likely to succeed and drew the following analogy, "if you randomly dropped a seed pod onto fertile soil its more likely to take root and sprout than if you dropped in onto barren soil." The denser network also translates into a

larger pool of potential advisors. However, he notes that the Silicon Valley advisors are much more likely to discuss compensation on the first visit than a route 128 advisor. With the inherent advantages of the Silicon Valley it might surprise some that Konarka was founded on route 128. Howard's answer is simple; he just likes the quality of life in the New England area.

There is a substantial difference in the type and quality of advice received between Howard's first few years as an entrepreneur and now. Commenting on the difference, Howard said, "when I was first starting, (I) didn't know that much and (I sought) advice on everything including some very mundane subjects." Howard observed that when he was younger the advice was much more general and now the "advice is unique to the industry or to the technology (the) new startup is pursuing." Furthermore, he now "seeks out on a more focused basis individuals with precise expertise in the area that you need their assistance. (Whereas) when you are younger just starting out you are happy just to get general business advice and counsel." However, regardless of the experience of the entrepreneur, Howard believes that an entrepreneur should "always find an advisor whose career and success has succeeded your own so it would be more likely that there is something to learn." He added that the advisor should not be significantly more successful than the advisee or else it will not be of interest to the advisor since advisor is not learning as much as he could. To make his point clear, he drew the following sports analogy, "if you play tennis with an individual that is at your level or slightly below your level you will never advance your skill. You always seek to find a player who is better than you but not too much better where it is so one sided that it is neither fun or you can not interact or play." It is no wonder that Howard's advisory

committee is full of acclaimed advisors and that he is an advisor to some young entrepreneurs.

Howard Berke's Biography⁴³

Howard Berke is chairman, chief executive officer and co-founder of Konarka Technologies. He has nearly 30 years of hands-on management experience launching, building and leading both public and private technology companies. This includes 20 years of general management with full P&L responsibility for eight start-up companies and nine years of business development and marketing focusing on emerging technologies.

Berke has founded or co-founded 13 start-up companies and has initiated and completed numerous corporate acquisitions, mergers and R&D joint ventures in the US, Europe and Asia. He advises start-up companies and entrepreneurs in a wide range of fields including medical devices, biotech informatics, software, networking, telecom and energy technology.

Berke serves as Konarka's delegate to the World Economic Forum's Technology Pioneers. He sits on the board of directors for the American Council on Renewable Energy (ACORE), and has guest lectured on entrepreneurship at Yale, Harvard, MIT and elsewhere throughout the world.

Berke received his MBA from the University of Chicago and his BA from Yale University. His academic training includes finance, accounting, operations research, corporate law, architecture and physics.

⁴³ Taken verbatim from Konarka's website (Konarka, 2007)

Timeline⁴⁴

2001

July – Founded

July – Series A funding of cash and license fees by University of Massachusetts

2002

October 23rd – Series B funding of \$13.5M (VCDeal, 2007)

2004

May – Named Red Herring 100 Company

June 24th – Series C funding of \$18M led by NEA & DFJ (VCDeal, 2007)

2005

May – Named Red Herring 100 Company (Red Herring, 2005)

2006

February 15th – Series D funding of \$20M led by 3i (Konarka Press Release, 2006)

August 9th – Daniel Geffken named as CFO

October 12th - Rick Hess named President and COO

⁴⁴ Constructed from the interview as well as other public documents

Appendix G: Miasolé



Company Snapshot

Industry	Stage	Founded	# of Founders	Headquartered	Total Capital Investment	Current # of Employees
Solar Energy	In Beta Test	2001	6	Santa Clara, CA	\$59M	90

Interview Snapshot

Interviewee	Title	Experience	Interview Date
Dave Pearce	President, CEO & co-founder	4 th Startup founded	12/28/06

Company Overview

Miasolé is planning to disrupt the existing solar cell manufacturing industry. Over 90 percent of solar cells are fabricated using processes and materials similar to that of the semiconductor fabrication industry (PV News, 2006). Although this silicon-based approach dominates the market, the complex manufacturing process and high silicon material cost are limiting the historical price depreciation of the cells. Miasolé solves the inherent issues with silicon-based cells by fabricating their cells with a thin layer of copper indium gallium selenide (CIGS) on a thin sheet of stainless steel using a roll-to-roll (think printing press) manufacturing process. By taking silicon out of equation and significantly reducing manufacturing complexity and costs, Miasolé will offer lower cost solar cells and panels. Miasolé is exploring markets that do not require high solar

efficiencies⁴⁵ and could benefit from this new product. As of February 2007, they have beta customers, plan on moving to full production by year's end, and plan to go public by the fourth quarter of 2007. (Kanellos, 2007)

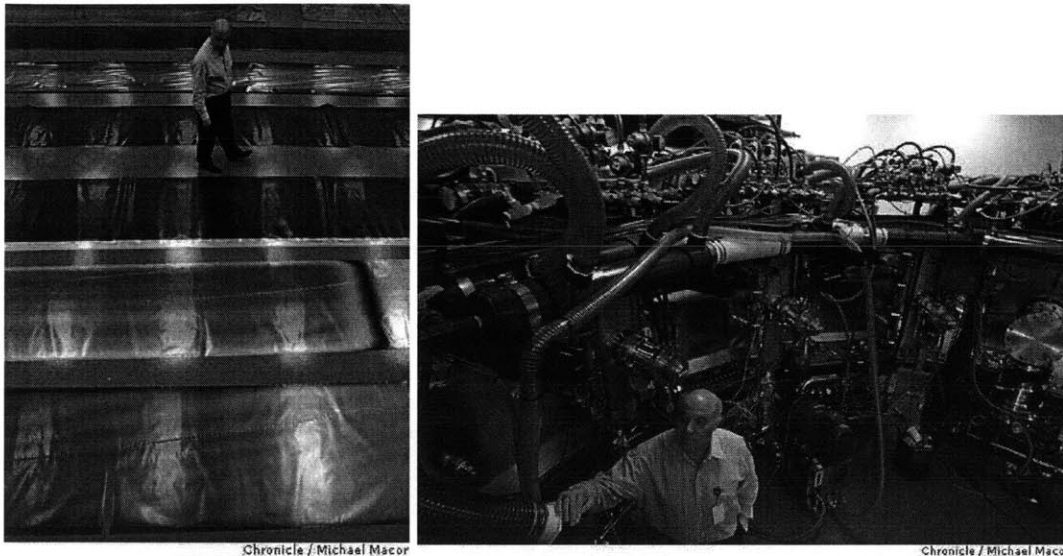


Figure 13. Dave Pearce, CEO & Co-founder, Next To Prototypes of Miasolé's Thin-Film Solar Cells (Left) and The manufacturing Equipment Used To Produce Them (right). (Baker, 2007)

Company Formation⁴⁶

Miasolé (Italian for “My Sun”) started in September of 2001 not as a thin-film solar company, but rather an optical equipment company named Raycom Technologies. Dave Pearce, CEO and co-founder of Miasolé, was forced to liquidate his last two companies after he “got caught in the meltdown of the telecommunications industry of 2001.” However, determined to get back into the optical equipment business, Dave bought back the equipment from his previous company, hired twenty five of the laid off employees, and incorporated the company as Raycom. Quickly Dave realized that the telecommunication industry was not going to bounce back, so he spun off the majority of the assets by creating a joint venture with a Chinese partner and was forced to let all but

⁴⁵ The expected efficiency of CIGS based thin-film solar is 10-12% whereas the silicon-based cells have an efficiency of 15-20%. Efficiency is not a factor in cost calculations since everything is quoted in \$/Watt.

⁴⁶ All quotes and data for this section were taken directly from Nick Cravalho's interview with Dave Pearce (Pearce, 2006).

five employees go.^{47,48} In October of 2002 the obligation to his Chinese partner was complete and Dave and his team were able to explore any option they desired.

For ten years Dennis Hollars, Dave's 20-year employee, former CTO, and Miasolé co-founder, had been telling Dave that the vacuum deposition equipment they had been using for data storage and optical components could be used for solar cell manufacturing. Dave always responded that their "plate was too full" and that the solar market was not yet ready. During the founding team's market exploration the idea of solar was again brought up. Times had changed, and Dave saw that the "(solar) market was big enough to be interesting." After researching government studies on thin-film solar the team decided they could modify their patented manufacturing equipment to fabricate CIGS base solar cells.

The team went to work using a tool originally designed for magnetic film application that was not part of the original asset spin-off and one vacuum deposition telecommunication equipment tool that they retained from the spin-off for an agreed upon term of one year. They made modifications to the equipment and within ten months demonstrated that they could fabricate a 12% efficient solar cell. Reflecting on this accomplishment, Dave Pearce commented, "(We had a) big running start because we had tools in our possession that were either on loan from the joint venture or written off to almost nothing so we had a pretty nice asset base with minimal carrying costs."

Dave Pearce originally financed the venture with 1.5 million dollars of his own money earned from previous ventures (Stone 2005). He continued to financially support

⁴⁷ The remaining five employees as well as Dave Pearce are Miasolé's co-founders.

⁴⁸ Dave Pearce has a history of bringing his previous employees to his new ventures. One of the founders has worked with Dave since 1985, two have worked with Dave since 1987 and two have worked with Dave since 1997.

the company during the first two years of its life, but by 2003 Dave was running out of money and staff had to work without salaries. During this dark period Dave looked to the venture capital community for financial assistance. At that time many venture capitalists were not that familiar with the solar market or technology. Dave had to devote a considerable amount of time educating them not only about his company but also about the entire solar industry and its potential for social and economic benefits. Vantage Point took an interest in the company but would only fund it once Miasolé had proven the technology. After the team had a neutral party inspect their prototype, Vantage Point and Miasolé quickly came to a partnership agreement with 5.4 million dollar series A investment in February 2004.

With the infusion of capital, Miasolé focused their efforts on developing an in-line CIGS vacuum deposition tool. It took the company almost a year to build an R&D tool and another year to perfect the manufacturing process. In July of 2006 Miasolé reached their initial target of fabricating a solar cell with 10% efficiency using production like equipment and a stainless steel substrate.

External Advice⁴⁹

Most of the business strategy came from Dave as he had over 20 years of experience working as a CEO for venture backed companies. In tribute to his reputation as a strategist and visionary, Dave mentioned that he has “been dubbed chief visionary officer.” He relies on his large and experienced founding team to help him create new ideas and direction. Very rarely will Dave go outside the company to seek general business advice. Yet, when developing Miasolé, he did seek advice from specialists. For

⁴⁹ All quotes and data for this section were taken directly from Nick Cravalho’s interview with Dave Pearce (Pearce, 2006).

example, he reached out to his trusted law firm to figure out how to properly structure the joint venture agreement with the Chinese company. Dave also sought specific advice for such matters as bridge financing and equipment leasing. Dave mentioned that these advisors were “business relations developed throughout the years. They were either people I knew or referrals from people I knew to address a particular business need we had.” According to Dave, “we used the network quite a bit” to fine tune the venture.

The three advisors Dave identified as important in the development of the company all sit on Miasolé’s board of directors. It is worth noting that all of them provided their services well after company was formed. They are highly regarded as significant thinkers and movers in Silicon Valley. Dave maintains weekly contact with his Board via email and telephone, and holds in person meetings with them at least once a month.⁵⁰

One key advisor is Marty Lagod. Dave was introduced to Marty by Clean Edge, a clean energy consulting company in San Francisco, when Dave was seeking funding in the middle of 2003. Marty, a venture capitalist from Firelake Capital, invested in Miasolé and became a board member. Marty’s advice centered on dealings with other venture capitalists(VC). He gave Dave valuable feedback on VC presentations and helped him identify just what it was that VCs desired. During the second round of financing Marty was resolute in his recommendation to go with Kleiner Perkins, Caulfield & Byers instead of Mohr Davidow Ventures (MDV), to which Dave was leaning. In the end Dave followed Marty’s advice and went with Kleiner Perkins. Later Dave reflected, “(there was a) good chance I would have selected MDV and that would have been a mistake.” Not only did Marty offer advice, but he also acted as a sounding

⁵⁰ Meeting frequency now moved to once every six weeks.

board and introduced Dave to very effective people including Miasolé's current VP of Sales and Marketing. In reflecting on the impact of Marty's Advice, Dave mentioned that "if Marty had not been around. I am sure that the outcome would have been much different."

John Doerr is often one of the first to come to mind when people think of venture capitalists (Malone, 1997). As a partner at Kleiner Perkins Caulfield & Byers John advises and sits on the board of directors of Google, Amazon, Intuit, and Sun to name just a few (KPCB, 2007). You can now add Miasolé to that list. As part of the series B negotiations with Kleiner Perkins, Dave was able to get John Doerr on this board. John's greatest strength is getting companies started and seeing "the big picture." At Miasolé, John stressed the first mover advantage and the need to increase the number of employees which he referred to as "the brain trust". He saw that Miasolé was struggling with a technical issue and thought they did not have enough people on the team to solve it. With John's prodding, Miasolé has bloomed from 25 to 90 employees within one year. Furthermore, John helped Miasolé by giving the company virtual access to his impressive rolodex. One of the significant introductions John made to Dave was Mark Allen, who became another of Dave's key advisors.

Mark Allen has an impressive background in the semiconductor industry. He was a VP of Operations at Cypress Semiconductor and Nvidia, as well as the CEO of Transmeta. As a board member, Mark advised Dave about operation strategy and technical issues. Mark is known for stressing backup scenarios for mitigating technology risk. However, his biggest impact on Miasolé has been in the role of CEO coach. In June of 2006 Dave and Mark began meeting for a few hours on a weekly basis. During

their weekly meetings the two discussed how board presentations went, how senior staff performed, what the board may really be thinking or anything else that was on Dave's mind. Dave recalls, "at the CEO level it is nice to have someone who is independent that you can go to for advice, and just to bounce ideas off. They can tell you candidly if you did an awful job in that last board meeting or tell you those things you don't want to hear but need to hear. Mark brings a different perspective than those of us who are living with the project everyday." Dave is quick to mention that the relationship is mutually beneficial when he adds that Mark "is also learning a lot from me."

It was the first time that Dave had ever used a CEO coach. He recommends it to other company CEOs, but would suggest that they not select someone on their board because of a potential conflict of interest, "it's an unusual arrangement. You normally don't want a board member in that role because they are in a conflicting position. They need to play the board role as well as be honest with the CEO about what they see can be done better."

In general Dave was content with the amount of advice he requested and received from these key advisors. He always listens to advice but normally doesn't take immediate action. Instead, he takes time to digest the information and then make an informed decision. In the future Dave expects to expand the number of advisors as the company expands as well as increase the number of specialty advisors. He likens it to experts in project finance or the bill and trade, who seek more support as the complexity of the company increases.

Dave Pearce's Biography⁵¹

Mr. Pearce has over 30 years of broad-based business, sales, operations and financial management experience in both private and public high-technology companies. He has been at the CEO level for the past 18 years. Mr. Pearce is a serial entrepreneur, having founded four venture-backed companies, including: OptCom, which manufactured precision thin-film optical filters, and SciVac which designed and manufactured thin-film vacuum-deposition equipment.

As president and CEO of Domain Technology (another venture-backed company), Mr. Pearce helped pioneer the manufacture of sputtered thin-film disks. This system was subsequently acquired by Seagate Technology and went on to revolutionize the cost, throughput, and precision-coating capability of the industry.

Prior experience includes serving as CFO/COO of MiniScribe (an early pioneer in small format hard-disk drives), and in financial management roles at Datapoint and Xerox Corporation.

Mr. Pearce holds an MBA from the University of Texas, Austin, and a BS in Industrial Management from Georgia Tech.

⁵¹ Taken verbatim from Miasolé's website (Miasolé, 2007)

Timeline⁵²

2001

September – Company incorporates as Raycom

November – Dave Pearce Invests \$1.5M of his own money into the company (Series A)

2002

April – Formed a joint venture and sold most all of the equipment to a Chinese firm

April – Idea for using their deposition equipment and technology for CIGS Solar

October – Satisfied obligation with partnership. Now could focus all the time on solar cell development.

2003

July – Marty Laged begins advising the company

November – Demonstrated 12% efficiency on a glass substrate

2004

Feb – Close \$5.4M Series A led by Vantage Point (freshnews.com)

May – Changed name from Raycom to Miasolé (Right after 1st round of financing closed)

2005

March – In-line tool capable of depositing all layers in CIGS process (Kicks off process development stage)

June – Close \$16M Series B led by Kleiner Perkins. John Doerr begins advising the company in the capacity of a board member.

2006

June – Mark Allen starts as CEO coach/advisor

July – Demonstrated 10% efficiency on SST substrate

October – Close \$35M Series C (Undisclosed terms).

October – Accepts first P.O. (from China)

⁵² Constructed from the interview as well as other public documents

Appendix H: QD Vision



Company Snapshot

Industry	Stage	Founded	# of Founders	Headquartered	Total Capital Investment	Current # of Employees
Display Manufacturing	Product in Development	2004	5	Watertown, MA	\$6M	21

Interview Snapshot

Interviewee	Title	Experience	Interview Date
Greg Moeller	Co-Founder & Director of Business Development	3rd Time Founder	11/7/06

Company Overview

The once stagnant display industry has experienced a tremendous influx of technology and innovation over the last ten years. However, if the team at QD Vision can deliver on their promises, then the display industry could witness a “quantum” leap in display performance within the next five years. QD Vision hopes to accomplish this by using nanotechnology from the labs of MIT (Carts-Powell, 2006). In particular, they are using quantum dots, particles with diameters between two and six nanometers, to emit light. The basic idea behind QD Vision’s novel displays is that when electricity is supplied to the quantum dots, light is emitted with visible color depending on the size of the quantum dot.⁵³ This concept is a paradigm shift compared to the existing approach which uses electricity to create a white light that is then filtered to get the desired color. QD Vision’s demand-based approach requires one third the power, enables a thinner

⁵³ A 6 nanometer diameter particle when excited will emit the color red and a 2 nanometer diameter particle will emit the color blue. QD Vision has a method of manufacturing quantum dots at various sizes.

form factor, covers more of the visible light spectrum and is easier to see in sunlight compared to today's liquid crystal display (LCD) solutions (Bullis, 2006). These benefits are sure to win over customers, but what excites display manufacturers is the simple manufacturing process that will reduce the cost to manufacture a flat panel display.

Don't expect to see a QD Vision enabled display at Best Buy anytime soon. The company is still in the very early stages of development and doesn't expect a commercial solution for another four years (Bullis, 2006). In the mean time they are generating revenue by contracting out specific research projects that are in-line with their technology roadmap.

Company Formation⁵⁴

The seeds of QD Vision were planted in February 2004 when Greg Moeller and Seth Coe-Sullivan met at the CEO Reception for E-Lab⁵⁵ Host Companies at MIT (Moeller, 2006-2). It is fitting that they would meet again at the E-lab reception. Six months prior, Seth had worked on an E-lab class project for Bluefin, Greg's company at the time. Greg was impressed with the quality of work and the effort expended by the Electrical Engineering PhD student on the semester long project. At the reception Seth told Greg about some exciting work he was doing with quantum dots. The conversation moved from the beautiful faculty club to Seth's research lab and continued until 2 am as the two discussed the benefits of the technology and potential markets. Over the next few weeks the two stayed in touch but focused primarily on their day jobs. It wasn't until Seth, Greg and Jonathan Steckel, PhD student from MIT who was also developing the

⁵⁴ Unless explicated stated, all quotes and data for this section were taken directly from Nick Cravalho's interview with Greg Moeller (Moeller, 2006-1).

⁵⁵ E-Lab stands for Entrepreneurial Lab. It is a popular MIT Sloan School of Management class that partners with technology start-ups. Students work in teams and work over the entire semester creating marketing strategies for the start-ups.

technology, met at the Royal East in Cambridge in May that all the parties committed to the founding a company based on Seth's and Jonathan's research.

A key source of validation for the new team came when Joe Caruso, an experienced entrepreneur and CEO coach, agreed to spend time coaching the initial founders. The team believed they were onto something special if someone as experienced as Joe would spend a considerable amount of time with the company. The team quickly extended Joe's role and made him a co-founder. Rounding out the founding team was Dr. Vladimir Bulovic', a Professor of Electrical Engineering and Computer Science at MIT and Seth's academic advisor. Although these two founders are not members of the active executive team, both Joe and Vladimir remain active in the company as members of QD Vision's Advisory Board.

The QD Vision founding team received a shot of adrenalin when they won first place in the Inaugural International Nanotechnology Business Plan Competition in October of 2004. Considering that the team spent ten percent of its initial founder level investment of 14,000 dollars just to fly out to Ohio to present in the finals, the 50,000 dollar grand prize was significant. However, the amount of press they received from winning the event was even more valuable. Within months venture capitalists were making unsolicited calls to QD Vision and in May of 2005 QD Vision closed on a 6 million dollar series A investment led by Highland Capital. The company was on its way.

External Advice⁵⁶

Greg and the founding team at QD Vision reached out to many advisors when developing the company. The advisors that had the biggest impact can be grouped into four categories (listed in order of impact): VC partners, VC advisors, friends & family and the MIT network. Absent from the list were any professional service firms and customers. In discussing why customer feedback and advice was not solicited, Greg noted that QD Vision “needed to get a certain nucleus before talking with them. IP was at risk. Relatively few customers (~12 companies manufacture FPDs worldwide), so any meetings with them needed to be conducted with a clear message and purpose.”

The founding team received advice that they took to heart when pitching their company to the venture capital community. Most of the advice received was “mechanical advice” that helped fill some of the gaps in their business plan. The team incorporated some of the advice and improved the presentation to the delight of the venture capitalists. Sometimes the advice was hidden in the guise of questions. For example, Stan Reiss at Matrix made an impact not based on the advice he gave, but rather by asking tough questions early on. Greg made it clear that venture capitalists didn’t shape strategy stating, “(the) external advice helped to better articulate the strategy. The strategy held up under intense scrutiny. We did consider all advice carefully, since these advisors brought different perspectives.” Not only did venture capitalists provide important advice, but also during due diligence they introduce QD Vision to key industry experts. Jamie Goldstein at North Bridge introduced them Willy Shih and Sean Dalton at Highland introduced them to Joe Carr. Both Willy and Joe would be become members of

⁵⁶ Unless explicated stated, all quotes and data for this section were taken directly from Nick Cravalho’s interview with Greg Moeller (Moeller, 2006-1).

the board of directors. Commenting on the value of the VC advice Greg said, “VC firms add a lot of value in the early stages (but) their involvement seems to taper off once they feel the senior management is in place.”

Advice from experts in the display industry was particularly import to QD Vision since they didn’t have any in-house expertise. They received most of the industry advice from the venture capital advisors that were tasked with evaluating the investment worthiness of the company for their sponsoring firms. QD Vision seized the opportunity when these advisors were asking tough questions of them. They would turn the questions around and ask what they thought of a particular technology or market. Of equal value to QD Vision was the access to these advisors’ rolodex. On this subject Greg commented, “(Venture advisors were) also helpful when we do not have leads at companies we’d like to get to know. (They) can get senior level introduction, saving months of business development work.” As an example, Joe Carr and Willy Shih have introduced them to many key senior executives in Asian display manufacturing companies. Paul Lo, another VC hired advisor, introduced Greg to Mark Pinto, Applied Materials CTO, who provided some interesting insights that Greg wouldn’t have had otherwise.

The final identified influential advisor to QD Vision was Sam Tolhoff. Sam and Greg met at Bluefin, a manufacturer of underwater vehicles, and became good friends. At Bluefin, Sam was a design engineer with excellent people skills and Greg was the Director of Business Development. Even before the company was formally launched, Sam advised QD Vision. He would stop by Greg’s house and the two would hover over the breakfast table to discuss a proposed business model. Even today, Sam is a valued sounding board. Greg will call him and seek his advice, particularly on people-related

issues because “Sam is a great people person.” In a testament to Sam’s perceived value, Greg tried to hire him as the Director of Operations, but Sam declined because he was more interested in business development. However, Greg was able to hire him as a consultant for facilities design and build out. When asked about Sam’s impact to the company, Greg said that “he was instrumental in selecting the ideal facility as well as getting the build out plan rolling. The facility build out went like clockwork in part due to Sam’s help. This saved us a month or two of valuable development time by allowing R&D to start soon than expected.”

Reflecting on the amount of advice received and incorporated, Greg mentioned that he would have requested more advice from his current advisors but feels like he incorporated the right amount of advice that was given. Greg did comment that he would have benefited by having some additional advice or having more start-up experience on the team during the venture capital term sheet negotiations. Although Greg has great affinity for venture capitalists, he does believe if you don’t have the right advisors or an experienced founder then the venture capitalists could take advantage of the situation.

Greg Moeller’s Biography⁵⁷

Greg is a founder and the Director of Business Development at QD Vision. Just prior to focusing on QD Vision fulltime, Greg was Director of Business Development at Lucent's Homeland Security Solutions group where he helped identify and capture green field growth initiatives by matching Bell Labs' innovations with unmet market needs. Greg founded or acted as a key contributor at three early stage ventures in addition to QD Vision, most recently at Bluefin Robotics (ACQ: Battelle). At Bluefin, Greg grew

⁵⁷ Taken verbatim from QD Vision’s website (QD. 2007)

revenues by more than 40% for two consecutive years and landed its largest sole-source contract just prior to acquisition. Before joining Bluefin, Greg was a Senior Associate at an early-stage venture fund.

Greg earned an MBA from the MIT Sloan School of Management, and an M.S. and B.S. in Engineering Virginia Tech and WPI, respectively. For his achievements at Sloan, Greg was awarded MIT's Ronald I. Heller Grant for entrepreneurship.

Timeline⁵⁸

2004

February – Reunited with Seth @ E-Labs reception (Genesis for company)

May - Dinner with Johnny/Seth/Greg @ Chinese restaurant (Commitment to the idea)

August - Incorporated (primarily to get MIT patents)

October – Won International Nanotechnology Business Plan Competition

December – First calls from Venture Capitalists

2005

February – Terms sheets out

May – Closed term Sheets. \$6M from Highland Capital

August – 1st Employee hired (Marshall Cox)

October 3 – Moved into headquarters

2006

January – Created a scientific advisory board

May – Comerford joins as new CEO

⁵⁸ Constructed from the interview as well as other public documents

Appendix I: Seahorse Power



Company Snapshot

Industry	Stage	Founded	# of Founders	Headquartered	Total Capital Investment	Current # of Employees
Waste Management	In Beta Test	2003	1	Needham, MA	\$2.2M	13

Interview Snapshot

Interviewee	Title	Experience	Interview Date
Jim Poss	CEO & Founder	1 st Time Founder	11/20/2006

Company Overview

Whereas most people look at garbage as a public nuisance, Seahorse Power sees it as an opportunity. Seahorse Power plans on solving the problem of overflowing public trash cans and high municipal waste removal operating costs with their innovative Cordless Compaction System (Seahorse Power, 2007). Their first product, the Big Belly, is a point-of-use trash receptacle that detects and compacts trash using power generated by the sun. Compacting the trash allows the same form factor as an existing can to hold up to four times the amount of trash, which translates into a seventy five percent reduction in frequency of trash pickup. Since labor and garbage truck fleet expenses are proportional with the collection frequency, then the customer will yield an operational savings that will cover the price of the product within a few years. In addition to the operational savings, there is also environmental savings (less greenhouse gases emitted by the garbage trucks) and an aesthetic improvement in the area around the Big Belly (no more over-filled trash cans).

Seahorse Power is initially targeting the municipal market, but wherever there is a trash can, there is a potential customer. Thus far, Seahorse has had two successful pilots of fifty cans each: Queens, New York (Martin, 2006) and Boston, Massachusetts (Brownlow, 2006). In addition, they have sold a handful of cans to various cities throughout the United States, including Baltimore, Santa Cruz, Ventura, and Cincinnati. Their success is starting to get recognized. Inc. Magazine named Seahorse power as one of the 50 “most intriguing companies that are helping to drive today's green revolution (Kanter, 2006).”



Figure 14. Boston Mayor Menino (Left) with Big Belly & Big Belly @ Baltimore's Harbor. (Seahorse, 2007-2)

Company Formation⁵⁹

While most of Jim Poss's classmates at Babson were considering which consulting firm or investment bank to join, Jim was contemplating which of his three ideas he should turn into a startup. As a passionate supporter of the environment, Jim's ideas were all based around using renewable energy. Jim settled on the solar powered trash compactor because out of his three options it had the most attractive market (Hedberg, 2005), was the easiest to commercialize and required the least amount of startup capital. As a first time entrepreneur Jim knew that it would be difficult to build a

⁵⁹ Unless explicated stated, all quotes and data for this section were taken directly from Nick Cravalho's interview with Jim Poss (Poss, 2006).

team and raise five to ten million dollars without a customer or product. The solar powered trash compactor idea allowed Jim to bootstrap the company while he built the prototype and landed key customers.

Jim incorporated the company in April 2003 while in his last semester in Babson College's MBA program. After putting 10,000 dollars of his own money up, securing 22,500 dollars in angel financing and receiving 12,500 dollars from the hatchery program at Babson College (Hedberg, 2005), he was ready to launch the company. His first effort was to find an early adopter that had a pain point and that would purchase a unit without seeing a working prototype. He found this customer at a resort in the town of Vail, Colorado. During the winter the resort would have an employee travel over one and half hours on a snow mobile to remove trash from a single site. Having a point of use compactor would save Vail a considerable amount of money. They purchased a single Big Belly for \$5,500 based solely on Jim's powerpoint presentation. Now, Jim needed to complete the design, build, test and ship it within four months. Jim had a background working for an electrical vehicle company as an application sales engineer and knew that "guts of the Big Belly were similar to the guts of an electrical car" so he did most of the mechanical work himself. He contracted out the electrical and sheet metal work and had a student at Olin do the CAD modeling. Although the team was over a month late, the customer was pleased with the product that worked even at zero degrees Fahrenheit.

With a working prototype and a visionary customer, Jim primarily focused his time on three parallel tasks: signing up more customers, improving the product design and raising more capital. In January 2004 Jim raised 500,000 dollars in convertible notes. The money funded the material and engineering for 20 redesigned Big Bellies that

were deployed to various customers. An inflection point for the company occurred when Queens, New York signed up for fifty units which were delivered in the summer of 2005 (Brownlow, 2005). This event generated great press for the company and interest from potential investors. Just a few months later Jim closed 1.1 million dollars of series A financing from angel investors (Viscarolasaga, 2005). Although Jim would continue to raise additional capital, improve the design of the product and sign up more customers at this point in time Jim believed that he had a “real” company that had a strong likelihood of success.

External Advice⁶⁰

“I am not shy to ask for advice” says Jim Poss as he finishes his last slice of pizza at Cambridge 1, a trendy Harvard Square restaurant. Not only is he not shy to ask for advice, but also he incorporates much of the advice received which leads him to “change directions based on the last piece of advice received.” This approach has been an asset for the first time founder, which has helped shaped some of his strategy and led to connections that he would not have had otherwise. However, Jim notes that incorporating a high percentage of the advice received has caused him to change strategic direction frequently which has caused confusion amongst his employees and customers.

Jim leveraged his network when seeking advisors. Most of his advisors can be lumped into two categories, paid consultants and personal contacts. Out of the four advisors that Jim thought were most influential in developing the company, two were paid consultants (Joe White & personal lawyer), one was the President of Babson (Brian Barefoot) and the one was a family friend (Dick Cole). Jim also mentioned that he

⁶⁰ Unless explicated stated, all quotes and data for this section were taken directly from Nick Cravalho’s interview with Jim Poss (Poss, 2006).

received useful advice from other sources including prospective consultants, his accounting firm, and from a short lived customer focus group.

Jim has known Dick Cole ever since he can remember. Dick was a good friend of his parents and lived in the same neighborhood. When raising money for his new venture Jim approached this “straight shooter” with an impressive background in manufacturing to invest in the company. Not only did Dick invest in January of 2004, but he also took an active role in the company by sitting on the Board of Directors because as Jim says, “he thought (the concept) was cool.” Dick’s advice has been primarily on manufacturing strategy and business fundamentals. Besides doling out advice, Dick also acts as a coach offering encouragement and instilling confidence and principles into the young entrepreneur. When times got tough and the future was not looking so bright, Dick would motivate Jim and help Jim believe that he can make it through the difficult period.

When bootstrapping his company, Jim left no stone unturned. Having just won the Douglas Foundation Graduate Business Plan Competition at Babson College, Jim thought that he had enough credibility to approach the President of Babson College, Brian Barefoot, and solicit an investment. At the conclusion of their first meeting where Jim gave a passionate pitch, Brian wrote a check for 25,000 dollars. Brian has given Jim valuable financial advice early on in the development of the company. In particular, Brian gave Jim advice on how to finance deals and how to value his company. Perhaps even more valuable was “access to his rolodex.” Brian introduced Jim to additional angel investors who eventually invested in the company. Since Jim has brought a full-time CFO, Steve Delaney, he does not receive as much advice from Brian but still stays in close contact with him.

In the beginning of 2006 Seahorse power was having manufacturing and supply chain issues. Steve Delaney approached a startup in a different industry who he believed excelled at manufacturing and asked what their keys to success were. They mentioned that their consultant, Joe White, had a major impact on their recent successes. With that piece of news in hand, Jim hired Joe as a manufacturing consultant. Although Joe only worked for Seahorse power for five months, his impact was significant. He helped find quality vendors, quoted the project and even did site inspections of potential manufacturers. Reflecting on Joe's impact, Jim said that "it was the best money I have spent. His advice was pivotal to the long term success of the company." Jim thought so highly of Joe that he offered him a full-time job, but Joe turned it down to take a higher paying job at a large corporation.

Jim won 1,500 dollars of legal advice from Brown and Rudnick at an investor forum in May 2003 (Hedberg, 2005). After meeting with the lawyers at the firm to get his "free" legal advice he decided to continue the relationship and hired them to help with filing patents and contract work. Jim was (and still is) appreciative of their honesty and openness. Even though they would have financially benefited by pushing Jim to file for more patents in various parts of the world, they advised him not to. They had good business understanding and stressed looking at patents as an investment. In their opinion it was not worth the investment to file in every country, whereas it is worth the investment to file in the four largest countries. Furthermore, they offered to Jim that "if you have any problems, call me. I will not charge." Jim took them up on their offer and received some worthwhile free advice.

Going forward Jim plans on receiving advice from his current advisors and from additional advisors. Looking at his advisor portfolio and where he plans on taking the company, Jim has identified that he needs to get advice from experts in the waste management industry and experts that understand how to sell into the Asian market.

Jim Poss's Biography⁶¹

James Poss, inventor of the BigBelly and founder of Seahorse Power Company, has served as President and CEO since the company's incorporation in April 2003.

Mr. Poss has significant experience in alternative energy, technology development and manufacturing. In 1994, he developed his first clean energy concept, a 1/2 KW ocean-wave powered generator, funded by the Pew Foundation and tested at the Beaufort Marine Lab at Duke University. He continued his pursuit of clean energy technology at Solectria Corporation (now Azure Dynamics), providing drive systems for electric, hybrid-electric, solar-electric and fuel cell vehicles. Subsequently, at Spire Corporation, a 30-year publicly traded solar energy company, Mr. Poss worked with top management to develop business plans and performance reports for Spire Solar Chicago and the overall Spire Solar division. He brings highly-relevant experience to the Company's current endeavors, and a history of innovative product development experience to help carry the mission forward.

Mr. Poss earned a BA in Environmental Science / Policy and Geology from Duke University, and an MBA from Babson College. Seahorse Power is his second startup. The first was a non-profit called Do Good Dates, based in San Francisco, which brought

⁶¹ Taken verbatim from Seahorse Power's website (Seahorse Power, 2007)

volunteers together to perform community service projects and meet new people. The organization attracted over 3,000 separate volunteers in 2000 and 2001.

Poss lectures regularly at MBA programs in the Boston area and co-teaches a course on Entrepreneurship at the Bainbridge Graduate Institute.

Timeline⁶²

2003

April – Company Incorporated

June – Filed first provisional patent

September – Received a purchase order from Vail, CO

2004

January – Dick Cole started to give advice

January – Closed on \$550k in convertible notes

February – Delivered the first prototype to Vail, CO

April - Won Douglas Foundation Graduate Business Plan Competition at Babson College.

June – Brian Barefoot started to give advice

2005

July – 50 Can Pilot in Queens launched

October 31st – Closed \$1.1M in seed funding (Mostly by Angels)

2006

February – Follow on \$550k of funding

April to September – Joe White consults with Seahorse Power

July – 50 Unit 6 month Pilot in Boston

October – Seahorse Power named one of Inc's top 50 Green Companies

⁶² Constructed from the interview as well as other public documents

Appendix J: Stion



Company Snapshot

Industry	Stage	Founded	# of Founders	Headquartered	Total Capital Investment	Current # of Employees
Solar Energy	Product in Development	2005	3	Menlo Park, CA	\$6.3M	12

Interview Snapshot

Interviewee	Title	Experience	Interview Date
Howard Lee	Co-founder & CTO	2 nd Time Founder	1/9/07

Company Overview

Stion is developing high efficiency nano-technology based solar cells that will enable solar energy to compete with retail grid-connect electricity. Their quantum dot nano-technology is fundamentally different than the prevailing solar cell technologies, base-silicon and thin-films, and thus has been categorized as Gen 3 (3rd Generation). Basically, using quantum dots of various sizes, Stion cells will be able to capture a greater amount of the solar radiation compared to the existing technologies.

The Menlo Park, California based company is over two years away from commercializing their technology. Recently coming out of “stealth mode” for the last year, Stion has announced that it is funded by Khosla Ventures (Shieber, 2006) and Moser Baer Photo Voltaic (Childs, 2006) and that it will focus primarily on large commercial and industrial installations. With their promised product attributes of low cost and high efficiency they will have customers beating down their door.

Company Formation⁶³

Howard Lee has spent the majority of his career researching and developing nanotechnology. During his thirteen year tenure at Lawrence Livermore labs he developed nanotechnology for LEDs, lasers, flat panels, biosensors, optical switches, solar cells and a variety of other applications. This enabled him to “develop a base of technology and a base of understanding.” He used this understanding to found an optical switching company in January of 2001. Once the acquisition of his new venture by Nortel in 2002 fell through, Howard decided to pull out of the switching business. After three months searching for another industry that would be able to leverage his team’s core capabilities, he decided to move into the emerging solar energy industry designing solar cells based on nanotechnology similar to what he had previously developed. He renamed the company from Ultra Photonics to Ultra Dots and after series C funding brought in a new CEO. In Howard’s opinion, this new CEO was the “worse decision the company ever decided to do.” After a public dispute with the CEO, Howard left the company on February 28, 2005.

While he was walking out of the Ultra dots facilities, Howard knew that he wanted to start another company in a similar space. He immediately called his friend Richard Stuebi whom Howard reached out to when Ultra Photonics was exploring the solar industry. He asked Richard for valuable advice and if he would help him raise money for the new venture. Knowing that they were lacking a CEO, Richard suggested that Howard meet with Tom Steding to see if he would be interested in joining the new

⁶³ Unless explicated stated, all quotes and data for this section were taken directly from Nick Cravalho’s interview with Howard Lee (Lee, 2007).

venture at least part time. Tom agreed and the three founded NStructures (named changed to Stion after Series A funding) and immediately began fundraising.

Howard was very careful that core technology for the new venture did not violate any of Lawrence Livermore's or Ultra Dot's intellectual property. When going through the funding process Howard only had the basic idea about using quantum dots to improve the efficiency of solar cells. At that time he did not have a working prototype, but he did feel confident that the concept would work because he believed that the fundamental physics behind it were sound. Thus, the idea was "validated by the related physics," explained Howard. Drawing an analogy, Howard said, "I know that gravity works. If I went up to a mountain and throw a rock out, I know that without having to validate it, that the rock will drop down."

In the summer of 2006, almost a full year after founding the company, Stion received Series A funding led by Khosla Ventures, which Howard believed would last the company roughly two years. With this money Howard and Tom⁶⁴ started building out a team of scientists and moved into their new office building. At this point Stion had the team, the technology and the money to develop the technology that in a few years could revolutionize the solar industry.

External Advice⁶⁵

Howard identified three advisors as being the most influential in developing the company. The core advisors were Richard Stuebi, John Steinhart and Tom Steding. Interestingly, all three were consultants and two (Richard and Tom) joined the founding

⁶⁴ Richard Stuebi left to work full time as the BP fellow in the Cleveland Institute. His role now is more of a periodic consultant to the company.

⁶⁵ Unless explicated stated, all quotes and data for this section were taken directly from Nick Cravalho's interview with Howard Lee (Lee, 2007).

team shortly after they started advising Howard. Although these three advisors had the biggest impact, Howard did receive some advice from other sources. For example, one short lived advisor from DFJ gave Howard a kernel of advice that Howard still values today. In addition, another investor gave Howard an interesting view of the solar energy landscape but couldn't invest because of a potential conflict of interest. However, the individual did offer Howard, "any help of any kind."

After finding Richard Stuebi's Next Wave Energy consulting firm from a Google search, Howard cold-called Richard. Howard was looking for specific market advice on the solar industry when Ultra Photonics was exploring various industries. Howard trusted Richard right away. His solid background in Economics from MIT and work at McKinsey gave him credibility in Howard's eyes. The consulting work and advice that Richard did for Ultra Dots impressed Howard. Once Howard left Ultra Dots, Richard was the first person he called. Although he was paid for his work with Ultra Dots, Richard was not paid for his advice to the new venture. However, he was given stock options in consideration for his advice. With Richard's solid background and understanding of the solar market, he advised Howard on how he could penetrate the market with his new technology. "If he said that it was not going to work out, then I wouldn't have gotten into PV (photovoltaic)," commented Howard. Howard views Richard's impact on the development of the company as "critical." In fact, he considers Richard one of the founders of the company. Richard primarily gave industry and general management advice. In addition, he helped with the marketing plan and with the near and long term business plan. Initially, Howard and Richard would communicate

about three times a week but now they communicate once every other week. Richard is now a BP Fellow in the Cleveland Institute and is a paid consultant to the company.

Richard Stuebi introduced Howard to Tom Steding shortly after the company was formed. Both Richard and Howard knew that they needed a CEO before raising any money. Howard was committed to starting a company but he believed that his talents were best served as the Chief Technology Officer and Richard was considered more short term help. Having been burned previously by a bad CEO, Howard listed the qualities that he wanted in a CEO. In particular, Howard wanted a CEO that had integrity and had a proven track record. After listening to Howard's requirements, Richard knew that the perfect candidate for this new venture was Tom. The problem now was how to convince Tom that he should quit his company and work for them. Taking a conservative approach, Richard and Howard asked Tom to be an advisor to the company. Tom said that was not acceptable and that he wanted to lead this new company. Howard and Richard were ecstatic and agreed on the spot.

Tom has founded six other companies, all of which were successful. In addition, he wrote a book called "Built on Trust" that was about succeeding in the Silicon Valley without being Machiavellian. Furthermore, Tom spent time as a tank commander. Thus it is not surprising that Tom is a tough but fair leader who is well respected in the Silicon Valley's entrepreneurial community. Later in his career, Tom became a CEO consultant where he would work part time. This was and is his role for Stion. Since Stion is focused on development, there is not enough work for a CEO to work full time. During the early stages of development, Tom's impact was "tremendous." He provided very high level advice on strategy. Since he had gone through the process multiple times, he

provided insights into the venture capital world and general advice on how to start a company. Additionally, he connected Stion to right people. In Howard's view, it "seems like he know almost everyone in Silicon Valley." Finally, Tom also acted as a coach and gave encouragement when necessary. Howard explained, "Tom was that steady hand so we wouldn't get freaked out about certain things." Not only do Tom and Howard have a good business relationship, they are also now good friends. Howard feels very strongly about the man, "it wouldn't be a stretch to say that I love the man."

One of Tom's connections led Howard to John Steinhart. Tom knew John through his Stanford network. John was the former director of Stanford GSB and now acts as a general management consultant. For Stion, John was paid⁶⁶ to be what Howard considers a "catch all consultant." John filled in many of the business holes to get the company up in running. This included getting the necessary facilities, writing the first employee handbook, securing insurance and advising on IP strategy. His network was vast and "if he didn't know (the solution to a problem), he would know who to call." Furthermore, John gave Howard confidence that Ultra Dots was not going to sue, a topic that consumed Howard for a brief while. "In the early stages (his impact) was tremendous. He helped accelerated everything," commented Howard. Currently he does not advise the company "because things are in place."

Howard believes that he requested and incorporated enough advice from these advisors. If anything, Howard thought that he "could (have been) more efficient in the advice I asked for. I now know better what kind of questions to ask." Howard is always looking for additional advisors. However, he mentioned that it is not about getting many advisors as possible, rather it is about "finding the right advisors." In fact, he believes

⁶⁶ John was paid in cash. No stock options were given for his work.

that there is “no shortage of people that are willing to take money from you for advice. The question is how worthwhile the advice is.”

Howard Lee’s Biography⁶⁷

Dr. Howard W. H. Lee is the Co-Founder and CTO of Stion. Dr. Lee has 27 years of experience in R&D and technology development in various scientific & technical fields such as nanotechnology, physics, chemistry, semiconductor device physics and fabrication, synthetic organic chemistry, materials science, photonics, optoelectronics, photovoltaics, optics, nonlinear optics, ultrafast phenomena, lasers, and atomic physics. He spent 13 years at the Lawrence Livermore National Laboratory leading the Advanced Photonics Materials Group and its research and development activities into nanostructured materials for a broad range of applications including Photovoltaics, All-Optical Switching & Signal Processing, LEDs, Displays, Solid State Lighting, Biotechnology, Nano-electronics, Nano-photonics and many others. Dr. Lee has also worked at the IBM Research Laboratory and The Aerospace Corporation, and has published over 80 scientific papers, given over 100 presentations, and served as doctoral research advisor for the University of California. He received a B.S. degree in Chemistry from Harvey Mudd College, a Ph.D. degree in Physical Chemistry from Stanford University, and holds 5 patents in nanotechnology, with 8 pending and others in progress.

⁶⁷ Taken verbatim from Frank Yang’s (Manager of Business Development for Stion) email on 3/9/07.

Timeline⁶⁸

2005

February 28th – Howard Lee left Ultra Dots

March – Called Richard about starting a new company

Early Summer – Brought in Tom as the new CEO

Late - Incorporated

2006

Early – Had 1st Term Sheet

Summer – Series A closes led by Khosla Ventures (Shieber, 2006)

November - Moser Baer Photo Voltaic of India takes 20%-ish stake in Stion (Childs, 2006)

⁶⁸ Constructed from the interview as well as other public documents

Appendix K: Surface Logix



Company Snapshot

Industry	Stage	Founded	# of Founders	Headquartered	Total Capital Investment	Current # of Employees
Pharmaceuticals	Product in Development	1999	4	Brighton, MA	\$82M	50 ⁶⁹

Interview Snapshot

Interviewee	Title	Experience	Interview Date
Carmichael Roberts	Co-founder & Ex-CEO	1 st Time Founder	12/1/06

Company Overview

Surface Logix's business strategy has morphed many times in its seven year history as the company grappled with how to commercialize the technology that came from Professor Whitesides' laboratory at Harvard University. Whitesides' patented surface engineering and soft lithography technology was potentially useful in a variety of different industries from the life sciences, electronics to the photonics industry. The company initially focused on the life science industry developing a product that would enable testing of human cells in the preclinical stage which would greatly speed up the drug screening process. It shortly became apparent to the Surface Logix that to take advantage of their core asset that they needed to develop drugs. Surface Logix is now a full fledged pharmaceutical company with portfolio of drugs in development. They have six drugs that have passed pre-clinical testing, four of which are currently in Phase 2

⁶⁹ As of the summer of 2005 when Carmichael left the company.

testing (Surface Logix, 2007).⁷⁰ Their core business strategy is to partner with larger pharmaceutical companies to develop and manufacture the drugs. Surface Logix is still private and has raised over eighty million dollars since inception.

Company Formation⁷¹

Carmichael Roberts first met his mentor, business partner and friend, George Whitesides, in 1995. Having just completed his PhD in organic chemistry from Duke University, Carmichael passed on industry offers to work in George Whitesides laboratory at Harvard University as a post-doc. Carmichael and George had mutual respect for each other during Carmichaels two years in the laboratory. The two stayed in touch after Carmichael left to join Union Carbide. It was partly based on George's encouragement that Carmichael left Union Carbide and joined MIT Sloan School of Management in 1998. One year into his program George propositioned the inspiring entrepreneur, "we could start a company." Thus, in the April of 1999 George Whitesides, Carmichael Roberts and two Harvard post-docs, Enoch Kim and Oliver Schueller, started Surface Logix with the idea of commercializing the surface engineering and soft lithography technology developed in George's laboratory. The company was kicked started by a 200,000 dollar investment by George and Carmichael (Lassiter & Roberts, 2005). Carmichael assumed the role of CEO.

Although this was Carmichael's first time founding a company, it wasn't George's first time. In fact this was George's fifth startup. He was a scientific advisor

⁷⁰Preclinical Testing. "A pharmaceutical company conducts laboratory and animal studies to show biological activity of the compound against the targeted disease, and the compound is evaluated for safety." These tests take approximately three and one-half years.

Phase 2 Development: "In this phase, controlled studies of approximately 100 to 300 volunteer patients (people with the disease) assess the drug's effectiveness and take about two years." (Wierenga, D., Eaton C.)

⁷¹ Unless explicated stated, all quotes and data for this section were taken directly from Nick Cravalho's interview with Carmichael Roberts (Roberts, 2006).

for Genzyme and founded GelTex Pharmaceuticals. Furthermore, George was an extremely connected person who seemed to know everyone in town. George's impeccable reputations and vast network were Surface Logix main assets in the early years. Carmichael cautiously leveraged these assets to find initial investors, business partners and customers. Commenting on these intangible assets, Carmichael said, "Whitesides said to me, here's a pile of business cards of people who are likely to be champions of this technology within their companies. It was a huge stack. We thought carefully about how to approach people (Lassiter & Roberts, 2005)."

Surface Logix secured 20 patents in the field of surface engineering and soft lithography from Harvard University. Surface engineering and soft lithography had previously been an academic curiosity. This would be the first time that a company would make a product out of the nano-technology. The potential applications were vast. Many industries were knocking on Surface Logix door to use Surface Logix technology to solve a particular problem they were having. The three main industries that were interested were life sciences, electronics to the photonics industry (Lassiter & Roberts, 2005). After a comprehensive study, Surface Logix elected to focus on life sciences segment. They believed that they could use their technology to create a tool for pharmaceutical companies to improve their drug development time. Basically, the idea was to take cells from humans and put them directly into assays to determine how drugs affect humans. Previously at this stage of development, pre-clinical, pharmaceutical companies needed to test their drugs on animals, which might react differently than human cells causing the company to either discard the molecule or advance it to Phase 1 and after millions more were spent to determine that the molecule was not effective.

After a few years of heading down the “tool kit” path, Surface Logix decided it would be best if they created drugs based on George’s technology rather than creating a tool that helped other pharmaceutical companies develop drugs. Carmichael brought in two pharmaceutical industry veterans, Paul Sweetnam and Stewart Campbell, to help develop a new strategy based on drug development. Carmichael attributes much of the success of transforming the company to these internal champions.

The underlying concept for the company in Carmichael’s opinion became more validated with each new hire and investor. He believed that if he could convince investors, employees and consultants that business concept was a good idea then he must be on to something. On the finance side, Carmichael raised 1.5 million dollars in February of 2000 from angel investors, most of whom were friends with George. Later that year Carmichael raised an additional 13.5 million (Lassiter & Roberts, 2005) and in November 2002 he raised 25 million from HBM BioVentures (Market Wire, 2002). In March of 2003 Carmichael stepped down as CEO and James Mahoney took over (Surface Logix, 2007-2). Carmichael remained active for another two years and left after he “believed the foundation of the company was in place.” He was confident that both the management team and business strategy were in place for Surface Logix to be successful. Carmichael has subsequently started up two companies, WMR and Nanoterra, with his friend and business partner George Whitesides.

External Advice⁷²

Carmichael’s identified external advisors are similar in many regards. All of them were introduced to Carmichael through George Whitesides. In addition, all of them

⁷² Unless explicated stated, all quotes and data for this section were taken directly from Nick Cravalho’s interview with Carmichael Roberts (Roberts, 2006).

are highly regarded in their field and lived in the Boston area during the development of the company. Moreover, all of them were Surface Logix investors and or were on Surface Logix's Board of Directors. Finally, all of his advisors wanted to develop Carmichael as a CEO. Commenting on the development role, Carmichael said, "they cared about their investment, but they also got a kick out of making sure that I was growing as this young CEO that has never done this before." Carmichael felt honored to have such influential and experienced advisors at his disposal. The five key advisors were Jerry Goldstein, Mike Loberg, Chuck Hartman, John Deutch and Joe Lassiter. Besides these advisors, Carmichael also said that he received valuable external advice from job candidates. During the interview process, Carmichael would ask them their thoughts on a subject to determine how well they thought on their feet as well as to get unique perspectives into problems he was trying to solve.

Jerry Goldstein and George Whitesides are good friends. Jerry is the CEO of the public company Advanced Magnetics where George sits on his board. Impressed by the Surface Logix team and technology, Jerry became one of Surface Logix's first investors. Carmichael built a relationship with Jerry and would often seek his advice on basic business issues like managing people and the investors. Furthermore, he also gave Carmichael strategic advice but didn't "advise on the details." As a public company CEO, Jerry gave unique perspectives that Carmichael valued. Carmichael believed that his biggest impact was his investment strategy advice. He often stressed to Carmichael to use angel investors first, which was advice that Carmichael followed. Carmichael and Jerry have moved beyond just a professional relationship and now have a true friendship.

They meet roughly once a quarter typically over Chinese food to talk shop and get caught up on each others life.

Mike Loberg acted as a CEO coach to Carmichael. As the CEO of a venture backed firm, Nitromed, Mike had a solid understanding of what it took to be a successful startup as well as had a good understanding of the venture funding process. They would meet about once a quarter to discuss industry related issues and personal development topics. Surface Logix's Board of Directors was comprised of many influential but also strong willed people. Mike would help Carmichael with strategies to deal with the board. However, his biggest impact in Carmichael's opinion was "shaping me so I would be less likely to fail. My job as a startup CEO is to make sure that there is a foundation and the people, including the investor base and those that advise the company, support it." In a testament to how much Mike believes in Carmichael, Mike has also invested in WMR, Carmichael's latest startup.

Chuck Hartman, a venture capitalist from the firm CW Group, invested his own money in Surface Logix and sat on the Board of Directors. He provided many insights on what venture capitalists valued and what business ideas they perceived as "backable." Commenting on his unique insights into the exclusive industry Carmichael said, "I got the advice of the VCs but with an angel investor." In addition to the specific investment advice, Chuck also helped develop Carmichael as a startup CEO and led CW to invest in the Series A financing. Carmichael maintained a friendly relationship with Chuck up until Chuck's untimely death in 2005.

John Deutch's resume is impressive. He is an institute professor and former provost at MIT. In addition, he sits on the board of Citi Group and Schlumberger. To

top that off, he is the former director of the CIA. It is no surprise that John thinks big. Most of his advice was aimed at helping Carmichael see the bigger picture and forcing him to recheck his assumptions if they were “too small.” At the same time, he understood that sometimes going big was not advantageous. John also took time to help develop Carmichael as a CEO. John was introduced to Carmichael by one of his best friends, George Whitesides, and invested in the company and sat on the Board of Directors.⁷³ Commenting on John and the rest of the Board of Directors, Carmichael said, “they would encourage, push and were tough. I don’t want to give you a sense that there was a nurturing environment. They genuinely liked me a lot and still do. That had nothing to do with it. This is business and time was precious and they were going to give me advice direct unfiltered, not sugar coated. The board meetings were tough” At the same time, they also gave Carmichael encouragement by saying, “you can do it.”

The final identified influential external advisor was Professor Joe Lassiter. Joe, a Professor at the Harvard Business School (HBS) who teaches a very popular Entrepreneurial Marketing class, was introduced to Carmichael by George Whitesides. “He is an educator. He is committed to getting young people to think and to grow,” said Carmichael describing Joe. After multiple investor pitches from Carmichael, Joe finally agreed to invest in the company. As he was writing the check he told Carmichael, “I don’t want you to think that I am investing in your company because I believe in your business plan per se. Because I don’t get it. This has to be one of the more squirrely things I have ever done. I am betting on George and I am counting on you to figure this thing out.” After that ominous start, Joe and Carmichael quickly developed a personal relationship. They would meet about once a quarter typically at the HBS café where

⁷³ John Deutch no longer is on Surface Logix Board of Directors.

Carmichael would spend the first third giving a company status update and Joe would spend the next two thirds of the time giving advice to help Carmichael develop as a CEO. Joe would give market and general strategy advice and give Carmichael material to read. Reflecting on the relationship, Carmichael noted, “he put more into our relationship, helping me develop as a young man trying to do this than help his money.” He would ask Carmichael, “what are you learning? How are things going with the board? How much time are you getting from these individuals.” Joe and Carmichael still stay in touch. Carmichael comes in every year to Joe’s class to add insights into the Surface Logix case in which Joe prepared a few years earlier.

Reflecting on his experience, Carmichael believed that he requested the right amount of advice from these advisors. He was very cautious about how often to ask for advice because he knew how valuable these advisors time were. However, Carmichael did note that if he had a chance to do it all over again, he would have sought advice from friends with business experience. He said that it would have been nice to have some impartial advice from people that knew his personality and values.

Carmichael Robert’s Biography⁷⁴

Dr. Carmichael Roberts is a long-time commercial and scientific collaborator of Dr. George Whiteside at Harvard University. In 1999, Dr. Roberts and Dr. Whitesides co-founded Surface Logix, a drug optimization company, and more recently, WMR Biomedical, a medical device company. Dr. Roberts has served in an executive capacity for both of these companies.

⁷⁴ Taken verbatim from Nanoterra’s website (Nanoterra, 2007)

Before starting his career as an entrepreneur, Dr. Roberts worked in business development at GelTex Pharmaceuticals, Inc., where he contributed to the design of business development strategies for the company's pre-clinical product line aimed at fighting infectious disease and obesity. Prior to GelTex, Dr. Roberts was responsible for new product and business development at Sentry Products, a life science venture wholly owned by Union Carbide Corporation (now Dow Chemical). While at Sentry Products, Dr. Roberts was an instrumental member of a group that developed several chemical-based technologies used in launching products like Pfizer's Procardia XL and Boston Scientific's balloon catheters.

Dr. Roberts serves on the advisory boards for MIT's Deshpande Center for Innovation, Harvard's Nanoscale Science and Engineering Center, and Dukes' School of Biomedical Engineering. In 1999, he was named by MIT's Technology Review Magazine as one of the world's top 100 young entrepreneurs.

Born in Queens, New York, Dr. Roberts received his B.S. and Ph.D. in organic chemistry from Duke University and was a National Science Foundation Fellow at Harvard University's Departments of Chemistry and Chemical Biology. He also earned an M.B.A. from the MIT Sloan School of Management.

Timeline⁷⁵

1999

April – Company founded

October – Listed on MIT's Technology Review's Top 100 Entrepreneurs Under 35. (Technology Review, 1999)

2000

February – Ed Hotard, Chuck Hartman & John Deutch join the board of directors

February – Raised \$1.5M from angels (Series A)

May – hired 3 scientists from Whiteside's lab, Scott Cannizzaro & Lisa Gordon

June – Carmichael graduates from MIT Sloan

Late – Raised \$13M in venture funding (Series B)

2002

November – Raised \$25M in Series C venture funding (led by HBM BioVentures)

2003

March – James Mahoney takes over as CEO

2005

Summer – Carmichael leaves the company

⁷⁵ Constructed from the interview as well as other public documents

Appendix L: Tropos Networks



Company Snapshot

Industry	Stage	Founded	# of Founders	Headquartered	Total Capital Investment	Current # of Employees
Wireless Networking	Shipping Product	2000	4	Sunnyvale, CA	\$41.8M	103 ⁷⁶

Interview Snapshot

Interviewee	Title	Experience	Interview Date
Christian Dubiel	Co-Founder & Former VP of Bus. Dev	1 st Time Founder	1/10/07
Ron Sege	CEO	N/A	1/11/07

Company Overview

Imagine a world where one can get internet access anywhere, anytime. Tropos is not only imagining it, but they are already making it a reality. Tropos is a pioneer in metro wireless mesh, which enables an entire city to have internet coverage using the same wireless network. Using a standard wireless modem that comes with most laptops, users can pay a fee to a third party (typically an ISP) to get internet access anywhere in their city. For example, they can surf the internet from their house, their favorite coffee shop or even their car all using the same Tropos enabled network.

Tropos is the backbone to the city-wide internet network. They provide the hardware and the software algorithms that route data from the central server to the end customer. To build out the network, roughly 30 routers are added per square mile where one tenth of the routers are connected directly to a central server. The routers transfer data to nearby routers until reaching the end customer. This “meshed” network

⁷⁶ As of the end of 2005.

architecture is highly scalable and very reliable. In addition, it is one tenth the capital cost and eight percent of the operating cost of the competitive city wide network architecture, the 3G cellular network. Since 2002, Tropos has had over 500 world wide deployments, which is greater than all of their wireless mesh competitors combined. They are signing up small cities and big cities alike. Recently, they became the equipment supplier of choice for Philadelphia, New Orleans, San Francisco, Atlanta and Houston (Tropos, 2007-2).

Company Formation⁷⁷

Devabhaktuni Srikrishna (Sri) and Narasimha Chari wanted to bring the broadband internet access to developing countries. Since these countries didn't have a wired infrastructure to work with, Sri and Chari determined that their solution would have to be wireless. After researching existing techniques in derivative fields, they determined that using a meshed architecture had possibilities. Furthermore, they also saw the potential of a scalable wireless network in many for profit industries.

A mutual friend who went to Caltech with Sri and Chari introduced them to Christian Dubiel and Jonathan Goldenstein whom the mutual friend knew while working as a venture capitalist at Globe Span. Christian, a principle at Boston Millennia Partners, and Jonathan, who worked a McKinsey and JAFCO America Ventures, were both interested in starting a company and were currently evaluating a couple of possibilities (Lassiter, 2006). After the four met in the summer of 2000, it was clear that they "got along very well and complimented each other." The four decided to start the company with Sri and Chari focusing on developing the technology and Jonathan and Christian

⁷⁷ Unless explicated stated, all quotes and data for this section were taken directly from Nick Cravalho's interview with Christian Dubiel (Dubiel, 2007).

focusing on developing the business. Shortly thereafter the team incorporated as FHP Wireless and moved from Boston to the Silicon Valley because as Christian said, “we are opening ourselves up the network effect and the openness towards start-ups (Ong, 2003).” Chari reiterated, “we saw the West Coast as being the nexus of innovation. It offered access to venture capital, engineering talent, other entrepreneurs, and other technology companies (Lassiter, 2006).”

“(The idea) was really driven by a core set of routing algorithms that were elegant and specifically designed to address some of the shortcomings of wireless networking,” Christian commented on the core technology. The first decision for the team was to determine what wireless architecture to base the technology on. They considered 802.11, cell networks like 3G and Blue Tooth. After a few brainstorming sessions, the team decided that the Ethernet standard (802.11) was the right platform because it was an open standard based on a robust and proven design and that some laptop manufacturers were already planning on incorporating 802.11 compatible hardware. The team envisioned a world where all computers had the cheap 802.11 hardware. They thought if they could just build the network, then they would already have enabled potential customers.⁷⁸ The team gained great confidence in their technology when they would talk about the idea with technical experts and those that had tried something similar in the past. A defining moment came when the founding team met with Mike Framwald, a venture capitalist from Skymoon and former CTO of Semiconductor Company. Mike recently tried something similar but couldn’t get over a technical roadblock. He was amazed that Sri and Chari found a way around it.

⁷⁸ This is directly opposite to the cell manufacturers’ philosophy of build the network, then acquire the customers.

Although they had great confidence in their technology, their biggest concern was finding a market for this unique technology. They initially looked at three markets, the carrier market, the ISP market and the enterprise market. The carrier market just spent 100 million dollars to buy the 3G spectrum so the carriers were not willing to invest in creating a competing network. After the “dot.com” crash the ISPs were struggling and didn’t have the capital to invest and were too busy just trying to stay afloat. Finally, the enterprise market initially looked attractive because of their need was strong and their pockets were deep. Unfortunately, “the value proposition for our stuff was not that clear since they were already well wired.”

Tropos was determined to find a market. They would chase almost every lead. One of those leads led them to the San Mateo Police Force. The police were looking for ways of getting internet access to their patrol officers. Each patrol officer had a laptop in their car so all they needed was a robust network. In late 2002 Tropos reached an agreement with the police force to blanket most of the city with wireless internet. Tropos then started to focus on the public safety market. Once cities became aware of the advantages of the Tropos network, they then began inquiring about blanketing their entire city not just for the benefit of the public safety groups but for the benefit of all citizens. Thus, after their first city wide customer, Chaska, Minnesota, the company focused all its efforts on creating a Metro Scale wireless market. Commenting on the difficulty of creating this new market, Christian said, “(It was a) path of incrementally making a market. You start out with a small city then have people see the light then eventually people become believers.”

Christian left Tropos at the end of 2003. He felt like all the pieces were in place for the company to succeed. The company had a VP of Engineering, a VP of Marketing and the CEO search was well underway. Furthermore, he believed that both the technology and the marketing strategy were in place. Commenting on his departure, Christian noted, "I really enjoyed the early part – dealing with uncertainty, positioning yourself in the market. Once we got to a point where we had a team, we had a market, we had validated product then it is much more about execution. It is an interesting challenge, but is a different challenge. I wasn't ready to commit to it just yet." During his tenure at Tropos, Christian spent most of his time raising money. He and his team raised 1.5 million dollars Series A in January 2001 led by Boston Millennia, 3.0 million dollars Series B in January 2002 led by Benchmark Capital⁷⁹ and 13.4 million dollars Series C in June 2003 led by Voyager. (Lassiter, 2006) In the end, Christian believed that it was the right time for him to step down and start another company. Christian is now the founder and managing director at Kingfish, a San Mateo, California startup focusing on linking senior advisors with venture capital firms, corporations and consulting firms. (Kingfish, 2007)

Early Stage External Advice⁸⁰

"When you are a first time entrepreneur there is so much that is new that having someone that has been there before saying, 'hey, it is always this messy' I found it very helpful." – Christian Dubiel, 2007

All four founders were first time entrepreneurs and didn't have an extensive advisory network to select from. Thus, most of their identified influential advisors were hired consultants that offered both general and specific advice. Christian Dubiel

⁷⁹ Tropos was one of only two Benchmark investments in 2002.

⁸⁰ Unless explicated stated, all quotes and data for this section were taken directly from Nick Cravalho's interview with Christian Dubiel (Dubiel, 2007).

identified four advisors as being instrumental in developing the company. The core four advisors were a CEO coach (Randy Komisar), a marketing consultant (Leslie Latham), a technical advisor (Jim Omura) and a market strategist (Tom Kippola). In addition to the core advisors, Christian also mentioned that the team had additional technical advisors that gave insightful advice and a project management consultant that introduced the company to some innovative ways of developing products.

As soon as the company moved from Boston to Silicon Valley in the beginning of 2001, Christian started his search for a general advisor to his company. A friend of a friend, Thi Thumasathit, introduced Christian to Randy Komisar⁸¹ who was an advisor to one of Thi's venture capital backed companies. After learning that Randy was the "virtual" CEO at WebTV and the author of the book *The Monk and the Riddle*, Christian asked Randy if he could advise his company. Randy agreed and in consideration for his efforts, he accepted equity instead of cash. Randy and the entire founding team would meet weekly where they would discuss "a large spectrum of things." Randy advised Tropos on strategic and operational issues, including hiring, marketing and funding strategy. Equally as valuable, Randy gave the team access to his vast network, which "opened a bunch of doors for us that we wouldn't have had opened otherwise." Not only did the introductions to VCs and technical advisors open doors, but also having Randy's name associated with the venture it give the team reflective credibility which helped them get initial meetings with customers and investors. Finally, Randy also acted in a "coaching role." He gave the founders confidence that they needed when going through difficult times. Christian found it helpful to have someone say,

⁸¹ Randy is now a partner at Kleiner Perkins (Kleiner Perkins, 2007)

“hey, it is always this messy.” Randy left after one year of service because the team grew after the Benchmark funding.

One of Randy’s introductions was to Leslie Latham. Leslie has made a career out of consulting startups on sales and marketing and worked with Randy at a previous startup. Like Randy, Leslie only worked part time and received equity instead of cash. Leslie basically acted as a VP of Marketing setting marketing and sales strategy. In particular, she advised the team on how to get customers and how to set a fair price. Although she only advised the company for six months she did make a lasting impact. With her assistance the sales and marketing effort was “kicked started” and the feedback from initial customers was fed back into the company. She also stopped advising when Benchmark capital invested in the company.

One of the co-founders, Jonathan Goldenstein, had met Jim Omura at a venture capital event a few years back. Jim, a Professor at UCLA and former founder of Cylink, was an expert in spread spectrum, which the technical founders wanted to better understand. During his weekly visits Jim and the founding team would brainstorm possible solutions to technical problems like wireless security. If the technical team and Jim couldn’t solve a particular problem, he would connect the team to the right technical people. He was well connected in the valley and “his involvement provided a degree of credibility.” In addition, Jim instilled confidence in the young technical founders by “reinforc(ing) that they were heading in the right direction.” Jim was an active advisor during the first year but once the team got over the technical hurdles his advice wasn’t as necessary. Like both Leslie and Randy, Jim received equity as consideration for his valuable and frequent technical advice.

Voyager led the Series C investment in Tropos in June 2003. Soon after, Voyager introduced Tropos to Tom Kippola who wrote the book “Gorilla Game” and was a partner at the Chasm Group. Tropos paid Tom directly for his services which lasted about two months in the middle of 2003. Tom used the “Crossing the Chasm” framework, which was authored by Geoffrey Moore, to create a marketing strategy for the young firm. His impact was significant. He recommended that the company focus exclusively on the metro wireless market. The company followed his recommendation and stopped all efforts on the other markets it was exploring. The sales team that was originally brought in to work the enterprise market was shortly thereafter fired when it became apparent to the management team that they could not sell into the new market. “Having a framework forced things to be black and white,” noted Christian. It ended a major debate that had existed within the organization over the previous year. Commenting on the value of the framework, Christian said, “if you have a startup and you don’t have anyone on the team that has gone through picking an initial market, it is very valuable.”

Going through the founding experience for the first time, Christian took home many lessons learned that he has and will apply to his next venture. First, he would have had more of a flexible arrangement with his advisors. Initially, he had the advisors come at a fixed interval. Often the work load and the advice required did not match the on-site visits. Instead, he would have arranged more of an ad-hoc arrangement saying to the candidate advisor, “these are the areas that I have needs that I think you would fit. As needs flare up, I would like to take your time.” Secondly, he was pleased by his and his team’s attitude toward advice saying “(we) knew what we didn’t know.” This humble

attitude allowed him to actively seek advisors that could help fill the identified holes in the team's portfolio of knowledge. Thirdly, he now understands that advisors are so much more than advice givers, they can give confidence and encouragement, "surrounding yourself around people who have seen that before and can tell you 'hey you are doing great.' 'Keep on going.' Or, 'you know what I tried that it didn't work and here is why' can be quite helpful." Fourthly, he points out that an entrepreneur should not rely on the advisors for answers to their problems. In his view, advisors are a sounding board and can give a good decision making framework to consider but "people who want to rely on outside advisors to give them the answer to something are generally going to be disappointed because what they are going to realize that the outside advisor inherently doesn't know as much about your business than you do cause you are doing it 24/7." Finally, Christian learned that advice is great, but at the end of the day, it is up the entrepreneur to make the final decision - a decision that he is going to have to live with and take full responsibility for.

Later Stage External Advice⁸²

"There is a direct correlation between the breadth of use of advisors and the success of the company." - Ron Sege, 2007

Ron Sege became Tropos' CEO in the beginning of 2004. Having run parts of 3COM and Lycos, Ron was actively looking to lead an exciting startup. At the same time, Tropos was transitioning from the development stage to the commercial stage so "the Board (of Directors) decided that it was time to bring in a more seasoned manager." Commenting on why he decided to join the company Ron mentioned, "I saw this (company) as an interesting bet in what I saw as a promising market opportunity, which

⁸² Unless explicated stated, all quotes and data for this section were taken directly from Nick Cravalho's interview with Ron Sege (Sege, 2007).

is mobile broadband. (There was a) good group of people, who were really smart and were doing some unique stuff. I liked the board and they had a good set of advisors. It was very similar to movies I have seen before.” Ron’s first order of business once he took over the reins of the company was to put in a basic infrastructure. He put systems and processes in place, filled out the management team and instilled discipline that was lacking.

Ron estimates that he has 25 – 30 advisors and that he is “quite reliant on (his) advisors and (their) advice.” In his opinion, “there is a direct correlation between the breadth of use of advisors and the success of the company.” Ron’s advisory portfolio is comprised primarily of his friends, Board of Directors members, customers and paid consultants. He not only reaches out to these individuals for advice, but also he uses the act of seeking advice to “engage somebody in bringing them around to your point of view because that is how you create buy-in (and) establish yourself in the marketplace.” Elaborating on the last point, Ron mentioned, “Ironically, I found that the more you reach out to people seeking their advice, talking things through and admitting you don’t know everything perversely enhances your reputation.” Ron categorizes his advisors into: people advisors, disciplinary advisors and strategic advisors. Once he has categorized an advisor, rarely will he ask that advisor for advice on a topic outside that advisor’s specialized expertise.

When Ron first started out in his career he rarely used advisors. He “viewed seeking advice as the admission of defeat.” Even though he is now more experienced, he uses many more advisors and uses them more freely than he did earlier in his career. One reason for the expansion of the number of advisors is because what he believes is the

network effect of advisors – one advisor introduces him to another potential advisor and so on until the advisory network is sufficiently large. In addition, Ron thinks that advice seeking is not only experience independent, but it is also company stage independent. In fact he believes that “advice is more valuable later than earlier because companies only increase in complexity as time goes on.”

One of the only key requirements in the advisor/advisee relationship in Ron’s opinion is trust. Trust is required because of the sensitive nature of the information being shared. The ramifications for the advisee could be significant if the private information shared to the advisor was leaked. Ron believes that trust can be either earned or bought. “(If) you hire a lobbyist (or consultant) and you pay them then they are trustworthy,” whereas a friend or colleague’s trust is earned throughout the years through many interactions. Both the paid consultant and the friend are personally motivated not to disclose information because the consequence of their actions is the end of their relationship. If they value the relationship, they will not break the trust. However, Ron also takes precautionary steps to assure that his valuable information does not get out to his competitors, “you talk about something very specific. When you do that it is difficult for them to put the pieces together in anyway that is meaningful.” In addition, he tries to get advisors that cut across disciplines, “if you use only advisors from your immediate industry then they would be much more likely to use your information elsewhere.”

Not only does Ron receive advice, but he also actively gives it. He was a former Chairman of the Board of Directors for the New England Chapter of Junior achievement. Recently, a friend of Ron’s asked if he could advise 3 founders of a mobile startup. Ron accepted and advises the startup primarily on general strategy. He doesn’t get any

compensation for his advice nor is he an investor in the company, rather he does it because he wants to give back for all the advice that he has received in his career.

Christian Dubiel's Biography⁸³

Christian has played a leadership role driving corporate strategy and business development activities for Tropos Networks since the company's inception. Prior to Tropos Networks, Christian was a Principal at Boston Millennia Partners, a leading Boston-based venture capital firm with over \$750 million in committed capital. At Millennia, Christian led investments in several companies developing telecommunications software and infrastructure products.

Christian holds a Bachelor of Science in Mechanical Engineering from Stanford University.

Ron Sege's Biography⁸⁴

Ron Sege is President and Chief Executive Officer of Tropos Networks. He has over 20 years of experience managing high-growth businesses in the networking industry, bringing exceptional business acumen and an exemplary track record of leading businesses through remarkable growth to Tropos.

Prior to joining Tropos Networks, Mr. Sege was CEO of Ellacoya Networks, which develops intelligent bandwidth management products for broadband access providers. While at Ellacoya, Mr. Sege oversaw the successful repositioning of the company and its products from the CLEC market segment to the incumbent carrier space, with carrier customers and partners in the Americas, Asia and Europe. As a result, Ellacoya raised \$14 million in venture funding during the toughest fund-raising

⁸³ Taken verbatim from the Stanford Case on Tropos Network (Ong, 2003)

⁸⁴ Taken verbatim from Tropos Networks' website (Tropos, 2007)

environment in memory. The company was recognized with numerous awards including Network Outlook's Investor's Choice Award in 2001 and 2003, and Mr. Sege was named a Mass High Tech All Star and an Ernst and Young Entrepreneur of the Year Finalist. Before Ellacoya, he served as President of U.S. Operations for Terra Lycos. At Lycos, Mr. Sege was responsible for generating significant traffic growth and consolidating a series of acquisitions into the "Lycos Network." Prior to joining Lycos, he spent 10 years at 3Com Corporation, most recently as Senior Vice President of one of three business units within the \$6 billion revenue company. In this role, Mr. Sege led the transition from point products to integrated customer solutions, resulting in a 10-fold growth in revenue and securing 3Com's position as a market leader in enterprise networking. He successfully integrated nine acquisitions, helping grow the company dramatically in an extremely competitive industry. Before joining 3Com, Mr. Sege worked for ROLM Corporation through its acquisition by Siemens.

Mr. Sege holds a bachelors degree from Pomona College and an MBA from Harvard Business School. He is a past Chairman of the Board of Junior Achievement of New England and of the Massachusetts Telecommunications Council.

Timeline⁸⁵

2000

June – Founding team started working on the venture full time

September – Had a working prototype

October – Incorporated as FHP

2001

January – Series A funding (1.125M for Boston Millennia & 475k from friends and family)

Early – Moved from Boston to Silicon Valley

~January – December - Randy Komisar advises the company

July - December – Leslie Latham advises the company

2002

January – Series B funding, \$3.1M led by Benchmark

Early – Dave Hanna becomes the CEO

Late – San Mateo Police Department signs up for a test pilot

2003

Early - Changed name to Tropos (Greek – “the method” or “the way”)

June – Series C Funding, 13.4M led by Voyager

September – 1st customer shipment

End of Year – Christian leaves the company

2004⁸⁶

January – Ron Sege joins as CEO

⁸⁵ Constructed from the interview as well as other public documents

⁸⁶ The Timeline stops in 2004 when Christian leaves and Ron Sege joins the company.

Appendix M: Thesis Timeline

Topic and Advisor Exploration	<i>March – May 2006</i>	I met with 8 potential advisors before selecting Professor Burton. It took me some time to determine what I wanted to study. Once I had a topic of interest, I had to find an advisor with a similar interest and one with which I thought I could have a good working relationship with.
Proposal Refinement	<i>June – Aug 2006</i>	Once I had a rough idea of a topic and had a preferred advisor, it took me some time to narrow the scope of the thesis and to write the proposal. Furthermore, during the summer I took a class and was working full-time so I didn't have as much time to dedicate to the thesis.
Proposal Signed	<i>September 10, 2006</i>	Professor Burton signed the final proposal. Now the fun begins! For the entire fall term I allocated exactly 6 hours per week for my thesis. This was in addition to the five, 12 credit classes that I was taking. My target was to complete the thesis in the spring term so I did not want to set any progress-based milestones.
Preliminary Research	<i>Sept – Oct 2006</i>	During this time I researched the topic and potential companies to interview. I created an excel document that listed each potential company with relevant data (market, product, funding, founding date and team, etc.). The cases were selfishly selected. Most of the 40 target companies were startups that I was interested in working for after graduation. Thus, by researching the companies for my thesis, I was also conducting career research.
Interview Guide Design	<i>October 2006</i>	It was imperative that the interview guide was written just right. I worked closely with my advisor on the design of the guide. It took about two weeks and three iterations to finalize the guide.
Interview Set-up	<i>Oct – Dec 2006</i>	One of the most time consuming processes was setting up the case interviews. Founders are extremely difficult to get a hold of. It took multiple emails to get a response then an additional few emails to find a time that worked with both my busy fall schedule and their crazy schedule.
Thesis Interviews	<i>Nov 2006 – Jan 2007</i>	Each interview took between 50 and 100 minutes. This does not include one to two hours of commute time. After each interview I sent a thank you note.

Case Facts	<i>Jan – Feb 2007</i>	After each interview I wrote up the facts from the case. This included exact quotes from the interviews as well as other observations. The facts were then sent to the interviewee for approval. The facts from each case needed to be approved or else I could not use the data. It sometimes took three emails and two weeks before the facts were approved. Since I was ahead of schedule, I waited for approval before writing the case narrative. Over fifty percent of the founders added more detail to the case facts and/or clarified some of the facts, which improved the quality of my case narratives – yet another reason to wait for approval of the case facts.
Case Narratives Write-ups	<i>February – March 2007</i>	Once the facts were approved, I created a 4-7 page case narrative that include a company overview, company formation and the interviewee use of external advice. On average it took between 4 and 7 hours to write up each case. All said, each case took about twelve hours. Multiple that by eleven cases, you get 132 hours for just the data collection portion of the thesis. My thesis advisor edited and approved each case piecemeal. The final case was sent to the respective company for their input (approval was not necessary since they approved the case facts). The final case write-ups went into the appendix of this thesis.
Data Analysis	<i>March 2007</i>	Creating a database and analyzing the data took about 30 hours worth of work. In total, over 40 tables and over 15 graphs were created in excel to help digest some of the data.
Writing (non-case)	<i>Feb – April 2007</i>	I started writing early since I didn't want to write the entire document at the end. Thus, I wrote the data methodology and analysis methodology section before completing the analysis. After the analysis I wrote the introduction and conclusion. Lastly, I wrote the abstract and acknowledgement sections.
Edits	<i>April 2007</i>	I sent the entire document with final formatting to my advisor for her review. I took her inputs and rewrote some sections before deeming the paper complete.
Signatures	<i>April 2007</i>	After reviewing the final version of the thesis, both Pat Hale, the SDM director, and Professor Burton signed the thesis.
Printed	<i>May 2007</i>	Printed 3 copies of the thesis on acid free paper for safe storage at the MIT library.
Submitted	<i>May 2007</i>	Done!

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