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The Early Environment and Schooling Experiences of High-Technology Entrepreneurs: Insights for Entrepreneurship Education

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Abstract. How do we prepare current and future generations of learners to anticipate, recognize, and act on high-technology opportunities so that they can join the ranks of future entrepreneurial leaders in our nation's emerging knowledge-based and technology-oriented economy? As one of the natural first steps in addressing the above questions, this study investigates for existing high-technology entrepreneurs the motivations, influencing factors, and obstacles encountered during their youth and early adult years. The authors developed an extensive survey instrument to probe the desired information, and the study's data was collected from a random national sample of 1,001 owners/founders of high-technology businesses with under 200 employees. Major findings are reported with respect to age of initiation; time from idea to action; key trigger events, reasons, and other factors influencing the high-technology venture initiation decision; best sources of preparation; and insufficient education as a major obstacle theme. The findings suggest an important potential role for education in general and entrepreneurship education in particular. One potential strategy recommended is to craft cross-cutting educational partnerships that carefully blend entrepreneurship education, technology content-specific education, and high-technology venture experience at both the high school and college levels.

Key words: high-technology, entrepreneurship, entrepreneurship education, early influences, national survey

1. Introduction

During the twentieth century, the United States transitioned from an agrarian economy to one of the world's leading industrialized nations. As we enter the twenty-first century, we are witnessing another major transformation that is well underway – the ever-deepening tilt of the U.S. towards an economy that ultimately will be driven primarily by technology and knowledge. It will be the norm for the infrastructures of new consumption products and new production approaches to be based routinely on the creation of new technologies and/or the innovative applications of existing technologies. Consequently, the success

of many ventures will depend increasingly upon how well they leverage opportunities in the technology domain. How do we prepare current and future generations of learners – from kindergarten through college and graduate school – both to recognize and to anticipate high-technology opportunities; and how do we endow these same learners with improved capacity for acting on such opportunities so that they can join the ranks of future entrepreneurial leaders in our nation's emerging knowledge-based and technology-oriented economy? What kind of early experiences do they need and when? How can individuals have access to these experiences and to the insights they provide for overcoming obstacles to entrepreneurship?

One of the natural first steps in addressing the above questions is to investigate the early environment and schooling experiences of *existing* high-technology entrepreneurs to ascertain what early elements were perceived to be important to their becoming high-tech entrepreneurs. In order to probe some of these key antecedent factors for technology entrepreneurship, the authors developed an extensive survey instrument and commissioned the Gallup Organization to collect the study's survey data from a national sample of 1,001 entrepreneurs in high-technology businesses. The results then were analyzed to explore the major early influences that appeared to encourage and prepare the sampled high-tech entrepreneurs to launch new businesses – with a view towards their implications with respect to the potential strategic role(s) of entrepreneurship education.

Technology has been one of the fastest growing sectors in the economy of the United States over the past few decades. A large number of new technology ventures were started to take advantage of business-to-consumer and business-to-business e-commerce opportunities. Changes and advances in various technology segments such as personal computers and digital assistants, microprocessors and integrated circuits, memory and storage devices, the software application industry, computer and peripheral manufacturing, telecommunications and networking, the Internet and the World Wide Web, and biotechnology created exciting possibilities for an array of new businesses and also for the expansion of existing businesses. In addition, major developments in the nation's technology infrastructure provided businesses with enhanced platforms from which to compete both in domestic and in global markets that were (and are) being transformed by technological innovation.

Although growth in the technology sector has slowed in recent years, there are still ample opportunities for initiating new high-technology ventures. Such technology-based start-ups will continue to be a major contributor to economic growth in the U.S. economy. Given this context, coupled with the intrinsic excitement generated by evolving technology and its applications, it should not be surprising that many youth and young adults are showing increased interest in starting high-tech businesses. They have grown up using computers and communication devices, sending e-mail, searching the Internet, installing and

learning new software, scanning documents and images, creating web pages, and using various types of new wireless and personal digital assistant technologies. These budding entrepreneurs have had substantially more exposure, education and training than past generations with respect to the use of technology. Perhaps most important, there are many role models and success stories in the form of high-tech entrepreneurs who have launched new businesses. Apple Computers, Microsoft, Intel, Sun, Oracle, Cisco, Dell, and AOL-Time Warner are but a few of the now major companies whose creation started from ideas in the heads of young entrepreneurs interested in the technology sector.

This study builds directly on previous survey studies of youth and entrepreneurship (Walstad and Kourilsky, 1999; Kourilsky and Walstad, 2000). These earlier investigations focused primarily on the entrepreneurial views of youth and young adults, with an emphasis on the key knowledge, skill, and attitudinal factors that youth and young adults thought would affect their interest in and preparation for starting a business *in the future*. The thrust of this new study essentially reverses the vantage point. Entrepreneurs – in this case, high-technology entrepreneurs – were interviewed to discover what they thought most contributed to their interest in and preparation for starting a business *in their past*.

2. Survey Development

The basic goals of the study were to discover what early influences on current high-technology entrepreneurs stimulated their interest in technology entrepreneurship, what major factors supported and prepared them for their decision to launch a new venture, and what significant obstacles they had to surmount. These goals were pursued through the development and administration of a targeted survey to a large national sample of technology entrepreneurs. The survey questionnaire was developed by the Kauffman Center for Entrepreneurial Leadership (Ewing Marion Kauffman Foundation) and the National Center for Research in Economic Education (University of Nebraska-Lincoln). It was subjected to five review and revision cycles to optimize its final form. Survey specialists at The Gallup Organization also reviewed each draft and checked each question for content and construct clarity, potential word bias, and suitability for use with the target sample.

The survey items included a range of questions designed to obtain information on the initial thinking and preparation of high-technology entrepreneurs during their youth and young adult years. The investigation of several major topics/unknowns shaped the specific content of the survey items. First, more understanding was pursued of the age at which current high-tech entrepreneurs first thought about starting a business and how long it was before

they acted on their initial dreams. Second, questions were asked about the value of education and skills in preparing these individuals for their decisions to venture into high-tech entrepreneurship. Third, questions also probed other sources of inspiration for embarking on technology entrepreneurship, such as work experience, family members, and role models. Fourth, information was sought on what these entrepreneurs thought were the major barriers and obstacles to starting their businesses. The survey contained a total of 30 questions, covering these topics as well as background characteristics of the survey sample.

The target population for the study was the universe of owner/founders of high-tech businesses, but with one qualification. The sizes of the businesses were limited to those with less than 200 employees. This constraint weighted the sampled businesses away from those that might be classified as large businesses or corporations – and skewed the sample towards businesses more in their formative stages of entrepreneurial development.

The term "high-tech" also had to be carefully defined to select the survey sample because there is no universal definition of a high-tech business. For this study, high-technology businesses were defined as those businesses with Standard Industrial Classification (SIC) codes in one or more of the following areas: (a) computer software (7374-7379); (b) electronic computers and related equipment (3571, 3572, 3575, 3577, and 3578); (c) computer hardware and development (8731.0203); (d) electronic components (3671, 3672, 3674, 3675, 3676, 3677, 3678, 3679); and (e) telecommunication (4813).

Gallup began with a business list acquired from Dun and Bradstreet (D&B). The D&B database is known to be a comprehensive, highly reliable, and accurate resource that spans the national business population and provides a variety of business information including SIC codes, number of employees, year business was started, annual revenue, name and address of the business, and a telephone number. For the selection of the study sample, companies that met the specified characteristics of SIC code and employee size (with an additional constraint on year started) were chosen randomly from the list. Each telephone number was then called up to five times to reach the owner of the business to complete the survey.

The surveying was conducted by trained and experienced executive telephone interviewers employed by Gallup in spring, 2001. These interviewers were briefed prior to full-field implementation specifically to prepare them for this survey. As part of Gallup's standard operating procedure, ten percent of the interviews were also monitored and validated by survey supervisors. Survey responses were entered into the computer at the time of survey administration. All open-ended questions were coded and edited by Gallup personnel who specialized in interpreting and tabulating open-ended responses. The response rate was 30 percent of the total potential respondents, a rate comparable to those reported by other professional organizations

conducting survey research. At the 95 percent level of confidence, the maximum expected range of the sampling error for the 1,001 business owners interviewed was plus or minus (+/-) 3.1 percentage points.

Table 1: Characteristics of Respondents

Demographic Characteristics	*Total* (*n* = 1001)	*Business Characteristics*	*Total* (*n* = 1001)
Age	%	***SIC Codes***	%
18-34	19.7	Electronic computers	
35-49	49.7	& related computers	4.4
50+	29.4	Electronic components	4.3
Refused	1.3	Telecommunications	16.0
	——	Computer software	75.3
Mean	**44.0**		
		Year Business Started	
Gender		1976-1992	26.6
Male	78.7	1993-1997	34.4
Female	21.3	1998-2001	39.1
Level of Education		***Business Employees***	
College graduate	72.2	1	41.0
Non-college graduate	27.6	2-4	36.1
		5+	23.0
			——
		Mean	**4.6**
		Business Revenue	
		$100,000 or <	46.5
		$100,001-$300,000	29.5
		$300,000+	24.1
		Region	
		Northeast	13.6
		Midwest	17.7
		South	28.1
		West	40.7

3. Sample Characteristics

Table 1 reports the demographic and business characteristics respectively of the business owners who were surveyed and of their enterprises. The businesses were small in size; over four in ten (41%) had only one employee,

almost four in ten (36%) had two to four employees, and just over two in ten (23%) reported five or more employees. They were also small in terms of revenue generated with almost half of the businesses (47%) producing less than $100,000. As was expected, many of the businesses (41%) were located in the western region of the U.S., a region that is known to have a major national presence with respect to high-tech development and venture initiation.

The starting years for most of the sampled businesses also corresponded roughly with the surging interest in high technology over the past ten years, with start-up dates concentrated heavily in the last three years of the sample period. Over three in ten (34%) were formed from 1993-1997 and almost four in ten (39%) were founded from 1998-2001.

In terms of sample demographics, the average age of the high-tech business owners/founders interviewed was 44 years old, with two in ten (20%) between 18 and 34 years old, almost five in ten (49%) between 35 and 49 years old, and close to three in ten (29%) with an age of 50 years or more. The great majority of the owners were highly educated, with over seven in ten (72%) reporting that they were college graduates.[1]

Note that three-fourths (75%) of the respondents' businesses would have been classified as computer software businesses if one relied solely on their SIC codes. This result was not unexpected because entry into the software business is attractive as an avenue for entrepreneurship, especially when one compares its relatively limited barriers with the significant capital costs of entering other types of high tech businesses, such as computer equipment, electronic components, or telecommunications.

It was recognized, however, that classifying by SIC codes alone would tend to mask the varied nature of the enterprises sampled and to put them into overly general categories. The following open-ended question was asked to obtain more insight about the specific purposes of the businesses surveyed: "What is the main tech product or service produced by this business?" The responses are reported in Table 2 and ranked by percentages. The percentage computer software businesses still leads the ranking, but now represents slightly more than one in five (21%) of the sample. Business owners gave a variety of other responses, reflecting the many opportunities and avenues available for business venturing in the high-tech arena.

1. Almost eight in ten (79%) of the respondents were male, and almost nine in ten (86%) were white – a random sample profile which is not surprising given the under-representation of minorities and females in the province of high-tech entrepreneurship. Examples of women and minorities rarely are found in many books discussing entrepreneurs in high technology (e.g. Sigismund, 2000). Also, high technology typically has not been the focus of African-American entrepreneurs (Dingle and Graves, 1999) or of women entrepreneurs (Silver, 1994). The challenge of broadening the demographic profile of high-technology entrepreneurs to include more minorities and women is the focus of another paper by the authors and will not be discussed in the current study.

Table 2: Main Tech Product or Service

Response	*Total* (*n* = 1001)
	%
Computer software	21.2
Web/Internet development/Design	14.3
Electronic computers	10.6
Consulting (non-specific)	8.1
Computer consulting	5.9
Telecommunication/Cellular phones	5.1
Computer hardware	3.3
Graphic design	2.6
Manufacturing/Product design	2.6
Computer or other repairs	2.4
Marketing/Sales/Advertising	2.2
Electronic components	2.1
Computer networking	1.7
Solutions/Service provider	1.6
Computer sales	1.2
Information services	1.0
Multimedia/Publishing	1.0
Computer training	0.9
E commerce	0.7
Financial	0.6
Writer/Technical documentation	0.6
Engineering consulting	0.3
Computer storage	0.2
Other	9.7
Don't know/None/Refused	0.1

Most of the entrepreneurs had a past history of entrepreneurship. Almost seven in ten (68%) said that they had started one or more businesses before they started their current business. The launching of a business was a new experience only for about three in ten (31%) of the sample. Additionally, the businesses that were launched were small. Over one in ten (14%) had no employees and about half (48%) had just one employee at their initiation. Finally, the businesses were almost all (98%) privately held firms.

4. Major Findings

The reporting of the major findings that follows is organized to parallel the sequencing of questions on the study survey. The first few questions focused on the decision age and the timing of the decision to become a high-tech

entrepreneur. The questioning then turned to significant events or major reasons that set the respondents on the course to entrepreneurship, and the importance attached to the factors identified. Preparation for entrepreneurship and obstacles encountered were topics explored next in the survey protocol. The final part of the survey assessed the degree of optimism about high-tech entrepreneurship.

4.1. Age

High-tech entrepreneurs appear to begin thinking about starting or owning a business when they are relatively young. The data in Table 3 reveals that almost two in ten *first* started thinking about starting a business when they were age 18 or younger.[2] Almost three in ten first thought about it when in the 19 to 26-years-old range, and another (almost) two in ten first thought about it from age 27 to 30. Thus, by thirty years of age, almost six in ten of these high-tech entrepreneurs had thought about starting a business. The seeds of entrepreneurship sprouted early in life for our participants.

Table 3: Age When First Thought of Starting Own Business

Response	*Total* (n = 1001)
	%
10 or less	4.2
11-14	3.3
15-18	10.4
19-22	12.3
23-26	16.5
27-30	14.8
31-34	5.2
35-38	11.1
39-42	8.0
43-46	4.6
47-50	3.9
51+	3.9
Don't know/None/Refused	1.9
Mean (age)	**28.93**
Standard Deviation	**11.61**
Median	**28.00**

2. This statistic may prove of some comfort to those who are distressed by what they believe is the popular image of entrepreneurship as something with which one must be "born."

4.2. Time

Most of the entrepreneurs were action-oriented after the idea first entered their minds. As shown in Table 4, they did not wait and think about the decision for many years before they launched their ventures. Two in ten (20%) thought about starting a business for *less than a year* before they actually started one. Almost three in ten (28%) thought about starting a business for *one year or two years*. What is remarkable is that within two years of conceiving of an idea for a new business, almost half (48%) of these high-tech entrepreneurs had acted on their dreams. Within five years, almost seven in ten (69%) had taken the plunge.

The fast-moving approach to new venture creation pursued by these high-tech entrepreneurs is very consistent with demands imposed by the rapid pace of technology change – which creates many new business opportunities, but often ones with limited windows for viable action. A high-tech entrepreneur must act quickly to be successful in the market – before the competition captures the market or the technologcal innovation underlying the entrepreneur's product becomes obsolete.

Table 4: Years Thought About Starting Own Business

Response	*Total* (n = 1001)
	%
Less than 1 year	19.9
1	13.6
2	14.1
3	7.3
4	4.1
5	10.1
6-9	5.7
10	8.3
11-15	5.3
16+	7.9
Don't know/None/Refused	3.8
Mean (years)	**5.60**
Standard Deviation	**6.99**
Median	**3.00**

4.3. Events

A wide array of events set these individuals on the path to starting or owning a high-tech business. Table 5 reports the many reasons given to the open-ended question that probed these events. Clearly, work experience was important, heading the ranking and noted by over two in ten (22%). However, the survey responses do not specify whether the job factors that motivated the desire to become an entrepreneur were positive or negative. On the other hand, the data in Table 5 suggest a number of significant positive antecedents to the respondents' entrepreneurship .

Table 5: First Significant Event Towards Starting Or Owning Business

Response	*Total* (n = 1001)
	%
Past job or job experience	21.5
Technology idea or opportunity/Inventing the system	12.6
Losing a job or becoming unemployed	8.9
Independence/Freedom/Be my own boss/Work at home	7.5
Technology hobby	6.4
Need/Demand/Market at right time	6.1
Dislike/Dissatisfaction with job/Burnout	4.6
Events or experience in family	4.6
Need for Money	4.2
High school/College course or experience	3.6
Events of experience with friends	3.2
Interest/Knowledge in the field	3.0
Secure client/Contract	1.0
Retirement/Retired	0.7
Fluke/Just happened/Meeting the right people	1.0
Purchased a computer	0.5
Dream/Goal	0.4
Boredom	0.4
Seeing others do the same thing	0.3
Offered job	0.2
Wanted a challenge	0.2
Other	5.6
Don't know/None/Refused	3.6

Many high-tech entrepreneurs went into businesses because they saw an opportunity, often from past job or work experience. Many had a technology idea or had invented a new technology system that they wanted to bring to market (13%), or they saw a gap or unfulfilled demand in the market that they

thought they could meet at the right time (6%). Others came to entrepreneurship from a technology hobby (6%), or because of interest and knowledge in the field (3%).

Also reported were more negatively charged milestones or issues that had to be overcome as the first significant event on the road to entrepreneurship. The event could be a life changing occurrence, such as losing a job or becoming unemployed, which was cited by almost one in ten (9%). Some also mentioned dissatisfaction with a job or job burnout as a catalyzing experience, which was noted by another one in twenty (5%). In addition, the desire for independence that comes from being your own boss pushed some of these high-tech entrepreneurs (8%) into starting a business, perhaps because they realized that having been employed by someone else, they now preferred to employ themselves. The need for money was also a motivating factor cited by a few respondents (4%).

Other experiences also set these entrepreneurs on their business paths. Those reported clustered around events or experiences in the family (5%), with friends (3%), or in a high school or college course (4%). A few mentioned retirement (1%), the securing of a client (1%), or a fluke event (1%) that occurred. In short, a review of all responses shows that there is no single life-changing event or experience, whether positive or negative, that first stimulated their desire to become entrepreneurs.

Table 6: Major Reason for Starting and/or Owning High-Tech Business

Response	*Total* (n = 1001)
	%
To use my skills and abilities	37.3
To be my own boss/Freedom/Control my own life	17.0
To earn lots of money	13.7
To grow or develop a high-tech firm	6.8
Interested in it/Enjoy it/Exciting	6.6
Need/Market demand	2.5
Promising future/Opportunity/Success	2.2
To overcome a challenge	0.9
Give good service	0.9
Disliked previous job	0.9
To build something for my family	0.7
Encouraged by someone (e.g., family, co-worker)	0.6
Work from home	0.5
Went to school for this	0.5
Needed work	0.5
Job security	0.4
To prove something to my family	0.2
Other	5.3
Don’t know/None/Refused	2.5

4.4 Reasons

The next question shifted from probing for key "triggering" events to identifying the major reasons for respondents having started high-tech businesses. In response to this question, the reasons given were mostly positive, a tone which is consistent with the generally optimistic outlook of most entrepreneurs. As shown in Table 6, the desire to fulfill their potential was at the top of the list, with almost four in ten (37%) stating the major reason they started a business was to use their skills and abilities. Second on the list was the desire to be their own boss and obtain more control over their life, a reason stated by almost two in ten (17%). Others saw the opportunity in the market to make money (13.7%) to grow a high-tech firm (7%), to meet a market demand (3%), or to be successful (2%). Some respondents (7%) said they were attracted to high-tech entrepreneurship because it was exciting, interesting, and enjoyable.

What is most surprising in the responses given is that the vast majority of these respondents were drawn to high-tech entrepreneurship for non-monetary reasons. Their major motivating reasons for entrepreneurship stem from deep-seated desires and dreams such as fulfilling their potential, building a business for the future, or seeking more freedom and control in their lives.

4.5. Importance

Several questions on the survey addressed the perceived importance of factors contributing to the decision to start a high-tech business. These factors focused on education (high school and college), technology experience (Internet and computers), influences from the media or news, the roles of friends or family, and the effects of work experience.

A telling statistical overview is the combined percentages of those saying that the factors surveyed were either very important or important in making the decision, as shown in Table 7. Not surprisingly, technology experience is extremely influential. Almost eight in ten (78%) of the respondents said that using personal computers for work or play was very important or important in their decision and almost six in ten (57%) cited the use of the Internet and World Wide Web as being very important or important. In addition, work experience in the technology arena is significant because it was rated as either very important or important by three-fourths (75%) of the high-tech entrepreneurs.

The joint influences of personal computer experience and work experience with technology are clearly key factors in the entrepreneurial decisions of the largest percentages of respondents (57% to 78%). Individual access to

computers and the far-reaching vistas that can be accessed via the Internet/ World Wide Web opened up new ideas and worlds to potential entrepreneurs. Familial and peer support also were important. Conversations with family or friends about technology exhibited influence in almost half the cases (43%). By contrast, seeing something in the media or news was of importance to only two in ten (20%) of the respondents.

Table 7: Importance of Factors in Decision to Start and/or Own High-Tech Business

Response	*VI 5*	*4*	*3*	*2*	*NAI 1*	*NA*	*DK*
	%	%	%	%	%	%	%
A. Education in high school or before high school (n = 999)[H]	20.1	13.6	16.2	14.6	33.3	1.3	0.8
B. Education in a college or university (n = 896)[I]	26.1	21.8	22.7	11.9	17.0	0.6	—
C. Using the Internet and World Wide Web (n = 1001)	44.8	12.5	9.8	7.9	19.7	5.3	0.1
D. Using personal computers for work or play (n = 1001)	61.5	16.8	8.2	3.7	7.9	18	0.1
E. Seeing something in the media or news (n = 1001)	8.3	12.1	21.6	20.8	37.0	0.2	0.1
F. Conversations about technology with friends or family (n = 1001)	21.1	21.7	25.4	14.8	16.4	0.7	—
G. Work experience in the technology area (n = 1001)	55.2	19.6	11.2	4.9	8.4	0.6	0.1

[H]Based for A: only those with some high school education or more.

[I]Based for B: only those with a college education.

Based for C-G is total group surveyed.

Education also plays a significant role, with about a third (34%) of the respondents reporting that education in high school or before high school was very important in the decision to become an entrepreneur. Almost half (48%) of those respondents who had completed an undergraduate education cited education as being a very important or important factor in their decision to start a business.

Additional surveying was conducted with the group of respondents who cited high school education as being very important or important in the decision to start a high-tech business. At the high school level, the factor most frequently viewed as influential was a key teacher or teachers. It was acknowledged by almost half (48%) of high school graduates as being a very important or important factor affecting their entrepreneurship decision. Other high school factors – although reported with less frequency – were also viewed as significant, such as classes that taught about technology (39%), classes that used technology (38%), extracurricular activities (38%), and classes that

taught about business and entrepreneurship (35%).

At the college level, the very important or important factors drawing the largest percentages of responses were classes that used technology (53%) and classes that taught about technology (52%). In contrast to the high school responses, the instructor effect was less frequently viewed as important at the college level than at the high school level, with about four in ten (38%) citing it as being very important or important compared with the almost five in ten (48%) identifying the key impact of the teacher at the high school level. Although classes that taught about business or entrepreneurship technically ranked third in percentage draw, they were still cited by a third (33%) of the college graduates as being very important or important to their decision to become entrepreneurs.

4.6. Preparation

In response to an open-ended question about what gave the most preparation for starting the participants' current businesses, the predominant responses were related to industry work experience and knowledge (see Table 8). Over four in ten (44%) cited either working at another business (37%) or knowledge of the industry (7%) as giving them the most preparation. Also considered to be of value were undefined "life experiences" (14%) and education in school (12%). Learning from others was a significant source of preparation, whether it occurred through talking with family, friends, or other entrepreneurs (8%) or learning from a family business (5%). Of less predominance was preparation through self-education or motivation (cited by only 5%). Taken together, the experiences and knowledge related to job, life experiences, education, and talking to others accounted for almost nine in ten (87%) of the responses to the preparation question.

4.7. Obstacles

Starting a business can be a daunting, if not overwhelming, task – especially in the high-tech arena. There are often serious concerns about areas that include financing, taking and managing the risks, establishing a viable market share, maintaining the technology "edge", managing the business, and motivating employees. The survey asked an open-ended question to elicit what the responding high-tech entrepreneurs thought were their greatest obstacles. Past studies have shown that obtaining financing is often thought of as the most important hurdle to clear. To get beyond that immediate and common response, a qualifier was added. The question stated, "Other than financing,

what do you think was your greatest obstacle to starting your current business?"

Table 8: Most Preparation for Starting Current Business

Response	*Total* (n = 1001)
	%
Working at another business	37.3
Life experiences	13.7
Education in school	11.8
Talking with family/friends	6.8
Interest/Knowledge of industry	6.6
Learning from a family business	5.3
Ability to spot an opportunity and go with it	2.5
Self taught education	2.2
Myself/Self motivation	0.9
Talking with other entrepreneurs	0.9
Military	0.9
Computer use	0.7
Reading about starting a business	0.6
Ability to learn	0.5
Desire	0.5
Nothing/Wasn't prepared	0.5
Money	0.4
Losing job	0.2
Other	5.3
Don't know/None/Refused	2.5

The list of potential obstacles is long, as shown in Table 9. At the top is finding clients or a market for the business (13%). There is also the closely related concern with marketing or establishing a name for the business (12%). Being willing to take the risk (cited by 13%) was another potential stumbling block in the minds of some of these entrepreneurs. Finding time to start the business was considered a problem (cited by 5%). In total, these obstacles account for over four in ten (43%) responses.

Beyond these often-reported obstacles, what stands out from the remaining responses is a common thread that can be labeled as an education factor. Included in this category would be lack of knowledge about technology or business (5%), lack of education and skills (3%), concerns about managing and motivating people (8%), finding, training, and educating employees (4%), handling government regulations, legal issues and taxes (4%), and handling money and benefits (2%). These education-related concerns were identified as the greatest obstacles by over a quarter (25%) of the study's participants.

That education is a major obstacle to high-tech entrepreneurship is further

Table 9: Greatest Obstacles to Starting Current Business

Response	*Total* (n = 1001)
	%
Finding clients/Market for business	12.9
Being willing to take the risk	12.8
Advertising/Marketing/Establishing a name for yourself	11.9
Concerns about managing and motivating people	7.8
Finding the time to do it	5.1
Lack of personal knowledge about technology/business	5.0
Finding/Training/Educating employees	4.0
Being able to handle government rgulations/ Legal issues/Paper work	3.5
Lack of education and skills	3.2
Coming up with good idea or opportunity	2.8
Young age or lack of experience	1.9
Making contacts/Networking	1.9
Money/Benefits	1.8
Organization	1.4
Motivation/Discipline	1.2
Competition	1.0
Location/Office space	0.9
Taxes	0.8
Having the equipment	0.8
Poor economic conditions	0.4
That I'm a woman	0.4
Leaving a good job	0.2
Other	8.8
Don't know/None/Refused	9.2

emphasized by the responses to a follow-up question that directly asked about the degree of knowledge and understanding about starting a business at the time the current business was started. As reported in Table 10, less than a third (30%) of these high-tech entrepreneurs said that their knowledge and understanding were excellent (8%) or good (22%) at the time they started their businesses. By contrast, over a third (37%) said their knowledge and understanding were poor (24%) or very poor (13%). The remainder (33%) gave ratings between good and poor.

4.8. Optimism

In spite of the recent downturn in the technology sector, these high-tech entrepreneurs remain enthusiastic and optimistic about the future. When asked whether they would want their child to become a high-tech entrepreneur, the great majority (85%) said yes, and less than one in ten (8%) said no – with the remainder not giving a response. This reaction may be interpreted as a

significant indirect endorsement both of high-tech entrepreneurship and of the opportunities in the field.

Table 10: Knowledge and Understanding of Starting a Business

Response	*Total* (n = 1001)
	%
5 Excellent	7.9
4	22.0
3	33.0
2	23.8
1 Very poor	13.2
Don't know/None/Refused	0.2

The major reasons given for not wanting a child to become a high-tech entrepreneur, among the few who supplied that response, basically centered on the degree of hard work and the difficulty of starting and running a high-tech business. This conclusion is supported by such responses as too much stress and too many hours (18%), too much hard work (7%), too difficult (6%), or too competitive (5%). These responses, however, should be interpreted with caution because of the small size of the sub-sample that would not want their child to become a high-tech entrepreneur. The other indicators of the optimism among these high-tech entrepreneurs are their views on the prospects for the future. As shown in Table 11, six in ten (60%) thought the prospects for high-tech entrepreneurship were excellent over the next ten years. Almost three in ten (28%) thought they were good. Only about one in ten (12%) thought they were either fair (9%) or poor (3%). These responses reflect a strong underlying faith in the future of high-technology entrepreneurship. They also suggest that a significant majority of these entrepreneurs anticipate sufficiently strong long-term opportunities in the high-technology sector to "stay the course" in that sector despite the turbulence (and perhaps even *because* of the turbulence) of today's technology markets.

Table 11: Ten-Year Prospects for High-Tech Entrepreneurship

Response	*Total* (n = 1001)
	%
Excellent	59.9
Good	27.6
Fair	9.3
Poor	2.7
Don't know/None/Refused	0.5

5. Conclusion

This survey examined the early environment and schooling of current high-tech entrepreneurs. The reported perspectives on motivations, influencing factors, and obstacles suggest an important potential role for education in general and entrepreneurship education in particular.

In terms of frequency of citation, education in school was the third highest factor identified as providing the most preparation for starting the respondent's current business. Its 11.8% response rate was only slightly behind the second factor – life experiences – with a 13.7% response rate. This statistic lends credence to the notion that entrepreneurship education both before and during college has the potential to play an important role in establishing the knowledge and skills foundation for future high-tech entrepreneurship.

High school and college students can benefit from increased access to and guidance towards technology coursework. High school coursework frequently impacts student choice of a college major, which in turn often influences heavily the fields in which a career path is pursued after graduation. Additionally, being a high-tech entrepreneur – especially if one is the sole employee or one of a handful of employees – tends to require a high level of technical proficiency in and/or experience with one or more aspects of technology, e.g. Web-based design and applications; object-oriented computer programming; hardware, software, and peripheral systems; computer network components and protocols; and the like.

Students also need to have improved access to personal work opportunities and to role models and mentors in the high-tech arena. Twenty-one percent of the entrepreneurs in the survey listed a "past job or job experience" as the first significant event towards starting or owning a high-tech business, and almost 75% of the high-tech entrepreneurs reported that "work experience in the technology area" was an important or very important factor in starting their own high-tech business. Giving students a taste of the possibilities and opportunities in the technology field during their schooling years would serve to increase their exposure to high-tech career options and help lay the seeds for future entrepreneurship in the high-tech sector.

Thus, effective entrepreneurship education cannot encompass coursework alone. It also must be linked with significant hands-on learning opportunities at the high school and college levels. For example, schools should be encouraged to develop partnerships with local technology businesses to create effective and meaningful experiences for students, to develop a pool of potential mentors, and to deepen student understanding of the fundamental role that education plays in becoming a high-tech entrepreneur. Approaches such as integrating entrepreneurship education with "balanced mentorship" experiences in high-tech firms that are still in their entrepreneurial start-up or early growth phases – potentially could have a large impact on both secondary

and college students. They would be able to observe first-hand the concepts and realities of "entrepreneurship in action" in a technology-oriented environment and at the same time would themselves play non-trivial contributory roles with respect to early stage entrepreneurship in the technology arena. Such combined experiences might help both to pique interest and to build confidence in pursuing a similar career path.

Also of note is that 17.9% of the entrepreneurs surveyed first considered starting a high-tech business while in high school, with that statistic swelling to 30.2% when college years are included. These numbers reinforce the strong indications that there is an important opportunity in general for entrepreneurship education to influence prospective high-tech entrepreneurs at the formative stages of their high school and college education years as well as to stimulate students who had not seriously entertained thoughts of entrepreneurship before because of lack of exposure. Furthermore, because over 25% of the entrepreneurs sampled viewed education-related issues as their greatest obstacles, an effective alliance between entrepreneurship education and technology education could lay the foundation of knowledge, skills, insights, and attitudes that tend to characterize successful entrepreneurship. Such a foundation also would facilitate the process of overcoming the hurdles that are more unique to the challenging product development and product marketing environments of the high-tech arena.

Finally, the results of this study draw attention to the heavy emphasis placed by respondents on the importance of classes at the college level that taught about technology and used technology. These findings may suggest that the more traditional B-school approach of teaching entrepreneurship as a separate course should be supplemented by a more content-specific approach. A recommendation which might flow from this observation would charge engineering departments, computer science departments, and medical schools, for example, to partner with B-schools in the development of entrepreneurship education curricula. The primary goal of these alliances would be to create tailored entrepreneurship education courses to be housed in the technical departments/schools (perhaps jointly listed with the B-schools). These "customized-to-content" courses would address specifically the application and integration of the concepts, processes, and skills of entrepreneurship with respect to the specialized technical subject matter of their respective areas.

In conclusion, this study's survey results with respect to a nation-wide sample of current high-tech entrepreneurs offer a revealing perspective on some of the key antecedent factors that were of early import to their technology venture initiation trajectories. Their demographics also suggest significant under-representation of women and minorities in the ranks of high-technology entrepreneurship. One potential strategy recommended for expanding and diversifying the pool from which our nation will draw its new vanguard of high technology leadership is to craft cross-cutting educational partnerships that

carefully blend entrepreneurship education, technology content-specific education, and high-technology venture experience at both the high school and college levels. The high technology entrepreneurship sector is a central component of this century's economic future. Of no less importance is the responsibility of the educational community to ensure that all segments of our society have the option to be prepared for and to contribute to this vital area of human endeavor.

References:

Dingle, Derek T. and Graves, *Black Enterprise Titans of the B.E. 100's: 1999. Black CEOs Who Redefined and Conquered American Business*. New York: Amacon.

Kourilsky, Marilyn L. and Walstad, William B. 2000. *The "E" Generation: Prepared for the Entrepreneurial Economy*. Dubuque, Iowa: Kendall/Hunt.

Kourilsky, Marilyn L. 1995. "Entrepreneurship Education: Opportunity in Search of Curriculum." *Business Education Forum*, 50(10), 11-15.

Sigismund, Charles G. 2000. *Champions of Silicone Valley: Visionary Thinking from Today's Technology Pioneers*. New York: John Wiley & Sons.

Silver David A. 1994. *Enterprising Women: Lessons from 100 of the Greatest Entrepreneurs of Our Day*. New York: Amacon.

Walstad, William B. and Kourilsky, Marilyn L. 1999. *Seeds of Success: Entrepreneurship and Youth*. Dubuque, Iowa: Kendall/Hunt.