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ABSTRACT

Contained in this document are papers presented at the Symposium on Technical Entrepreneurship at Purdue University by researchers who were then or had previously been engaged in research in the area. Because formal research in this area was in its infancy, there was a particular need to afford investigators in the field opportunities to compare findings and to discuss possible directions for future research. Titles of the twelve papers presented are: (1) Factors Influencing the Rate of Formation of Technical Companies, (2) The Technical Entrepreneurship Process in Austin, Texas, (3) Comparative Profiles-Entrepreneurs Versus the Hired Executive: San Francisco Peninsula Semiconductor Industry, (4) The Process of Technical Company Formation in a Local Area, (5) Research Parks and Regional Development, (6) Incubator Organizations and Technical Entrepreneurship, (7) Influences Upon Performance of New Technical Enterprises, (8) The Role of Marketing in Technical Entrepreneurship, (9) Role of the Financial Community in the Formation, Growth and Effectiveness of Technical Companies: The Attitude of Commercial Loan Officers, (10) Two Approaches to University Stimulation of Entrepreneurships, (11) Graduate Student Views of Entrepreneurship and Courses on Entrepreneurship, and (12) A Preliminary Study of the Personal Values of High Technology Entrepreneurs. (Author/SN)

# TECHNICAL ENTREPRENEURSHIP: A SYMPOSIUM

Edited by

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**CARY HOFFMAN**

Cary Hoffman's primary research interests are involved in the development and application of analytical techniques and measures to a large number of areas especially concerned with the management of research-oriented industries and specialties and with the formation and growth of high technology firms. He also serves as a consultant to several technical R and D companies.

Mr. Hoffman has participated in studies of the role of the financial community in the formation, growth, and effectiveness of technical companies; the development of a program for making the Ozarks region attractive to small and intermediate-sized technical companies; the role of entrepreneurship in the formation, growth, attraction and survival of new technical companies; the role of small technical oriented business in federal R and D activities; and the role of the small firm in the large economy.

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Richard P. Howell is Managing Director of Howell Associates of Palo Alto. He specializes in various aspects of management analysis and control procedures. Recently his interests have been focused on high technology industry with special attention to the management problems of key employee recruiting, compensation, and enhancement. His concern about "what makes a technical area grow," has stimulated him to participate in the financing, formation, and management of several successful, small, high technology companies.

Aside from the breadth of experience afforded him by participating in multidisciplinary research for over thirteen years with SRI, Mr. Howell's broad capabilities have been enhanced by industry assignments in establishing accounting, budgeting, analysis and control systems.

His articles have been published in leading journals read by financial executives, investment analysts, engineers, and general management. Representative titles are *Economic Appraisal of Proposed Equipment — The Cost Element, Improve Your Ratios, Can Leadtimes be Shortened by Atom Lessons, Aerospace Nomads — How Professionals Move, On Professional Salaries, and Are Defense Engineers Switchable?*

Mr. Howell received a B.S. degree in mathematics from the University of Washington in 1942 and has had post graduate work at UCLA in Aerological Engineering.

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Dr. John L. Komives is the Director of The Center for Venture Management, 811 E. Wisconsin Avenue, Milwaukee, a not-for-profit, educational research institute dedicated to the study of entrepreneur and new business enterprise formations. Dr. Komives was named director of The Center in July, 1968.

Prior to joining The Center, Dr. Komives was director of the Center for Management Studies of Kalamazoo, Michigan, attached to Kalamazoo College. He also collaborated with the Upjohn Institute for Employement Research. Dr. Komives also has an extensive private business background.

Dr. Komives received his doctorate from Michigan State University in 1965. The title of his doctoral thesis was "Some Characteristics of Selected Entrepreneurs." He received his B.A. and M.B.A. from the University of Detroit.

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Dr. Lamont is presently doing research on different aspects of technology-based enterprises including technology transfer, entrepreneurial characteristics, marketing and finance. Future research will investigate the diffusion of industrial innovations and the marketing of research and development.

Dr. Lamont and his wife have two children.

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**ALBERT SHAPERO**

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Mr. Shapero's research, teaching, and consulting interests are in the management of technical enterprises. At Stanford Research Institute, as Director of the Technology Management Division until 1966, he had for ten years been principal investigator, project leader, or participant in numerous research projects concerned with the management of change, economic development, systems analysis, human factors, and the management of technical and intellectual resources

In 1970 Mr Shapero received an award for teaching excellence from the Standard Oil (Indiana) Foundation. He has also testified before Senate Committees as Expert Witness on "scientific manpower" and "impact of R & D expenditures."

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Dr. Susbauer was educated at Seattle University (B.C.S., 1964), Indiana University (M.B.A., 1966) and the University of Texas at Austin (Ph.D., 1969). He served as Assistant Director of Evening Classes, Seattle University, and was Administrative Assistant to the Manager of Technical Operations, Aerospace Research Applications Center, Bloomington, Indiana. He recently completed an assignment on the Army General Staff, Washington, D.C., engaged in developing automated management information systems and performing operations research and systems analysis for Army program budgeting.

Dr. Susbauer is an active consultant to high technology industry and is currently developing an experimental program of entrepreneurial studies at Cleveland State University. He has published several articles and monographs and is currently writing two books on business policy and administrative science. He is a member of the Academy of Management, Beta Gamma Sigma, Alpha Kappa Psi and the Society for the Advancement of Management. He and his wife, Kay, are also currently researching and writing about management of the health sciences. They have two children, Stephanie and Kimberley

**KARL H. VESPER**

Dr. Karl H. Vesper is an Associate Professor of Business Administration and Mechanical Engineering (a dual appointment) at the University of Washington. He received bachelor of science and master of science degrees and his doctorate at Stanford and his master in business administration from the Harvard Business School.

Since joining the University of Washington in 1969 he has been teaching courses in Business Policy, Entrepreneurship, Planning and Decision Theory in the Business School and also courses in Mechanical Design and Systems Engineering in the School of Engineering.

Prior to his post at the University of Washington, Dr. Vesper worked at Stanford on introduction of case method instruction to engineering education.

Dr. Vesper and his wife, Joan, have three daughters.

## Introduction

The Symposium on Technical Entrepreneurship was held at Purdue University on October 7 and 8, 1970. This was the first time that those doing research on the founding of high-technology firms had gathered together to exchange findings and observations.

Because formal research in this area is in its infancy, there was a particular need for those investigating this field to compare findings to date and to discuss possible directions for future research. In addition, because technical entrepreneurship had been concentrated primarily in a few widely scattered locations, each of which had been studied by different researchers, there was a need to compare findings — to discover, for instance, whether the Boston, Ann Arbor, and Palo Alto complexes had developed in the same way.

In addition to those whose papers are presented here, there were several active participants who did not present papers, but whose questions and comments enriched the proceedings. They included Alan Bostrom — an entrepreneur located in New Jersey, Jerome Kohl of North Carolina State University at Raleigh, Borje Langefors of The Royal Institute of Technology in Stockholm, Sweden, Paul Root of The University of Michigan, John Roethle of Anderson/Roethle and Associates, Inc., in Milwaukee and Max Rumbaugh, Jr., of Midwest Applied Science.

The Symposium proceeded in an informal manner, with frequent interchanges between the speakers and the audience. These edited proceedings include many of these interchanges.

The Symposium was sponsored jointly by The Krannert Graduate School of Industrial Administration and The Center For Venture Management. We are indebted to Dean John Day of The Krannert School and Mr. Karl Bostrom, the founder of The Center For Venture Management, for their generous support.

The editors express their appreciation to the participants whose papers are presented here. We hope that these proceedings capture some of the stimulation and intellectual excitement which we felt were present at this Symposium.

**John L. Komives**

**Arnold C. Cooper**

*The Center for Venture Management was established and initially endowed in 1968 by Mr. Karl A. Bostrom. He was Chairman of the Board of the Bostrom Corporation until 1967 when the company was acquired by Universal Oil Products Corporation.*

*The Center was founded in the belief that the dynamics and vitality of free enterprise is sustained by the continual birth of new enterprises and improvement of existing firms by increased sophistication of their management. Because of ever new technology and the increasing complexity of the economic and social environments, entrepreneurs should be sought out, encouraged and nurtured by new and improved means for transfer and exchange of knowledge and experience. The Center is the first of its kind whose objectives are primarily concerned with entrepreneurs and new enterprise formations. The monumental problems faced by all economies must be met by increasing productive wealth, a large part of which must be contributed by the new entrepreneurs, large and small. The Center will seek to meet these objectives through research and to make new knowledge available as widely as possible.*

*The Center for Venture Management is a Wisconsin non-profit corporation and registered with the Bureau of Internal Revenue as an exempt organization. It is headquartered in downtown Milwaukee, Wisconsin. The Center director was employed in July, 1968, and The Center opened operations as of that date. A Special Library specializing in the field of new enterprise formation and in studies of the entrepreneur are housed in the same office suite. The Center has no affiliation with any other organization or institution, but will seek to contract or participate with such organizations for these purposes through program development, research, seminars and conferences.*

*The Center welcomes those interested in research and other objectives related to the role of entrepreneurs in a free enterprise economy.*

CONTENTS

## Glossary of Terms

In any emerging body of knowledge there soon develops a jargon which for the cognoscenti in that field is a very useful and time saving communication system. There are concepts and phenomena which are known and accepted in that field and which can be named or described by one word or one short phrase. High Technology Entrepreneurship is no stranger to this human efficiency. The following is an attempt to acquaint the reader with this terminology for faster reading of the symposium proceedings.

HIGH TECHNOLOGY - is a term used to describe companies which engage in researching or producing or marketing a product or service which requires a fairly high degree of acknowledged technical sophistication. Often it requires personnel with advanced collegiate degrees and it usually is on the forefront of the knowledge of that particular field. It is an arbitrary term, and quite imprecise; e.g., an automobile is a highly sophisticated product, but is not included in this usage, nor is the intricate art of steamfitting.

ENTREPRENEURSHIP - The act of founding a new company where none existed before. Entrepreneur is the person and entrepreneurs are the small group of persons who are new company founders. The term is also used to indicate that the founders have some significant ownership stake in the business (they are not only employees) and that their intention is for the business to grow and prosper beyond the self-employment stage.

BEGAT CHART - This is used in the same fashion as a genealogist uses it to describe a family tree. Recent research has shown that certain companies tend to have a great number of former employees who become entrepreneurs and found new businesses which are in the same general technological area as the former employer.

SPIN-OFF - The term is used both as a verb and as a noun, and relates entrepreneurs to the former organizations where they were before becoming founders. For instance, "his company was a spin-off from Sperry-Rand" or "Raytheon had five spin-offs during this period." Some of the symposium participants restricted the term to that organization where the founder was employed immediately before starting his firm; other participants applied the term more broadly, so that if the founder had ever been a member of a particular organization, he could be counted as a spin-off from that organization. In almost all cases, the former employer has no legal, financial or management connection with the new enterprise.

N-ACH and N-POW - These are terms usually ascribed to David McClelland and Winter and Berlew to describe a measurement of the psychological "need for achievement" or the "need for power". These are quite well understood psychological terms, the reader only needs to know whether n-ach was high or moderate or low to adequately understand its usage in these proceedings.

## ONE / KIRK P. DRAHEIM

### Factors Influencing the Rate of Formation of Technical Companies

As I am one of the few non-academic types on the panel I will try to be on good behavior. Actually, when Arnie called and said that he was scheduling this Symposium, and not being too smart, I quickly grabbed a dictionary while I was still on the phone to find out what I was getting into. As you may know, the word is from the Greek, and quoting from the dictionary, it is "an ancient Greek drinking together, usually following the banquet proper, with music, singing and conversation; hence, a banquet or social gathering at which there is free interchange of ideas." So, naturally I said "yes". And then I get here and see two pages of speeches. I wish to say, Arnie, that you have really subordinated the real purpose of a symposium, and I'm not so sure I would have come had I known your real purpose!

At any rate, it is a pleasure to be here and my presentation will deal with the "Factors Influencing the Rate of Formation of Technical Companies." Two different approaches will be taken to identify the factors. One approach will be geographic, comparing Minneapolis/St. Paul, Buffalo, St. Louis and some of Arnie's work in Palo Alto. Then another cut will relate to specific industries, the semiconductor industry and the computer industry, which have a rapidly changing technology.

I will be working mainly from tables and charts to identify these factors, and if there are questions as we go along, please do not hesitate to ask them.

**Technical Company Formation in Minneapolis/St. Paul** - the first chart refers to the study on the Twin Cities, (Minneapolis/St. Paul) when I was at SRI. This project was done with Dick Howell and Al Shapero. In this particular chart we show the chronology of surviving Twin City high technology company formations. Over a period of years they have formed a total of one hundred and forty-two technological and related companies grouped in six major categories. They are automatic controls, medical and surgical devices, electronic equipment, computers and date processing, ordinance and accessories, miscellaneous high technology, and supporting industries. You will note that two-thirds of their technical industrial base has come since 1950, with particular emphasis during the periods of 1950-54, when there was a total of nineteen new company formations, then thirty-one during the period 1955-59 and, finally, thirty-six formations during the period 1960-65. Looking further into some of the figures we can isolate some factors that tend to be fairly important. Of the medical and surgical devices companies formed, the first five were "hearing aid" companies. It was important that this be one of the Twin Cities' first technical industries. As you know, hearing aids were among the first products to use miniature vacuum tubes and circuits, and then transistors. This early development was to provide the Twin Cities with a very important base for what was later to become their computer industry and for the manufacture of components that went into computers. Actually, out of these five hearing aid companies there were a total of eight spin-offs. The hearing aid industry gave the Twin Cities a technical base; there were hundreds of technicians and

Table 1

CHRONOLOGY OF SURVIVING TWIN CITIES HIGH TECHNOLOGY COMPANY FORMATIONS

| Period | Automatic Controls & Measuring Instruments | Medical & Surgical Devices & Apparatus | Electrical & Electronic Equipment | Computers & Data Proc. | Ordnance & Accessories | Other High Technology Establishments | Supporting Industries & Services | Total Formations |
|---|---|---|---|---|---|---|---|---|
| Pre-1905 | 1 | | 2 | | | | 1 | 4 |
| 1905-1914 | 1 | | 1 | | | | 1 | 3 |
| 1915-1924 | 2 | | 4 | | 1 | 1 | | 8 |
| 1925-1934 | 2 | 1 | 2 | | | 1 | | 6 |
| 1935-1939 | | 1 | | | | | | 1 |
| 1940-1944 | | 3 | 3 | 1 | 1 | 1 | 1 | 10 |
| 1945-1949 | 3 | 3 | 5 | | 1 | 2 | 5 | 19 |
| 1950-1954 | 5 | | 11 | | | | 3 | 19 |
| 1955-1959 | 4 | 3 | 11 | 3 | | 2 | 8 | 31 |
| 1960-1965 | 6 | 4 | 10 | 5 | | 2 | 9 | 36 |
| n.a. | | 1 | 3 | | | 1 | | 5 |
| Totals | 24 | 16 | 52 | 9 | 3 | 10 | 28 | 142 |

n.a. = not available.
Source: Stanford Research Institute.

Table 2

CHRONOLOGY OF TECHNOLOGICAL COMPANY FORMATIONS — TWIN CITIES

| Year | Automatic Controls & Measuring Instruments | Medical & Surgical Devices & Apparatus | Electrical & Electronic Equipment | Computers & Accessories | Other Technological | Total |
|---|---|---|---|---|---|---|
| 1950 | | | 3 | | | 3 |
| 1951 | 1 | | 1 | | | 2 |
| 1952 | 2 | | 2 | 1 | | 5 |
| 1953 | 1 | | 2 | | 2 | 5 |
| 1954 | | | 1 | | | 1 |
| 1955 | 1 | 1 | 1 | | 1 | 4 |
| 1956 | 2 | 1 | 1 | | | 4 |
| 1957 | | 1 | 8 | 1 | | 10 |
| 1958 | | 1 | 1 | 1 | | 3 |
| 1959 | | | 4 | 1 | 1 | 6 |
| 1960 | 4 | 3 | 5 | 1 | 1 | 14 |
| 1961 | 5 | 3 | 10 | 5 | | 23 |
| 1962 | | 1 | 2 | 1 | | 4 |
| 1963 | | 1 | 1 | | | 2 |
| 1964 | | | 1 | 1 | | 2 |
| 1965 | | 1 | | | 1 | 2 |
| Totals | 16 | 13 | 43 | 12 | 6 | 90 |

approximately fifty degreed engineers employed. At one time, the Twin Cities was considered to be the hearing aid capital of the world, having total sales of ten million dollars per year. The Twin Cities are still an important center for the manufacture of hearing aids, claiming some twelve companies. Obviously then, the existence of a technical labor pool is an important factor in the formation of technical companies. The Twin Cities were ripe for Bill Norris and his group to establish Engineering Research Associates (ERA), the forerunner of the computer industry in the Twin Cities, because there were technicians already skilled in the manufacture of miniaturized electronics.

At this point, let us review the next chart, which breaks down for more recent years the situation in the Twin Cities. This chart starts with 1950 and is on an annual basis.

There are a few things during this 15 year period that you should note. The Twin Cities had a total of 90 technical company formations, with the most active period being 1957 through 1961. Some of these years are important from the standpoint of technical company formations. 1957, for example, was the year that Control Data spun-off from Univac. There were ten company formations that same year. This was a rather unique situation — the establishment of Control Data. A little background may be of interest. The predecessor company was ERA (Engineering Research Associates). These people were out of the Pentagon primarily, and in 1946 a team of 40 to 50 scientists and engineers decided before they left the service, to go into the commercial application of some of the theories and techniques they developed during the war years. They cast about for locations. There was nothing particularly important about the Twin Cities, except that they were able to obtain $10,000 of venture capital and a vacant building. This is why they located in St. Paul. They were acquired by Remington-Rand in 1956. This relationship did not last long. The decision to again spin-off was a case of absentee management and control of the budget at corporate headquarters in the East. This is another factor influencing spin-offs from technological companies. We refer to these factors in our Twin Cities' report as the "pushes" and "pulls" that influence companies to spin-off.

Another important factor influencing company spin-offs in the Twin Cities was present in the late 50's and early 60's when you had most of the new company formations. This was a period of high activity for the glamour stocks and there arose an environment in the Twin Cities referred to as the "dollar-stock market." The formation of Control Data actually started this situation. The Corporation Commissioner and his office, which was about five people at that time, had never had any experience with companies of this type. A man in his 60's was Minnesota Corporation Commissioner at the time. After Bill Norris and his co-founders had explained the venture, the man's reaction was "this sounds to me like another Tucker (automobile) situation." So they received very little help by going to the Corporation Commissioner in Minnesota. They couldn't get an underwriter; they sold Control Data stock themselves - 600,000 shares at a dollar per share. This was the beginning of the over-the-counter market that helped develop the Twin Cities as a technological area. Two thirds of Twin Cities' technical companies were formed during this period. There were about 200 companies formed, both technical and non-technical. This chart is concerned with just the higher technology

start-ups. Two-thirds of these issued public stock at a $1.00 or a $1.15 per share, the 15¢ indicating that they had an investment underwriter. It took more than the establishment of Control Data, however, to bring other entrepreneurs "out of the woodwork". The second important technical spin-off was also from Univac. The company was called Data Display and was later acquired by Control Data. The formation of Data Display involved a group of project engineers; they were not like the strong team out of Washington that had 15 years of experience, who founded ERA and Control Data (the kind of team you look for to assure yourself a successful new company formation). When the Data Display principals also sold their stock issue "out of their glove compartments," it influenced "everybody and his brother" who thought they could form and operate a company. The credibility gap was closed; in effect these entrepreneurs said, "If they can do it — so can we". In this case, the factors influencing formation were credibility and existence of a financial market.

Most of the companies starting after 1957 actually got their first capital from a public stock offering. This is somewhat unusual and, as we will see later, most of the failures of Twin City technical companies were **among** those who received their first capital from a public stock offering.

Another situation that I want to point out reveals a factor influencing company formations. You noticed in the previous charts an example of this: hearing aids. If there is one successful start-up, chances are that there will be more of the same type of new companies formed; this happened with the semiconductor industry.

The same thing happened in the Twin Cities in the medical devices. After Medtronics was formed, there were several who were interested in forming heart pacer and other medical companies. There were several medical device companies formed in the Twin Cities following the success of Medtronics, which was formed in 1949.

With regard to the computer industry, five companies started computer operations in Minneapolis/St. Paul, starting with the formation of ERA in 1946. This is, perhaps, another factor in the formation of technical companies; not only does the credibility of successful company formation help, but there may be more credibility if the company formation is in the same line of activity with which the would-be entrepreneurs are associated.

This next table shows a record of the failures of Twin City technical companies. The survival rate is not too much different than the approximate 75%-80% rate experienced by the SBIC's in other parts of the country. If you eliminated from consideration those companies supporting technical industries, the survival percentage rate of technical companies in the Twin Cities has been around 72%.

The worst survival record was for medical/surgical device companies which experienced a 57% failure rate. It should be added, however, that based on what we learned from the study and have since observed, a significant medical/surgical company has not developed anyplace, so the Twin City failure rate for this type of company is not too surprising!

Table 3

TWIN CITIES TECHNICAL COMPANY FAILURES, 1950-1961
(no Record of Company Failures for 1962-1965)

| Industrial Category of Company* | Company Formations | Company Failures | Failures as % of Formations |
|---|---|---|---|
| Automatic controls & measuring instruments | 17 | 3 | 18% |
| Medical-surgical devices & apparatus | 14 | 8 | 57 |
| Electrical-electronic equipment | 44 | 12 | 27 |
| Computers & data processing machinery | 11 | 2 | 18 |
| Other high technology | 4 | 0 | 0 |
| Supporting industries & services | 21 | 1 | 5 |
| Totals | 111 | 26 | 24% |

* Ordnance material category omitted because no companies were formed in this period.

Cooper: Kirk, I have a question. When you refer to company failures, what is your definition? A company which is unsuccessful, but is acquired — is that included as a failure?

Draheim: No, failures are those companies that cease doing business for all intents and purposes. As we say "down the tube;" if the company is acquired, it is not considered to be a failure. Please note that 19 out of the 26 companies that failed in the Twin Cities attained their first money through a public stock offering. Also, most of these founders had never had any previous business experience. As a side note, I have a collection of prospectuses of Twin City companies formed in the late 50's and early 60's, and they're very interesting. It was an exciting period; the Corporation Commissioner tried to get budget approval for more people (they had only eight employees during the "heyday"). There was a rapid turnover of Corporation Commissioners — five during that 4 year period. I tried to talk to these former commissioners; it was difficult to get any of them to talk. Minnesota Corporation Commissioners' revenues compared to their expenses, represented a factor of 4 to 1. Issuing new stock was a profitable business for the State. Approval to issue stock to be sold in Minnesota was almost automatic during the late 50's and early 60's. These issues were sold intrastate so did not require approval. There was a rash of these new issues and a number of people got burned! However, with a success rate as high as 75%, one could make a very strong case to justify the cost, (losses incurred) for establishing a technological base. Unfortunately, after this period of rapid new company formations, new company formations almost dried up after the stock market crash in May 1962. Thereafter, new company formations were at the earlier rate of 2 to 4 a year. It was several years in coming back. In fact, one company who got approval for their stock issue just prior to May 1962, before the market crashed, needed over two years to sell all of their issue. I believe the offering was around 500,000 shares at one dollar per share.

Roberts: This was a public issue?

Draheim: Yes. It required considerable time for the stock market to "come back" and for new companies to be formed. The Twin Cities have reached the rate of new company formation that it had during the late 50's and early 60's. The situation may have been somewhat transient and there is some question whether the new company formation rate will ever return to the earlier level. We will see later a table showing a comparison with Palo Alto and the existance of a different company formation situation there.

Roberts: Kirk, in this data you have 111 technical companies that were formed from 1950-61, and in the same time period 26 of those 111 failed?

Draheim: The record of failures covers the period through 1965, so the time periods are not quite the same.

Roberts: Is that what your table says, i.e. that no record of company failures for 1962?

Draheim: Subsequent to the publication of the report, I checked and there were no failures of those technical companies during that time period which we could trace. The survivors at the time of the project were still survivors.

Komives: As of 1965.

Roberts: Twenty-six of those 111 have failed.

Draheim: That is correct.

Roethle: Kirk, one other question — would possibly the part of the environment influencing so much new company formation be the looser laws? I don't know this to be a fact. If they had looser security laws in Minnesota, would more of these firms get started? Then if they tightened up the regulations on who could start firms and what you had to have to start, would this then negate new firm foundations?

Draheim: To a certain extent, but now you have a more sophisticated financial community to evaluate these companies than in the late 1950's.

At that time, if you invested in a new issue you could expect the price to double possibly within a week. Consequently, people bought anything. This situation prevailed in the country generally, but more specifically, in the Twin Cities because it was local money and a more limited supply.

Roethle: Was Minnesota's security department any looser than other security departments that you studied?

Draheim: Yes, however, one must add that the only states that had very tight control at that time were New York and California, states that had had some experiences with new company formation. The majority of states had never experienced this situation up to that time. Minnesota got caught in a "snowballing" situation.

Shapero: I think that back on this date if there had been tighter regulation — there might have been a little bit more delay in formation but it would not have stopped the wave of formations. In other words I don't think the wave of formations was a function of the looseness — it just would have changed the numbers somewhat. Maybe as Kirk says in the 26 failures, there might have been fewer — though it is not sure. There was an environment in which brokers were pulling non-entrepreneurial engineers out of companies and said "come on — come on — start a company". That is why we were calling it pulls at the time — they were really hustling new companies into being. It was that kind of period. There was a big failure at the end — it wasn't just the financial situation. Wasn't it Westec — or something like that — which was the name of the company that failed?

Table 4

PRINCIPAL SOURCES OF TWIN CITIES TECHNICAL COMPANY SPIN-OFFS
1944-1965

| Year | Sperry Rand Corp. | | Honeywell, Inc. | | General Mills, Inc. | | Univ. of Minn. | | Totals of Establishments | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. of Spin-offs | Failed or Moved | No. of Spin-offs | Failed or Moved | No. of Spin-offs | Failed or Moved | No. of Spin-offs | Failed or Moved | No. of Spin-offs | Failed or Moved |
| 1944 | | | 1 | | | | * | | 1 | |
| 1945 | | | 1 | | | | | | 1 | |
| 1946 | | | | | | | 1 | | 1 | |
| 1947 | | | | | | | | | 0 | |
| 1948 | | | | | 1 | | | | 1 | |
| 1949 | | | | | | | | | 0 | |
| 1950 | | | 1 | | 1 | | | | 2 | |
| 1951 | | | | | 1 | | 1 | | 2 | |
| 1952 | | | 1 | | | | 1 | | 2 | |
| 1953 | | | | | | | | | 0 | |
| 1954 | | | | | | | | | 0 | |
| 1955 | | | | | | | | | 0 | |
| 1956 | | | 1 | | | | 1 | | 2 | |
| 1957 | 3 | | | | 1 | | | | 4 | |
| 1958 | 1 | | | | | | | | 1 | |
| 1959 | 1 | 1 | 1 | | 1 | | | | 3 | 1 |
| 1960 | 3 | 2 | 1 | | | | 1 | | 5 | 2 |
| 1961 | 3 | 1 | 2 | 1 | 2 | | 1 | 1 | 6 | 3 |
| 1962 | 2 | | | | 1 | | | | 3 | |
| 1963-65* | | | | | | | | | | |
| Totals | 13 | 4 | 9 | 1 | 8 | 0 | 6 | 1 | 36 | 6 |

* No spin-offs recorded in this period.
Source: Stanford Research Institute.

Draheim: Midwest Tech — an investment company that was providing financial assistance to several local companies.

Shapero: And it failed and was a miserable poor case and that was a sapper at that time.

Draheim: Some university people on their Board of Directors and also members of their academic advisory group were tried in the U.S. District Court. Let that be a lesson to you academic types!

Roberts: The regulations of the SBIC at the state level, are they not supposed to be a process of assuring open disclosures?

Draheim: This is true . . . .

Roberts: And in these companies, open disclosure has never had any effect whatsoever except to increase the price of the stock.

Draheim: To be safe within security issuance regulations you see some of the most negative prospectuses you have ever seen, and often the more negative the prospectus, the more of a demand for the stock.

Roberts: That was in the old days.

Draheim: They had all kinds of disclaimers eventually in the Minnesota stock prospectuses. The principal difference between those prospectuses and the ones approved by the SEC is disclosure. You have to be a C.P.A. to figure out some of the financial statements. Some were just a listing of expenditures. Just try to determine the profit or loss; that was a real exercise.

Let's take a look at the sources of spin-offs now. The most important source was Sperry Rand. The principal factors influencing company formation were the "pushes" of absentee management and the establishment of credibility with the formation of Control Data and Data Display. Honeywell has always had a few spin-offs throughout the years. General Mills has been the same situation, although the rate of spin-offs picked up when they stopped operating several businesses. Their Mechanical Divisions after the war became the Electrical Division, which started developing computers. They were at it for about three years, then got out of the business. Another company using some of the products developed at General Mills, started a computer company. General Mills tried to get into the field of remote handling of nuclear materials. They sold out to employees and this became the basis for another company getting started — Programmed and Remote Systems, Inc.

Finally, one of the ways to get companies started is to close or threaten to close a university laboratory. Rosemount Aeronautical Lab was always threatened with being closed down or not having contracts. These "pushes" influenced four spin-offs during that period. Three of the companies were successful; these companies are still viable.

Conversely, we found only two spin-offs from 3M, one of the Twin Cities' largest employers.

**Technical Company Formation in Buffalo -**
In the next Table we are going to take a look at the technical company formation experience in the Buffalo area. This material is from a study done about two years ago when I was a consultant for Management and Economic Research in Palo Alto, a spin-off itself from Standard Research Institute. The Buffalo spin-offs are shown starting in 1951.

You'll find that many of the companies are chemically related like the industrial base already existing there. Buffalo has always been strong in the production of chemical and electro-chemical products. In the case of Minneapolis/St. Paul, initially Honeywell tended to set the pattern there, companies with products related to automatic control. None of the Buffalo spin-offs could be related to any of the big chemical companies. We talked with several large chemical and electro-chemical companies that had big laboratories or big research departments and they had experienced no spin-offs. The chemical company spin-offs in the Buffalo area were probably started by technicians primarily and not by the degreed engineers and scientists that you find in the laboratories of the big chemical companies in the Buffalo area and Niagara area. In the aero-space category, spin-offs were primarily from Bell and, you will note, at the end of the Korean War, the phasing out of government contracts. This tended to be a period when the "pushes" influenced the formation of a few companies. In the scientific instruments category which also includes hospital and surgical supplies, again we find the pattern being set by one company, Mennen-Greatbatch, Inc., (heart pacers) formed in 1963, and the following year, Cardiac Electronics. Again we see the pattern of company formation being more credible when you are in the same line of activity as previously established spin-offs.

There is another factor that influences the rate of spin-offs. Please notice that in 1967, under the scientific instruments category (which includes hospital and medical supplies), the companies were all producing hospital and medical supplies. This was the time of the debates on Medicare and Welfare programs. Government funding doesn't have to be defense related to be influential in the formation of new companies. The new entrepreneurs perceived opportunities related to people spending more money on medical and hospital services and government financing of some of these expenditures. Surprisingly, a good technical base is forming in Buffalo. If you eliminate the late 50's and early 60's, Buffalo has experienced as comparable a record of technical company formation as has Minneapolis/St. Paul.

Table 5

CHRONOLOGY OF TECHNOLOGICAL COMPANY FORMATIONS IN BUFFALO, 1951-67

| Year | Chemicals & Related | Aerospace | Scientific Instruments | Electrical & Electronic | Other | Total |
|---|---|---|---|---|---|---|
| 1951 | | 1 | | | | 1 |
| 1952 | | | | | | 0 |
| 1953 | | | 2 | | | 2 |
| 1954 | | | | | | 0 |
| 1955 | | 1 | | | | 1 |
| 1956 | | | 1 | | | 1 |
| 1957 | | | | 1 | | 1 |
| 1958 | | 1 | | 3 | | 4 |
| 1959 | 1 | 1 | 1 | 1 | | 4 |
| 1960 | 3 | | | 2 | | 5 |
| 1961 | 4 | | 1 | 2 | | 7 |
| 1962 | 1 | | | | | 1 |
| 1963 | 1 | | 1 | 1 | | 3 |
| 1964 | 1 | | 2 | 1 | | 4 |
| 1965 | 1 | | | | 1 | 2 |
| 1966 | 1 | | | | | 1 |
| 1967 | | | 4 | | 1 | 5 |
| Totals | 13 | 4 | 12 | 11 | 2 | 42 |

**Comparison of Technical Company Formation — Twin Cities, Buffalo and Palo Alto**

The next chart compares the Twin Cities, Buffalo and Palo Alto, which makes use of Arnie's data. Arnie's Palo Alto data starts in 1960; the Minneapolis/St. Paul data commences in 1951. The important point here is that Palo Alto has experienced a continuous high rate of technological company formation not experienced in Minneapolis/St. Paul since early 1960. Buffalo had an increase in company formation at the same time. Except for the formation of hospital/medical supplies companies, Buffalo's company formation rate has been one or two and not over four companies per year. In Buffalo, one thing I noticed in interviews with many of the financial interests was their conservatism. Minneapolis/St. Paul had a similar situation at one time, but the establishment was forced out of it during their experience of the "dollar-stock market". Buffalo still has some of the "establishment" with their conservative viewpoint of "we made our money in wheat and shipping so let's not venture it; let's conserve it. Unless something significant happens in Buffalo, I think the rate of technical company formation will continue at much the same rate as it has been. Buffalo has much difficulty in getting venture capital from private sources, whereas Minneapolis developed this type of financial community, then it faded after people got "burned" and now is coming back somewhat.

Palo Alto consistently has had and will continue to have sources of venture capital. Many of these people providing the money made their money as entrepreneurs and are now investors themselves — significant number wouldn't you say, Arnie?

Cooper: During this time . . . . yes . . . .

Draheim: I think one of the important things shown in the comparison is the sustaining rate of technical company formation in the Palo Alto area that will continue indefinitely.

Roberts: How would you relate to the size of the scientific engineering community over those time periods in those three cities? Palo Alto presumably has been steadily growing. This is true, but what about these other places? Minneapolis/St. Paul has been growing.

Draheim: We notice reverse trends in migration. Finally, Honeywell and Univac have been able to compete for employees, salary-wise, and attract some engineers to Minnesota. This trend was just starting at the time of our project in 1964-65.

Roberts: But, what about Buffalo?

Draheim: Buffalo has not yet experienced any significant changes of this nature. You get some development of activity with the new university setup, plans for a new, big campus, and the like. But, I was not able to identify any significant change in the number of engineers and scientists, particularly entrepreneurial.

Roberts: Looking at your data it looks to me like you could make a case that there has been a decline in technical company formation in Minneapolis/St. Paul, but I don't think you can make any statement about Buffalo.

Table 6

TECHNOLOGICAL COMPANY FORMATIONS

MINNEAPOLIS-ST. PAUL, BUFFALO, AND PALO ALTO AREA

| Year | Minneapolis St. Paul | Buffalo | Palo Alto Area |
|---|---|---|---|
| 1951 | 4 | 1 | * |
| 1952 | 5 | 0 | * |
| 1953 | 3 | 2 | * |
| 1954 | 1 | 0 | * |
| 1955 | 4 | 1 | * |
| 1956 | 5 | 1 | * |
| 1957 | 9 | 1 | * |
| 1958 | 2 | 4 | * |
| 1959 | 6 | 4 | * |
| 1960 | 13 | 5 | 17 |
| 1961 | 22 | 7 | 25 |
| 1962 | 4 | 1 | 21 |
| 1963 | 4 | 3 | 18 |
| 1964 | 2 | 4 | 24 |
| 1965 | 2 | 2 | 16 |
| 1966 | * | 1 | 27 |
| 1967 | * | 5 | 37 |
| 1968 | * | * | 44 |
| 1969 | * | * | 36 |

* Not available.

Draheim: This is true. I think this may be temporary; it would be interesting to go back and check this out. I do notice this trend; we have had people coming from the Twin Cities to Crocker Capital for money. We know the Twin Cities' financial picture is more sophisticated. It is perhaps significant that these Minnesota companies are casting around the country for their money.

Howell: One other interesting thing, Kirk. I went back to Minneapolis about two years ago and talked to the President of the Federal Reserve Bank, and he indicated that they were somewhat disenchanted with the technical industry. This is just a philosophical attitude.

Shapero: Why?

Howell: I don't know why. They were just a little concerned about getting too heavy in technology.

Shapero: I think I can speculate on why they are disillusioned. We found, and this is really a local culture thing, that in general, midwest companies had a lower turnover rate. Lower migration mobility than other places.

Howell: They work harder!

Shapero:We ask guys why you stay here, etc. Their answer often is "Midwesterners work harder". And we say, "why do California companies win contracts at base efficiency? And they say that if you look carefully those are Midwesterners who are out there working. But theirs is a conservative viewpoint and they don't like this kind of race. I am speculating now, that this is a little too flashy — too much movement. We had guys in Kansas City who talked about turnover in a technical company of about 1 or 2 percent and they say we think that may be a little low. Well, when you get up in Minneapolis where they are switching between companies, you know, they begin to say, "This is an immoral thing; it is unethical, this kind of switching, hauling, starting and doing." It is really funny — we found real regional differences in this regard.

Roethle: Is there any comparison between Palo Alto and the Boston, Massachusetts, area?

Draheim: We do not have that detail on the companies; possibly Ed has that data for Boston, but I haven't seen it.

Vesper: What happens to these Palo Alto numbers if you subtract electronics? Do they vanish?

Draheim: Certainly the bulk of them. 13% are semiconductor companies. There remains a substantial number of non-electronic companies. Perhaps Arnie can count on that.

Cooper: I would agree — **mostly** electronics.

Vesper: Would the number be more like 10% of the ones we see up there — if you took away electronics?

Roberts: Why should you want to take away electronics?

Vesper: Well, maybe because it turns out that electronics is a special case. You see, in Buffalo they are talking about whether there are more chemical companies than any other kind.

Draheim: Buffalo has had a substantial number of electronic companies formed; there have been ten or twelve.

Roberts: When you say that maybe electronics are a special case, what would that mean?

Vesper: It means that you can make electronic things pretty easy if you have an oven and you did it at your last company and . . .

Roberts: Well, you can make mechanical things easier.

Draheim: And probably you could make hospital supplies easily.

Vesper: Why are you resisting subtracting electronics?

Draheim: Because I don't think the category is atypical.

Roberts: Why in the world would you subtract the largest growth industry in the country?

Vesper: Just to see what happens to the numbers. I think that it turns out that all the numbers go to zero then. It would be nice to call Palo Alto strictly an electronics area.

Draheim: No, the new company formation figures wouldn't go to zero. There is some mechanical and electro-mechanical technical company formation in Palo Alto. There is considerable new company formation in computer peripherals. Would you call this electronic?

Shapero: I think Karl has a point; perhaps there is different industrial logic, that in some industries one might expect a higher entrepreneurial formation and others less. It would be interesting if you got some of this into your discussion — to make one crosscut that way just to see what it shows us. It's not a question of whether electronics is good or bad.

Vesper: If you are in another city and you want to get industry started and it turns out that, where you have electronics there is a lot and where you don't have electronics there isn't much, then maybe, that says that the way to go is to try and get some non-electronic industry.

Draheim: Let me make another point; there was a time when most electronics was not particularly capital intensive, but now, when you start a semiconductor company using integrated circuits and MOS technology, your capital requirements are millions of dollars. Nevertheless, the capital intensity factor hasn't slowed down new company formation in the semiconductor field. Things that we used to think important as factors are perhaps not so important with respect to company start-ups.

Roberts: Now, wait a minute; that is a point that I would be very hesitant to accept. Mainly that the degree of capital intensity isn't important in affecting the rate of start-ups.

Draheim: I am not saying capital intensity is not an important factor in technical company formation; all I'm saying is that this factor hasn't slowed down the formation of semiconductor companies. As you will see here, there have been almost a hundred new semiconductor companies formed in recent years.

Roberts: Well, yes, but you always have cost-benefit trade-offs in some sense. But, I think that, if in fact those companies could be formed for a much smaller entry cost — if you could find hundreds formed now, you could then find thousands.

Draheim: To summarize, my point is that you can't, as a class, say that electronics (and I include semiconductors), is per se, a type of company that you can get into without too much capital; there are forms of electronics that are as capital intensive as you could find in the chemicals and other industry classifications.

**Technical Company Formation in St. Louis**

Let's move on with comparisons. I'll dwell just a short time on the St. Louis situation. I don't have the data; this was a project related to the development of an economic plan for St. Louis poverty areas. As a part of the project, I made a point in the interviews with some sixty companies to determine what the technological company formation rate was. It has been practically nothing in St. Louis; nothing out of McDonell; nothing out of Monsanto. There was no indication of a very exciting financial community.

Vesper: How about Sylvania spin-offs in Palo Alto?

Draheim: Not more than one, as I recall . . .

Cooper: I don't have the exact data with me, but very few considering the number of employees.

Roberts: I wonder about the accuracy of those data, since the founder of the Sylvania electronics division told me that he could "off the cuff" name a dozen companies that came out of Sylvania Mountain View Laboratory, which amounted to 100 million dollars worth of business.

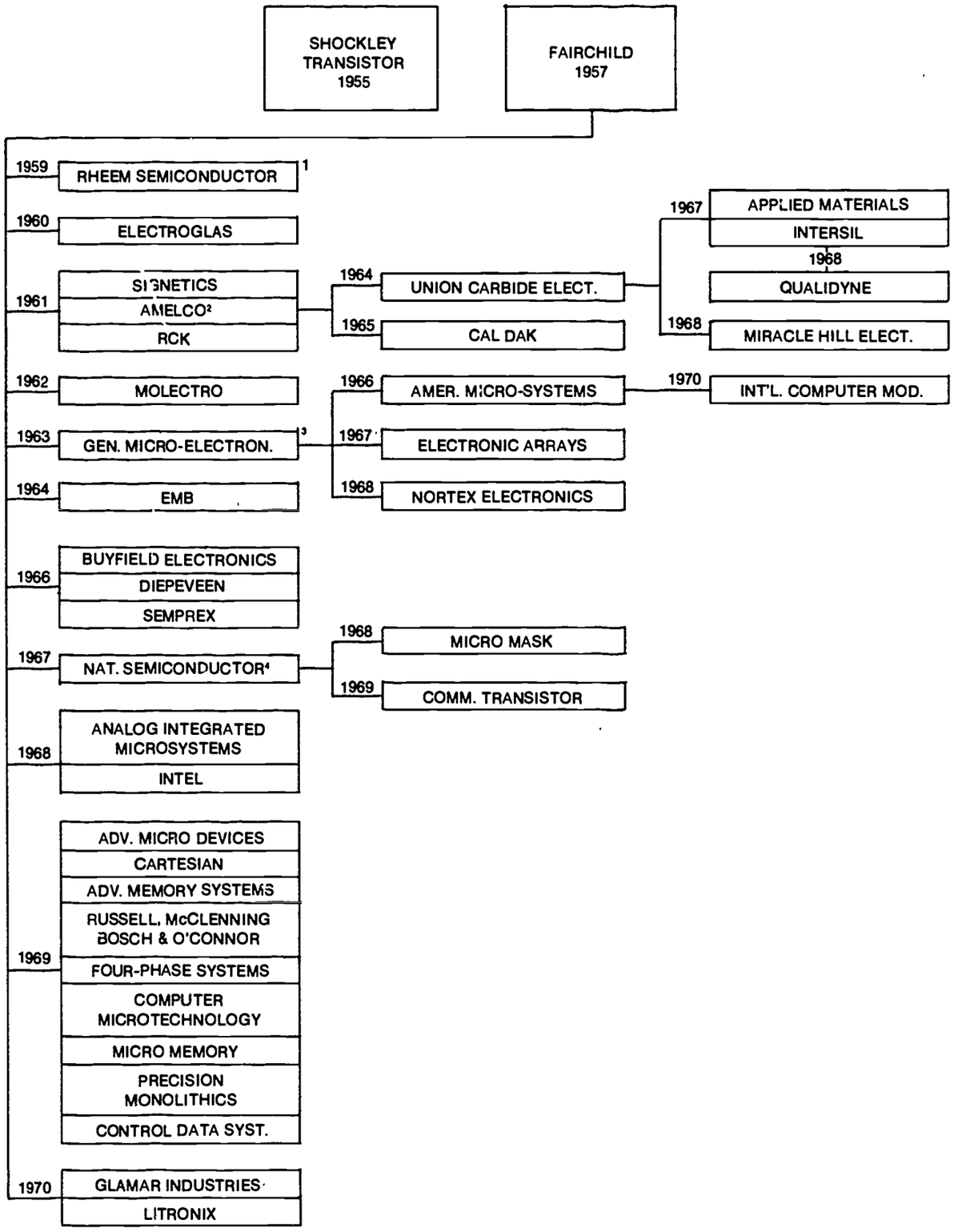
Cooper: He **may** be referring to situations where they went someplace else to work and then later spun-off. I'm referring to direct spin-offs.

Roberts: I wonder about the data just cited in the St. Louis situation — you talked to 60 companies — were they the source of information about no spin-offs?

Draheim: No, I also went through several industrial directories to find technical companies and couldn't find any significant number.

Roberts: It is kind of amazing . . . .

Figure 1




1 Acquired by Raytheon in 1961
2 Subsidiary of Teledyne
3 Acquired by Ford Philco in 1966
4 Reorganized and moved from Conn. to Calif.

**Technical Company Formation in the Semiconductor Industry**

Draheim: Let's look at the semiconductor industry. This begat chart is the result of some work done with SRI Dick Howell and Al Shapero were also involved. Starting with Bell Laboratories, you get some idea of the spin-offs and the dates of these. Texas Instruments (TI), the semiconductor division, got started in 1951; since then there have been 17 spin-offs from Texas Instruments. Transitron has had at least 5 and the Semiconductor Division of Sylvania, 4. Here you at least get some indication of this, but not necessarily in the Palo Alto area. Spin-offs from the Shockley chain (primarily from Fairchild) have totaled 39 since 1955. Other principal sources of spin-offs not related to Bell Laboratories were General Transistor, starting in 1953, with 3 spin-offs; RCA about the same time — 6 spin-offs; Hughes in 1954 — 6 spin-offs; Motorola — 7. A question: why in a fast moving industry have there been so many new semiconductor companies formed in the Palo Alto area and not so many out of Motorola in Phoenix?

Shapero: You have TI spinning off from Bell — I don't think it should be a direct line. This was that big conference seminar with the licensing that got it there and it was not a spin-off. Shockley, you might say, was a spin-off — he left the organization. I don't think you would say that this is true of TI . . .

Draheim: Next is the TI chart and its spin-off chain. Cary Hoffmann and I were able to talk to four of these companies as part of another research project. Out of Siliconix there have been six spin-offs. Dr. Hugle is an interesting subject. This man started four companies; he's now in the Palo Alto area where Hugle Industries is located. Hugle produces equipment for the semiconductor industry, primarily handling equipment.

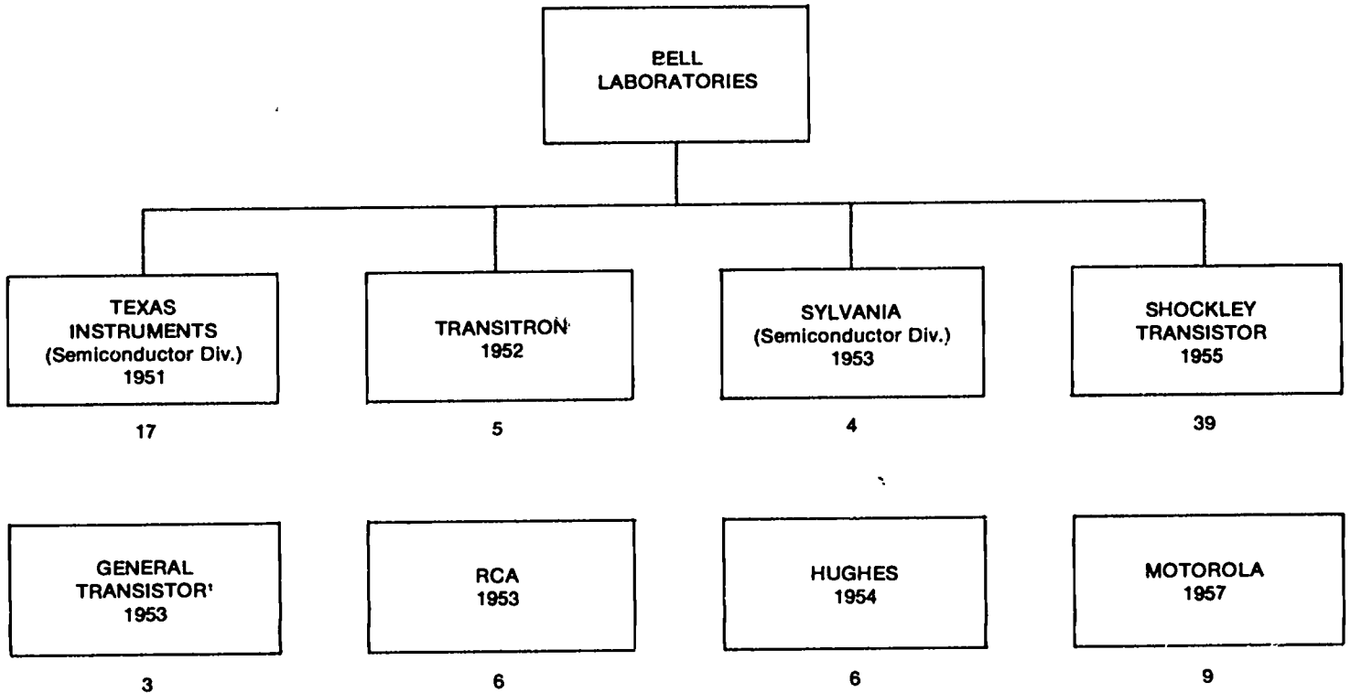
With respect to the Fairchild situation, these are some interesting charts. The year having the largest number of new company formations was 1969. That was the year that Fairchild had many problems and Dr. Hogan left Motorola and joined Fairchild in October, 1969. Nine companies were formed out of Fairchild in that year. These were "pushes", primarily, people felt threatened both before and after Hogan joined Fairchild. Probably some people were asked to leave. Another interesting situation is General Micro Electronics — acquired by Ford Philco in 1969. Three companies were formed as a result of the merger. Partly responsible was a change in technology; about this time MOS (large scale array type of semiconductor activity) was being developed. These people received cash at a good time and started their own companies with the new techniques.

Another interesting company formation movement is that of Dr. Hoerni. First, he was a principal of Shockley Transistor; then he was one of the eight that formed Fairchild Semiconductor. He also was a founder of Amelco; then a consultant to Union Carbide's Transistor operation; finally he started Intersil. Some of these people you can track rather significantly as founders of new technological companies.

Is there anything else upon which you wish to comment — Dick or Arnie?

Howell: I think just the fact that there are over 30 technical company formations in about a ten-year period of time is worth commenting on.

## Table 7
PRINCIPAL SOURCES OF SEMICONDUCTOR COMPANY
SPINOFFS - 1951-1970




Note: Numbers below the boxes indicate number of companies in the complete spinoff chain, i.e., includes spinoffs from spinoffs.

Draheim: Company formations from Fairchild represent about 13% of the total technical company formations in the Palo Alto area during this period. The percentage was as high as 28% in 1969.

Roberts: Did these spin-offs represent companies formed immediately upon departure from the particular source company?

Draheim: Yes, that's right.

Roberts: Did you look at former Fairchild employees who participated in forming companies? What would be the number of company formations?

Draheim: That number would be higher. This chart represents this type of thing.

Roberts: What about all the companies formed from companies spun-off from Fairchild? Were those people formerly at Fairchild?

Draheim: Most of them were also at Fairchild previously.

Howell: You can follow most of them from company to company.

Draheim: This tracking could be done with little difficulty. There were a few founders that were not from Fairchild — financial types, for example.

Roberts: Well, they could have come in at the second stage . . . .

Shapero: Ed, we did a study, a cut across the moves of executives. We have several thousand biographies of this — and we looked at technical companies — men do move in clusters. Now, we tried to trace how many of them were together two or three companies earlier. We found that there were some instances of that — but the great bulk are men together for the first time.

Komives: They form a new nucleus at the new company.

Shapero: Yes, sometime you pick up one or two — we found a certain amount of that, but the bulk of them are in this last place.

Roberts: Well, then I can see the information as a good begat chart, but I don't know whether it is a statement of spin-offs from Fairchild.

Cooper: Well, it depends upon how you define spin-offs.

Draheim: Technically, you are right, Ed, but essentially it's both a Fairchild begat chart and a Fairchild spin-off chart.

One more chart and I'm through. The principal point I want to make in touching on the semiconductor industry and the computor Industry is that in industries of rapid obsolescence or having a fast

Table 7

COMPARISON OF SELECTED METROPOLITAN AREAS BY NUMBER OF DEFENSE R & D CONTRACTORS INCLUDED IN FIRST 500, VALUE OF AWARDS, AND PERCENT TO LARGEST CONTRACTOR FY 1963-1965

| | Number of Defense R & D Contractors | | | Value of Defense R & D Awards (millions of dollars) | | | Percent of Area Awards to Largest Contractor | | | Largest Contractor in Area |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1963 | 1964 | 1965 | 1963 | 1964 | 1965 | 1963 | 1964 | 1965 | |
| Complexes | | | | | | | | | | |
| Los Angeles | 92 | 86 | 98 | $1,006.3 | $1,114.9 | $790.8 | 38% | 49% | 22% | North American |
| Boston | 56 | 65 | 59 | 255.0 | 282.4 | 308.2 | 28 | 35 | 39 | MIT |
| Midwest centers | | | | | | | | | | |
| Twin Cities | 8 | 12 | 13 | 56.8 | 56.4 | 49.7 | 38 | 30 | 31 | Sperry-Rand-Univac Division |
| Detroit | 14 | 12 | 12 | 28.7 | 47.4 | 69.0 | 23 | 81 | 72 | Ling-Temco-Vought |
| Milwaukee | 3 | 3 | 3 | 58.1 | 37.4 | 13.8 | 99 | 98 | 87 | General Motors |
| Cincinnati | 5 | 4 | 6 | 14.1 | 13.0 | 52.4 | 85 | 79 | 95 | GE-Flight Propulsion |
| Chicago | 19 | 18 | 20 | 35.6 | 29.1 | 28.7 | 33 | 26 | 31 | IIT |
| Ann Arbor | 6 | 5 | 3 | 24.8 | 26.7 | 33.1 | 41 | 65 | 42 | (1963 & 1965) Bendix Systems Division (1964) Univ. of Michigan |
| Columbus | 5 | 5 | 6 | 10.8 | 19.5 | 35.5 | 45 | 46 | 54 | (1963 & 1964) Battelle (1965) N. American |
| Cleveland | 11 | 10 | 10 | 25.8 | 15.0 | 16.3 | 66 | 51 | 28 | Gen. Motors 1963-64, Clevite 1965 |
| St. Louis | 5 | 5 | 8 | 10.8 | 15.2 | 25.2 | 79 | 64 | 56 | McDonnell Aircraft |
| Indianapolis | 4 | 3 | 3 | 6.4 | 20.5 | 24.2 | 95 | 98 | 99 | General Motors - Allison |
| Akron | 4 | 3 | 3 | 18.9 | 10.5 | 4.0 | 92 | 86 | 60 | Goodyear-Aerospace |
| South Bend | 2 | 2 | 3 | 11.8 | 21.5 | 2.8 | 95 | 98 | 80 | Bendix Mishawaka & Aerospace Divs. |
| Wichita | 3 | 2 | 1 | 11.0 | 9.1 | 13.3 | 79 | 50 | 100 | Boeing |
| Dayton | 13 | 14 | 21 | 8.9 | 10.6 | 12.2 | 25 | 24 | 25 | Dayton University |
| Urbana | 3 | 2 | 3 | 8.0 | 7.1 | 7.5 | 94 | 95 | 78 | University of Illinois |
| Kansas City, Mo. | 1 | 2 | 2 | 2.6 | 1.6 | 2.3 | 100 | 98 | 98 | Midwest Research Institute |
| Madison | 1 | 2 | 2 | 1.7 | 2.2 | 2.3 | 100 | 95 | 95 | University of Wisconsin |
| Cedar Rapids | 1 | 1 | 1 | 2.6 | 0.5 | 0.7 | 100 | 100 | 100 | Collins Radio |
| Sioux Falls | 1 | 1 | 1 | 0.5 | 0.2 | 0.5 | 100 | 100 | 100 | Raven Industries |
| Omaha | 1 | 0 | 1 | 0.1 | 0.0 | 0.1 | 100 | 0 | 100 | ITT 1963, IBM 1965 |
| Other centers | | | | | | | | | | |
| Denver | 9 | 7 | 6 | 249.0 | 218.0 | 136.1 | 97 | 98 | 96 | Martin |
| Orlando | 3 | 2 | 2 | 17.8 | 74.2 | 88.7 | 86 | 94 | 84 | Martin 1963, Western Electric 1964-65 |
| Tucson | 6 | 9 | 4 | 125.6 | 19.9 | 1.4 | 91 | 48 | 60 | Martin 1963, Pan American Airways 1964 University of Arizona 1965 |
| Buffalo | 10 | 10 | 10 | 48.1 | 70.5 | 44.4 | 46 | 61 | 47 | Sylvania |

Source: Office of the Secretary of Defense, **500 Contractors Listed According to Net Value of Military Prime Contract Awards for EDTR Work**, FY 1963, 1964, and 1965.

changing state of the art, you experience a greater rate of spin-offs. Take semiconductors, for example. First you have discrete components, i.e. transistors, diodes, resistors, etc.; then you have integrated circuits, and now, we have newly formed companies making MOS and large scale arrays. As long as these technologies change, you are going to have a fast rate of spin-offs.

**Technical Company Formation in the Computer Industry**

Draheim: Representative of the computer industry, the situation in Minneapolis/St. Paul is pertinent. As indicated by the chart, there were 13 companies spinning off from Sperry Rand. The fast moving technology during this period was a factor in the rate of new company formation.

**Summary of Factors Influencing Technical Company Formation**

In summary, the following factors that influence the formation of technical companies have been identified and are listed in the sequence discussed:
1) Existence of a technical pool of labor. (The hearing aid industry in Minneapolis/St. Paul and their experience in miniaturized electronic products as a predecessor to establishment of a computer industry).

2) The credibility of forming a new company as a result of other known persons in the area establishing a new company. (The large number of companies formed in the Twin Cities after the successful founding and sale of public stock by Control Data and Data Display in 1957).

3) The availability of venture capital. (ERA being established in the Twin Cities because of the $10,000 of seed capital made available to them).

4) Perceived threats to employees of existing companies. (The absentee management and remote control of budgets affecting the Univac Division of Remington Rand).

5) Existence of underwriters and a private and public stock market willing to finance small, technical companies. (The Twin City "dollar-stock market" in the late 1950's and early 1960's).

6) The degree of sophistication for the formulation and administration of state laws governing the issuance of securities by small companies. (The Minnesota situation in the late 1950's and early 1960's).

7) The successful existence of companies producing similar products. (Hearing aids, computers and medical products in the Twin Cities; chemical companies and companies producing heart pacers in Buffalo; automobiles in Detroit; and tires in Akron). This covers the factors of credibility, availability of technical manpower pools, the availability of financing and possibly the availability of required supporting services.

8) Actual threats to employees, such as layoffs caused by going out of business, economic conditions, mergers and relocation of a company or division. (General Mills getting out of the computer and other businesses in the late 1950's, the possibility of the University of Minnesota's Rosemount Aeronautical Laboratory being shut down, and Ford Philco acquiring General Micro Electronics).

9) The organization and structure of the R & D function of some large companies. (no spin-offs from 3M, Sylvania and the large chemical and electro-chemical companies in Buffalo).

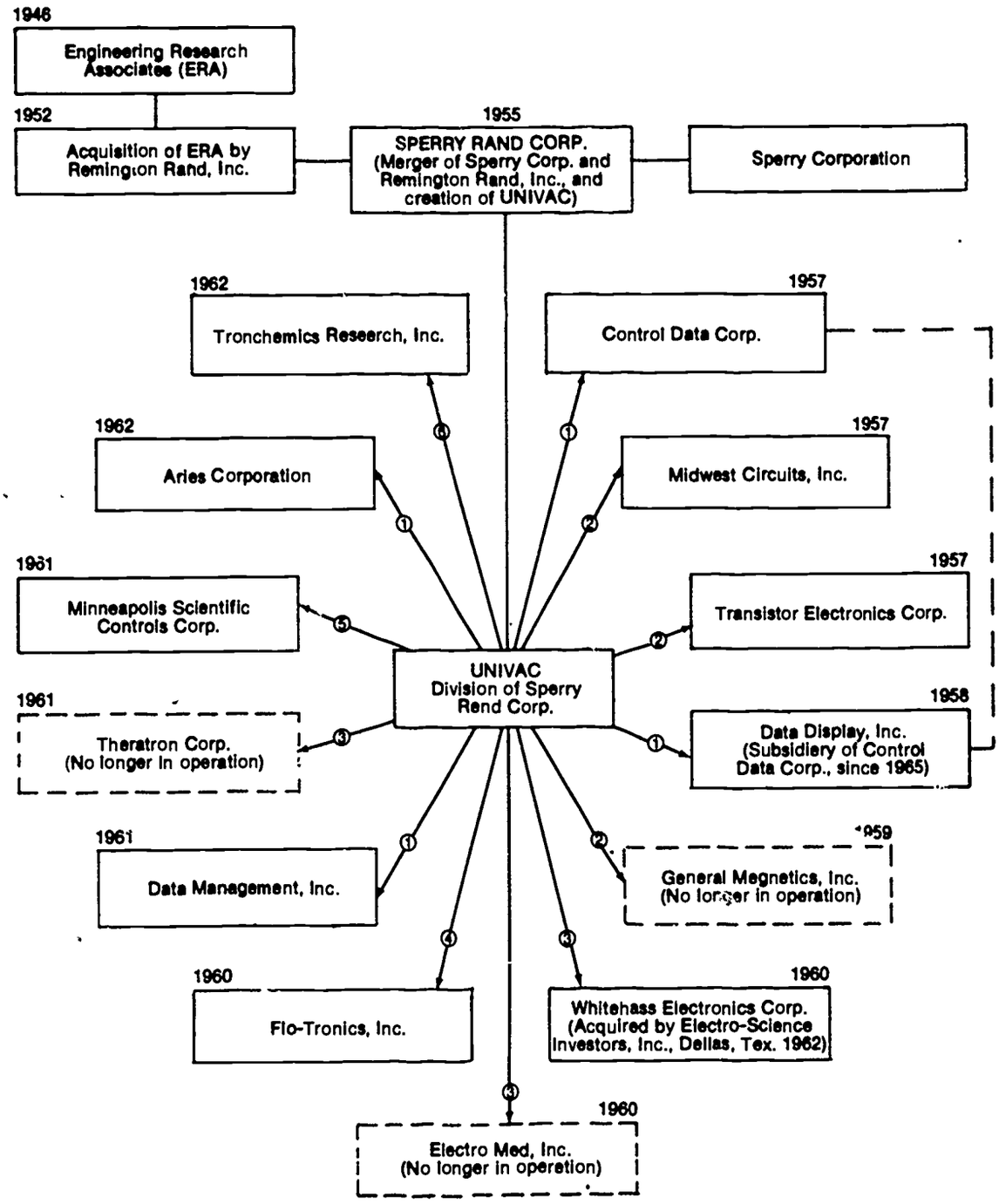
10) The availability or non-availability of government contracts and government financial assistance programs. (The spin-offs from Bell Aircraft with the end of the Korean War when contracts terminated; the new medical products companies formed in Buffalo during the year Medicare was debated and passed).

11) The degree of capital intensiveness. (The higher rate of new company formation among technical companies requiring smaller amounts of capital).

12) The availability of entrepreneurs with a "track record". (The company formation records of Dr. Hugle and Dr. Hoerni in the Palo Alto area).

13) The degree of change in the "state of the art" of the technology. (The higher rate of company formations from the semi-conductor and computer industries, as compared with other slower moving technologies).

Figure 2 EXAMPLE OF TECHNICAL COMPANY FORMATIONS, SPIN-OFFS, AND MERGERS ORIGINATING WITH ENGINEERING RESEARCH ASSOCIATES (ERA)*




| Industrial Categories | Table Ref. |
|---|---|
| ① Computers and Data Processing | B-7 |
| ② Electrical and Electronic Components | B-6 |
| ③ Medical and Surgical Devices | B-2 |
| ④ Misc. Electrical and Electronic Equipment | B-5 |
| ⑤ Industrial Electrical Equipment | B-3 |
| ⑥ Data Processing, Process Control, Chemical and Food Processing | |

*This example depicts only the first line of spin-offs subsequent to the formation of UNIVAC. A number of spin-offs from spin-offs have occurred and are continuing to occur.

## TWO / JEFFERY C. SUSBAUER

### The Technical Entrepreneurship Process in Austin, Texas

I want to talk to you this morning about the study I did on technical company formation in Austin, Texas.

### Purpose of the Study

This was an empirical exploratory research designed to ascertain the important variables in the technical company formation process, and the variables important in the development of a region or a city as a technical complex. We studied the social, economic, and psychological variables associated with technical company formation, and investigated the differences between technical and non-technical entrepreneurship. We looked into the characteristics that are considered important for being an entrepreneur, including the variables important in his motivation; the conditions under which formations can occur and do occur; the existence of a university with a high science or engineering input as a precondition to entrepreneurship.

There were a number of side issues investigated, too. We also looked at Norman Smith's (Michigan State University) concept of the "opportunistic" entrepreneur versus the "craftsman" entrepreneur. And we attempted to make some critical evaluations of March and Simon's concepts of decision making and decisions to leave or stay with an organization as systemic variables aiding an explanation of the technical company formation process.

The data from the study support rather highly all the research that S.R.I. had done, and what Ed Roberts had done at M.I.T. It was very gratifying to find the data emerging in such a positive reinforcing way. I'll try to briefly summarize some of this research for you this morning, but two other preliminary topics need to be examined first: the sample, and some definitions about it.

### Some Background and Definitions

We began the research in early 1968, and we knew what we wanted to investigate; but the locus of the study presented a problem. We didn't want to pick a city that had been worked over before, and we were lucky to find, after some searching, that we had a suitable technical community in Austin, Texas. Conveniently enough, it fit many of our criteria — there was a fairly good array of different technologies, a good and semi-documented history of technical company formations, and it also was very economical to study.

I would like to acknowledge financial support for the study received from the Abell-Hanger Foundation and the College of Business Administration Foundation of the University of Texas. I also would like to acknowledge the assistance and suggestions of Al Shapero and Cary Hoffman during the study.

We had a much smaller sample than Kirk was talking about — there were 31 firms formed in Austin between 1939 and mid-1968 that qualified as technical companies for us. Austin is a lively place; there have been 5 or 6 subsequent local formations. Twenty-two of these 31 companies were surviving at the time of the study, in one form or another (either merged with another organization or under a different name), and the principals were still around. We interviewed every company — including the failures . . . .

Shapero: And those are hard to catch.

Susbauer: They are.

We got secondhand information from one company — the founder had gone to California and wouldn't talk to anybody, even on paid long-distance. The sample is not quite 100% firsthand, but it is well-based. We interviewed nearly 100 people in all — the principal and any secondary founders of each company, people in the financial community, the University, the University labs, in fact, anyone we felt could possibly give us input about how these companies were formed, when they were founded, how they were started, how they are growing, the backgrounds and histories of the entrepreneurs.

**Some Definitions**

We restricted the sample to technical firms founded in Austin which produced products; this excluded software and various kinds of consulting firms. We also excluded divisions of national and regional firms which were established in Austin, such as I.B.M. and Texas Instruments. We wanted to have a sample which reflected entrepreneurship in a community and did not want to study paper-product organizations which, we felt, had different entrepreneurial characteristics associated with them.

We borrowed our definition of a technical company from the S.R.I. R & D Studies Series; if we were in doubt about the suitability of a particular firm for inclusion, we looked to the clause, "characterized by a relatively high fixed overhead of technical personnel". We also relied upon S.R.I.'s definition of a spin-off; under this definition, the principal founder of the company must have come directly from the spawning organization, with no intervening employment.

**A Note About Austin**

I think I should say something here about the locus of the study, because for reasons we'll go into later, I think that Austin and other University towns create a special kind of environment for technical entrepreneurship.

Texas appears to be — and is — entrepreneurial. Austin is the State Capitol and the site of the main campus of the University of Texas system. The city's population of slightly over 200,000 is primarily WASP, though there are some sizeable ethnic and racial minorities — Germans, Spanish-Americans, and Blacks. Most of the entrepreneurs in the sample conformed to the WASP population characteristics. Perhaps more importantly, Austin is viewed as a highly desirable place in which to live by the people that have lived there. This is one of the reasons why we had a relatively sizeable technical community emerge.

**The Firms in the Sample**

Of the thirty-one companies which conformed to our definition, Tracor, Inc. is undoubtedly the best known and most economically successful. That company was formed as a result of a merger in 1962 between two local companies, Textran, and Texas Research Associates. Prior to 1962, there had been sixteen companies formed; since 1962 through mid-1968, 15 more companies were founded. From another view, taking 1956 (the start of the Sputnik era) as a significant year in technical company formations, we found that only six of these thirty-one companies had been formed prior to that date, or 25 in the 12 years just previous to the study.

Danilov: What kinds of products did they produce?

Susbauer: There's a fairly good sized group of nuclear companies. Seven nuclear instrumentation companies; eight research and development companies producing products; six electronic components firms; seven producing test equipment; and three which were formed as support services companies (though these have all gone on since to produce products themselves). So, primarily we are dealing with a small nuclear instrumentation and components community.

Roberts: What about the chemical industry?

Susbauer: The chemical industry was not really native to Austin, though there are some sizeable chemical firms there. They did not conform to the selection criteria of the study.

Cooper: How many of these 31 were university spin-offs?

Susbauer: Only ten did not have a direct or indirectly traceable tie to a university department or research laboratory. There were nine direct spin-offs in the population, and the rest were "secondary" spin-offs.

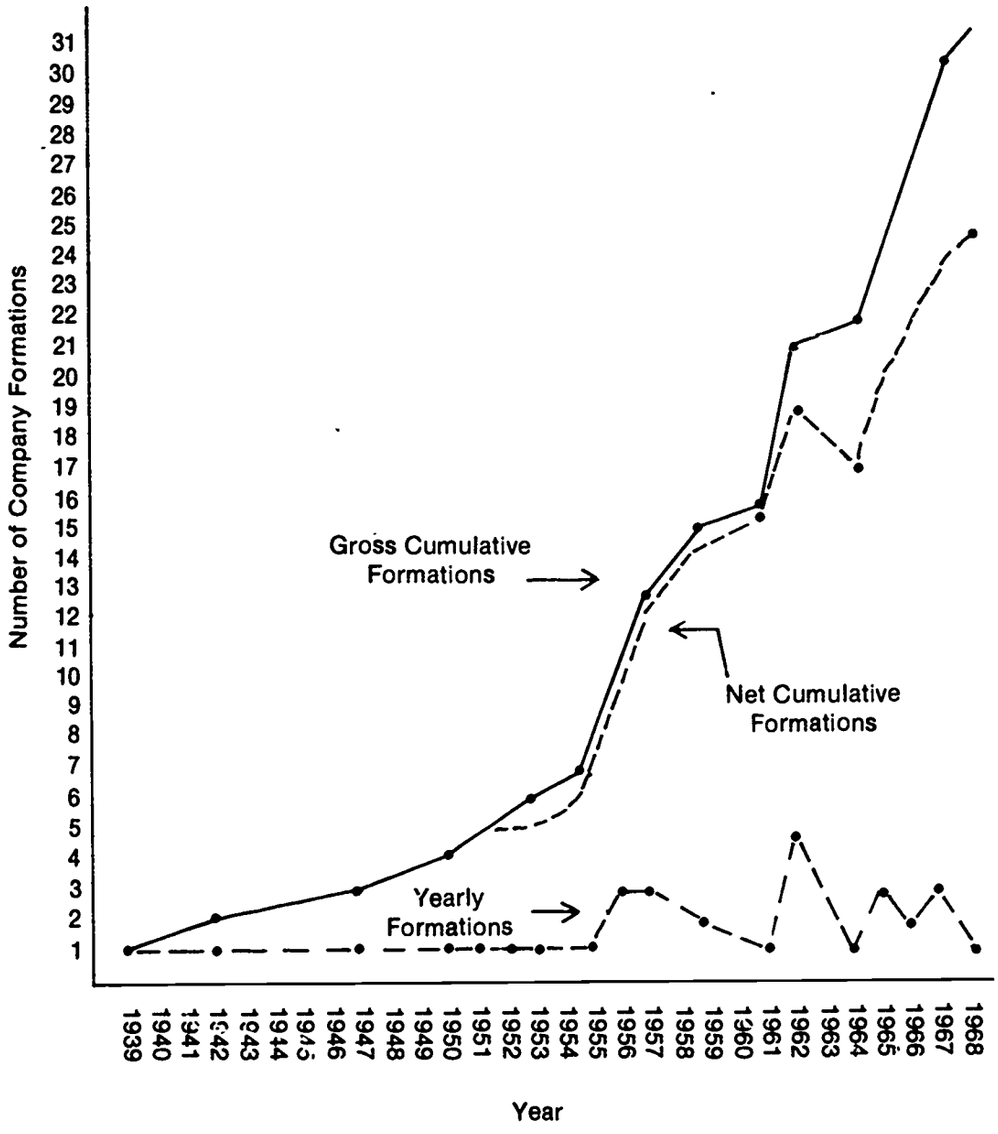
This brings up a very interesting fa[illegible] the study: most of the formations came from the physics department, and this would be a good time to explore that a bit.

**Digression on the Encouragement of the Physics Department**

The first company formed in Austin, a little gravity meter firm called LaCoste and Romberg, was founded by two physics professors in 1939. They had the basic patent on these meters, which are used extensively in measuring the depth of oil wells and offshore drilling operations. The combination of the depression, very low pay in university teaching at that time, and the encouragement of the physics department chairman caused them to set up operations.

Their experience is not atypical of other university-based enterprises in Austin; we found time after time that the physics department was very entrepreneurially encouraging, and at the same time, the engineering departments (which were much larger, by the way), surprisingly enough, were at best neutral, and often-times very negative towards outside activities by faculty and staff. There have been some engineering faculty members that have their own consulting organizations, but that is about it. We were told by several people we interviewed, that the College of

Exhibit 1 Austin Technical Company Formations, By Year



Engineering had a conscious policy during much of the past twenty-five years specifically forbidding outside work.

The physics department administrators not only encouraged vocally, but they also sought capital funds for their students and colleagues, rented out university facilities in off-peak and idle hours in the various laboratories, and have generally been very reinforcing to technical entrepreneurs, including some people who probably would never have started their own companies without this kind of backing. I think we see in the physics spin-offs a definite university partnership with private enterprise, which makes tremendous sense but does not occur with any great regularity, unfortunately. This process of the physics department encouragement has other implications I'll address later on, too.

Cooper: I have one question about these university spin-offs. Were the principal entrepreneurs graduate students, or professors, or full-time researchers in a contract laboratory?

Susbauer: A little of each. It is difficult to categorize them absolutely because of joint departmental/laboratory appointments, but of the direct spin-offs, four of the companies were founded principally by faculty members, three or four more were formed by laboratory staff members, and one or two were formed by graduate students who were concurrently staff members of labs.

Draheim: In combinations, or teams?

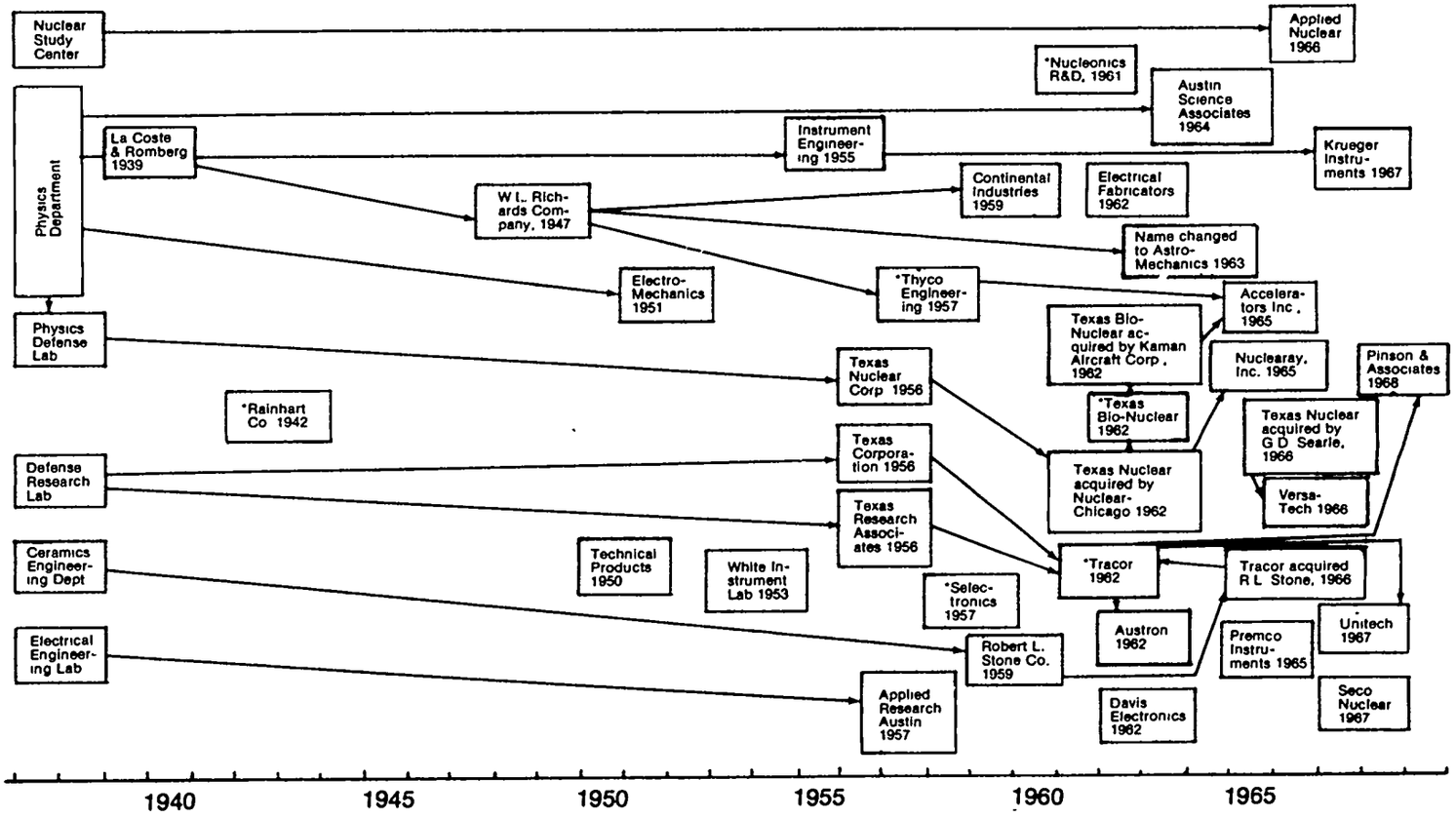
Susbauer: In combinations and as single individuals. More often than not — there were only two university spin-offs which were really single entrepreneur formations — combinations seemed to be the entrepreneurial mode. Teams from the research labs were especially prone to this activity. And it is becoming more and more prevalent. We think it has real importance in terms of the survival and growth possibilities of these kinds of firms.

**The "Begat" Chart**

I think it would be well to refer to the "Begat" Chart at this point. LaCoste and Romberg were themselves a source of encouragement for others. W.L. Richards Co., later renamed Astro-Mechanics, was such a company. Astro-Mechanics, by the way, is one of the United States' leading makers of high precision large optical telescopes. Mr. Richards, in turn, has influenced at least two other entrepreneurs directly, and a host of other local companies. For example, there is no way to show on a chart his influence in Tracor's predecessor organizations.

Tracor itself, which is the only real spin-off from the largest laboratory, the Defense Research Laboratory (since renamed the Applied Research Lab), has spawned several spin-offs. The predecessor organizations of Tracor, Textran and Texas Research Associates, spun-off the university separately in 1956. Both rented space from the Richards Company, and Richards furnished them precision machining as well. They started off in acoustics and related research in 1956, merged in 1962, and the rest is history.

Exhibit 3 Chronology of the Origins and Major Changes in the Austin Technical Community, 1939-1968[a]




[a]Firms having no directly traceable origins from university departments, research laboratories, or other Austin technical firms are shown without lines and directional arrows. Firms not included in the study are indicated by an asterisk (*) preceding their listing on the chart.

The success of Tracor appears to have created the necessary preconditions for the takeoff of Austin as a technical community. Tracor was responsible for three spin-offs by the time of the study, and my Texas friends tell me that several more have since occurred or are in the process of occurring.

The Tracor experience exemplifies several aspects of the technical company formation process, we think. They have set upon a conscious growth pattern by merger and acquisition. R.L. Stone Co., an Austin firm formed out of the Ceramics Engineering Department in 1959, was acquired by Tracor in 1966, for example. A large chunk of Tracor's sales come from acquired subsidiaries like this one. At the same time, the spin-offs from Tracor show a strange mixture of encouragement and discouragement of entrepreneurship. Austron (1962), a spin-off formed just shortly after the Tracor incorporation, is an example of encouragement. Tracor executives consciously encouraged this firm, including some financial and directorship backing. Pinson and Associates (1968) was a case of Tracor divesting itself of a portion of its business. Tracor executives, in this case, encouraged a whole department to break off, and gave them a contract backlog in the process. Unitech (1967), on the other hand, was really pushed out the door. Once the Unitech group decided to leave, Tracor management hastened their planned departure by three or four months.

Danilov: One comment on Tracor. They have a substantial investment in an Ann Arbor spin-off. I think it is Ripp Laboratories — they provided them with a sizeable amount of capital to get them started.

Susbauer: Before moving on to other findings, I think perhaps we should comment on the companies which had no university ties. Two examples come readily to mind — Seco Nuclear, formed in 1967, and White Instruments, founded in 1953. Seco Nuclear's principal founder had been a technical representative for nuclear instrumentation companies in the Southwest for several years; when he decided to form his own company, he decided upon Austin because of the environment. He, like the founder of White Instruments, had no local ties. Mr. White, on the other hand, had been in Texas during the War, was an executive of a Los Angeles technical firm, quit, and came to Austin to form his company.

The local environmental considerations are very strong in many of these company formations. People don't like to leave Austin, once they have lived there. The early nuclear instrumentation companies coming out of the physics department and labs are certainly a part of this phenomenon, for example. The paradox, of course, is that Austin is not really close to sources of sales of most of the products created there.

Draheim: Jeff, did you find that after about five years people do stay put? We found this out in our Twin City study that even though they came in from another area, they tended to gain new roots.

Susbauer: Very much so. As a contrasting example, we were in Cleveland in August interviewing technical companies there, and Cleveland appears to be a pure case of people returning to their birthplace — if they ever left in the first place — to form their companies. They won't leave, and won't even consider other places.

## Summary of the Findings

Susbauer: Against that background, now let me summarize the major conclusions of the study along three major lines; the characteristics of the entrepreneurs, some circumstances of the formation act, and the conditions for formation.

## The Characteristics of the Entrepreneurs - Age

We found the average age of Austin entrepreneurs when they formed their companies was 34. Ed Roberts found his M.I.T. sample average to be 35.

I think that age at formation is an accident; there's much conjecture we can make about age as a variable. When you add up high education, a possible military obligation, and couple this with the fact that for it to be credible to form a company the entrepreneur needs to get around a little bit — and work for three or four companies — the early or mid-30's is about the earliest age a man **can** form a company in this field. Further, the age distribution of technical entrepreneurs we found in Austin conforms very closely to the average age curve of scientists and engineers in the population.

## Education

Technical entrepreneurs in Austin had high formal educational qualifications. Ten of 31 principal entrepreneurs studied held doctorates, while three of them had only a high school education. The high school diploma holders were somewhat surprising, but they did not form "high-high" technology companies. In fact, very few of the companies in Austin are really high technology. The entrepreneurs are very practical-minded. They are definitely applied researchers, and the majority perceive themselves as such. The educational attainment and other characteristics of these people, which are not typical of the scientific and engineering population, lead me to believe that the university spin-off environment may be atypical of all technical enterprises.

## Previous Experience and Company Forming Experience

Their company forming experience was low, and there is obvious reason for that — since few companies fail, few opportunities to form companies are present. This is certainly different from nontechnical entrepreneurs, where it is typical to find people forming company after company as they switch between failure and success.

Most of these technical entrepreneurs in Austin had significant previous experience — the majority of them worked for four or five companies before they formed their first company. This in itself is not too important, but the kinds of jobs they had made it more credible for them to form their own companies. For example, most had contract administration and marketing responsibilities, and in almost all cases, they felt that this was something that really made them find the act of company formation to be a possibility instead of just a probability.

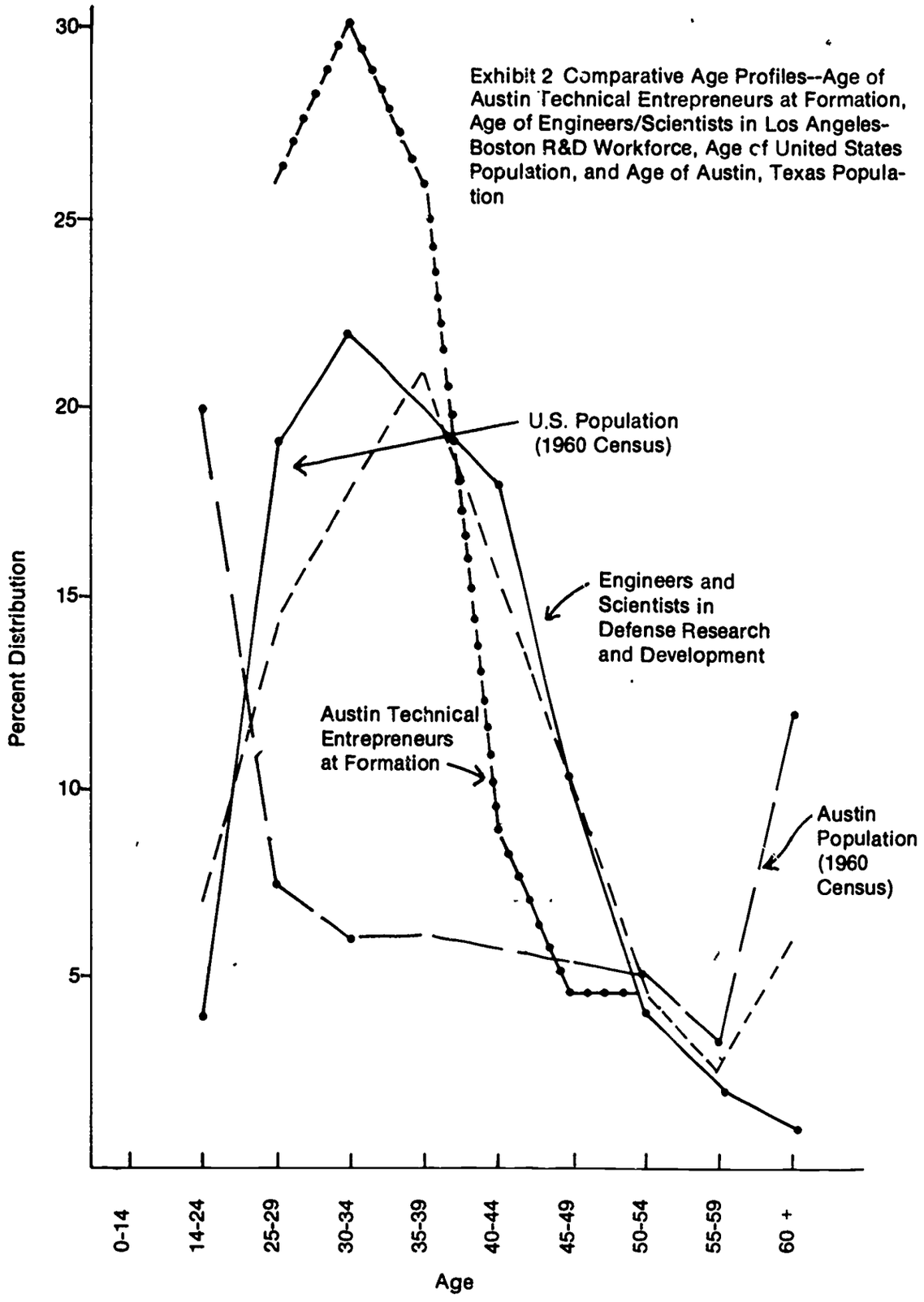



Exhibit 2 Comparative Age Profiles--Age of Austin Technical Entrepreneurs at Formation, Age of Engineers/Scientists in Los Angeles-Boston R&D Workforce, Age of United States Population, and Age of Austin, Texas Population

Sources: Shapero, Howell, and Tombaugh, **Structure and Dynamics,** Figure 5, p. 24, and **City and County Data Book, 1967.**

**Applied Vs. Theoretical Researchers**

I said that they viewed themselves primarily as applied researchers, not as "blue-sky" scientists. Only two entrepreneurs in the sample felt that they were "blue-sky" researchers, and their companies reflected that orientation.

These men were individualists, building companies which really were monuments to themselves. They had nice buildings and very little new business coming in the door. Most of the business originated from the telephone of the president-founder, as opposed to people actively marketing the firm's capabilities. This in itself is a variable when one considers the conditions for pushing entrepreneurship.

**The Family Characteristics**

We investigated the entrepreneurs' family backgrounds because, among others, Ed Roberts has found it to be a characteristic of entrepreneurs that their fathers or other close relatives were in business for themselves.

As you might expect in Texas, most of the entrepreneurial population we sampled had fathers whose principal occupation was in ranching or their own business. Surprisingly, most of their fathers did not encourage their company formation activities. I think there are obvious reasons for this, too. Their fathers, in most cases, didn't understand the business that their sons were going into. Also, most of their fathers had lived through the Depression and barely survived. We often heard the entrepreneurs quote their fathers as commenting: "It is so hard to make a buck (in small business) today, why start this business?" As we have just discussed, there were other encouragers in the community and the entrepreneurs' contacts tended to offset this negativism.

Danilov: Are you saying that most of these people were natives of Texas then?

Susbauer: About 65% were. Only two were born within a 50-mile radius of Austin. I think that this illustrates a unique point once again; the lure of Austin as a place to settle is very strong. Having the university there was what drew most to Austin originally.

Cooper: Jeff, from our earlier comments about previous employment, I gather that 30 out of the 31 principal entrepreneurs had been employed in Austin — where they made the decision to start their own company.

Susbauer: Most were employed in Austin prior to starting their own companies; I can think of only three or four major exceptions, including the company started by the man who moved to Austin from Los Angeles.

Komives: I have one question about the biographical data of these entrepreneurs. I'm particularly interested in the group coming out of the physics department. Was there any reportable distortion in terms of religious, ethnic, or cultural backgrounds of these people? You mentioned that most of them had fathers or people they identified with were in independent business. Were there any other discernable characteristics? Were there more Jewish entrepreneurs?

Susbauer: We don't have many Jews in Austin; the study population conformed very closely to the population of the region.

Kohl: Do you really mean that? You said there were a lot of Mexican-Americans.

Susbauer: The study population was primarily WASP, as is Austin. Though Austin does have a Spanish-American minority group, there were no technical entrepreneurs from this segment of the population. This is, I think, understandable given the need for technical education and experience, which few of these people acquire.

Roberts: Don't you have any Jews in your sample? Mexican-Jews? Seriously.

Susbauer: No, unlike at M.I.T.

Shapero: Especially along the border cities there are Mexicans and Jews in business, but not in technical businesses.

**Some Characteristics of Austin Company Formations**

I think we have to recognize that the technical company formation process is very complex. There are so many variables that no one set of variables really explains all the factors which makeup an entrepreneurial decision to start a company. We did learn some things, however, about the process of formation which I'll try to summarize now.

**Critical Mass**

We could see rather clearly in the Austin population the S.R.I. notion of "company formations breeding company formations." A critical mass of companies, coupled with a significant success, seems to be necessary to move a technical community into action. Tracor was not an overnight success, but since 1962, the date of Tracor's founding, fifty percent of the technical company formation in Austin has taken place.

**Financing**

Financing difficulties were not a critical variable in the Austin technical companies. Most of these companies were formed with internal sources of capital. There are very few examples where a company needed to raise public capital. One or two companies, Tracor among them, did look to sources outside Austin for particularly costly initiating organizations.

Komives: Jeff, you say internal sources of capital. The nucleus group of entrepreneurs put up the money or they had some silent partners within the Austin area put in money?

Susbauer: That's right. Their companies were very closely held, and most of the funds came from their own or close relatives' pockets. Most of these companies were not highly capital-intensive.

Roethle: You must have had some fairly progressive banks there for working capital.

Susbauer: The Austin Financial community I can't really classify as progressive throughout the years. It is, to a certain extent, now, however. This is primarily because of Tracor's growth and success. Prior to 1962, the enterpreneurs told us, there was no way the banks in Austin would lend money for working capital or for any other purpose for a technical company, because they didn't understand it. Tracor supposedly went to Boston to get money in 1962. In 1968, the Austin banks couldn't get to the technical companies fast enough. They were all falling over each other. They still didn't understand what was going on — but they were afraid of missing another Tracor. We talked to one company, for example, just fifteen minutes after a third bank had been in to see him that day. Cary is going to deal with this whole question of financing tomorrow, I am certain.

Hoffman: There is a mix of bank sentiment in Austin — some of them are very willing to support, but few of them know what they are doing. Some of them are willing to support the technical companies down there and others of the bankers told us that any banker who would loan money to a technical company is unethical — he is not carrying out his responsibilities to his customers and to the bank's depositors. So there is a mix.

Cooper: What was the median amount of initial capital?

Susbauer: We did not ask that particular question, but on the whole, it had to be very low. Very few of these companies, except for some of the nuclear instrumentation firms, needed a high amount of initial capital.

Cooper: By low, you mean within the tens of thousands?

Susbauer: Definitely.

Cooper: One other question. In terms of internal sources of capital, were stock options in the previous company a very important source of capital, which they then subsequently invested in their own company?

Susbauer: That was another question we didn't ask. However, most of these companies were group formations, and certainly in the last five years. relied very heavily upon inducements of this sort to get people to come with them and to attempt to keep people.

Komives: On the other hand, most of them came out of the labs, where I presume there are no stock options, so that they have saved their money some other way.

Danilov: I have a question about the experience at the University of Houston, which is now part of the Texas system. Did that come into play here at all? We're talking about the same time period — in fact, the university was a partner in the nonprofit research institute formed by some faculty members who spent part time on this. Eventually it became so touchy that the university was forced out of it and sold its interest to the faculty members who now run this as a contract research/product/R&D service operation on a private basis in Houston. Did this come up in any of the discussions you had in Austin?

Susbauer: I was never made aware of any connections between them from the study respondents. The only ties to Houston I can recall the Austin companies having were one or two companies going to Houston for initial capital in the late 1950's and, of course, the Houston oil complex served as a principal outlet for some Austin companies' products.

Shapero: Let me make a point here. In Austin, you wouldn't know that the University of Houston existed. There is no real exchange between the University of Houston and the University of Texas, except an individual here and there. There is a university system, but it isn't a system in the ordinary sense. The schools are run very independently, and it is not like California, for example.

Danilov: I realize that. I know Texas is a big state, but at a distance you think of perhaps Houston not being too far away, and I was interested in some of the ramifications of that experience, which were quite profound in the academic community in Houston.

Shapero: What I was saying was that Austin university people are very involved with Houston industry and NASA, but not with the University of Houston; we never hear about what is going on there.

**Initial Customers**

Susbauer: Most of these companies began with a guaranteed first customer, which certainly helps. They had a very short start-up time in general. The initial capitalization generally was low because of these factors. They had contracts in hand and even then the banks wouldn't loan them money.

Shapero: Jeff, if I remember correctly, didn't you find that they were mostly private industry oriented. They did not start out with government contracts.

Susbauer: Yes, this is another important local characteristic. They started out with contracts offered by private firms.

Shapero: They were a commercial product and customer oriented group, and this is a difference from other areas I've studied.

Susbauer: We shouldn't forget that these companies could get time and facilities from the university too. And this makes a difference also in getting started.

Hoffman: In the case of Texas Research Associates — now part of Tracor — I believe that Union Carbide actually pushed them together. Carbide wanted them to produce a product that the Defense Research Lab wouldn't let them produce because it was commercial. Union Carbide suggested that they form a company, and they did.

Susbauer: This is true, and in a large number of cases they started out this way.

Only three companies out of that 31 did not have some sort of revenue-producing activity during the first year of operations. Having a guaranteed first customer is one factor making company formation very credible. However, as I said before, these are not high-high technology companies in Austin, with a couple of exceptions, and this makes a difference. They were practical-minded and felt that they could advance the state of the art later if they wanted to, but were interested in survival first.

**The Conditions Fostering Technical Company Formation**

That discussion really moves us into the final major topic area, the conditions fostering technical formation. I think we found strong support for three basic categories of findings. The first we called the entrepreneurial role model, the second, "pulling" factors, and the third, the "pushing" factors. We borrowed these terms from the S.R.I. study of Minneapolis/St. Paul, and they seem to be extremely appropriate for summarizing a vast array of responses.

Let me point out here that any entrepreneurial activity may certainly have aspects of all three factors inherent in the formation act. It might be well to view the company formation process as bridging a threshold barrier. There is an invisible chasm separating inactivity from activity, from thinking about it and doing it. The pushing and pulling factors, coupled with the entrepreneurial role model, serve to kick or pull the potential entrepreneur across the barrier. And it certainly helps the process if the potential entrepreneur is at least neutrally disposed towards company formation in the first place.

**The Entrepreneurial Role Model**

We've already discussed the entrepreneurial backgrounds of this population and their families. The literature of entrepreneurship certainly shows a common belief that it is much easier to go into business for yourself if your father or someone close to you was in business for himself, and particularly if they were successful. In over 80% of the companies we studied in Austin, knowing other entrepreneurs, including their relatives, was cited by the principal entrepreneurs as a persuasive factor in starting their own companies.

This concept of the role model serves at least one function and perhaps others. At the very least, when put in combination with assorted pushes and pulls, it serves to make company formation very credible to the potential entrepreneur. This precondition of credibility I cannot over-emphasize, because I think that it may be the variable that serves, more than any other, to start the chain of events which can result in company formation.

**The "Pulling" Factors**

I also think that "pulling" factors, which are principally factors of encouragement, do not have the total impact that the "pushing" factors have. Yet, they apparently must be present for technical company formation to occur.

A very significant "pull" for Austin entrepreneurs, which we've already mentioned, was having a guaranteed first customer. This makes company formation much more realistic. In some cases, particularly after Tracor became a known success in the community, the potential entrepreneurs took the attitude, "Why, I can do as well." Because the scientific community is fairly closely knit, the Austin entrepreneurs knew of the other company forming activity in Boston, the Bay Area, and other places, and because of associations with many of these entrepreneurs in various labs during the War and after, they knew the company formers personally. This all serves to help make company forming credible.

Having a patron, such as the guaranteed first customer, or as in the case of several companies given space and encouragement by people like W.L. Richards, seems to be a tremendous boost to credibility.

Cooper: What kind of people were these patrons?

Susbauer: It varied, of course, in the Austin case, as anywhere. Department chairmen, even the Directors of the various research labs have encouraged potential entrepreneurs there. As I just mentioned, other entrepreneurs, like Richards, also have served this function.

Draheim: Is money ever the influencer?

Susbauer: To a certain extent. Going back to LaCoste & Romberg again, it was hard to survive in the late 1930's on faculty salaries, and the company seemed to hold promise of a way to eat. I think the appeal of making money, of being your own boss, or fulfilling the American Dream is generally great, particularly when we get to addressing the "pushing" factors in a couple of minutes. Money, in most cases, I would not rank as high an influencer as freedom. Having someone back you might constitute a very powerful motive, but we had little of that sort of backing in Austin. Only two or three firms really started with "angels" of any size.

Again, I think Austin may represent a particular case of technical entrepreneurship, as the companies are not generally extremely high-technology based, and did not, in the main, take a great deal of money to get started. They may be more representative of university-affiliated spin-offs than anything else, and I suspect the goals and operations of most of these firms would not be considered as high-powered by most financial estimators.

That's a roundabout way of answering your question, Kirk, and I should also add that I was told over and over by these entrepreneurs that having their own company was one of the few ways left to amass some wealth in our economic system. So, they thought about it, but most weren't achieving it.

Another strong "push" that existing organizations seem to unwittingly perform is that of rejecting the entrepreneur's idea, product, or process. In the Austin experience, time after time we found that the entrepreneurs went to the existing employer first, and simply evinced little or no interest. That kind of action makes search activity much more credible.

In the research laboratories of the university, one of the principal reasons cited by the entrepreneurs for starting their companies was the policy decision not to follow up the research with development work leading to a product. In small companies run by other entrepreneurs, one of the biggest "pushing" influences causing entrepreneurial activity was the lack of freedom given by the owner-entrepreneur to do the very things he left his previous organization for.

One of the strongest "pushing" influences we uncovered was the "push" of relocation. In a less desirable community, I suspect that it would not be too important, but in Austin, we found potential entrepreneurs going to great lengths to stay there, even if it meant starting their own companies. Coupled closely with this is the lack of suitable other employment in the area. There are simply points in a man's life when he can't — or won't — move, for a variety of reasons. Kids in school, wife's refusal to move, and so on. One of the alternatives under this set of circumstances is the opportunity to be more receptive to the encouragement and role model factors. We saw this in most of the early companies formed in Austin, and it is still true.

Business decline appears to cause some formations to come about. This is strongly supported in Austin, and we feel it ties in with all the other things we've learned. When companies start cutting back people, there are decisions to be made by the organization member. There's real organizational uncertainty if you aren't sure that you'll be at your desk on Monday — or even have a desk — and this can cause those who have some interest in it to rethink their entrepreneurial desires.

Draheim: Jeff, on the point of economic times, we're seeing this in the Palo Alto area. There have been some 50 companies starting up and coming to us since the first of the year for money.

Shapero: The same thing is true in Austin. Tracor has had a real cutback, in fact, a series of cutbacks. And the interesting thing that happens here is, it's not the people who are fired necessarily that start the company; it is the people who feel threatened and are not under the gun, who have sort of a decision space in which to work. We have had more formations since Tracor had trouble, since the cutback in the general economy, than in previous years.

Vesper: That's about ten per month — what is your normal average?

Draheim: Well, let's say it would be closer to two or three, based on Arnie's figures.

Roberts: Yes, but when you say it "came to you" that, I think, is probably due to the intense unavailability of venture capital that is causing everybody to look so much harder.

We have had more "group" formations in Austin in recent years, and these groups always cited the encouraging pull of bringing all the right people together at the same time as being very instrumental in their decisions to form. They unanimously viewed the group as having synergistic qualities which made company formation a very realistic action. I think in part group formations aid credibility because the group tends to spread the risk involved and the perceptions of it. Incidentally, these technical entrepreneurs, at least in retrospect, did not perceive that their company formation activity was a high-risk situation. This is quite unlike non-technical entrepreneurs, which, even after the fact, still view their company formations as being high-risk. (And of course, the available data confirm the correctness of these perceptions, since relatively few technical companies fail, while 60-80% of non-technical companies go under).

Cooper: But, looking back they were very confident — they said they were very confident.

Susbauer: Well, they always felt that they could sell their talents at least. Sell their bodies and minds to somebody else — merge.

Cooper: Even if it didn't work out well you could get your investment out through a merger.

Susbauer: Because they didn't invest much **money.** They invested their **time.**

I think I should also add that perceptions of risk are highly colored by the amount of time since formation and the conditions of formation. We talked to the group that formed Unitech (1967), and they still perceived the business as very "iffy", but they had no contracts in hand when they left Tracor. On the other hand, we talked to Pinson & Associates (1968) within a month of their formation, and they did not view the move as risky at all — or so they said. Undoubtedly, this was because they were given a contract backlog when they separated from Tracor. But when the formation had taken place, several years before, the entrepreneurs were almost in agreement that the company starting was not particularly risky.

**The "Pushing" Factors**

There are an almost infinite variety of factors which can "push" the potential entrepreneur out of one position and into another, including company formation. Being passed over for a promotion, switching organizational product orientations and simultaneously cutting out part of your business, internal management fights — all are conducive to the "push" phenomenon.

We found evidence that one of the best ways to cause a "push" is to throttle the enjoyable parts of a job. Large organizations seem to have a penchant for this — constant reorganizations, switches of functions which remove the project member from contact with the customer, are but two examples of this kind of circumstance.

Draheim: But, then something triggered them to start thinking about forming a company, and it has been layoffs.

Roberts: But you are saying that more companies are being formed and I am suggesting that you're seeing more companies of those that are being formed. Everybody is going to anyone they can think of because of the shortage of venture capital. In the old days you went to one or two and you got your money.

Draheim: I just think more are looking, or trying to form. Some won't even incorporate; they don't feel that secure, so you may not even track them as new formations.

**Some Concluding Remarks**

Susbauer: In summary, I think we can highlight the Austin experience as follows:

The technical entrepreneur, at least in this university spin-off environment, is likely to be relatively young, have gained a wide degree of experience in several companies, including marketing and contract administration. He has moderate to high education, and he probably had close relatives with entrepreneurial experience. He is more likely to form his company today in combination with a group whose talents compliment his own, and he probably views company formation as relatively riskless.

At least in Austin, the technical entrepreneur has had a penchant for having a guaranteed first customer in hand before starting his company, and this usually has been a private firm customer. Because most of the firms were not "high-high" technology-based, and because of the nature of the projects undertaken, few entrepreneurs have had to rely extensively on outside initial capital sources. Because of Tracor's success, other capital requirements could generally be satisfied within the region.

The Austin technical entrepreneur has historically had a wealth of role models encouraging and making company formation credible, including peers, bosses, and university administrators.

He has frequently chosen to form a company because he did not want to leave Austin and no other desired occupational alternatives were perceived. Further, he often went to his former boss first, only to have his idea, product, or process rejected.

The Austin experience also suggests that without factors making company formation credible, there is a very small likelihood of technical companies forming. While positive, encouraging factors, are important to the process, it seems that negative, pushing factors have far more impact on the actual decision to form a company. And, while there are many factors which influence company formation, no combination of variables can be said — at this point, at least — to constitute **the** set of conditions causing technical company formations.

This concludes my presentation, I thank you for your attention.

TABLE 4

CHRONOLOGY OF AUSTIN TECHNICAL COMPANY FORMATIONS--GROSS FORMATIONS, DISAPPEARANCES, AND NET FORMATIONS, BY INITIAL PRODUCT LINES FOR SELECTED GROUPS BY YEARS[a]

| Years | Initial Product Line | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Totals[b] | | | Nuclear Instrumentation | | | Research & Development | | |
| | (1)[c] | (2)[d] | (3)[e] | (1) | (2) | (3) | (1) | (2) | (3) |
| 1939-49 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1950-55 | 4 | 1 | 3 | 0 | 0 | 0 | 1 | 0 | 1 |
| 1956-59 | 8 | 0 | 8 | 1 | 0 | 1 | 4 | 0 | 4 |
| 1960-62 | 6 | 4 | 2 | 2 | 2 | 0 | 1 | 2 | (-1) |
| 1963-65 | 4 | 3 | 1 | 2 | 0 | 2 | 0 | 1 | (-1) |
| 1966-68 | 6 | 1 | 5 | 2 | 0 | 2 | 2 | 0 | 2 |
| Totals | 31 | 9 | 21 | 7 | 3 | 4 | 8 | 3 | 5 |

[a]Years were grouped in unequal intervals because the years in each interval corresponded to important growth eras in the development of the community. For example, the period 1950-55 covers the time just prior to the forming of Textran and Texas Research Associates; the period 1963-65 includes the period following the founding of Tracor, Inc.

[b]Totals are somewhat confounded by the discrepancy between disappearances and failures. A disappearance is not necessarily a failure, but in the majority of the cases in this report, disappearances did constitute failures. The exceptions in the data here are Textran Corporation, Texas Research Associates, and Texas Bio-Nuclear. Textran and TRA merged to form Tracor, Inc., in 1962; however, all Tracor data have been reported in this study as the two originating firms. Texas Bio-Nuclear was acquired by Kaman Aircraft Corporation before operations were begun, and thus was not included in the survey population. Therefore, existing enterprises at the time of the study numbered 21, but are treated as 22 firms, and failures in the Dun and Bradstreet sense are 6, from 31 original company formations.

[c]Gross Formations

[d]Disappearances

| Initial Product Line | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Electronic Controls & Components | | | Other Test Equipment | | | Precision Machining | | |
| (1) | (2) | (3) | (1) | (2) | (3) | (1) | (2) | (3) |
| 0 | 0 | 0 | 2 | 0 | 2 | 1 | 0 | 1 |
| 0 | 0 | 0 | 2 | 1 | 1 | 1 | 0 | 1 |
| 1 | 0 | 1 | 2 | 0 | 2 | 0 | 0 | 0 |
| 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 6 | 7 | 4 | 7 | 2 | 5 | 3 | 0 | 3 |

[e]Net of Column (1) minus Column (2). (-1) indicates net decrease for interval years.

Source: **Directory of Texas Manufacturers, 1945-1968 passim;** Economic Development Department, Austin Chamber of Commerce; Austin news media; personal interviews.

## THREE / RICHARD P. HOWELL

### Comparative Profiles — Entrepreneurs Versus The Hired Executive: San Francisco Peninsula Semiconductor Industry

Are Technical Entrepreneurs Different People? I think we Americans like the idea that entrepreneurs succeed because they have some special ability rather than through accident of birth, personal connections or lucky chance occurrence. I think that most of us, however, recognize the word ability as a many faceted word — it has many dimensions.

And those of us that are kind of taken up by empirical research, try to support these dimensions through our research. A questionnaire survey was conducted in late 1969 and early 1970 by SRI; I think both Kirk and Al have mentioned it earlier here. The survey was concerned with the mobility of executives in the semiconductor industry. This provided me with an opportunity to do just the type of empirical research that we like to do — to see if these technical entrepreneurs differ from the other hired executives in the industry. I'm going to proceed in this paper from a discussion of the survey to a comparison of biographical and motivational statistics to a very brief discussion of the differences found and finally a critical evaluation of the findings.

The Survey — first of all, it covered all seven of the larger semiconductor companies in the Palo Alto area. These were companies that employed 300 people or more. We asked a total of 170 executives to fill out a single page questionnaire that had such background and biographical information as what companies they worked for before; what industry it was in; what position they had; what their beginning and present salaries were in their present position; what their salaries were in each prior position; and what outside activity they participated in. We also asked what most influenced them to make the change in jobs and what avenue they followed in making job changes. Out of the 170 questionnaires submitted we got 139 responses, (actually we got 12 in addition to that but they didn't arrive in time to be included in the analysis). But the 139 represents about an 80% response. So, I think you can say that we fairly well blanketed the population of the executives in the Peninsula Semiconductor Industry. Included among the responses were questionnaires filled out by 12 founders of the companies participating. Although by strict definition there may be entrepreneurs among the others, for the purpose of this paper we say that these company founders constitute what we define as entrepreneurs. Although this is a small number from which to derive or draw any comparative conclusions, it has the advantage of being all within the same industry and all within a confined geographical area, (these companies are all within a radius of about fifteen miles) and within a short time period. We thereby reduce any inter-industry or any inter-geographic variables and errors of memory. I will proceed now to show you some of the data.

Survey Results -
Table I is a biographical sketch that supports to a large extent the findings of Ed Roberts and Jeff Susbauer that the age of entrepreneurs, compared with other hired executives, is lower on the average. I think it is interesting that 91% of both the hired executives and the entrepreneurs are married — in a geographical area that is known for its very high divorce rate. But, the fact that 91% of them are married may be a contributing factor in decreasing the number of entrepreneurs in the middle-age bracket, at which time they have heavy personal burdens to carry.

Susbauer: Is this age today — or age at founding?

Howell: This is age at founding.

Roberts: What is the age of the non-entrepreneur?

Howell: Age as of today. In terms of outside activity we found that the hired executives had, on the average, about 2.1 outside activities compared to only 1.6 for the entrepreneur. We found that many of the entrepreneurs had hobbies or did things that "normal" people don't do. Included, for example, would be such things as flying aircraft.

Shapero: He can afford aircraft . . . .

Shapero: Dick, these outside activities — were they after they had founded the company?

Howell: At the time of the questionnaire — which is current. And I don't know if I should raise the issue, but we also made the same type of survey in the Boston area. It is not included here — because there were only two companies involved and they both had converted to semiconductors from other types of industry. Hence, companies from the two areas are poor comparisons. But, it was kind of interesting — the one Boston company in which there were still two of the founding entrepreneurs — these two entrepreneurs were very, very busy in outside activity. But, they were in companies that had been founded maybe twenty or thirty years ago.

Komives: What is the average age of the age of the companies on the right hand column — were they about four or six years old now as a general observation?

Howell: I'd say that they average around five years. There's only one of them that is over ten or eleven, that is Fairchild's Semiconductor Division.

In regard to degrees achieved, the entrepreneurs had a higher average education. However, the number of Ph.D.'s was no more than the population generally.

Table I
Biographical Sketch
S.F. Peninsula Semiconductor Executives

| | Non Entrepreneurs (N = 125)** Percent | Entrepreneurs (N = 12) Percent |
|---|---|---|
| AGE* | | |
| 25-29 | 6.4 | 16.7 |
| 30-34 | 16.8 | 33.4 |
| 35-39 | 43.2 | 16.7 |
| 40-44 | 20.8 | 16.7 |
| 45-49 | 10.4 | 8.3 |
| 50-54 | .8 | 8.3 |
| 55-59 | 1.6 | — |
| Total | 100.0 | 100.1 |
| | (N = 126) | (N = 12) |
| MARITAL STATUS | Percent | Percent |
| Married | 91.3 | 91.7 |
| Single | 4.0 | — |
| Divorced or Separated | 4.8 | 8.3 |
| Total | 100.1 | 100.0 |
| | (N = 127) | (N = 12) |
| OUTSIDE ACTIVITIES | Percent | Percent |
| Sports | 76.3 | 58.3 |
| Civic | 18.1 | — |
| Professional Assoc. | 40.1 | 25.0 |
| Social Clubs | 11.8 | 8.3 |
| Church | 25.2 | 25.0 |
| Other | 22.8 | 41.7 |
| None | 4.7 | 16.6 |
| Average per person | 2.1 | 1.6 |
| | (N = 125) | (N = 11) |
| EDUCATIONAL LEVEL | Percent | Percent |
| No Degree | 5.7 | — |
| Bachelor's | 56.8 | 36.3 |
| Master's | 27.2 | 54.5 |
| Ph. D. | 10.4 | 9.1 |
| Total | 100.1 | 99.9 |

*Entrepreneur's Age at Time of Spin-off
**2 -- no responses
Source New Management Center
Extracted from a questionnaire survey conducted by Stanford Research Institute (SRI)

Table II was a surprise to me in terms of the number of jobs the individuals had had during the past decade because the entrepreneurs showed up as having just as many as the hired executives. Both groups had quite a high turnover in jobs, with the average during the past ten years, resting around 3 jobs per individual. In other words, they both average pretty close to a 33 1/3% turnover. I don't have Hoerni in this survey. He had been in on the founding of five companies in eleven years — so you can see the type of thing that's going on.

Kohl: If you related that to the average years that they had stayed at each job — what would that look like?

Howell: It is quite low for all these people.

Roberts: Well, it would have to be because it is in the same decade.

Howell: As I recall, among the 139 responses, over 40% had been in their present job for less than a year and a half.

Table III is concerned with how they got into their present situation. I think that here again the findings of Jeff Susbauer are supported — that either bosses, or people they work with, or colleagues induce them to spin out of their prior companies to start up. For the entrepreneurs, this response labeled "other" involved two of them that said "started a company" or "a new company." So, not knowing how you would classify that, we listed them as "other."

I think that as far as these hired executives are concerned — it was quite surprising to me in our earlier SRI studies — to find that about 50% of the technical-professionals found their jobs through friends and acquaintances. Since that time there was a study made by Mark Granovetter in a Boston suburb indicating that the executives in that area — about 60% of them — had found their jobs through acquaintances. So this led us to break this questionnaire down to try and find out a little more about them, and we asked specifically if they found their jobs through a personal contact, and whether this personal contact was a former boss.

And you can see that almost a third of the people found their present jobs through their prior bosses. It's kind of like Pied Pipers going from one job to another, followed by somebody whom they learned to get along with (and vice verse, I guess).

Kohl: I'm not clear about how that applies in a case of entrepreneurs. Are these people now heads of companies that they have started?

Howell: Not all of them, but some are. We defined entrepreneurs as those who started with the company at the date that the company was formed, so one may be a financial vice-president, for example, and it may have been his boss who really started the company. But, the two of them as founders are considered here as entrepreneurs.

Table II
Number of Jobs Held During Past Decade
S.F. Peninsula Semiconductor Industry

| Number of Jobs | Non-Entrepreneurs Percent (N = 125)* | Entrepreneurs Percent (N = 12) |
|---|---|---|
| 1 | 8.0 | — |
| 2 | 27.2 | 33.3 |
| 3 | 36.8 | 33.3 |
| 4 | 16.0 | 25.0 |
| 5 | 8.0 | 8.4 |
| 6 | 4.0 | — |

*2 -- no responses
Source: New Management Center
Extracted from an Industry Survey conducted by SRI

Table III
Avenue to Present Position
S.F. Peninsula Semiconductor Industry

| | Non-Entrepreneurs (N = 124)* Percent | Entrepreneurs (N = 11)** Percent |
|---|---|---|
| Executive Recruiter | 8.9 | 9.1 |
| Other Placement | 3.2 | — |
| Advertisement | 3.2 | — |
| Personal Contact | | |
| Former Boss | 31.5 | 27.3 |
| Colleague | 38.7 | 45.4 |
| Social | 1.6 | — |
| Other | 12.9 | 18.2 |
| | 100.0 | 100.1 |

*3 -- no responses
**1 -- no responses

Source: New Management Center
Extracted from an Industry Survey by SRI

Now, proceeding to Table IV - what most influenced the executives to make job switches, and you can see that in the case of the entrepreneurs about 91% became entrepreneurs through positive influence, (what has been referred to here earlier as "Pulls"). It is rather interesting, again referring to the Boston Sample, that 24% of the Peninsula executives attributed their job change to "opportunity" compared to about 8% who gave this as a reason in the Boston area. And only 6.9% in the San Francisco group gave the reason for what most influenced them to make a change as "responsibility" or "advancement" compared to about 28% in the Boston area. This difference is great, but I don't know how to interpret it.

Cooper: Dick, one question that ties into what was asked before. I gather that a number of these men who were counted as entrepreneurs were members of the founding teams but were not the driving force which organized them.

Howell: Both were included — some of them were the lead founders. Now, one of the interesting things here is that five of these entrepreneurs gave the reason for job switching as "stock option" and "ownership" and there were **none** among the hired executives who gave this as a reason for switching jobs.

Draheim: I think that would depend upon the time. Because this is a period of declining stock prices, options aren't worth it. In another period it might be different.

Susbauer: Dick, did you give these categories to them or did they fill these in with you doing the summation?

Howell: This was an open-ended question. And then we went through and categorized their responses the best that we could.

One of the things that we asked for was their salary on their prior jobs and their salary when they first started on their present jobs. We found, as shown in Chart I, that 50% of the entrepreneurs were willing, or had made the change from their prior jobs to their present positions, with either no increase in salary or a cut in salary, compared with an average increase of someplace between 10-19%, or at least a mode between 10-19% for other executives.

We attempted to associate rates of increase in salaries, (annual rates of increase in salaries) with outside activity. And we found that there was only one outside activity that could be associated with salary increase — those that participated in sports were more likely to have a higher annual increase.

Komives: Participator sports — not spectator.

Howell: That's right — sports participants. Whether or not this is some kind of an indirect way of determining that they are very competitive people who would be the type to get large increases or what is involved here, I don't know.

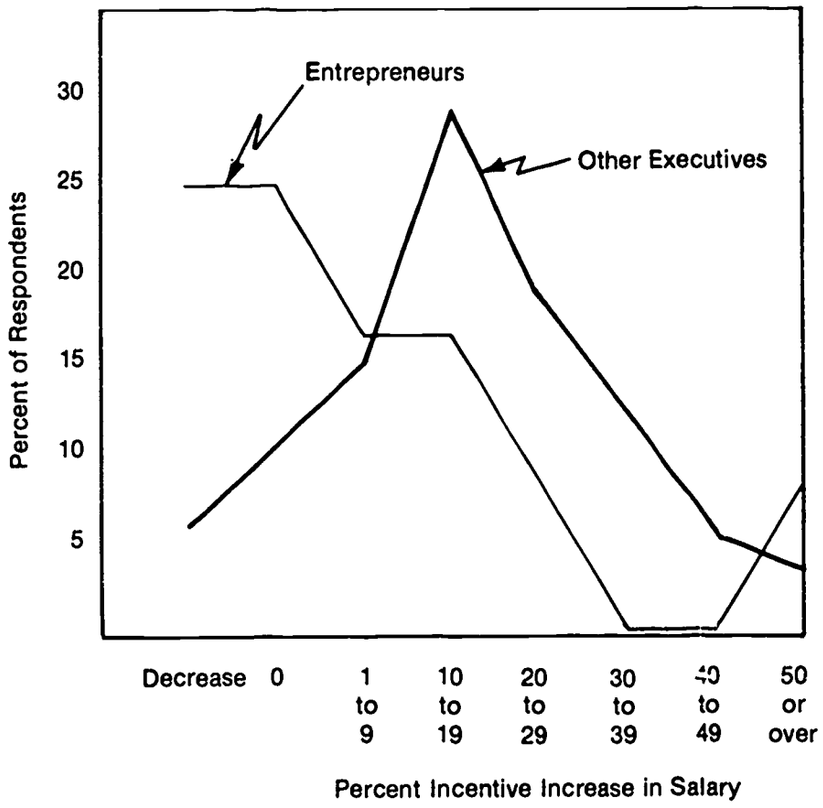
Table IV
What Most Influenced S.F. Peninsula Semiconductor
Executives to Make Job Switches

| | Non-Entrepreneurs (N = 116)* Percent | Entrepreneurs (N = 12) Percent |
|---|---|---|
| **Positive Influences** | | |
| Opportunity | 24.2 | 16.7 |
| Responsibility -- Advancement | 6.9 | — |
| Challenge | 8.6 | — |
| People to Work For | .9 | 8.3 |
| Growth Prospects | 7.8 | — |
| Money | 10.3 | 8.3 |
| Location & Work Conditions | 7.8 | — |
| Stock Options and Ownership | — | 41.7 |
| Other Pulls | 7.8 | 16.7 |
| Total Positive Influences | 74.3 | 91.7 |
| **Pushes** | | |
| Poor Management | 6.0 | — |
| Laid Off | 3.5 | — |
| Other Negative Factors | 16.4 | 8.3 |
| Total Pushes | 25.9 | 8.3 |
| Total | 100.2 | 100.0 |

Source New Management Center
Extracted from an Industry Survey Conducted
by Stanford Research Institute

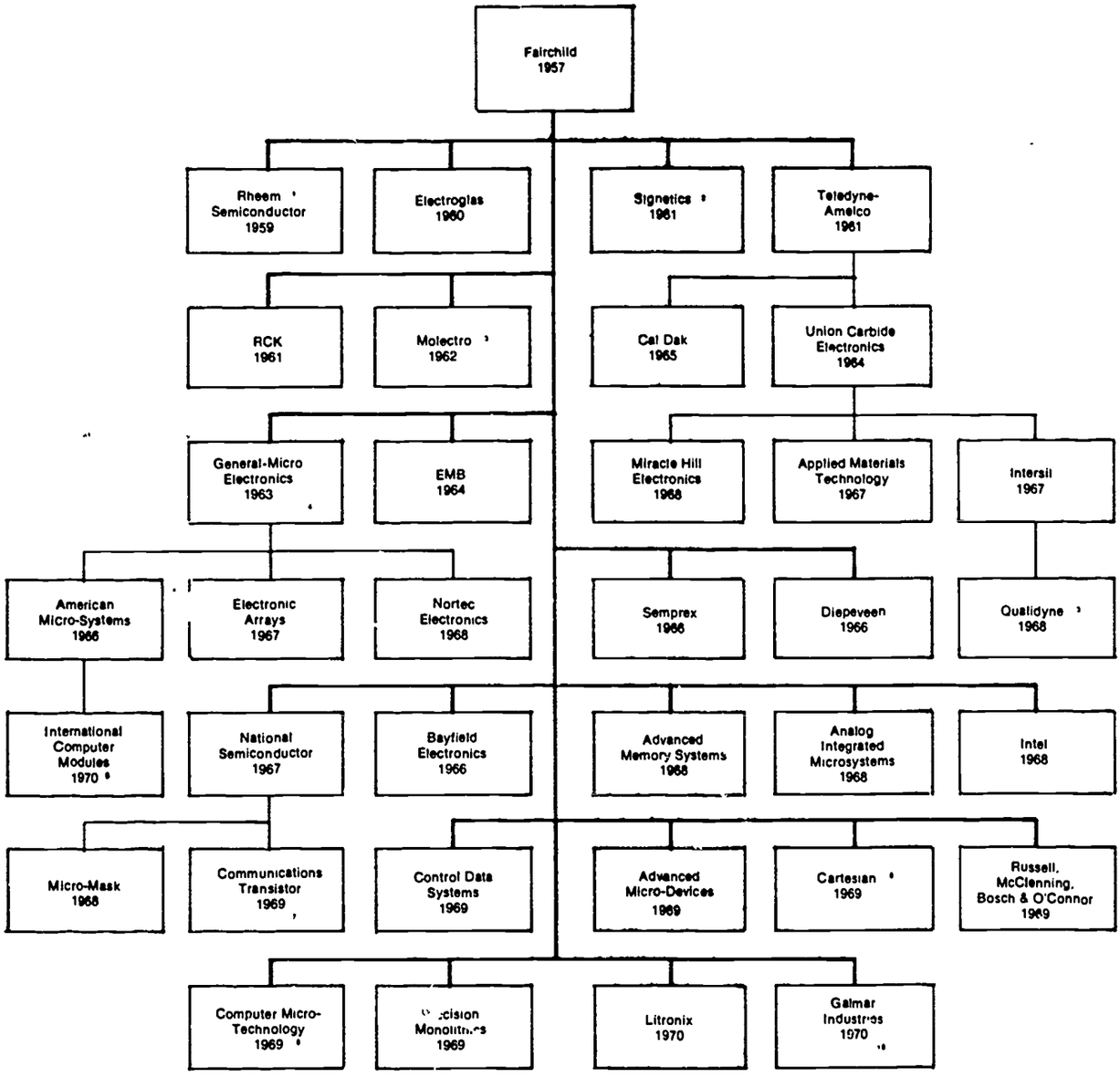
* = No Response

CHART I
SALARY INDUCEMENTS AT JOB CHANGE
SAN FRANCISCO PENINSULA SEMICONDUCTOR EXECUTIVES




Source: New Management Center
Extracted from an Industry Survey Conducted
by Stanford Research Institute

## CHART II
## FAIRCHILD BEGAT TREE




NOTES:
1. Acquired by Raytheon in 1961
2. Two founders were from Semiconductor Corp.
3. Assets of Molectro acquired in reorganization of National, which moved from Connecticut to California
4. Acquired by Ford-Philco in 1966
5. Other founders were from Circuit Engineering & Design, Fairchild, GE, and Union Carbide.
6. Three founders from AMI and three from Hewlett-Packard.
7. Two founders from Fairchild
8. One founder from Philco-Ford Microelectronics.
9. Four founders from Fairchild and one from ITT Semiconductor.
10. Two founders from Fairchild, and one from Semimetals, Inc. and one from Peripheral Systems Corp

Source: Kirk P. Draheim, Crocker Capital Consulting Corp., Palo Alto, Calif.

Komives: Dick, before you get off of that other chart, was it made very clear in your questionnaire that stock options were not to be considered part of the salary when you asked the question? The suggestion that the entrepreneur is willing to take less salary also correlates with the previous chart that he was very interested in the stock options.

Howell: We had a quite detailed breakdown on the type of fringe benefits they were receiving, and we also asked the question, "What is your subjective value of these in terms of your present salary"?

Now, I am not going to go over this Chart II again; it is the same "begat tree" that Draheim showed to you earlier. I think he has added a couple of companies to his charts since I prepared this one here. The important point is that from these companies that spun out of Fairchild, the Peninsula now is benefiting by revenue of well over $100 million dollars a year and many people are employed — so that really they should build some kind of a monument.

Susbauer: I'm curious how much more, you say over $100 million more, as a result of the spin-offs?

Howell: Yes, that's correct.

Susbauer: How about employment?

Howell: I don't know exactly what the employment is, but it is certainly several thousand.

Susbauer: I'm very curious — would Fairchild have developed that $100 million themselves? We always think of spin-offs as highly desirable.

Howell: I think the answer is no . . . .

Draheim: When they left — Fairchild was really down.

Roberts: What is Fairchild's sales?

Howell: Fairchild's overall is about $200 million of which over $100 million is semiconductor. In addition to Fairchild, organizations like National Semiconductor are up around 50 million dollars. American Micro-systems is also getting to be quite good sized. The companies that have been taken over — Rheem and Signetics — also have substantial sales.

Roberts: Do you have any estimate of what the total current sales are of those companies that you showed under Fairchild?

Howell: Well, it is over $100 million.

It's hard to estimate exactly for many of them are part of larger corporations. For example, Amelco is part of Teledyne, Union Carbide has this as a division, so you don't know what sales this part of the organization has — I can't give you an accurate estimate.

Roberts: Would it be closer to $200 million?

Howell: Substantial revenue, yes.

Roberts: How many people — how many former Fairchild people — were involved in co-founding that total cluster of companies that are there?

Howell: Forty to Fifty — if not more?

Cooper: I'm not sure. I would have to check the data.

Howell: I think you have an average of two founders per company; it might be a little higher.

Howell: In going in to talk to some of these companies — for example National Semiconductor here, I had contact with a man in the personnel department and another man in the administrative area. By the time I came back with the results of the survey these two people had spun out into other new companies.

Roberts: Are these only semiconductor oriented manufacturing companies?

Howell: I believe so. I think there are some semiconductor support companies like Micro-Mask, for example, and then there is another one that makes plastic containers and things like that.

Roberts: Then you don't have any electronic distributors?

Draheim: No . . . .

Cooper: That well may be the background of some of those distributors within that area. I know in my own research, which I think you gentlemen have both built upon here, I explicitly excluded distributors, and didn't even look at them. I expect that some of the distributors in the area did have earlier associations with Fairchild and other companies.

Roberts: I read Electronic News every week and it seems to me that the largest number of formations is in the category of distributors.

Shapero: Ed, turn it around the other way. We are beginning to find a lot of companies now in manufacturing — started by manufacturers' reps. In other words, the marketing guy is the guy who sees that outside world most clearly.

Draheim: And we can pull off these figures quite simply. Ed you had asked for the number of Fairchild people and dollar sales.

Roberts: Did you know their background records?

Draheim: Well we had a list of these formations although we didn't necessarily know the names — although that could be determined. We knew about two from Fairchild, one from Philco and one from Sylvania.

Roberts: But, again from that you mean in the same way that Arnold means his — mainly the immediate prior job.

Roberts: In all my studies I never limited myself to the immediate spin-offs and consequently the figures that I cite as spin-offs are spin-offs immediately or later.

Kohl: I was going to make a comment that in the nuclear instrument industry the formation of rep firms come about because, first of all, it is a very inexpensive thing and, secondly, it frequently is a man fired out of an existing operation or released when their business drops down. If you look at the nuclear instruments' rep firms you will find that many — most of them — have a short life. The man goes back to work for a large company. One of the large groups sold out to Hewlett Packard — another picked up with Tec-tronics.

Roberts: Have you looked at nuclear instruments' rep firms?

Kohl: Well, I worked with them for the last fifteen years. And I hired reps and fired them and hired **salesmen** and fired those who started their own rep firms. I haven't looked at them from an academic point of view, but I could give you a fair sample of the individual ones and I would know how they came about — what happened to them.

Howell: Minimizing the small size of the data base and purposely avoiding an exercise in statistical significance, you might delineate the nature of the entrepreneur investigated as follows: He adheres to the technical entrepreneur description by Roberts and his colleagues and others here as being young, but not necessarily so, and of being well educated. He tends to be single-minded, channeling his energy to overcome the challenges of competition and to manage the risks of the companies he has founded. I think the evidence shows, for example, that they had very few outside activities.

Komives: Double divorce rate.

Roberts: That was one person out of twelve.

Howell: Another way of interpreting this minimal outside activity statistic may be theorize that it reflects the entrepreneur's lower need to achieve (which would conflict with the work that Ed has done) than the hired executive who takes on a higher number of extracurricular activities in his drive for recognition.

Shapero: Are you saying that he has a lower need to achieve because he has less outside activities?

Howell: This would be one way of interpreting the data.

Shapero: Another way, you could say one gets it through the business and the other finds it through other combination circumstances.

Howell: Right . . . .

Roberts: Besides, I would argue that if you go back to McClelland's extensive discussion of need for achievements, that the activities you listed are **non**-achievement activities — that they don't manifest themselves in tangible measures of reward and feed back to the environment. I don't really see why you would assume that personal participation and self enjoyment — sports and other things — would meet the need to achieve.

Howell: Professional associations, civic duties, church . . . .

Roberts: Zero. I think McClelland would take every one of those things and say "definitely not!"

Howell: Okay — as I say, this is just a theory. Let me give you one other view on the entrepreneur's low participation in sports. As you recall it was 58% as compared to about 70%. It may also signal less of a team participation attitude. This view, that of an **independent** or a loner, would be supported by the fact that he does not choose to join the professional associations or clubs.

Roberts: That's useless!

Kohl: Don't you think that he just doesn't have the time?

Howell: That's the first conclusion that you make, but you might just theorize on these others.

Roberts: I speculate exactly the opposite — that the professional associations are useless activities for a driving executive. He couldn't get a thing from them. That it is the kind of thing you do if in fact you use professionalism and career building as your way of life. If you view entrepreneurship as your way of life you clearly wouldn't associate yourself with professional activities because there are no entrepreneurs supporting professional activities. Not unless you join the Young Presidents' Club, which you probably wouldn't list as a professional activity . . . .

Draheim: It might be different on the Coast. I could name many of the company founders who were officers in Westcon and Wema.

Shapero: Many of the people who have been successful entrepreneurs, after their companies are successful, they look for other areas of actualization or realization — now they are in the monument stage — they like to be a fellow IEEE and make pompous speeches.

Howell: Right. This is the point I made earlier, Al. In the Boston area where the entrepreneurs had formed their companies about 20 years ago, both individuals were members of professional organizations and both active in civic affairs, so this would again support what you are saying, I think.

Shapero: I think you would have to compare it with the age of their company.

Howell: The entrepreneur tends to remain within the industry which would support some of Arnie's findings. They tend to move between organizations about as frequently as other executives. His colleagues influence him to make such moves just as the hired executive is infuenced to a greater extent by his colleagues. Although financial gain was not spelled out as the prime motivator for job changes or company spin-outs, other reasons such as opportunity or responsibility may be valid expressions as the drive for greater wealth. Failure by the respondent to come out and say so may be the mark of the times in which the drive for great wealth is not as socially acceptable as more altruistic aspirations. Finally, the credibility of attaining success, given the opportunity of financial backing, is clearly evident as a company forming incentive. Observing a colleague no more talented than one's self, achieving the goal of successfully starting a new company can be a powerful incentive. And as demonstrated by Hoerni and others, the experience of one successful spin-out whets the appetite for another.

Roethle: Pardon me, Dick, I wonder if in that particular context you don't find that personal identification becomes a very major factor today? That many people who go into business for themselves do it because in the larger organizations you lose all identification, whereas in a small organization the company may have your name on it. Every time an invoice goes out your name is on it — or a check or what have you. This is personal identification — plus giving you the chance to do your own thing the way you want to do it. Now how do you express that?

Howell: Well, I think one way that it came out in the data here is that all the companies that had been taken over. (Amelco was taken over by Teledyne, Rheem by Ratheon, Signetics by Owens-Corning, and General Micro Electronics by Philco Ford.) In all of these cases there were none of the forming entrepreneurs left in the organization. One of the entrepreneurs, in stating the reasons why he left the acquired organization said that he wanted to get away from the red tape and the dominance by the parent corporation. So these are people that, as you say, like to have their name up there, but even more so they don't want dependence.

Shapero: You know it's not so much name or identification, I think it's room in which to swing and make decisions by choice. My example for this would be 3M which had fewer spin-offs. Another place is Elliot Automation in Britain (which was later absorbed) where the man made a point of spinning out groups with complete independence. Or Stanford Research Institute in earlier days, versus now.

Shapero: As long as there is a chance for "entrepreneurial expression" in the organization there are fewer spin-offs. The minute you take some of that away, then the spin-off rate would go up. It isn't so much identification it's the chance to swing and act or make autonomous decisions; and to have freedom to do certain things. I think we could run an experiment using a projective technique and ask the guy would you take a combination of twenty thousand dollars of stock and this structured organization, or fifteen thousand dollars and more freedom to act.

Susbauer: In other words, an idealist thesis The only statistically significant, psychological characteristic in all the entrepreneurs that we found was they want to be independent.

Roethle: Who found that? . .

Shapero: On a master's thesis, a student did a psychological evaluation of a bunch of entrepreneurs and a control group of managers in other fields and ran this 16 personality factor test through them. It came out, independence was the one feature which distinguished the entrepreneurs.

Howell: Well, that's interesting because that's just about the conclusion that I reached here. We have shown above that entrepreneurs in the San Francisco Peninsula semiconductor industry have different biographical characteristics from the hired executive in the industry. We have shown also that the volunteered explanations for spinning out differ from the expressed motivations for the hired executive job-switching. The question we must critically ask ourselves, however, is whether the divergent biographical and psychological profiles of the entrepreneur are at the root of the new company formations rather than situational differences. My own view is that despite biographical differences which we have discovered between entrepreneurs and the hired executives, the urge to become an entrepreneur is quite basic, perhaps to every man in one degree or another, and the right set of circumstances will trigger just about anyone into the act; whether to open a hot-dog stand, or, if his training permits, a technically based company. That young people will be more prone to take a risk is more of a reflection, I believe, of circumstances than age, per se. That an entrepreneur devotes more of his time to his child than a hired "babysitter" would, is also circumstantial, and certainly no surprise. And only a fool would venture into a highly competitive technical industry as an entrepreneur without having experience in the industry through one circumstance or another. In short, if entrepreneurs are different people, they are not **much** different!

I conclude, therefore, that rather than people with special abilities, a receptive environment is the key to the formation in growth of new technical enterprise. There are latent entrepreneurs everywhere waiting for the right circumstance to do their thing. Such a receptive milieu existed in the San Francisco Peninsula in the semiconductor industry and look what happened. As one entrepreneur put it, "Things clicked at the right time."

Shapero: There's one difference and that's a critical one. One started a company and one didn't.

Considering the need for achievement test of McClelland, managers would rate highly, particularly West Coast managers, because they are migrants, and migrants are high in need for achievement. So you get high education, migrants, technical orientation, West Coast elite group, this is everything that goes into the need for achievement. I would expect to find high need for achievement in both managers and entrepreneurs. I would say the one area to look at, if we pressed it further, would be in this desire for independence. And one other thing, some larger number of credibility examples in father, relatives, culture milieu, peers and so forth. I'm not quite willing to give up yet on the notion, despite the demographic characteristics that you have, that there is no difference. I don't think that a lot of other things that we look at are important. I think the situation is very important.

Howell: I think it's because of the credibility, but this is a situational factor.

Roberts: Self-employed parents are a factor. There are a lot of explanations for it, including the need for autonomy, but you pass on the value of need for autonomy in that kind of environment. Part of it is the credibility gap; if you grow up in a home in which business talk and business custom and business practice are habitual, the concept of going into a business isn't such a terribly difficult kind of thing.

Shapero: Growing up in a Jewish family, Jewish community, my father-in-law asked, when I was working at Hughes Aircraft, "Why is it that an intelligent, educated man like you would work for anybody?" Jeff's father who is a machinist working in Portland said, "Gee, you've got this education, why would you risk it?" This is cultural, I had to explain why in hell I worked for someone. He has to explain why he considers leaving a job. That's a cultural difference and that makes a hell of a difference.

Howell: I believe there are a lot of entrepreneurs in the woodwork everywhere, and when one comes out successfully in the proper environment, it's going to trigger many as it did here on the San Francisco Peninsula. This number of firms did **not** start anywhere else in this time period, in this industry.

## FOUR / ALBERT SHAPERO

### The Process of Technical Company Formation In a Local Area

I want to talk about the process of technical company formations in a local area. I will draw upon much of the work you heard about this morning, upon studies made by many people sitting at this table, as well as on some recent and current work that I'm engaged in concerning technical entrepreneurship and its relationship to economic development. In our work we started with the assumption that it is important in economic development to get the kinds of dynamic activities that are found in small technical companies and in the process of their formation; if for no other reason than to hold or attract the young, dynamic, educated children of the people of a region.

In 1968 approximately 250 technical companies* were formed in the 141 United States counties which had populations between 30,000 and 450,000, and which had at least one technical company. Each of these technical company formations was the end result of a process that included, or was affected by a large number of factors interacting in a complex manner. The relevant factors included the potential entrepreneurs, the local social and economic conditions that acted to enhance or limit the possibility of company formation, and the national economic and social environment that affected local conditions.

Since the national environment of 1968 was common to all of the counties represented in the sample above, the variations in the amount of local company formations must be sought in the local conditions, including the presence and characteristics of the entrepreneurs in the area.

The model of the technical company formation process in a local area which is presented here is a data-based "model." It draws upon numerous studies of entrepreneurship, studies of company formations, and the literature on regional development. It includes the results of analysis of local social, and economic conditions associated with the presence and rate of technical company formation that were performed as part of the study being reported here. The many and diverse studies, performed for a variety of reasons, have been brought together here to present a cohesive and coherent description of the overall process.

* Technical companies are defined as those listed under SIC 1925, guided missiles and space vehicles, completely assembled, 1941 sighting and fire control equipment, 3573, electronic computing equipment; 3611, electric measuring instruments and test equipment, 3622, industrial controls, 3662, radio and television transmitting, signalling, and detection equipment and apparatus, 3673, transmitting, industrial, and special purpose electron tubes, 3674, semiconductors and related devices, 3679, electronic components and accessories, 3693, radiographic X-rays, fluoroscopic X-rays, therapeutic X-ray, and other X-ray apparatus and tubes, and electromedical and electrotherapeutic apparatus, 3721, aircraft, 3811 engineering, laboratory and scientific and research instruments and associated equipment; 3821, mechanical measuring and controlling instruments, except automatic temperature controls, 3822, automatic temperature controls, 3831, optical instruments, 3841, surgical and medical instruments and apparatus, 7391, commercial research and development laboratories, and 7397, commercial testing laboratories

The technical company formation process can be described from a variety of viewpoints: (1) From the viewpoint of the individual entrepreneur or would-be entrepreneur, (2) In terms of the individual company formation and factors influencing it, (3) In terms of the company formations in a community, and (4) In national aggregative terms.

For this study we deliberately chose to describe the technical company process at a level of social and institutional interaction, a level at which local and regional development groups can act most effectively at the social rather than at the individual psychological level.*

The technical company formation process in a local area is described here in terms of what is known about:

- the technical entrepreneur
- sources of technical entrepreneurs
- the triggering event or situation
- phases and factors
- the first phase — the first company formation
- the second phase — accumulation and incubation period

* In other words, we recognize the excellent work of such scholars as David McClelland and his associates, who identify the relationship between the need-for-achievement motive and entrepreneurship, but rather than attempt to identify individuals measured as having a high need for achievement and then work with them, the approach taken is one in which the operations are aimed at factors in the environment that let the potential entrepreneur identify himself and come forth

Table I

**ENTREPRENEUR CHARACTERISTICS AND PERSONAL BACKGROUND**

Data From 11 Empirical Studies of Entrepreneurship

**TECHNICAL COMPANIES**

| Study (Year) | Age | Education | Previous Occupational Experience | Previous Entrepreneurial Experience | Father's Occupation |
|---|---|---|---|---|---|
| Federal Reserve Bank (Boston) (1958) | | | Primarily technical experience in university labs or academic departments or in existing technical companies | | |
| Maryland (1963) | | | Typical owner had been formerly employed in a similar corporation, self-employed, or in governmental service. | | |
| MIT (1966) | Average: 32 Median: 36 at company founding | Average: Master of Science equivalent or slightly above | Primarily development-oriented academicians and laboratory researchers | | 50% were self-employed |
| Stanford Research Institute (1966) | | | Principally, some phase of R&D work, in university lab or industrial firm | Most did not have previous business experience except as research project or program managers | The father "in many instances" was himself an entrepreneur or executive |

Table I (Continued)

| Study (Year) | Age | Education | Previous Occupational Experience | Previous Entrepreneurial Experience | Father's Occupation |
|---|---|---|---|---|---|
| Southern Pennsylvania Regional Development Lab (1967) | Average: 35 at company founding | 30 had college degrees; 9 had advanced degrees | Industrial experience of an unspecified nature other than "technical" | | |
| Susbauer (1969) | Average: 34 at company founding; Range: 26-51; same as for general scientist/ engineering population | Median: Masters; (10 Ph.D; 4 MS; 6 BS; 3 no degree) | Wide experience in various business functions, and with more than one employer | Five of 23 had previously formed companies | 13 of 23 self-employed in business or ranching |
| Oxenfeldt (1943) | "Mature"; average age is increasing | | | "Large proportion" of 300 shoe mfgrs. had owned at least one previous business | |
| Mayer & Goldstein (1961) | Median: 40 at time of study | Median: 11.0 yrs. State median: 9.3 | Most were manual laborers (49) or white collar workers (22) | 26 of 81 had previously owned one or more businesses | |

Table I (Continued)

| | Study (Year) | Age | Education | Previous Occupational Experience | Previous Entrepreneurial Experience | Father's Occupation |
|---|---|---|---|---|---|---|
| NON-TECHNICAL COMPANIES | Davids (1963) | Average: 36-38 for the Georgians (manufacturing only) | | Mfg. only: from managerial or professional ranks | About 45% of founders of manufacturing firms had founded one or more previous businesses, usually in same category of enterprise | |
| | Collins & Moore (1964) | Average: 52 (men only) at time of study | Average about 11 years, -- slightly higher than state median | | | 25% self-employed<br>19% farmers |
| | Delano, Johnson & Woodworth (1966) | Average: 45 at time of study | Average slightly nigher than state norm | Formed companies in fields where they had substantial work experience or skills applicable to the type of business | About 60% had formed at least one previous business | |

— the third phase — sustained growth
— sequence and mix of industries
— differentials in rates of formation
— company growth
— community factors

**The Technical Entrepreneur**

For the purposes of this study the entrepreneur is considered as the man who starts " . . . business enterprises; furthermore, when we use the term entrepreneur, we mean the innovating entrepreneur who develops an ongoing business activity where none existed before." (Collins & Moore, 1964), or the man who is " . . . the active initiator of a new enterprise in the form of a new company. He plays a major role in starting the company and managing it, and usually has an important equity position in it." (Draheim, Howell, Shapero, 1966). The **technical** entrepreneur is the man who actively initiates a company that has a relatively large amount of scientific and engineering labor in its final product or service. (See Table I)

It is found that the technical entrepreneurs matched the profile of the general population of scientists and engineers in most respects. On the average, the typical technical entrepreneur was found to have the following characteristics. He is approximately 35 years old at the time of founding his company. He is highly educated as compared to the general population. The majority have a college degree, a percentage with graduate degrees. He is primarily educated in physics and engineering (this conclusion is biased by the fact that there have been no studies of the company formation process in the chemical, petroleum, pharmaceutical, and software industries). His work experience is fairly varied and extensive, the great majority having worked for two or more employers in their professional careers even though they are relatively youthful. The previous occupational experience was varied in marketing, finance, production, management, and research and development. He is personally secure in that he feels no doubt in his ability to obtain work if his business fails — despite the fact that nearly all are married and the majority have two or more children. He has a strong desire for independence. He is most likely to have come from a family where the father was self-employed in business or farming. He is highly mobile, geographically.

**Personality and Attitudes of the Entrepreneur.**

What kinds of men in what kinds of situations are most likely to start a technical company? Many studies of the personal characteristics found in entrepreneurial individuals have been undertaken from a variety of viewpoints and with a variety of methods of approach. In summary, the various studies, both empirical and non-empirical, describe the entrepreneur as an individual who has a high need for achievement, rejects and resents authority and routine, has a strong need for independence, likes moderate risks in which his efforts can help achieve a successful outcome, does not follow fixed patterns and procedures, and seeks out challenge.

The work of D.C. McClelland in associating a particular set of attitudes on the part of an individual and his entrepreneurial behavior has by far provided the most interesting research available into the relationship between personality and economic development. McClelland and his

associates have measured what they see as a **need for achievement.** It is defined as a need to overcome obstacles, to exercise power, to strive to do domething difficult and to do both as well as possible and as quickly as possible.

The relationship between the need for achievement and entrepreneurship nas been shown in a variety of ways. Atkinson and Hoselitz summarize:

In a number of empirical studies of achievement motivation, McClelland has called attention to the correspondence between characteristics attributed to entrepreneurs and characteristics evinced by persons highly motivated to achieve. Their motive is not money for its own sake, but rather for generalized success where money is simply the objective measure of degree of success They appear to be independent-minded and autonomous They seek out situations which allow them to have a feeling of personal responsibility for the outcome and where the results of their efforts are clearly measureable (Atkinson and Hoselitz, 1963)

By examining the personality characteristics and behavior found in individuals with a high need for achievement we are able to get some notion of some of the more specific personality characteristics and behavior that can be associated with entrepreneurship.

In studies of occupational preference, it was found that there was a high, measured need for achievement among individuals who prefer business occupations, such as management, sales, and marketing (McClelland, 1955). High need for achievement was found to be highly correlated with migration and mobility. Migrants have been found to have a high need for achievement by McClelland (1961) and by Kolp (1965). It was found to be correlated with innovativeness (Rogers and Neill, 1966), and individuals with a high need for achievement were found to prefer activities that involve intermediate degrees of risk (Vroom, 1967). McClelland, in his book, *Motivating Economic Achievement,* states:

. . . And how do achievement-oriented people behave? they set moderately difficult goals for themselves, neither too easy nor too hard, so as to maximize the likelihood of achievement satisfaction. They are more than normally interested in concrete feedback on how well they are doing In this respect they seem to be particularly like businessmen who, more than professionals, get concrete feedback in concrete performance terms as to their relative success or failure. They like assuming personal responsibility for solving problems, because in that way they can get a sense of achievement satisfaction from completing the task, whereas they cannot if success depends on luck or circumstances beyond their control, or if they are working exclusively on someone else's problem

The relative unimportance of money per se is pointed out by Atkinson and Reitman:

. interested in excellence for its own sake, rather than for rewards of money, prestige, or power Men high in N-achievement will not work harder at a task when money is offered as a reward

The attitude towards risk is pointed out in Heckhausen's summary of many studies of goal setting under conditions of risk:

. . the following propositions seem to be valid (1) Men high in need for achievement are more concerned with achieving success than avoiding failure (2) they pay more careful attention to the realistic probabilities of success which are attached to various alternative actions in a given situation (3) They sharply distinguish situations in which they have some control from situations which depend on chance . .

**Group Entrepreneurship**

Extensive data collected on the mobility of executives in American industry show that there is significantly more group mobility in technical industries than in other industries. In other words, men in technical companies are more likely to rely upon group interaction and decision making than do men in similar positions in less risk encountering ventures. The same group effect is found in studies of small technical company formations. One study of 955 prospectuses for company offerings show that 59% of the technical companies were formed by groups, as compared to 27% of the non-technical companies. A study of the technical company formation process in Austin, Texas (Susbauer, 1969) found that approximately half of the formations studied (11 out of 23) were group formations.

One highly reasonable explanation of these data is to be found in the uncertainty, or apparent risks, to be found in technical undertakings. Studies of risk-taking point out that there are differences in the way groups perceive risks, as opposed to how the same individuals, who make up the group, see risk by themselves. There is evidence that groups discussing potential decisions will opt for "riskier" alternatives than will individuals. In responding to an uncertainty-filled environment, which is typical of technical industries, men are apt to seek reinforcement from others. Whereas the process is stable and predictable in mass production and one man can often perceive, control, and manage the total process, this is a highly unlikely situation in a highly technical field.

A differentiation must be made between the risk of a company failing and the risks in the work done by the company. Technical companies have a very low failure rate as compared to other companies, though they work on projects that are highly uncertain as to their outcome.

**Sources of Technical Entrepreneurs**

Logically, it is highly unlikely (and the data bear out the logic) that we will find technical company formations being initiated and carried through by non-technically oriented entrepreneurs; thus, we find that technical companies are formed by individuals or groups that are predominantly made up of scientists, engineers, technicians, and manufacturers' representatives for technical products. When the question is posed, "Where are the potential technical company formers to be found?" it is obvious that they must be men with some technical skill or involvement (i.e. the manufacturers' representatives for technical products) who are occupied in some undertaking or activity in a technical professional capacity. Thus, given some distribution of potential technical entrepreneurs in any collection of scientists, engineers, or technical representatives, it is likely that wherever there are establishments that use technically trained people, there will be a higher likelihood of technical company formations.

The "pools" of technically oriented people from which technical company formers have been drawn include sources such as: universities, technical functions within or for organizations with little technical orientation, industrial organizations with a high-technology content, government laboratories, test and monitoring stations, and nonprofit research organizations.

## The University

There has been a strongly held popular belief that the university is a major source for the spin-off of technical companies, but the available research data do not support this viewpoint. While there are notable examples of universities that have been identified with numbers of technical company spin-offs, they are the exception rather than the rule. These exceptions include MIT and the highly publicized development along Route 128 (in the Boston area), Stanford University and the San Francisco peninsula electronics industry, the University of Michigan/Ann Arbor development, and, to a lesser extent, the University of Minnesota and the University of Texas.

The fact that technical company spin-offs is associated with only a handful of the thousands of institutions of higher learning in the United States has been a puzzling question to those who have performed research on the subject. This is particularly true of universities with technical and scientific capabilities. However, as has already been stated, universities have seldom "borne fruit," even when extensive efforts have been made in terms of research parks and programs directed to commercial product developments.

On the basis of research on the subject, what are the ingredients or conditions that are associated with the limited number of successful examples? The most important conclusion that can be drawn, from a series of studies on how technical companies develop in a community (Shapero **et. al.,** 1964, 1965, 1966; Draheim **et. al.,** 1966; Howell **et. al.,** 1966), is that no single factor can be considered necessary and sufficient to the development of a technical industrial complex within a community. Thus, the university by itself, or any other single institution, cannot provide the means and conditions that lead to the development of technical companies. However, where universities have been associated with technical company spin-off, certain conditions have been found that appear to have high value in development. These include the following:

1. A positive encouragement by the administration or its passive acceptance of entrepreneurial activity on the part of the faculty. In a 1966 study of the role of universities in defense of R&D, it was stated that the first condition, encouragement, means that someone of stature, reputation, and prestige — who is in a policy-making position in a university with strong technical departments, with R&D contract work and grants, and with capable and productive laboratories — first decides that it is a function of the university to create spin-off R&D businesses, and then encourage promising students, faculty members, or employees to venture into the commercial world with an academically derived product or less.

The most noted example of this encouragement in the Stanford-Palo Alto area is that provided by Professor Frederick E. Terman, former Vice-president and Provost of Stanford University. So great did his reputation become for encouraging the founding of new business that few left the University to found a new R&D business without his recommendation. (Yet when Dr. Terman assisted Stanford students Hewlett and Packard in beginning their new business, which is now the world's largest electronic measuring instrument company, he was a young professor in his department.) Thus, the encourager from the university, as in Dr. Terman's case, is not necessarily always in a position of stature and influence.

In the great majority of cases, university administrations take a negative attitude toward such entrepreneurial activity or take steps to regulate against it to the point of dismissing faculty members who start companies. In all the successful cases, a positive attitude towards company formation was found.

2. Contract research. To date, the majority of technical company spin-offs from universities had their origin in a contract research center or laboratory rather than a faculty department. In the case of the University of Michigan, Shapero and his colleagues pointed out that:

"Personnel from the Willow Run Laboratories of the University of Michigan, with the support of the Bendix Systems Division in Detroit, spun-off into the Bendix Research Laboratories, then spawned the formation of several other new R&D businesses Optronics Division, Electro Optics, Beta Corporation, Technological Planning Center, Inc., and Sensor Dynamics Other spin-offs from the Willow Run Laboratories were Conductron, Kipp Siegel, Inc., Laser Systems, Inc., and John Strand Company. In the case of Conductron and Kipp Siegel, there were also strong ties to the university departments. The founders, although doing research at Willow Run, were of professorial rank, and taught at least one course in their university departments.

In still other cases, the university departments played a pure role in the formation of new companies Two companies, Applied Dynamics and Gordon Roberts, came directly from the Electrical Engineering Department of the university. Other companies, formed with strong university help and encouragement, were: Tecumseh Products Research Laboratories (the president of the university was on the board of directors, and the initial company set-up was worked out by the university's Electron Physics Laboratory); Barry Electronics; Sarns, Inc. and XRC Company " (Shapero et al., 1966)

In the case of the University of Minnesota, in the period 1944-65, there were six university spin-offs, of which four were from the university's Rosemount Aeronautical Laboratory (one of these has since failed).

In the case of MIT, over 100 spin-off companies from its contract research laboratories were identified by Roberts and his students in the series of research studies (Teplitz, 1965, Wainer, 1965, Forseth, 1966).

In a study of the development of technical companies in Austin, Texas, it was found that, where the university could be identified as a source of a company spin-off, in a majority of cases the spin-off came from the contract research laboratories, (Susbauer, 1969).

3. A supportive community environment. Though local community conditions varied in the successful cases, there were community factors that in every case appeared to be associated with the formation and survival of technical companies that had spun-off from the local university. These included such economic factors as good transportation and communication facilities, and such socioeconomic factors as a banking community that provided financial support, and community amenities that helped retain technical entrepreneurs in the community (often in the face of economic and technical difficulties).

**Technical Functions Serving Non-Technical Organizations**

One source of potential technical entrepreneurs that is found in any and every region is the large variety of technical professionals performing many technical functions in non-technical organizations. These include engineers and scientists performing the test, evaluative, and regulatory functions in local, state, and federal government agencies; sales engineers and manufacturers' representatives selling and servicing many kinds of industrial and technical equipment used in government, education and industry; designers and managers in manufacturing

concerns; engineers and technicians providing services such as those associated with computer services; and architects and engineers associated with the construction industry.

There is some evidence to support the suggestion that the first technical company in an area is often formed by technical professionals serving non-technical organizations in an area. A number of instances were noted, in the course of studies of the company formation process in Austin, Texas, in Tucson, Arizona, and in Minneapolis-St. Paul, in which sales engineers formed companies. In these cases, the individual entrepreneur was either responding to a market opportunity (often first rejected by his employer) or to an impending and undesired move (even when it was a promotion). In the past three years, the popular business literature has detailed several cases in which computer service salesmen or operators have formed computer service companies.

**Industrial, Governmental and Nonprofit Organizations**

The great bulk of technical company formations originate with technical professionals, managers, or the technicians in industrial, governmental, and nonprofit organizations that are engaged in scientific and technical activities. These include the whole range of establishments from those manufacturing high precision mechanical devices to those engaged in the most advanced basic research.

At one extreme, in a "university town", Austin, Texas, 14 of the 23 surviving technical companies in 1968 were spin-offs from other companies. At the other extreme, of 142 defense-related technical companies surviving in Minneapolis-St. Paul in 1965, only three could be traced to spin-off from the University of Minnesota; the other 139 had industrial antecedents.

Since there are essentially few such organizations within an under-developed region, sources of potential entrepreneurs are often such organizations in other areas which have technical professionals with some probability of natural migration to the developing region. The importance of these kinds of organizations as sources of potential technical company spin-offs strongly commends that some of the action experimental effort include them.

**Migration**

Historically, the United States has been marked by distinct patterns of migration which have taken the form of streams of migration. The streams that have been identified over the years are persistent and continuing, modified in their rate and volume of flow by a variety of economic and social conditions. New streams form, but the old streams have shown strong persistence throughout the history of this country. By a series of studies (Shapero **et al.** 1964, 1965, 1966; Draheim **et al.** 1966), the mobility and migration patterns of scientists and engineers engaged in the aerospace industry were studied.

It was found that despite a high demand for their services and ability to "go anywhere" during the period covered by the study, the scientists and engineers followed the traditional migration streams almost to the same precise extent as the general population. The engineers and scientists were found to follow the large, powerful, long-established currents and cross currents of flow, and even the preferred routes followed by the U.S. population in general. For example, it was found that an engineer from Boston would consider a job along the classical Southern route west from Boston (the Santa Fe Trail) but not jobs along other routes. Thus, an engineer from Boston would consider a job in Tuscon, but would not consider one in Denver, and if he left Tuscon he would continue on to California.

A study of the mobility of graduates of the University of Arkansas (Venus, 1965) shows that the same kinds of patterns apply to professionals from the Ozarks region. A study of migrations of new technical graduates into the Dallas area further confirms this general conclusion.

One of the major findings of many studies on migration in general, and of American scientists and engineers specifically, is that every migration stream develops a counter stream; furthermore, a counter stream is predominantly made up of individuals and families that had originally come from the area in question. This has been referred to by one researcher "as the home and mother syndrome." Essentially, it points out that the powerful social networks of home, family, friends, previous associations are critical factors in determining where an individual moves and stays. For example:

" . a counterstream is established for several reasons One is that positive factors at origin may disappear, or be muted, as during a depression, or there may be a reevaluation of the balance of positive and negative factors at origin and destination The very existence of a migration stream creates contacts between origin and destination, and the acquisition of new attributes at destination, be they skills or wealth, often makes it possible to return to the origin on advantageous terms Migrants become aware of opportunities at origin which were not previously exploited, or they may use their contacts in the new area to set up business in the old. Accompanying the returning migrants will be their children born at destination, and along with them will be people indigenous to the area of destination who have become aware of opportunities or amenities at the place of origin through stream migrants. Furthermore, not all persons who migrate intend to remain indefinitely at the place of destination For example, many Italian immigrants to the United States intended to stay only long enough to make money to be comfortable in Italy" (Jackson, 1969)

Kohl: Could you clarify this Willow Run thing. What became positive there?

Shapero: Willow Run was operating very independently as a contract-research lab, in the pattern of MITRE and Lincoln Labs, with various degrees of freedom. As I understand it (again through telephone discussions with Michigan people) the university reasserted faculty control over the lab. The university changed Willow Run from a contract-research-go out and get your work thing. The university changed the nature of the place and insisted on the use of graduate students and the researchers being on the faculty. For a year nothing happened and then a number of organizations began forming in the Willow Run area. By the way, I understand that the university administration had been in favor of faculty starting companies, but the faculty resisted in a traditional faculty way.

Shapero: I'm not saying they were asked to leave. I'm saying that the nature of the place was changed and that they could no longer be as independent. They did not close down Willow Run, but there was a step change, and the men who were displaced by this change became the founders of companies.

Kohl: They were pushed out that way - by your "pushed" idea?

Shapero: No, they could have accepted the change in mode and stayed. They weren't fired, but they were displaced.

Kohl: Okay. I thought you were referring to it as a change for the good.

Shapero: If you are looking from the viewpoint that it is good to have a company started — it was towards the good. If you are looking from the viewpoint of an academic who says this kind of work is not the university's — it is towards the good. From the viewpoint of the men that were operating and living in Willow Run, I think it appeared bad, until they took their next step.

Komives: You haven't mentioned any alternative choices yet.

Shapero: Which way? Oh, nothing much has been said about facilities. The logical thing that many people say is that companies will want university facilities such as the library, the research laboratories and the consulting. When we studied Denver, Tucson and Orlando in 1963 and 1964, we found that when we actually looked at the records that they did not agree with the mythology propagated by intelligent men who think logically. In Denver we found no consultants hired from the local universities but that the local technical company had provided 33 faculty to the local schools. We found no contracts given to the university for the use of its facility, but the university buying computer time and use of the standard labs from the company. We found exactly the reverse of the popular illusion. The company had the best computer in town, had the best land and it was not in need of the facilities of the university. In the Stanford University Industrial Park, incidentally (I would ask the other fellows in here to verify this), I heard from companies feeling that they

paid too much for education since the university charges the companies double. They don't use a library and they get angry at the university for claiming somehow that it provides them with something more than a place for the rent they pay. We found in Austin that, though the university is very near to the technical companies, unless there is someone in the company on the faculty, the university facilities are used very little indeed.

Lamont: Does the university charge them? Do they have to pay for the services received?

Shapero: It varies in every place — in every place with an outside company, I don't know of any university which provides it for free.

Lamont: We did at Michigan and found just the opposite.

Shapero: They did use them?

Lamont: It was free and they could have overdue books and everything like that.

Shapero: It appears to be a function of how easy it is to park there. I have found that is a critical variable. If you don't have good and convenient parking facilities than there's not going to be much usage of the university.

Lamont: We mail the books.

Shapero: Oh! You mail the books.

Cooper: Stanford has recently set up a very extensive closed circuit television system with various large industrial companies so you can work on your master's degree without ever really leaving the plant.

Shapero: We found that a local university does provide a chance to get a degree, but, again when we checked the records of companies in these cities we found that little use was made of this chance. If you ask engineers in any survey, "Do you want to be near a university where you can get a degree?" that rates high. However, if you take a look at how many take a course or even finished a course in big cities, it may be as high as 7%; in the smaller ones it's considerably less.

Roberts: You aren't saying the university isn't an attraction.

Shapero: No, it's an amenity.

Roberts: The average university doesn't provide a service . . . .

Shapero: That's right . . . .

Roberts: It provides people in a sense that it provides graduates who want to stay in the area.

Shapero: That's right . . . .

Roberts: So, therefore, it provides a good skilled labor market for anybody who happens to be in the area so they can recruit from them.

Shapero: That's right.

Shapero: Again, when we look at the purchase records we find that almost nobody in industry buys from universities, but that it goes the other way. The universities give subcontracts to industry. The idea that industry buys from universities is an illusion based on a distorted view of Route 128 or Stanford on the part of people who have never checked the data.

Roberts: Route 128 wouldn't support those distortions in ideas either, because M.I.T. has no evening courses, and M.I.T. has a minimal number of special students, for whom it charges an arm and a leg to the sponsoring companies.

Shapero: That's at Stanford, too.

Roberts: Because they try to discourage it and they don't want to have them in the classes, every year they increase their rules and regulations. M.I.T. has a very negative attitude towards library loan services, M.I.T. charges even alumni an astronomical fee for library usage and even for faculty club usage. The only people who use the faculty club besides the faculty and a few graduate students are some very fat-cat local industrialists. Not the new enterprise guys; they couldn't afford it. They couldn't afford the $200 bucks a year dues to come in and have lunch once in a while.

Shapero: Incidentally, on the hiring of professionals from local universities, the people who benefit most from this are large corporations that make a distinct effort to recruit. The little companies get local graduates as a result of word of mouth, if it all, because they don't recruit on campus.

Shapero: Well, the thing that I find is many companies make the decision to move next to universities because of what they believe, but the record of what actually happened in reality doesn't support their illusions.

You see we can make the reverse case. If you want to build a university — get technical industries. They'll knock themselves out to build local universities. The reverse case cannot be made. In Orlando, all the local companies got together and brought in a branch university of Florida and T.V. In Tucson when a big company came in they unwisely got a doctoral program.

Vesper: You mentioned manufacturer's reps as potential company formers. The reps are only going to be where there already is some of that technical industry though.

Shapero: Not necessarily. You have computer people selling services in the agricultural areas of Texas, where they are actually using linear programming for cattle feed operations and for all of the accounting of large ranches. That is a service that requires technical people. There are lots of schools that will buy nuclear accelerators; you can find people selling technical products like computers and that. Now these guys see a market for an instrument or something — and they try to convince the home company or they see an opportunity to start it. Another source is industrial, governmental, and nonprofit organizations.

In Orlando we found that small companies had more spin-offs than the large local companies. The large company had no spin-offs while the small companies were far more prolific. Radiation, Inc., started by six men, had five spin-offs. Martin Marietta of Orlando with 16,000 employees who were red-blooded American boys and girls just like everybody else — didn't have one spin-off during the period studied, a period of almost ten years.

Roberts: This I think is interesting because Arnold says the same thing . . . .

Cooper: I'm going to present data that exactly supports this . . . .

Roberts: It's totally different from what you find in the Boston area, and the one industrial firm we studied was a large firm. We lined up a list of companies that matched our control characteristics. There were eight of them, I was positive that any one of the eight would have given me a large sample size.

Shapero: Let me make a point, I'm going to make a case as to why I think we found what we did. I think it is part of this business of credibility. It's not necessarily tied to a small company, but the one thing that you can say about a small company is that the chance that the potential entrepreneur will see the whole process and see a man who puts on his pants one foot at a time is better than in a large company.

Roberts: I agree . . . .

Draheim: The chance nature of this one company starting in Orlando is a factor — because I think chance plays an important part.

Now, these migration patterns presumably relate in part to men who were hired by existing organizations . . . . Did you find very many instances in which a man quit a previous job in one part of the country — decided to start his own business, and went to another part of the country to start a new company?

Shapero: No, I didn't find any . . . .

Draheim: Some fellow who started Whitaker was a spin-off from the lab there and he relocated. Another situation is interesting. Three fellows formed Sierra Electronics and well, how come a name like that in Buffalo?

Well, the president wanted to go to California — the other two wanted to stay in Buffalo. They bought his stock — he went and they stayed. The company is still Sierra Electronics in Buffalo.

Kohl: One founder left Maryland and came back to Raleigh to start Humphrey Electronics. He had gone to school there; he was going to start a company and he asked his wife, "I'm planning to go into business myself, do you have any ideas where I can go?" She said "Let's go back to Raleigh."

Shapero: Incidentally, I just gave the example of Radiation, Inc.; two of the founders came back to their home state to start a company.

Roberts: We found that 40% of the companies that we traced from Boston organizations were non-Boston oriented companies. This was using different criteria for spin-offs; it was not limited to whether they had immediately left the parent organization When they were set up 40% of them were outside of the greater Boston, Massachusetts, area.

Cooper: I wonder though, how many of those had first taken a job away from Boston?

Roberts: I don't know. We have the data.

**The Triggering Situation or Event**

The formation of a company is a distinct, discrete event that requires explicit legal, contractual, and financial actions on the part of its organizers. Though the formation is almost always the end result of a process in which many factors play a part, the specific event itself almost always entails a precipitating or "triggering" situation. The triggering situation is primarily an actual or perceived personal displacement that disposes the entrepreneur(s) to take the kinds of explicit and risk-associated actions that finally result in a new technical company.

In the many studies of technical company formations, seldom is a case found in which a gradual, phased, carefully planned succession of actions and discussions leads to a company formation. The situation is better described as one in which the individual or group is subjected to a constantly interacting and dynamic field of forces that pushes him in all directions. These forces include both internal and external components and the individual is often balanced between internal pushes and external constraints, or vice versa. Usually the forces counterbalance each other so that there is some stability and continuity in an individual's occupational movements. When the forces are out of balance, the individual is "pushed" to act; if he is a potential entrepreneur, the act may be a company formation.

The forces that have been found to exert the most influence in the decision to form a company tend to be negative rather than positive in nature. A personal displacement, or anticipated displacement, precipitates the decision to form a company. Among the many negative displacements that result in the formation of a technical company are a cutback in contracts to the potential entrepreneur's current employer and the subsequent layoff of colleagues in the company; the promotion of a colleague which results in the feeling that it means a negative evaluation and limited future for the potential entrepreneur; plans to move the plant, company, or individual from a current location to another city; or management's decision not to undertake a desired project or program.

Though individuals are less likely to take action in response to positive as opposed to negative information, some positive displacements that have precipitated company formations include an immediate market opportunity in the form of a contract that can be obtained or a request for work that can be performed; a design for a product that is perceived to have a future (and that has, in many cases, already been refused by the employee's company); a sudden access to financing, e.g., a very "hot" public issues market.

Internally developed displacements trigger some individuals to start a company without any regard to the market, the locations, the financial situation, etc. These entrepreneurs come to the decision to form a company independent of any external circumstances or events. One example is the man who has thought of starting a company for many years and suddenly says, "I'm 40 years old! It's now or never!" Another example is the man who has suddenly received a large amount of money from a bequest or from an endowment policy and is similarly triggered.

Though displacements occur in every individual's life situation that cause him to take action, some individuals are more likely to perceive company formation as a reasonable alternative than are others. Given two men from the same ethnic-social-cultural background with similar educations and demographic characteristics, what explanation is there for the fact that, when faced with the same situation, one man sees forming a company as a credible alternative while it never occurs to the second man?

Past research on the company formation process (Draheim **et al.**, 1966, and Susbauer, 1969) suggests that the propensity for one to start a company when he is displaced may be a function of the "credibility of the act to the individual." Starting a company must appear as a credible personal alternative to the displaced individual. Whether or not it does appear to be credible to an individual is usually determined by personal contact with others who have started companies, or by personal observation of such entrepreneurs.

Previous studies have shown that a high percentage of technical company spin-offs are from small companies where the potential entrepreneur could see the original founder with all his personal capabilities and failings (Shapero **et al.**, 1964). In a study of company formations in Minneapolis-

St. Paul (Draheim **et al.**, 1966), it was found that after the vice-president of a major corporate division had spun-off to form a company there was little evidence of subsequent spin-offs. However, when a group of engineers, low in the same corporate division hierarchy, had spun-off to form a company, they were followed by a large number of company formations by men who commented, "If guys like you can do it, so can I." There are also many cases of company formations in which there is evidence that the entrepreneur was exposed to the notion of the credibility of company formation because of the entrepreneurial actions of friends, family, peers, reference groups or, "significant others."

Available data show a substantial number of company formers come from families in which the father was self-employed. This factor may largely explain the apparently high representation of entrepreneurs in certain cultures (e.g., Jews, Lebanese, certain groups of East Indians, etc.). Another important way in which the credibility of company formation occurs is attributable to the mass media when they present "others like one's-self" who have started companies.

Vesper: Al, have you seen any evidence that there is a higher incidence of these kinds of role models occuring in the families of those who become entrepreneurs?

Shapero: It comes from Ed Robert's data. All the data we found in Minneapolis and the data we found in Austin show that 50% of their fathers were independent farmers or businessmen.

Vesper: What percent of people in that generation just were anyway?

Roberts: We have controlled study data.

Shapero: Oh, very little — very few . . . .

Roberts: We did control studies on that, we did control studies on Lincoln Lab and Instrumentation Lab. Of the people we sampled, one third were the people who stayed. The answer is that 30% of the guys in the laboratory had been from self-employed families, compared with 50% of the entrepreneurs from the labs.

Shapero: But, let me make a point, the credibility could come through reading, through movies. What I'm trying to say, is that conceivably credibility is best achieved through observing someone like yourself . . . .

Roberts: Credibility could be done through teaching.

Shapero: I definitely think so . . . .

Roberts: If you take McClelland's programs in India. McClelland argues that what he was doing was training people to see themselves in a perspective of entrepreneurial behavior. He could, through processes of personal development, cause guys to see themselves in a different light,

totally different from where they started. If you have enough time and enough control over the process, I suspect you can probably make the behavior semi-natural.

Shapero: I led a seminar this spring in which I just said to the students. "You will start a company, it is to be formed by the thirteenth week and presented to financial people whom you will find." One of the companies that was founded is going on stream. The other one had partnership fights as if they had been in business for years. I made the company formation act credible, I knew exactly what I was trying to do with the students.

We designed some experiments and approached people who had left the Ozarks and had gone to California and Fort Worth. I'm saying that when credible people — a banker, a professor, a government official from the Governor's office say, "Gee, you're the kind of guy who starts a company, how come you don't start a company?" And suddenly they put him in the mood to see himself in that position. Well, merely say credibility is achieved in many ways.

**Phases and Factors**

As previously mentioned, the individual technical company formation comes about as the result of the actions of a technical entrepreneur or group of technical entrepreneurs in response to some triggering event, or situation resulting from many interacting, personal and environmental forces.

Among the forces and factors leading to an individual company formation that play on important role is the presence in the area of at least one surviving technical company formation and the environmental conditions, if any, that contributed to its survival. Thus, the first formation affects the second; and the number of technical companies already formed in an area affects the probability of subsequent formations and their survival. Consequently, the technical company formation process in an area varies in rate and quality with the number and kinds of technical companies already in the area, and with the variations in the social and economic environment.

An analysis was made of U.S. counties with at least one technical company in 1968 that fell within the population range of counties in the Ozarks region. One result of this analysis was a categorization of an area's technical company formation processes into three phases denoted by the rate of technical company formation. The phasing, though not universal, was noted in the large majority of counties examined. The three phases were identified as follows (see Figure 2):

1. A period in which the first one to four technical companies are formed as if by chance.

2. A period of accumulation and incubation in which companies are formed at a rate of approximately one per year.

3. A period of accelerated and sustained growth in which the technical companies are formed at a rate of approximately two or more companies per year.

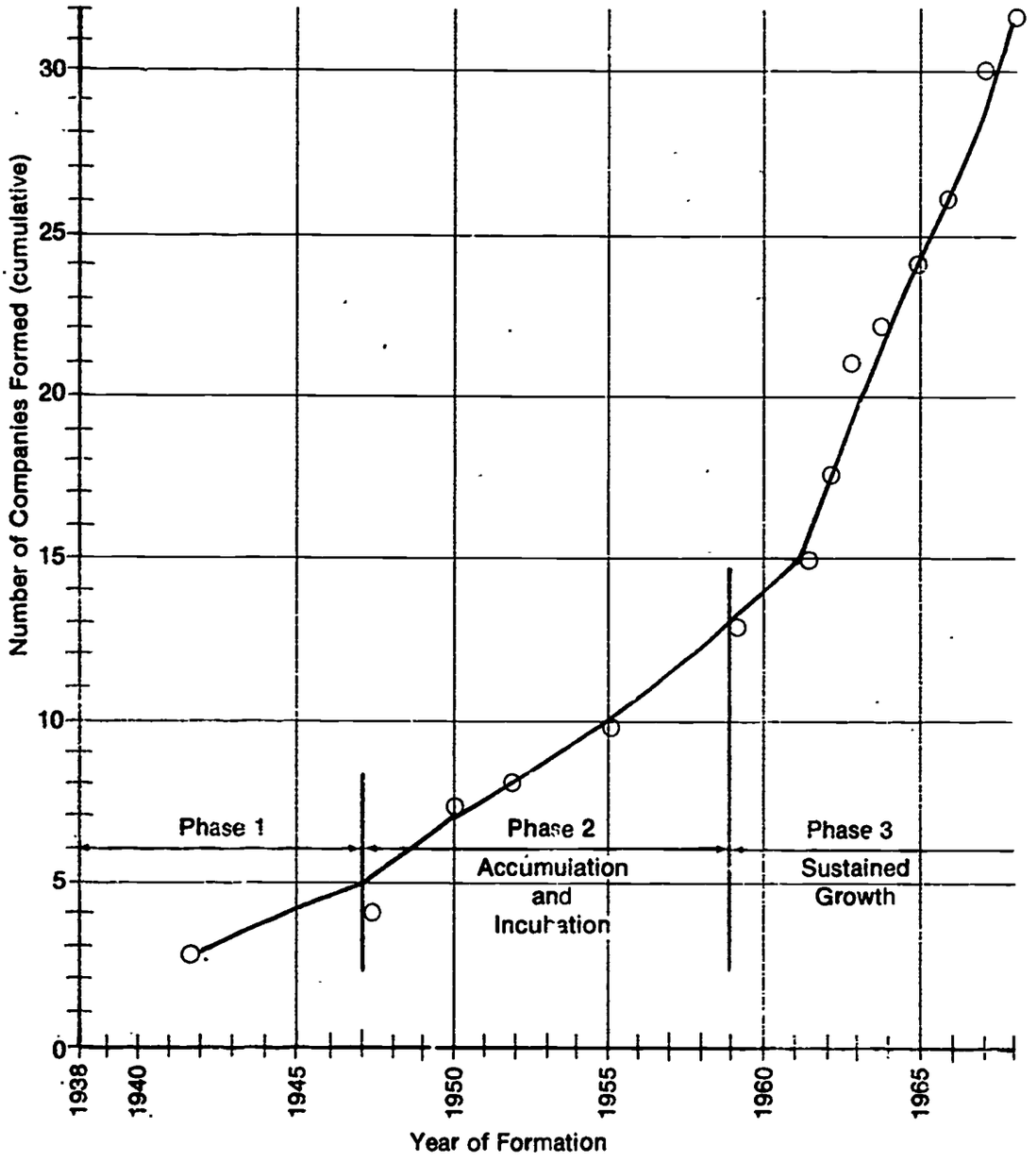
Another result of the initial analysis was the further selection, from the initial sample of 141 counties, of a second sample of 22 counties that could provide a better basis for an analysis of the technical company formation process. This second sample consisted of counties that:

1. Had reached the third phase of accelerated and sustained growth, thereby, providing data on the kinds and mix of technical company formation in each three.

2. Were not suburban. Counties that are suburbs of major metropolitan areas do not experience the same technical company formation process found in other areas, since the proximity of a large metropolitan area changes the number and kinds of companies formed. Furthermore, the development of suburban counties is not of concern to the Ozarks region.

Figure 2

THE THREE PHASES IN THE TECHNICAL COMPANY FORMATION PROCESS IN AN AREA, AS EXEMPLIFIED BY MERCER COUNTY, NEW JERSEY



The 22 counties making up the second sample used in analyzing the entire technical company formation process, had a total of 497 technical companies and are listed below:

**County** (major city, if any)

Hampden, Massachusetts (Springfield)
Onandoga, New York (Syracuse)
Pinellas, Florida (St. Petersburg)
Tulsa, Oklahoma (Tulsa)
Sedgewick, Kansas (Wichita)
Monmouth, New Jersey (none)
Broward, Florida (Ft. Lauderdale)
New Castle, Delaware (Wilmington)
Lake, Illinois (Waukegan)
Salt Lake, Utah (Salt Lake City)
Mecklenburg, North Carolina (Charlotte)
Mercer, New Jersey (Trenton)
Pima, Arizona (Tucson)
Orange, Florida (Orlando)
Bernalillo, New Mexico (Albuquerque)
Palm Beach, Florida (West Palm Beach)
Travis, Texas (Austin)
Kane, Illinois (none)
Santa Barbara, California (Santa Barbara)
Cumberland, Pennsylvania (Carlisle)
Madison, Alabama (Huntsville)
Boulder, Colorado (Boulder)

In the 22 counties, the data on the tape also showed us the year of formation. We hand-checked, we called everybody on the list within those S.I.C.'s. We didn't believe that the Dandy Bread Company was really making electronic components, or that a dress shop should be listed under electronic systems. Also, we knew that many companies had been acquired or merged that may have formed in the local area. We called the companies; we cleaned up the data.

In the case of the company formations we could plot the year of formation by S.I.C. and their size as of 1968 in terms of their sales or their number of people for each of the counties.

Draheim: Incidentally, Al, I would say that your curve there is understated because of mergers and acquisitions.

Shapero: Well, we checked those as far as we could. When we saw a division of a major company, as we did in many cases, we would call the Chamber of Commerce, or the industrial people in that area and check.

Draheim: Yes, but I think it would be difficult in defining some of these from the D & B company, to the predecessor company.

Shapero: What I'm saying is the tape was used as a starting point. So we called and checked. In many cases we found that the division was an acquired independent company.

Roberts: Al, I think that your data are of the right form and right approximate timing, but I also suspect that they probably should be shifted upward, because of the fact that D & B understates the number of companies that exist since D & B doesn't get companies into their files through the specific kinds of checking processes.

Shapero: We made a rough check on this in a couple of cases, Ed. because we were worried about it. One thing that happens is that if the company is less than a year old, it may not be in the D & B yet. That's why we took 1968 as our cutoff point, though we had data up through the middle of 1969. We decided to use 1968 because it takes a year to get into the tape for new companies.

Roberts: I disagree . . . I could show you a large percentage of the companies in my sample on which we could get no D & B, because there was no D & B. And we went further to the Greater Boston Chamber of Commerce which prided itself on two major, extensive directories — they weren't in either of the directories either.

Shapero: I find it surprising — because where we could check it was a pretty accurate listing.

Roberts: It has to get size, it has to get into credit situations to show up in D & B Chamber of Commerce listings.

Shapero: Let me say, I don't know if this would differ in a large metropolitan area, but in other areas D & B is pretty complete. Maybe it is simply the manpower of D & B and because we've gone through the process. We see how they work out of San Antonio and how they get in touch with companies. As a methodological point, perhaps you're right and the whole curve could be shifted.

**The First Phase — The First Company Formation**

The first technical company formed in a local area can be considered as almost a random event. This is pointed out by the fact that over half of the counties in the U.S. had at least one technical company in 1968. The first company formations appear to be contrary to any rational explanation of an "economic man" making a calculated decision. In many instances, a single technical company forms and survives in an area for decades without the support of important services and without a subsequent company formation.

In the 22 county sample, the time lag between the formations of the first and second technical companies was as much as 40 years in one case, 33 years in two cases, 19 years in one case and 16 years in three cases.

The first company may be followed by one to three additional formations over a period of years before any substantial change occurs in the rate of formation of successful technical companies. In the 22 county sample, there were five counties that had four technical company formations before reaching the second phase, six that had three formations, six that had two formations, five that had one formation. and one that apparently entered the second phase without experiencing a typical first phase.

The length of time covered by the first phase in the 22 county sample varied from a high of 38 years in two counties to one county that skipped a first phase; the median was between five and six years.

The industries represented among the initial company formations in the 22 counties were four electronics component companies (SIC 3679); eight mechanical instruments companies (SIC 3622, 3811, 3821, 3822, 3831, 3841); three electronics instrument companies (SIC 3662, 3573); three electronics systems companies (SIC 3662), two R & D companies (SIC 7391, 7397), and one aircraft company (SIC 3721).

It is amazing that the first company formed in a county survives in the absence of many of the required services. The survival of the first, quasi-random, formations is dependent upon the ability of its founders to get financial support, to obtain technically skilled workers, to provide services not available in the area (usually at an increased cost to operations), and to bring the market to the company. In some cases, a location in a college community has provided a low cost, skilled labor force of students and new engineering graduates. In other cases, the initial product has been unique enough and has been marketed well enough (e.g., the oscilloscope of Tektronix of Portland) that the company monopolized a particular segment of its market for a crucial period of time.

Previous studies that include data on an area's first technical company indicate that a large diversity of situations result in the formation of the first company. These situations include an entrepreneur who saw a market, an opportunity, or wished to return home, and despite the many real handicaps, formed a company with a technical product or capacity unique enough to survive the immediate obstacles. That this is done at a price is evident in the decision of some of these early companies to move the main part of their operations from their original locations (e.g., Collins Radio moved their headquarters from Cedar Rapids, Iowa, to Dallas, Texas).

**The Second Phase — Accumulations and Incubation**

During the second phase, the formation rate of technical companies is about one per year, though there are some years in which no new formations occur. The second phase of company formations in an area varies in terms of the length of time required. For the 22 counties in the sample, the second phase varied from 0 to 17 years, the median being between 10 and 11 years per county. The county with essentially no second phase experience (i.e., 0 years) was Salt Lake, Utah, which reflects a special state and city effort to attract and encourage technical companies.

Daniloy: Well, in the case of Salt Lake City, there was a special effort made, not only by the church, but by the state. They actually went around with teams trying to convince companies to locate there because they

had all these Mormons that they were recruiting back to Utah to form this labor pool. That was really a political as well as a religious decision.

Shapero: The one thing it suggests is that you can shorten the period by concerted and direct and intelligent effort.

The cumulative number of surviving technical companies in a local area before the formation process becomes self-sustaining varies widely. In the 22 county sample, the number of companies varied from 3 to 16, with a median between 10 and 11. The second phase appears to be an accumulation and incubation period. It is a period in which technical company formations begin to lose their random nature. New companies are formed by men spinning off from the companies already in the area; they are usually involved with the same technologies found in the companies they had left. With an increase in the number of companies having related technologies, an area begins to generate a demand for special material and services. Thus, that makes the area business a viable market for establishments that can profitably supply this demand. There is a growth in the pool of technical professionals and technicians available in the community. The financial community becomes familiar with the special needs of technical companies. In many instances, as the number of technical companies increases, there is an increasing amount of interaction between the local companies. For example, it is quite common for a local technical company to sell the services of its machine shop to other companies in the area. The exchange of services occurs with report production, plating, drafting services, computer and reproduction facilities and services, and even with the rental of temporarily unused space.

Not the least in importance is the exchange of information on government contracting procedures, special accounting practices, and the security regulations that are associated with the major market for high technology — the federal government. One of the special drawbacks faced by the first company in an area in its dealings with government R&D markets is the lack of local professional services that have the familiarity and knowledge required for this area of specialized procedures. One important aspect of the accumulation and incubation phase is the "education" of local accountants, lawyers, and bankers in the specialized needs of high technology companies.

Often during the second phase, an area receives its first in-migrating corporate division. Contrary to a popular belief held by many economic developers, there are very few instances where the development of a local technical-industrial complex is initiated by a large corporate division engaged in technical work. In a comparison of selected metropolitan areas receiving large defense R&D awards (Draheim **et al.**, 1966), it was found that areas dominated by a single corporate division showed little subsequent development in terms of numbers of technical companies. In the 22 county sample, there was only one case in while a corporate division preceded the first technical company formation. In Bernalillo, New Mexico (Albuquerque), the first in-migrating division and the first local formation

occurred in the same year. The county in which the corporate division came first was Madison County, Alabama, (Huntsville). A large number of corporate divisions moved to Madison County in order to service major programs of the Army and NASA at their Huntsville centers. Currently, with completion of the NASA programs, there has been a consequent, drastic cutback in the corporate divisions in the area. The cutback in NASA funding to Huntsville has also led to the demise and out-migration of some of the smaller companies that had formed in the area.

During the accumulation and incubation period, corporate divisions do play an important role in attracting skilled labor that often eventually finds its way to the small companies in the area, and in attracting suppliers and services to the area, thereby, increasing the ability of the small companies to operate more efficiently and to survive. However, seldom does a local corporate division provide a market for the goods and services of the small local company. This was pointed out in one study by Shapero **et al.**, 1964, in which it was concluded "that the likelihood is not high that a small R&D company will have a capability, product line, or service so unique that it will be in continuous demand by a prime contractor throughout the life cycle of a given project or for a sequence of projects".

**The Third Phase — Sustained Growth**

In the third phase the rate of formation of technical companies reaches approximately two companies or more per year. The rate becomes logarithmic, as with Broward, Florida (Ft. Lauderdale) with 12 technical companies formed in 1968.

Among the conditions for the third phase are enough technical establishments in a community that require the same essential services so that they can support independent establishments that provide these services. When these kinds of independent establishments are established, the existing companies no longer need to own and maintain marginal and expensive operations to provide these same services. As services are phased into independent establishments in a community, the area's technical companies become more able to compete nationally due to more efficient operations. It also becomes easier for new technical companies to survive because they are not faced with the costly problem of establishing marginal, but essential operations. This process was illustrated in a study by Howell **et al.**, 1966, in which it was shown that defense R&D companies in such major technical industrial complexes as Los Angeles and Boston spent a substantially greater proportion of their contract dollars in obtaining material and services from subcontractors and vendors than companies in areas that did not have a large number of technical companies and that, furthermore, a large proportion of these dollars went to local companies. As additional technical companies were formed in the less developed areas, the expenditures patterns of their companies began to approach those of companies in the larger complexes.

Among the goods and services that are increasingly supplied by independent companies in the third phase are machining, plating, technical report preparation, and component manufacturing, sales and warehousing. In the 22 county sample, it was found that component companies were formed with a higher frequency in the third phase than any other type of technical company. For example, in Broward County, Florida (Ft. Lauderdale), almost half of the companies formed in the third phase were electronic components companies. Of the companies formed in Salt Lake, Utah, between 1966 and 1968, 7 of the 11 companies manufactured electronic components. Similarly 6 of the 12 companies formed in Santa Barbara, California, between 1965 and 1968 were manufacturers of electronic components.

The output of highly technical companies tends to consist of "tailormade", short run, high-specification, ever changing products. Furthermore, it is a business in which future outputs and requirements cannot be predicted with any accuracy. Consequently, small technical firms cannot afford to establish and support many vital functions that are operated only intermittently. Thus, the ready availability of outside suppliers of required goods and services can be a critical ingredient in the technical company formation and survival process. On the other hand, the suppliers of the kinds of goods and services required in highly technical industries usually do not depend upon a single client for their survival and tend to locate where enough clients are available to assure a somewhat continuous loading. We therefore, find the "takeoff" phenomenon in an area when there are already enough local technical companies who can use the same kinds of services; when there are a number of small local companies together with a large corporate division in the community; or when the community is easily serviced due to its proximity to a major industrially developed area or to the easy transportation to such an area. The latter partially explains the growth of technical companies in suburban counties.

**Sequence and Mix of Industries**

An analysis of the sequence and mix of technical companies preceding the third phase (all companies formed during phases one and two) shows a large variety of technical industries in the 22 counties studied. In 17 of 22 counties, both industrial controls (SIC 3622) and electronic components companies (SIC 3679) preceded the third phase. In 13 counties, industrial controls, electronics components and commercial R&D laboratories (SIC 7391) preceded the third phase, and 11 of the counties had these three categories of industry plus mechanical instruments (SIC 3821).

The counties with the greatest number of technical companies tended to show the most variation in the mix of types of companies formed during the first and second phases. In the county with the most technical companies (Monmouth, New Jersey), three mechanical instrument companies, three electronic instrument companies, six electronic systems companies, an optics company, a commercial R&D laboratory, and two electronic

component companies were formed in the first two phases. In 9 other counties that had more than 24 technical companies, a similar, if not always as extensive, mix of types of companies was found. The counties with the least variations were Madison, Alabama (Huntsville), which had only mechanical instrument and electronic components companies, and Cumberland, Pennsylvania (Carlisle), which showed only two kinds of industries, one being a concentration of crystal producing component companies.

**Differentials in Rates of Formation**

There are large variations in the overall rates of technical company formations in the counties studied. As can be seen in Table 3, the overall rate of company formation between 1940* and 1968 varied among the 22 counties from a high of 2.5 companies per year for Tulsa County, Oklahoma, to a low of 0.5 companies per year for Mecklenburg County, North Caroline (Charlotte), and Cumberland County, Pennsylvania (Carlisle).

* The year 1940 was used as a common base to compare the counties since that year marks significant shift in both the kind and amount of high technology in the U.S. With the initial effort to supply the allies and with U.S. entry into World War II, the electronics, systems, aircraft, and R&D industries essentially developed (e.g., defense R&D expenditures rose from $40 million in 1940 to well over $7 billion per year in the 1950's and 1960's).

**Table 3**

RATE OF TECHNICAL COMPANY FORMATION FROM 1940 THROUGH 1968 IN 22 SELECTED COUNTIES

| County (Majority) | Technical Companies Formed (1940-1968) | Number of Years | Rate of Company Formations Per Year |
|---|---|---|---|
| Tulsa, Oklahoma (Tulsa) | 32 | 13 | 2.5 |
| Mercer, New Jersey (Trenton) | 31 | 17 | 1.8 |
| Monmouth, New Jersey | 48 | 29 | 1.7 |
| Santa Barbara, California (Santa Barbara) | 42 | 24 | 1.7 |
| Lake, Illinois (Waukegan) | 22 | 14 | 1.6 |
| Broward, Florida (Ft. Lauderdale) | 41 | 29 | 1.5 |
| Kane, Illinois | 21 | 14 | 1.5 |
| Madison, Alabama (Huntsville) | 12 | 8 | 1.5 |
| Salt Lake, Utah (Salt Lake City) | 25 | 18 | 1.4 |
| Pinellas, Florida (St. Petersburg) | 22 | 18 | 1.2 |
| Pima, Arizona (Tucson) | 14 | 12 | 1.2 |
| Onand. ga, New York (Syracuse) | 20 | 18 | 1.1 |
| Travis, Texas (Austin) | 30 | 29 | 1.0 |
| New Castle, Delaware (Wilmington) | 12 | 13 | .9 |
| Orange, Florida (Orlando) | 17 | 19 | .9 |
| Palm Beach, Florida (West Palm Beach) | 12 | 13 | .9 |
| Boulder, Colorado (Boulder) | 17 | 19 | .9 |
| Hampden, Massachusetts (Springfield) | 23 | 29 | .8 |
| Bernalillo, New Mexico (Albuquerque) | 15 | 20 | .8 |
| Sedgewick, Kansas (Wichita) | 15 | 25 | .7 |
| Mecklenburg, North Carolina (Charlotte) | 15 | 29 | .5 |
| Cumberland, Pennsylvania (Carlisle) | 11 | 19 | .5 |
| Total | 497 | | |

Tulsa, Oklahoma, with the highest rate of formations, was one of the counties that had entered the third phase very early (1958). In 1966, 1967 and 1968, Tulsa had four technical company formations each year. Other counties that had also entered the third phase at about the same date were Monmouth, New Jersey (1957), with the third highest formation rate in the sample (1.7 companies per year), and Salt Lake, Utah, which began its third phase in 1958. Salt Lake, which had no real accumulation and incubation period (i.e., no second phase), had a formation rate of 1.4 companies per year.

Cumberland, Pennsylvania, and Mecklenburg, North Carolina, the two counties in the sample with the lowest rate of company formation (0.5 companies per year), had barely entered the third phase of development in 1968. Cumberland, Pennsylvania, and Sedgewick, Kansas, a county with the second lowest rate of company formation, were the most specialized technically, with Sedgewick specializing in aircraft and Cumberland in the development and manufacture of crystals.

**Company Growth**

Of the 497 technical companies found in the 22 counties studied in 1968, 66 had over 100 employees. The range was from 100 to 19,000 employees. Those with the most employees were aircraft companies, one of which has now become a division of a major aircraft corporation. Twenty of the 22 counties in the sample had at least one technical company with over 100 employees in 1968. One county, Monmouth, New Jersey, had ten companies with over 100 employees in 1968 and these varied in size from 160 to 3,100 employees.

There appeared to be some relationship between age of the company and size. In nine of the counties, the first surviving technical company had over 100 employees by 1968. In six of the counties, the first 2 surviving companies had over 100 employees by 1968; in two of the counties the first 3 companies experienced such growth and in two counties this was true of its first four technical companies.

Relating growth of the companies to type of industry, it was found that 21 of the 66 companies with over 100 employees in 1968, or about 32%, were electronic components companies; 16, or about 24%, were electronic systems companies; 16 were mechanical instrument companies; 4, or 6% were aircraft companies, and 3 or 5% were commercial R & D laboratories. This compares with the total sample, in which 32% of the companies were electronics components companies, 20% were electronics systems companies, 26% were mechanical instrument companies, less than 1% were aircraft companies and 16% were commercial R & D laboratories.

In general it must be concluded that technical companies, as represented by those in the counties studied, tend to be small.

**Community Factors**

An analysis was made correlating a number of selected social/economic/ de mographic factors with the number of technical companies in the 141 counties of the initial sample. One purpose of this analysis was to determine which factors might be associated with the presence of technical companies in an area.

The factors that were correlated with numbers of technical companies included measures of population, income, education, age, manufacturing, employment, and services. The data on the facts correlated with the numbers of technical companies are from the 1960 Census and the 1963 Census of Manufacturers; the data on the number of technical companies are 1968 Dun and Bradstreet statistics.

The data used to determine the numbers of technical companies in a county were approximately 5 to 8 years later than the data on the factors correlated with number of technical companies. The lag in data permit some reasonable speculation on the factors present when the growth and establishment of technical industry in a county was taking place.

With population of less than 100,000, the factors most highly correlated with number of technical companies are population, number of service establishments, and total local expenditures on education.

After the county reaches a population of 100,000, the factors most highly correlated with number of technical companies shifts from population and service establishments to manufacturing.

Analyzing the sample of 22 counties that had reached the third phase of development in the technical company formation process, eight of them can be considered high tourist attraction areas; which include the "sunshine" states of Florida, California, Arizona and the mountain states of Utah, New Mexico, and Colorado.

This is perhaps one of the environmental characteristics most prevalent in the 22 counties, and is found in four of the ten counties with the highest rates of company formation. Though seven of the counties have major universities, several had no college when the technical company formation process was well underway.

Among other local factors often given some credit for sparking the technical company formation process is the presence of a technically oriented government facility. Such facilities are found in three of the counties, Madison, Alabama (NASA), Bernalillo, New Mexico (AEC) and Orange, Florida (NASA and AF at Cape Kennedy), but they do not seem to have any particularly important effect since these counties have not shown the high rate of growth, with a possible exception of Madison, Alabama. However, it is currently suffering a severe local cutback due to the completion of major projects.

It is important to note the importance of the amenities, cultural, climatological and recreational, in the development of a high-technology industrial complex. In a study of the precision instrument industry (Spiegelman, 1964), it was reported that "personal consideration" was the factor given by far the most importance as a determinant for location

by companies queried. This factor was followed by "availability of professional staff." As was pointed out by Shapero (1966), in testimony in the Senate:

> A community must become an exciting and attractive place if it is to attract and retain the technical professional work force that is the chief production factor in high-technology industries. This highly trained body of workers is relatively young, highly mobile, in great demand, and has a choice of places to work and live. It will not stay in a community that does not have within it a selection of amenities that are available elsewhere.

Danilov: You haven't answered one question that, I'm not sure I have the answer for either, but is it possible through regional development efforts to make a science center out of a non-science center?

Shapero: I think so. Let me say, I am committed to it.

We have developed "Three Experiments in Entrepreneurship," in answer to the question, "How would you elicit company formation?" We're trying to develop a region through an engineering rather than a scientific approach. In our efforts we're saying we want to start with a community with certain minimum size, and through a series of carefully designed efforts we are fairly confident we can do it. We would approach technical people who migrated from the area and work with them in groups and individually. We would get credible people to come to them, and knowing what is known about persuasive communication and attitude change, we feel that there is good likelihood of company formations.

Danilov: Do you know of any area that has become a rich, high-technology center, through its own efforts as opposed to accident?

Shapero: So far, I think one area has shown some signs of it — I don't think any have done it. Look at our conference here. You've got all those in the country who have done **anything** on technical entrepreneurship with any data. Lots of people are talking about it, but here are all those who have done more than talk. Here, we're trying to get each to listen to the other, let alone industrial developers who believe that if you get in a garment factory for fifty cents an hour labor on the basis of unorganized labor they've made progress. One area that has done a little bit — let me speculate on that because I'm not sure if they really reached it yet — is Boulder, Colorado.

Danilov: I don't think that's a community there.

Shapero: I know of one area that tried development through arbitrary practice and it is one of the good pictures of disaster and that is Huntsville, Alabama. Corporate divisions came in or were practically forced in to get a contract. Now that the NASA dollars have run out, we called the small companies and most of the few small companies are gone.

## FIVE | VICTOR J. DANILOV

### Research Parks and Regional Development

The rapid expansion of science-based industry in the last two decades has been accompanied by the rise of so-called "research parks" and increasing emphasis on regional development activities aimed at attracting technological enterprises.

It is obvious that all three developments are related. But it is not clear what role research parks have played in furthering science-oriented industrial and regional growth. The subject simply has not received sufficient study.

The term "research park" — sometimes called "science park" — has been applied almost arbitrarily to any real estate development designed to appeal to science-related activities. In general, there are three types of research parks:

1) Parks that are restricted to scientific research and development activities.

2) Parks that are less restrictive, but are intended primarily for science-based activities.

3) General industrial parks that specifically seek and have a level of occupancy by science-oriented companies.

There are at least 120 research parks in the United States and Canada. They differ widely in size, composition, sponsorship, purpose and degree of success. This paper will examine the research park concept and its industrial, economic, and community impact.

Research parks have been described as effective vehicles for regional economic development. In fact, they have been credited with giving impetus to the scientific and technological surge of California and Massachusetts since the 1950's. Yet, relatively little evidence is available to support a thesis.

There is no question that research parks contribute to the conducive environment of a region, but I doubt if they play a substantial role in generating new enterprises or in attracting industrial activities to an area. I am inclined to believe — after a series of studies over eight years — that most companies would have located in the same region regardless of the availability of a research park.

The nation's first science-based industrial park was established by Stanford University in Palo Alto, California, in 1951. It was an attempt to supplement the income and to complement the program of the university, while providing attractive sites for new and expanding technological companies in the San Francisco Peninsula area.

It was a novel idea that started out slowly with the leasing of 10 acres to Varian Associates. By 1955, only seven companies had located in the park. However, with the growth of the electronics and space industries, the

research park concept began to catch on. By 1960, the number of tenants had increased to 32. Today, there are some 70 science-based companies with facilities at the 770-acre park.

The companies have an investment exceeding $300-million in research, development, and production facilities; employ more than 17,000 people (including 7,000 scientists and engineers); pay some $7-million in property and sales taxes each year; and contribute more than $2-million to the Stanford budget annually through their leases.

Stanford Industrial Park is one of the great success stories in the research park field. It was part of the great scientific and economic boom in the Bay region and served as the model for research parks across the nation.

Perhaps it is because of this spectacular success at Stanford — and a few other places — that the mistaken impression has developed that all research parks have been smashing successes. Unfortunately, this is not the case. As a matter of fact, it can be argued that there have been more disappointments than successes.

Research parks represent about 5% of the nation's industrial parks. They differ from other industrial parks in that they emphasize "nuisance-free" science-related activities and do not accept — or minimize — such facilities as distribution centers, warehouses, sales offices, service enterprises, and ordinary manufacturing plants.

Surprisingly, only about 20 of the 120 research parks are restricted to R & D activities, and nearly all of these developments are operated by universities. The great bulk of research parks are less restrictive, but still are operated primarily for science-based activities.

The greatest concentration of research parks can be found in California, which has 20 such developments — most of which are clustered around Los Angeles and San Francisco. Maryland is second with 14. Then comes Colorado with eight; Massachusetts and Virginia, seven; Texas, six; and Pennsylvania and Michigan, five.

The city with the most research parks is Rockville, Maryland, which has six parks. San Diego and Boulder, Colorado, rank second with four developments each and Lexington, Massachusetts, is third with three parks. Seven communities have two industrial parks that are science oriented.

Ninety-four of the 120 research parks have been established since 1960, with 64 being founded between 1962 and 1965. The greatest number (19) came into being in 1963.

There has been a noticeable decline in the launching of new research parks since 1965. Five were announced in 1966, three in 1967, eight in 1968, and none in 1969 and 1970, compared to an average of 16 per year during the prior four-year period.

Two-thirds of the research parks were started by realtors and land developers as a business investment. However, about 25 were established by municipalities, chambers of commerce, and local industrial development groups primarily to attract new industry to the area.

Universities founded 20 research parks — nearly all restricted research parks — and cooperated with community groups in the formation of at least 10 others. In most instances, the motivation was not monetary, but rather a need to expand university facilities or a desire to interact with industry, to assist the community, and/or to build a science complex that would reflect favorably upon the institution.

Four research parks were started by science-based companies that built new facilities and sought to induce other firms to locate on their property. This usually was done to recover some of the developmental costs, or to create a scientific community for the exchange of ideas or business.

Nonprofit research institutes founded three parks and a utility group established another. In all four cases, the objectives were mainly regional development and business expansion.

Here are other statistics of interest:

— The total acreage of research parks is 70,459, with the average being 592 acres. If you deduct the huge 20,000-acre Sterling Forest development in Tuxedo, New York, the total is 50,459 acres and the average 428 acres. Other large tracts are the Research Triangle Park, near Raleigh, Durham, and Chapel Hill, North Carolina, 5,000 acres; Irvine Industrial Complex, Newport Beach, California, 4,000 acres; Orlando Central Park, Orlando, Florida, 2,000 acres; and Huntsville Research Park, Huntsville, Alabama, 2,000 acres.

— The parks contain 2,129 industrial, government, university, and other occupants. The average is 19 facilities per park. Complete figures are not available on the extent of occupancy by science-based activities. But it is estimated that less than 50% of the occupants are involved in science-related work. The totals are distorted somewhat by a few extremely large parks, such as Irvine Industrial Complex in Newport Beach, California, with 280 occupants; Southeast Industrial Park in Fullerton, California, 210; Orlando Central Park in Orlando, Florida, 130; Washington Rockville Industrial Park, Rockville, Maryland, 97; and Stanford Industrial Park, Palo Alto, 75.

— Facilities located in science parks employ at least 183,617 persons, based on returns from about three-fourths of the 120 parks. Approximately one-fourth (38,907) are scientists and engineers. This comes to an average of 1,974 and 493, respectively. Once again, a handful of parks is responsible for the bulk of the total. Stanford Industrial Park has a total employment of 17,000, with scientists and engineers numbering 7,000. Other large employers — with the number of technical people shown in parentheses — Greater Baltimore Industrial Park, Baltimore, 8,000 (5,000); Research Triangle Park, 7,000 (3,850); Huntsville Research Park, Huntsville, Alabama, 6,000 (2,500); Rancho Conejo Light Manufacturing Industry and Research Center, Thousand Oaks, California, 5,000 (1,250); and Westgate Research Park, McLean, Virginia, 3,000 (2,100).

— Perhaps the most revealing statistics are those dealing with occupancy. The average occupancy rate for the 120 parks is 40%. There are five parks with 100% occupancy — Technology Square, Cambridge, Massachusetts;

Rancho Conejo, Thousand Oaks, California; Lowell Research Park, Lowell, Massachusetts; Washington Rockville Industrial Park, Rockville, Maryland; and Lexington Office-Research Park, Lexington, Massachusetts. However, the majority of research parks have rather low occupancy percentages. Thirty-two parks — or about one-fourth — have three or less occupants. But this is a considerable improvement over a similar survey two years ago when 44% had two or less occupants.

Unfortunately, there has been a tendency to assume that because there have been a few big winners — like Stanford, Research Triangle, Huntsville, and Technology Square — virtually any research park can succeed with little or no effort and that every park has enormous regional implications. Nothing could be further from the truth.

An examination of the research park movement shows the path strewn with obstacles and carcasses of parks that failed to make it. It would be no exaggeration to say that more than half of the science parks have been failures or disappointments.

Some research parks never get beyond the announcement stage. Among those that suffered this fate were the Panther Hollow project sponsored by the University of Pittsburgh, the International Research Center initiated by the University of Miami, and the IIT Research Park proposed by Illinois Institute of Technology.

A number of universities have announced plans to develop research parks, but have not done anything to implement them. In this group are such institutions as Washington, Indiana, Kansas, Iowa State, and Tulane Universities.

Universities are not the only ones having difficulties in executing research park plans. In Detroit, Chicago, Philadelphia, and Cleveland, slum clearance programs have stymied community science center plans.

In 1963, the mayor of Detroit proudly announced federal approval for a $4-million Research Park West adjoining the campus of Wayne State University. The project still is tied up in red tape.

In Chicago, the technical societies initiated a drive in 1965 for a multi-million-dollar Chicago Engineering & Science Center. The original plan was to lease one of the city's new skyscrapers. Now the center is slated for an urban renewal site near the Chicago campus of the University of Illinois on the near west side. But no one knows who will supply the necessary developmental funds.

The Philadelphia story is somewhat more encouraging. Although the slum clearance site has not been cleared — and probably won't be for several years — the University City Science Center has begun operations in a renovated building near the University of Pennsylvania. Eighteen Delaware Valley institutions are shareholders in the science center, which will cost at least $100-million to construct.

The urban renewal program in Cleveland has had better luck in providing a partial site for the University Circle Research Center adjacent to Case Institute of Technology and Western Reserve University. As a result, the

first building in the proposed $100-million science center — announced in 1965 — was completed in 1967.

Many research park developers have the necessary land, but apparently lack some of the other ingredients for success. They simply have not been able to attract industrial (and sometimes governmental) facilities to their respective parks. As a result, they have come up empty-handed after several years of conscientious effort.

Many research parks have attracted a facility or two, then stagnated. More than a dozen parks — including those in Gainesville, Florida, Clemson, South Carolina, Lexington, Kentucky, and Phoenix, Arizona — fall in this unfortunate category.

One of the first science parks was the Gainesville Industrial Campus founded by the local Chamber of Commerce in 1954. After more than a decade of promotion only three tenants have located in the 265 acre development in sunny Florida.

Clemson University established Ravenel Research Center along the shores of Hartwell Lake in 1959. Although an attractive setting, the park has been able to attract only one facility.

Spindletop Research was created as a nonprofit research institute in 1961 through a $3.5-million grant from the State of Kentucky. At the same time, the 220-acres surrounding the Lexington Institute was designated as a research park. So far, no one else has located in the park.

In 1962, a private developer set out to establish an ambitious Phoenix International Science Center in Arizona. Because of the tract's proximity to two large industrial installations — General Electric and Sperry Rand — the developer had high hopes. But only one small firm took the bait.

Sometimes a company will locate in a research park and find that it does not live up to expectations. Such was the case with the General Electric Advanced Electronics Center, which became the first occupant of Cornell University's Industry Research Park in Ithaca, New York, in 1952.

The 350-man GE center was shut down and consolidated with the company's Electronics Laboratory in Syracuse in 1965. A number of factors influenced the decision, including the desire to bring together the company's electronics talent and to have them work closer with the product departments. However, the remoteness of Ithaca and insufficient interaction with the Cornell academic community also were factors in the decision to withdraw from the park.

Partly as a result of the General Electric move, Cornell is making a renewed drive to attract industry. With financial aid from Tomkins County Area Development, Inc., Cornell has initiated an extensive direct mail and advertising campaign without much success.

When a research park experiences difficulty in attracting R & D facilities, it sometimes will accept borderline activities — such as technical sales offices, routine manufacturing operations, and miscellaneous government facilities. This has occurred at Purdue University Industrial Park in West Lafayette, Indiana, and Science Industrial Park in San Antonio, Texas.

When faced with the lack of industrial interest, some universities — such as Colorado State, Georgia, and Missouri — have concentrated on locating institutional and governmental laboratories in their parks.

Colorado State University now has 10 university and federal regional laboratories located in the 1,700-acre research park it established in Fort Collins in 1958.

In Athens, the University of Georgia has eight facilities in its seven-year-old 300-acre research park, but most of the laboratories are federal regional institutions that probably would have located in the area regardless of the development.

There are eight institutional and governmental occupants in the 85-acre University of Missouri Research Park, founded in Columbia in 1962.

It should be obvious from this sampling that the research park movement is not as successful as we have been led to believe. But it would be a mistake to conclude that the concept is a failure. There are numerous examples of successful science parks.

In addition to Stanford Industrial Park, there are at least 30 other research parks that have achieved high degrees of occupancy and can be considered successful.

California has the greatest number of research parks and one of the highest success ratios. Two other major concentrations can be found in the Boston and Washington areas.

There are six research parks with high occupancy percentages and major installations in Massachusetts. The Washington area has six flourishing science-oriented parks.

Successful research parks can be found scattered throughout the nation. They include Huntsville Research Park in Alabama, Research Triangle Park in North Carolina, Greater Manchester Industrial Park near Philadelphia, Normandale Center in Minneapolis, and Westpark in Houston.

There appears to be no formula for success or failure in the research park field. What pays off in one place does not necessarily work elsewhere. The circumstances frequently are quite different.

About the only thing most developers agree upon is that less restrictive science parks have a better chance of succeeding than pure research parks.

Most companies seem to prefer broader-based parks because they encourage greater cross-fertilization; allow more flexibility in construction, subleasing, and selling; and receive a better reception in financial circles.

The evidence seems to indicate, with a few exceptions, that parks restricted to R&D activities are having much more difficulty in finding occupants than those science-oriented parks that are similar to regular industrial parks. One of the principal reasons, of course, is that the number of available R&D facilities is much smaller than the light industry universe.

It appears that most of the research park failures and disappointments occur for one or more of the following reasons:

— Lack of a specific reason for locating in the area, such as proximity to a relevent university, government facility, or industrial complex.

— Inadequate park organization, planning, and/or developmental funds.

— Insufficient sales promotion to acquaint prospects with the advantages of the park.

— The high cost of leasing or purchasing property.

— A poor site from the standpoint of available acreage, construction, highway access, utilities, services, air transportation, and/or physical layout.

— Too restrictive zoning or covenants.

— Lack of the type of living and working environment that appeals to scientists and engineers.

— Disappointing interaction with the academic and/or scientific communities.

From a regional development standpoint, research parks usually do not succeed for somewhat different reasons. Basically, it is questionable if such real estate developments have much influence in the launching or the attracting of new science-based enterprises.

An examination of the 2,129 occupants of research parks shows that a relatively small proportion of the facilities — perhaps less than 5% — were located or succeeded in an area because of the availability of a research park.

Research parks generally do not attract new spin-off companies because most technological entrepreneurs cannot afford such high cost sites. It is far more common for a new struggling technical firm to locate in a low-rent district, at least until it becomes financially sound.

A few research parks — such as the one at Purdue — do have "incubator" facilities designed to help new companies get started. In such cases, a technological entrepreneur can rent an office or two at modest cost until he is ready to expand into his own building. But such facilities are rare.

Most science-based companies do not move to a new region because of a research park. The larger firms make the move for other reasons — such as the proximity to a leading university, the availability of technical talent, or the need for a regional support operation. The research park usually becomes a factor after the basic considerations are resolved and the attention turns to selecting a suitable site. If the research park did not exist, the company probably would locate in the area anyway.

Most small companies — and particularly those started recently by technological entrepreneurs — usually do not move from the region in which they are founded. They prefer to stay in the area with which they are

familiar and have professional, academic, financial, business, and social roots. Distant research parks have almost no appeal to this group.

Several years ago, I did four surveys to find out what makes an attractive science site. I received responses from some 1,200 research scientists and engineers, 200 R&D directors, 100 company presidents, and 70 organizations located in research parks.

The findings tended to confirm the belief that there are basic differences between the needs of scientific and non-scientific facilities. The four surveys reveal that the factors considered important in the selection of a site for a laboratory or science-oriented plant are quite different from those of an ordinary industrial or commercial facility.

Industrial site studies conducted by three other magazines — **Business Week, Fortune** and **Chemical Week** — have disclosed that an ample labor supply and good transportation are considered the most important qualities for an industrial plant site.

These two factors were followed by nearness to markets, proximity to raw materials, suitable land for growth, low taxes, economical utilities, and a favorable community attitude.

As you can see, nearly all of the principal factors relate to the cost of production and marketing in a typical industrial or commercial operation. The four **Industrial Research** surveys show this is not entirely true in science-based undertakings. The environment plays a much greater role in the selection of a site for a laboratory or other science facilities.

Consensus of the four **Industrial Research** surveys seems to be that the most important single consideration is proximity to centers of academic excellence. Close behind are the availability of technical manpower and proximity to corporate headquarters.

Here is the order in which the survey participants ranked the "most important" factors in the selection of a science site:

— Proximity to universities.

— Availability of technical manpower.

— Proximity to corporate headquarters.

— Cost of living.

— Proximity to existing customers.

— Proximity to other research activities.

— Proximity to new markets.

— Availability of sk lled labor.

When asked to check all the factors that should be considered in a science site selection, the survey respondents showed a greater interest in environmental factors. The ranking of considerations ran as follows:

— Availability of above-average schools.

— Availability of technical manpower.

— Proximity to universities.

— Availability of adequate land.

— Availability of air transportation.

— Availability of suitable housing.

— Availability of cultural activities.

— Availability of skilled labor.

— Cost of taxes.

— Proximity to other research activities.

— Proximity of recreational opportunities.

— Cost of living.

— Availability of technical library.

Research parks, as such, were not mentioned as essential ingredients of a suitable site. There were references, however, to the need for adequate land and services.

Let us take a closer look at the responses from the 70 research park occupants. As you can see from the following table, the most common reason — by far — for locating in a research park was its proximity to a leading university.

| | |
|---|---|
| Near leading university | 32.4% |
| Manpower available | 13.2% |
| Near customers | 13.2% |
| Near other R&D activities | 13.2% |
| Professional environment | 13.2% |
| Pleasant living conditions | 11.8% |
| Available land | 8.8% |
| Transportation | 5.9% |
| Company founded here | 4.4% |
| Near other company locations | 4.4% |
| Proximity to other industry | 4.4% |
| Availability of raw materials, water, power and facilities | 2.9% |
| Government choice | 2.9% |
| Low construction costs | 2.9% |
| Favorable tax environment | 1.5% |
| Financing available | 1.5% |

Slightly more than half of the respondents (56.5%) were located in restrictive research parks, as opposed to science-oriented industrial parks. The primary function was research and development in 70% of the cases. The breakdown on others was: production, 27.6%; service, 18.6%; training and education, 11.4%; and sales, 10%.

Over two-thirds (70%) of the respondents headed industrial firms. The other types of organizations represented were government, university and others — each with 10%.

The vast majority (81.5%) said the park had lived up to expectations as a location for their facilities. Of the others, 11.4% had no opinion and 7.1% said "no."

As mentioned earlier, a company usually remains in the same region where it was founded. The survey of 1,200 research scientists and engineers appeared to support this position. Nearly half of the respondents (49.2%) cited founding as the principal reason for the present location of their respective companies. Other reasons given were:

| | |
|---|---|
| Company founded here | 49.2% |
| Near customers | 10.6% |
| Manpower available | 7.4% |
| Near leading university | 6.5% |
| Near corporate offices | 6.3% |
| Availability of raw materials, water, power & facilities | 5.1% |
| Low construction costs | 4.9% |
| Pleasant living conditions | 4.0% |
| Government choice | 2.4% |
| Professional environment | 2.2% |
| Adequate land | 1.8% |
| Financing available | 1.5% |
| Remote location | 1.4% |
| Transportation facilities | 1.0% |

When asked how important the company's location was in deciding to accept their present positions, more than three-fourths of the respondents replied "somewhat important" (47.3%) or "most important" (28%).

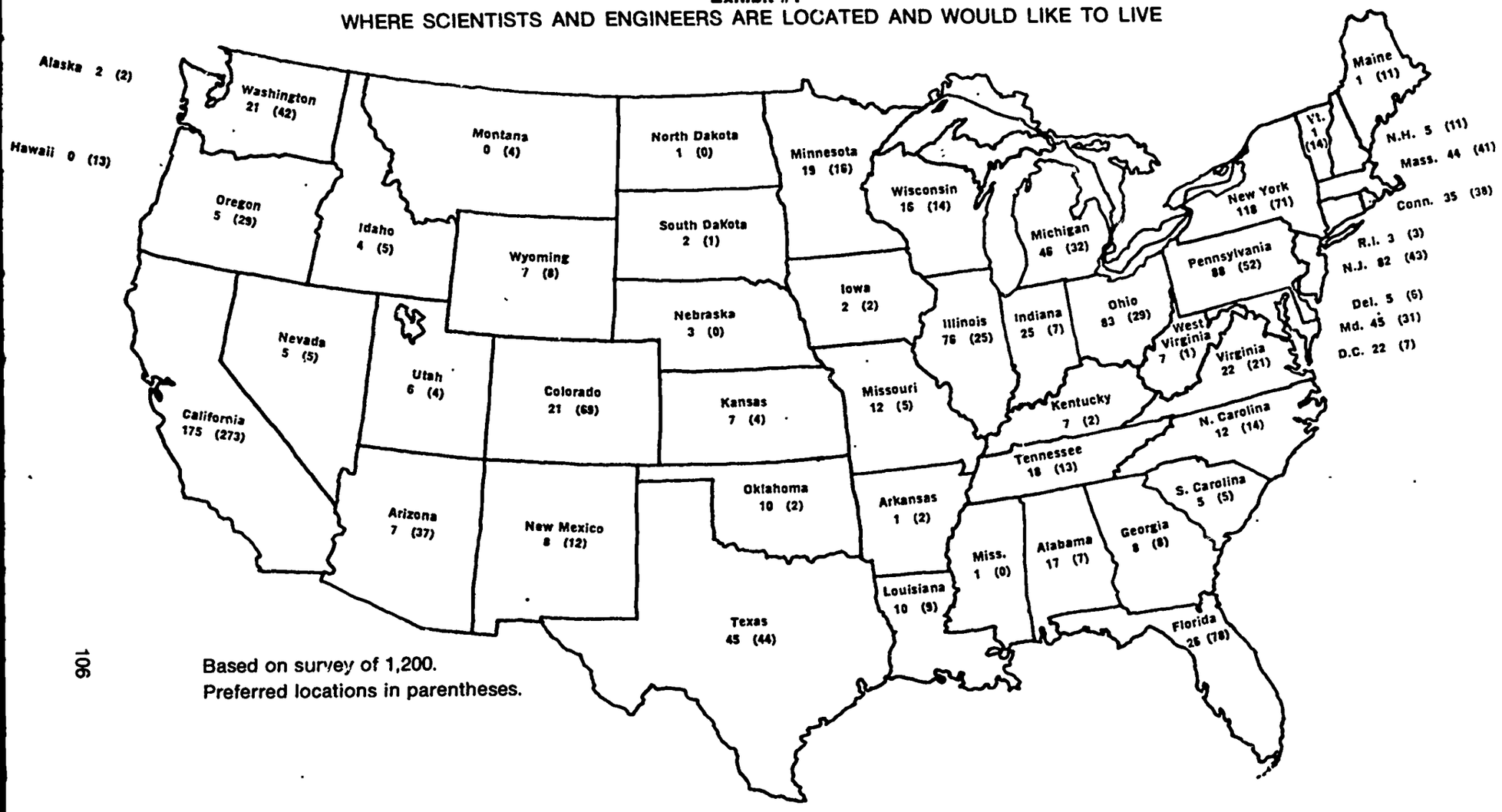
However, when requested to list the factors that would be most important to changing jobs, the following ranking emerged:

1) Nature of work.
2) Salary.
3) Professional environment.
4) Stability of job.
5) Living conditions.
6) Laboratory location.
7) Reputation of employer.
8) Fringe benefits.
9) Physical plant.

It is interesting to compare where the respondents were located, as opposed to where they would prefer to live and work. The accompanying map shows some startling differences.

**Exhibit #1**

WHERE SCIENTISTS AND ENGINEERS ARE LOCATED AND WOULD LIKE TO LIVE




Based on survey of 1,200.
Preferred locations in parentheses.

I'm not certain what all this proves, since some of the findings are contradictory. However, I am convinced that research parks have been overrated as stimulators and attractors of science-based industry. On the other hand, they have performed an invaluable function by providing pleasant nuisance-free sites for conducting industrial activities that make a substantial contribution to the regional economy.

## SIX / ARNOLD C. COOPER

### Incubator Organizations & Technical Entrepreneurship

This paper focuses upon the birth of new, technologically-based firms (NTBF's). The particular concern is with the role of established organizations in influencing entrepreneurship and with one measure of the results of that influence — spin-off rates from established organizations.

This paper reports some of the findings from a program of research conducted in one of the nation's centers of technical entrepreneurship — the San Francisco Peninsula area around Palo Alto, California. Specifically, the research included three phases:

1) Intensive interviews were conducted with thirty entrepreneurs. The typical interview lasted about two hours and focused upon the events and decisions associated with the founding of their firms.

2) Summary data were gathered, chiefly through telephone interviews, relating to the founding of virtually all of the new, technologically-based firms started on the San Francisco Peninsula since 1960. In total, data were gathered on the founding of about 250 new firms. This probably represents most of the companies of this type started in the area since 1960, and might be regarded as a reasonable approximation of a census of the population.

3) Interviews were held with executives from established organizations. Data were gathered about spin-offs from their firms and about internal factors which may have encouraged or discouraged entrepreneurship.

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### Definitions

A technologically-based firm is defined as a company which emphasizes research and development or which places major emphasis on exploiting new technical knowledge. Only firms involving the full-time effort of at least one professional person are included in this study; part-time ventures are not considered. Firms offering only management consulting, computer software, or wholesaling and selling services are excluded. Also omitted are "sponsored spin-offs," in which a parent firm voluntarily establishes and holds stock in a newly formed company intended to perform some of the business of the sponsoring firm.

### Framework For Analysis

We might start by considering a framework for analysis, one which has elements in common with that presented by Al Shapero. The founding of a new firm is, in a basic sense, a decision made by one or several entrepreneurs. Three major factors appear to influence this decision:

1) The entrepreneur himself, including the many aspects of his background which affect his motivation, his perceptions, and his skills and knowledge.

2) Various external influences, many of them regional in nature. These include the availability of capital, the accessibility to suppliers, personnel and markets, and the collective attitude toward entrepreneurship and the risks and rewards associated with it.

3) The established organizations in an area, which might be termed "incubator" organizations. They affect the kinds of people hired and brought into an area, the technical and market knowledge developed by these people, and the motivations of these prospective entrepreneurs.

The focus of my remarks is primarily upon this third factor — the incubator organizations. We shall consider ways in which incubator organizations influence technical entrepreneurship and one measure of the results of that influence — spin-off rates from established organizations.

**Location of the New Firm**

The first way in which incubator organizations influence technical entrepreneurship is in the location of the new firms. Regional entrepreneurship is related closely to the established firms or incubator organizations located in **that same region.** New firms are typically founded by entrepreneurs who are already employed in organizations in the same geographical area. In the Palo Alto area, it was found that 97.5% of the new companies had one or more founders who were previously working in the area. In 92.2% of the new firms, all of the founders were already located there. One might presume that the Palo Alto area would be particularly attractive to the mobile entrepreneur, both because of its living conditions and the presumed advantage of being located in a "complex" of related firms. Despite these advantages, technical entrepreneurs have not come frequently from other parts of the country to start NTBF's in Palo Alto. Technical entrepreneurs tend to start firms where they are already living and working.

Interviews with founders suggest why they tend to start firms where they are already located. The tremendous number of tasks involved in getting a business started, including securing people and facilities and establishing relationships with suppliers and customers, is made much easier if the founder can rely upon contacts and knowledge already acquired in a particular area. In addition, it becomes possible to get some of these tasks started, to begin laying the groundwork, before abandoning the old job altogether.

It is true that there have been instances of entrepreneurs moving into an area and having a significant impact. For instance, Dr. Shockley came to Palo Alto in 1955 to start Shockley Transistor. Although his firm was not very successful, it did "seed" the Palo Alto area with respect to semiconductor technology. However, the mobile entrepreneur appears to be quite rare.

The significance of these findings is that technical entrepreneurship in a particular area appears to be related closely to the incubator organizations already there. Unless such incubator organizations exist in a region, it is unlikely that there will be any new, technologically-based firms born there.

**Nature of Products or Services Offered**

Established organizations in a given region also affect the **kinds** of new companies founded there. An entrepreneur typically starts his new firm to exploit that which he knows how to do best. This usually is related to the market and technical knowledge which he learned and helped to develop in the parent firm. Even though he may have worked for a succession of employers previously, it is in the job he has just left that he has acquired the most up-to-date knowledge of markets and technologies. In 85.5% of the cases studied in Palo Alto, the new firm served the same general market or utilized the same general technology as the parent company or companies. (See Exhibit 1)

One implication of these findings is that the nature of the business of an established organization is likely to influence the extent to which it functions as an incubator.

Industries vary widely in the extent to which there are attractive economic opportunities which can be exploited by **new** firms. If an industry is growing rapidly and if there is a high rate of technical change, there may be pockets of opportunity for the fledgling firm; a group of engineers with a product idea may be able to establish a competitive advantage in some segment

**Exhibit 1**

Comparison of the technology and market of the new firm to those of the parent firm

(n = 220)

| Market | Technology: Similar to parent | Technology: Different than parent |
|---|---|---|
| Similar to parent | 139 firms 63.2% | 1 firm .5% |
| Different than parent | 48 firms 21.8% | 32 firms 14.5% |

of the market. Established firms in such an industry are teaching potential entrepreneurs skills which can be applied directly in a small or new firm, and the result may be a high spin-off rate. By contrast, an established firm in an industry which requires heavy capital investment or large organizations to compete is likely to have a low spin-off rate. For instance, many of the employees of an aerospace prime contractor or a large scale producer of consumer electronic products are acquiring technical and market knowledge which would be difficult to apply on a small scale. On several occasions, I have talked to engineers in large midwestern firms who hoped to become entrepreneurs. When asked what they could do better than their future competitors, they usually replied that they could produce on a mass basis at slightly lower cost. When asked about the investment required to put them into business, they usually concluded that at least one or two million dollars was required. Their firms usually had never had any spin-offs.

An important consideration in whether an established firm functions as an incubator is the nature of its business, and, in particular, whether the potential entrepreneurs within the organization are developing skills which can easily be exploited by a new firm.

Draheim: I'm amazed that 14.5% of the new firms are based not only upon a different technology, but also upon a different market from that of the parent firm. That's striking; would you comment upon this?

Cooper: One explanation for this is that some of the new firms were based upon market and technical knowledge acquired in earlier jobs, positions held before the entrepreneur went to work for the parent firm.

Danilov: In your analysis (Exhibit 1), where does one find the situation of a large company which decides that a certain technology or product is incompatible with its present business, so that people take this idea which "doesn't fit in" and go out on their own?

Cooper: If the new company is based upon technology from the parent firm but not upon market knowledge, it is included in the lower left-hand cell of Exhibit 1. There were several instances in which the parent company wanted to get out of an established business. In these cases the entrepreneur started a new firm to conduct the same kind of business as that which the parent firm was withdrawing from. Sometimes, this was done with the parent firm's blessing.

Shapero: In the past two weeks there have been two examples of established companies getting out of a line of business. One involved an aerospace company which decided to sell its line of vacuum equipment, including the people involved, to a smaller company. These are not spin-offs in the usual sense, but in a way that's what it amounts to.

Howell: Would you give some examples of firms in the lower right-hand cell (Exhibit 1), those with different technologies and different markets than the parent firm?

Cooper: One example involved a man who was in charge of a computer laboratory in a large organization, and whose hobby was music. He started a firm which had as its first product an electronic tone-generator to be sold in the music field. Although the product had electronic components, it did not utilize the specific computer technology which had been his primary concern before. Another example involved one of the original founders of a semiconductor firm. He later left and started a teaching machine company.

Draheim: One of the Stanford Research Institute long-range planning reports had a matrix similar to that in Exhibit 1. It was concerned with company diversification, and the box in the lower left-hand corner corresponded to product development and the box in the upper right-hand corner involved market development. "True diversification," involving both product and market development, was in the lower right-hand corner. They found that companies going into product development or market development had higher success rates than those going into true diversification.

**Motivation**

We might now consider motivation and the way in which the incubator organization motivates the entrepreneur. The ability to start a new firm is essential, but it is not enough. There must also be motivation. Obviously, many factors may influence the prospective founder, including his attitude toward risk-taking and the perceived social-status, risks, and rewards associated with entrepreneurship. Granting the complexity of these decisions, it was clear that the entrepreneurs studied in Palo Alto were motivated to an important degree by events which they perceived to be happening within the incubator organization.

In most instances, spin-offs were indications of frustration within the established firm. Of thirty founders studied intensively, seventy percent could be described as highly frustrated in their previous positions. Of the remaining founders, seventeen percent described themselves as happy in their previous positions. An additional thirteen percent were forced to leave through bankruptcy, being "laid off," or the closing out of branch offices or plants with no attractive opportunities elsewhere in the company. (See Exhibit 2)

Investigations of this sort are, of course, open to the criticism that the entrepreneurs are merely providing an "after the fact" rationalization of their actions. In previously published S.R.I. studies, mention was made of "pushes" and "pulls" as they related to motivations for entrepreneurship.[1] I suspect that research involving mailed questionnaires or casual contact with the entrepreneurs would reveal a number of publicly acceptable, rational explanations for the move; these would emphasize the positive attractions of entrepreneurship — the "pulls." However, my experience has been that detailed interviews, involving the establishment of considerable rapport with the entrepreneurs, often disclose the important influence of negative factors associated with the previous job — the "pushes."

Of those interviewed in Palo Alto, the situation was usually unambiguous. Extreme frustration was particularly evident for those founders (thirty percent of the total) who quit their previous jobs without any specific plans for

**Exhibit 2**

Motivation of entrepreneurs

(n = 30)

| | | |
|---|---|---|
| Forced to leave previous position | | 13% |
| Happy in previous position | | 17% |
| Frustrated in previous position: | | |
| Quit without specific plans | 30% | 70% |
| "Would have quit even if had not become an entrepreneur" | 40% | |

the future. In these situations, the founder often quit his job suddenly, usually as the culmination of mounting frustration. It was then several days or even months later that the idea of starting a specific new business developed.

Forty percent of the founders said that, even if they had not started their own businesses, they would have quit their previous positions. They usually went on to add a series of epithets about the extent of their frustration. One man commented, "I had become disillusioned; my immediate supervisor was a "clod." By the end of each day, I was so frustrated that it took three or four martinis for me to relax." One group of engineers, disturbed by what they saw as an absentee management unreceptive to new ideas, advertised themselves as a "department available" in the classified section of the newspaper.

The major cause of frustration, broadly stated, was a lack of confidence in management, a feeling that poor decisions were being made and that the division or company faced an unpromising future. As these men described their frustration, two areas of concern were mentioned again and again One centered upon the selection and development of managers and was reflected in comments such as: "I could see the wrong people being placed in key positions;" or, "I couldn't respect my supervisor." The other area of major concern had to do with investment in products and technologies: "Management was investing in the wrong new products;" or, "The president wanted to take the company in a direction in which I had neither interest nor competence."

Evidently, a high spin-off rate is indicative, in part, of poor morale and frustration within the organization. The industrial firms which are prolific incubators usually have been through times of internal troubles.

Vesper: Did Hewlett-Packard have many spin-offs?

Cooper: It is a large organization, and has had several spin-offs; however, it has not had a high spin-off rate.

Vesper: Interestingly enough, they have encouraged spin-offs. They had an advertisement in **Scientific American** which said something like, "If you want to be in business for yourself, come to work for us, and we'll help you."

Cooper: Some of the spin-offs from Hewlett-Packard do relate to that approach. In several instances, they sponsored the establishment of independent firms as suppliers, encouraging people from within the H-P organization to become entrepreneurs and providing venture capital. Later, they folded some of these companies back into the parent H-P organization. Subsequently, some of those who had had a taste of managing their own firms spun-off and established completely independent new firms.

Kohl: Have you investigated the motivations of people who left and didn't form their own companies? For instance, if you talked to 100 people who quit their previous jobs, would 70% of them be equally frustrated?

Cooper: No, I have not done that. I think that frustrations play an important part in causing a man to quit a previous job. Frustrations don't necessarily lead him to start his own business, rather than to work for somebody else. The decision to become a founder is influenced, in part, by factors in the man's personal background, by whether he has the capability to start a viable firm, and also by various external factors, including the availability of venture capital and the presence of examples of entrepreneurship.

Danilov: Is this enough of a sample to generalize about motivations?

Cooper: I don't know. A larger sample might give somewhat different conclusions. As I conducted the research, I was surprised at the extent to which frustration seemed to be an important factor in causing the entrepreneur to act. Anecdotal evidence from the larger sample and from technical entrepreneurs in other parts of the country suggest findings consistent with these.

Draheim: Data in the Twin Cities and in Buffalo support these findings.

Shapero: There is enough spot data that you know these conclusions are very plausible. We can predict that the next 30 are going to show similar findings.

Roethle: I happen to be an officer in our state consulting association. One night things became rather intimate and personal, with everyone proceeding to tell how he really got into consulting. These were successful, well-established consultants. One of the things that came out was that three out of every four people in that organization had been fired earlier.

Howell: In California, you are never unemployed; you are a consultant.

Cooper: Let me add a comment which has to do with regional factors. One of the ways in which a complex of related firms encourages entrepreneurship is through the opportunities it provides for consulting. Those men who have quit previous jobs without specific plans can sometimes support their families through consulting, while trying to decide what to do. For instance, in Kokomo, Indiana, about 30 miles from here, the Delco division of General

Motors employs about 700 engineers, many of them working in the semiconductor field. They have never spun off a technologically-based firm, despite the fact they have had some employees who have told me they wanted to leave and start their own firms. One reason for this lack of entrepreneurship is that there are few opportunities for consulting.

Shapero: Also, if they had one successful example of entrepreneurship . . . .

Cooper: And they don't. I once administered a questionnaire to a group of engineers from Delco, in which I asked them to list the names of successful founders of new, technologically-based firms. Almost none of them knew of any instances of this. Entrepreneurship appeared to be a step into the black unknown. This contrasted sharply with the Palo Alto experience, in which almost every entrepreneur interviewed could name many successful founders whom he had known personally.

**Spin-Off Rates**

Clearly, technical entrepreneurship depends upon local incubator organizations which hire, train and motivate the prospective entrepreneur. The extent to which individual organizations function as incubators is reflected in the spin-off rates from those organizations.

Development of spin-off rate data in an area of active entrepreneurship should help us to understand whether firms function differentially as incubators. The remainder of this paper focuses upon questions such as the following: How do spin-off rates vary among major organizations within a region? What kinds of organizations have high spin-off rates and what kinds have low spin-off rates? Is there any systematic variation in spin-off rates among different divisions or departments within large organizations?

In determining spin-off rates, any new, technologically-based firm is defined as a "spin-off" regardless of whether it is engaged in the same kind of business as the established organization which the founders left. Although an entrepreneur may often have worked for several pervious employers, the only incubator firm for the NTBF is the organization which employed him immediately prior to his starting the new firm. If the new company is started by a group of entrepreneurs who represent different incubator organizations, (which was the case in about 25% of the new firms), the spin-off calculations are based upon the proportion of the founding group from each firm. Thus, if one founder is from Company A and one from Company B, the new firm is counted as 0.5 spin-offs from each parent company. (Some founders are more important than others, and, ideally, one might wish to weight the spin-off calculations accordingly. However, information as to relative importance of founders is difficult to obtain and evaluate.)

Spin-off "rates" from an established organization are calculated as follows: the numerator consists of the total number of spin-offs from the organization during the period from January 1, 1960, to July 1, 1969; the denominator is the average number of total employees during this period. (Ideally, one might wish to base spin-off calculations on the number of prefessional employees only, since most technical entrepreneurs are from this group. However, these data were not available.)Thus, a firm which employed an average of 500 employees during the 1960's and which had employed all of the founders of three new firms and half of the founders of another would have a spin-off rate for the decade of 3.5/500.

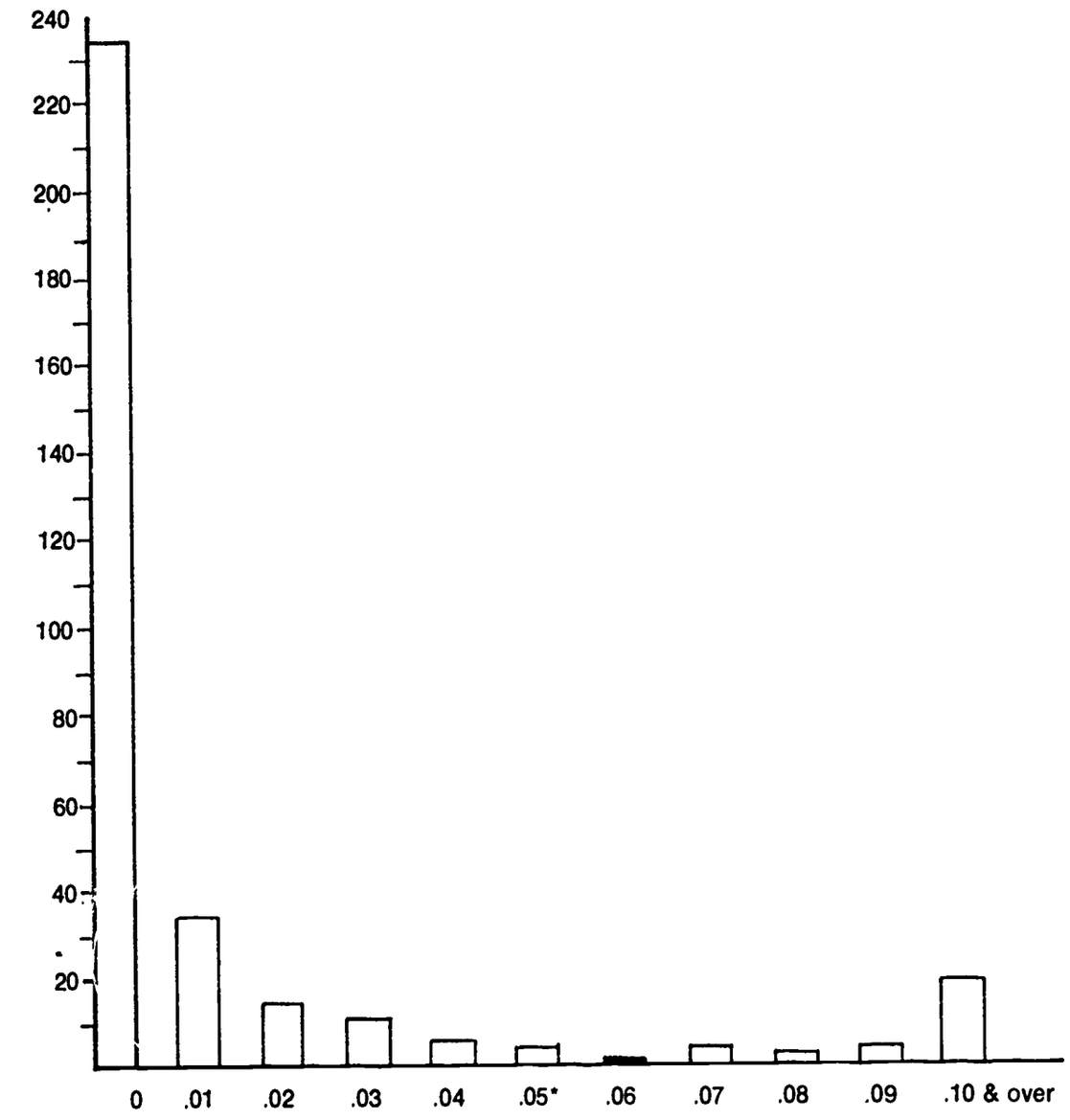
Based upon data developed in this study, one can calculate the average spin-off rate for all of the high-technology incubator companies for the decade of the 1960's. The average total employment for these companies was estimated at 77,600. (Estimates of employment were arrived at by first using the survey data collected annually by the Western Electronic Manufacturers Association. These data were supplemented with employment figures for additional organizations known not to have been included in that survey.) There were 243 new firms identified for which incubator firms could be specified. Only six of these new companies (2.5% of the total) were started by founders who were out of the area; 237 of these firms had one or more founders who had been working for companies on the San Francisco Peninsula. The spin-off rate for the high-technology companies as a group was 237/77,600 or 1/306.

Spin-off rates were calculated for 325 individual organizations, some of which are no longer in existence. The distribution of these spin-off rates is given in Exhibit 3. There were many companies, particularly small ones, which had no spin-offs.

Among firms that had 3 or more spin-offs, the range in spin-off rates was from 1/3100 to 1/14. Sample spin-off rates, indicating the wide degree of variation, are given in Exhibit 4. This variation is particularly notable when considering that all of these companies were in the same regional environment. Those geographical factors which might encourage entrepreneurship, including the availability of venture capital and the possible advantages of being located in a "complex" of related firms, presumably acted to encourage prospective entrepreneurs in all of the organizations in the area. Despite this, one finds vast variations in the extent to which established firms act as incubators of new firms.

**Exhibit 3**

Frequency Distribution
of
Estimated Spin-Off Rates
n = 325




*.04 < Rate ≤ .05

**Exhibit 4**

Selected Spin-Off Rates From
Established Organizations
During Decade of the 1960's

| | Number of Spin-Offs / Mean Employment | Spin-Off Rate |
|---|---|---|
| Company A | 8.3/25,700 | 1/3,100 = .0003 |
| Company B | .33/750 | 1/2,250 = .0004 |
| Company C | 2.8/2400 | 1/850 = .0012 |
| Company D | 12.75/7,450 | 1/584 = .0017 |
| Company E | 1.7/600 | 1/283 = .0028 |
| Company F | 6.05/770 | 1/127 = .0079 |
| Company G | 3/180 | 1/60 = .0017 |
| Company H | 3/42 | 1/14 = .071 |

**The Effect of Organizational Size**

Spin-off rates were calculated for incubator firms of different size classes. Established firms were classified as under 500 employees, over 500 employees, and as subsidiaries of under 500 employees. As can be seen in Exhibit 5, the spin-off rate for "small" firms was about ten times that for "large" firms. The spin-off rate for "small subsidiaries" was about eight times that for large firms.

These findings appear to be consistent with those reported by Forseth in his analysis of spin-off rates at four M.I.T. laboratories, although differences in definitions used make direct comparison difficult. In his analysis, the size of a laboratory was based upon total funding. He reported that spin-off rates were inversely related to laboratory size, that is, that the smallest laboratory had the highest spin-off rate, etc.[2]

**Exhibit 5**

Spin-Off Rates from Established Firms
by Size Class of Established Firm
During Decade of the 1960's

Established Firms, Size Class[1]

| | Less than 500 Personnel | More than 500 Personnel | Subsidiary Less than 500 Personnel | All Firms |
|---|---|---|---|---|
| Spin-Offs | 96.5 | 120.0 | 20.5 | 237.0 |
| Average Total Employment | 5,800 | 70,300 | 1,500 | 77,600 |
| Average Spin-Off Rate | 1/59.2=.017 | 1/586=.0017 | 1/73.2=.014 | 1/306=.0031 |
| Ratio of Rate to Rate of "Large Companies" | 9.7:1 | 1:1 | 8.0:1 | 1.8:1 |

[1]Does not include spin-offs from universities

It is common knowledge that certain large firms in the Palo Alto area have been important incubators. Companies such as Fairchild Semiconductor and Ampex have received considerable publicity in this respect. It is thus interesting that the highest spin-off rates belong to the classes of small firms and small subsidiaries.

The research suggests several reasons why small firms have higher spin-off rates:

1) Large firms are often engaged in activities which require heavy capital investment or large organizations to compete; economies of scale are often important. A new firm, established to compete in these same segments of industry, may be at a substantial disadvantage. By contrast, the employees of smaller firms are, by definition, learning how to do things which can be exploited by a small firm.

2) Professional employees in small firms develop rather broad backgrounds, often assume substantial responsibilities at early stages of their careers, and learn about the particular problems of managing a small firm. This experience constitutes a valuable education for the prospective entrepreneur. There is close contact among the managers in different functional areas so that it is easier to assemble a team of entrepreneurs with the requisite skills in development, manufacturing, and marketing.

3) There is probably a self-selection process, whereby those who choose to go to work for small and new firms are the most prone to be entrepreneurially inclined. These attitudes are usually reinforced in the small firm environment, as the technical employee learns what is involved in managing a small company and sees before him the living example of a successful entrepreneur — his employer.

4) Large firms probably employ a higher percentage of nonprofessional employees. These workers are less likely to become technical entrepreneurs than the engineers and managers. Thus, a higher percentage of the total employees in a small firm are potential entrepreneurs.

The high spin-off rates for small subsidiaries is probably due, in part, to the above mentioned factors. In addition, most of these subsidiaries had, at one time, been independent companies which were subsequently acquired. The management then had to adjust to being no longer independent. Terms of the acquisition often had made them relatively wealthy and liquid; the financing of new ventures was thus feasible.

**Nonprofit Organizations**

To what extent have technical entrepreneurs come from nonprofit organizations during the decade of the 1960's?

In the Palo Alto area, three major nonprofit organizations employing technical personnel are: Stanford University, Stanford Research Institute, and the Ames Research Center of the National Aeronautics and Space Administration. Lists of known spin-offs from each organization were developed; as a check on the completeness of these lists, senior personnel from each organization were consulted to determine whether any omissions could be identified. For each of these organizations, spin-off rates were calculated. The findings are listed in Exhibit 6. The definitions given previously were applied, so that only new, technologically-based firms founded since 1960 were included. Spin-off firms providing consulting of a non-technological nature were excluded.

The spin-off rate for the nonprofit research institute (1/678) is about the same as that for large companies as a group. The rate for the government laboratory (1/1950) is very low, in fact one of the lowest rates encountered for any organization studied. The university spin-off rate varies from 1/122 to 1/736, depending upon the base population used. The appropriate population might be defined solely as engineering faculty and research associates; it might also be broadened to include faculty, research associates, and graduate students in engineering, the physical sciences, and business.

In total, these nonprofit organizations have served as incubators for slightly less than three percent of the NTBF's founded in the 1960's. The principal incubators have been the industrial firms.

In response to queries about the low spin-off rate from the government laboratory, two reasons were suggested most often by those who knew the laboratory. One was that much of the work being done there did not appear to have great commercial applicability. In addition, the typical professional employee was described as more scientifically oriented and less commercially and entrepreneurially oriented than his industrial counterpart.

**Exhibit 6**

Spin-Off Data
Selected Nonprofit Organizations

| | Number of New Firms Spun-Off[1] | Number of Spin-Offs / Mean Employment | Spin-Off Rate |
|---|---|---|---|
| Nonprofit Research Institute[2] | 3 | 1.8/1220 | 1/678 = .0015 |
| Government Research Center | 1 | 1/1950 | 1/1950 = .0005 |
| University - (engineering faculty and research associates)[3] | 2 | 2/245 | 1/122 = .0082 |
| (engineering faculty, research associates, and graduate students)[4] | 2 | 2/1040 | 1/520 = .0019 |
| (engineering, physical sciences, and business)[5] | 4 | 3.75/2760 | 1/736 = .0014 |

[1]Number of new firms founded with at least one founder from the organization listed. Because some founders may have been from other organizations, these may count as fractional spin-offs in calculating spin-off rates.

[2]Various non-technologically oriented consulting firms have also spun-off; they are not included. Only those professional and support personnel associated with engineering and the physical sciences are included in the base population which constitutes the denominator.

[3]New firms founded by people from the engineering school divided by average number of engineering faculty and research associates.

[4]New firms founded by people from the engineering school divided by average number of engineering faculty, research associates, and graduate students.

[5]New technologically-based firms founded by people from any part of the university divided by average number of faculty, research associates, and graduate students in engineering, physical sciences, and business school.

The fact that the Stanford University School of Engineering (one of the most prestigious in the country) has had relatively few spin-offs was surprising. There appears to be a marked contrast with the experience at the Massachusetts Institute of Technology. Direct comparisons of spin-off data are difficult because of differences in definitions used; however, M.I.T. and its laboratories appear to have had much higher spin-off rates.[3] Research focusing upon these differences might be useful. One factor which may account for some differences is that Stanford, unlike M.I.T., does not employ large numbers of full-time researchers in semi-independent laboratories. Conversations with entrepreneurs and with professors associated with Stanford suggest that its principal contributions have been in providing a continuous flow of technically-trained people to companies in the area, in providing technical expertise through consulting, and in providing the opportunity for continuing education for professional employees. In earlier years, spin-offs from Stanford may have played an important role in "seeding" this industrial complex — Hewlett-Packard being one notable example.

Shapero: How late in the 1960's did your study extend? What was the cutoff point?

Cooper: My cutoff point was July 1, 1969.

Roberts: In your definition of spin-offs, did the founder have to leave his previous organization to form a company?

Cooper: Yes, he did have to leave. The new firms which were counted had to be full-time businesses; part-time ventures were not included.

Roberts: What if a man founded a new firm and it became a full-time business, but he didn't leave his previous organization?

Cooper: I only counted as founders those who had made a full-time commitment. There were many organizations which had consulting relationships with professors, and possibly equity participation by those professors; however, I did not count such men as founders unless they made a full-time commitment. Furthermore, the date of founding was defined as the date when there was a full-time commitment by at least one professional person.

Roberts: What if the professional person who made the commitment wasn't the founder? Apparently, you didn't call the man who founded the firm the founder.

Cooper: There are a few instances like that and they get very messy as to how to count them. Most of these situations did not raise such problems.

Roberts: I think your exhibit on spin-offs from the university is very misleading, specifically because of the way you make your definition. When you are talking about university spin-offs, it is unreasonable to assume that faculty will be full-time at the outset, or even full-time at a later date. And yet clearly, they are the founders, the entrepreneurs, the principals of many of the firms.

Cooper: What you describe may be the M.I.T. experience. I can think of instances in Palo Alto in which professors acted as consultants and had equity participation, but, even in most of those cases, they were not the driving force.

Roberts: Clearly, that is not the M.I.T. example.

Shapero: I think one of the reasons for the difference is that M.I.T. has always openly encouraged consulting and activity with industry. This is not typical in the United States. Stanford represented an attempt to move somewhat in that direction.

Cooper: At Stanford there is great pressure for each professor to continue doing teaching and not to get involved simply in full-time contract research. As I recall, there was a requirement that you had to teach if you were a professor.

Roberts: You have a misunderstanding of M.I.T. if you think that is not the case. There are no professors who do research only, nor do professors work in the large laboratories (affiliated with M.I.T.). At the Instrumentation Laboratory with 1200 men, there are five faculty members who have meaningful relationships with the laboratory. At Lincoln Laboratory I don't think there are that many.

Shapero: With your definition of spin-offs, how many times have M.I.T. faculty started new firms?

Roberts: Looking at just five departments within engineering, I found 69 spin-offs. These were companies formed by present or former faculty of full-time research staff.

Shapero: How many of those founders would still be present in the university?

Roberts: About half would still be with the university. The faculty members who left were the rare exceptions.

Cooper: Many of the people I interviewed thought that Stanford University had been a far more important factor in nurturing new firms in the earlier years than in the 1960's. It may be that Stanford played a key role in seeding the area — Hewlett-Packard and Varian Associates being examples. However, the total industrial complex has grown so much, relative to the size of the Stanford engineering school, that the university has had a relatively minor role in influencing entrepreneurship in recent years.

Vesper: What about the size of the engineering and science faculties at Stanford as compared to M.I.T.?

Roberts: M.I.T. is much bigger, and that would account for some of the difference. However, Arnold's (Cooper) argument is that the bigger the organization, the less likely it is to be a source of spin-offs.

Cooper: It appears to be clearly the case in industrial organizations; I don't know about universities.

Shapero: I think it is related to the length of time that M.I.T. has been committed to consulting and to being involved with industry. This results in role models for entrepreneurship. When I was at M.I.T. one summer, there were professors who felt they had to start a company, because they would be left behind if they were not entrepreneurs. In another school, it would never have occurred to them.

Kohl: Is there a third technical school which might be considered, such as California Institute of Technology or the University of Michigan?

Roberts: I visited CalTech, and they said there was very little of this kind of activity. They also said it wasn't encouraged; it was specifically frowned upon.

Vesper: CalTech is a very small school, also. Another contrast with M.I.T. is Carnegie Institute of Technology. It doesn't spin any firms off either.

**Variations Within Large Organizations**

For some of the large, prolific incubator firms in the area, spin-off data were available for individual parts of the organization. The data are illustrated by the following examples.

— One rapidly growing firm had eight spin-offs during the decade of the 1960's. Eighty percent of the firm's employees were in one division whose activities were concerned mainly with one large government contract and the associated follow-on contracts. Only one of the firm's spin-offs was from this division, while the remaining spin-offs were from the other 20 percent of the company's business.

— One semiconductor manufacturer had about 85 percent of its personnel working on the development and production of semiconductor devices, with the remainder in the equipment division which developed production equipment for manufacturing semiconductors. Of the firm's six spin-offs, four were from the smaller equipment division.

— One large firm had had no spin-offs from the major division which accounted for 50 percent of its sales. All seven of its Palo Alto spin-offs came from smaller departments which offered a variety of products and which made up the other 50 percent of the business.

Such evidence suggests that in large firms the spin-off rate is likely to be highest in those departments which constitute the "small businesses" of the firm. This hypothesis is entirely consistent with the finding that small firms as a class have higher spin-off rates. The reasons advanced for explaining the high spin-off rate for small firms probably also apply here. In addition, small divisions of larger firms may, on the average, be more poorly managed than the large divisions and may have more frustrated managers. This may be because of their low visibility, the fact that top management often comes from "backbone divisions," and because the small divisions lack internal bargaining power to obtain discretionary resources such as investments in new products.

## Conclusion

The focus of this paper has been upon the role of the incubator organization. We have considered ways that incubator organizations influence entrepreneurship and the results of that influence as reflected in spin-off rates.

It is interesting to speculate as to how one might design an organization to have a high or low spin-off rate. A firm with the following characteristics probably would be a very good incubator.

It would be in a rapidly growing industry which offered opportunities for the well-managed small firm with good ideas; it would be a small firm or would be organized as a series of "small businesses;" it would be good at recruiting ambitious, capable people; and it would periodically be afflicted with internal crises sufficient to frustrate many of its professional employees and lead them to believe that opportunities were being missed and that "Even I could manage the business better." This, incidentally, is a fairly good definition of many of the firms which have been established in the Palo Alto area in the past ten years.

Shapero: Could I suggest a modification of one of your adjectives? A growth industry is desirable, but there can be an opportunity for the badly managed small firm. I know of small companies which are terribly managed, but which could survive because they were so good technically and because the market was so good.

[1] K. Draheim, R. Howell, and A. Shapero, **The Development of A Potential R&D Complex.** Menlo Park, Calif Stanford Research Institute, 1966.

[2] D. Forseth, "The Role of Government Sponsored Research Laboratories in the Generation of New Enterprises," S M. thesis, Sloan School of Management, Massachusetts Institute of Technology, 1966, pp. 125-127, 130.

[3] E. Roberts and H. Wainer, "New Enterprises On Route 128," **Science Journal,** December 1968, p. 78-79.

## SEVEN / EDWARD B. ROBERTS

### Influences Upon Performance of New Technical Enterprises

Good morning, friends and others. In looking at all of what we were talking about yesterday, I suddenly realized that the entire discussion was focused on questions of formation, and no one talked about correlates of performance or determinants of performance of new, technically based companies. Based on that, I realize that we're off in a different direction this morning, by my focusing on the factors that are related to the performance of new, young, technically based companies.

Now, in fact, I'm not going to present anything new — that is, those of you who have been reading prior publications by me and my research assistants and thesis students will have seen these findings before.

I just want to indicate some tracks of some of the companies that we have been studying. Exhibit One shows those companies that came out of the M.I.T. Instrumentation Laboratory. You can see the kind of growth patterns that they have had; these are sales curves. This shows that generally these companies achieve, in a relatively short period of time, sales of about one million dollars; they go higher than that in some cases. At the top are several companies that go off-scale, and we compress the scale to within the range of most of the firms. There are a couple of companies that go out of business. There are some companies that don't grow very impressively; they grow to a hundred thousand, or a couple of hundred thousand in sales, and they don't seem to be going anyplace beyond that. But, the general track of the companies seems to be upward and onward. The easiest sales curve to try to fit the data would be rising exponential.

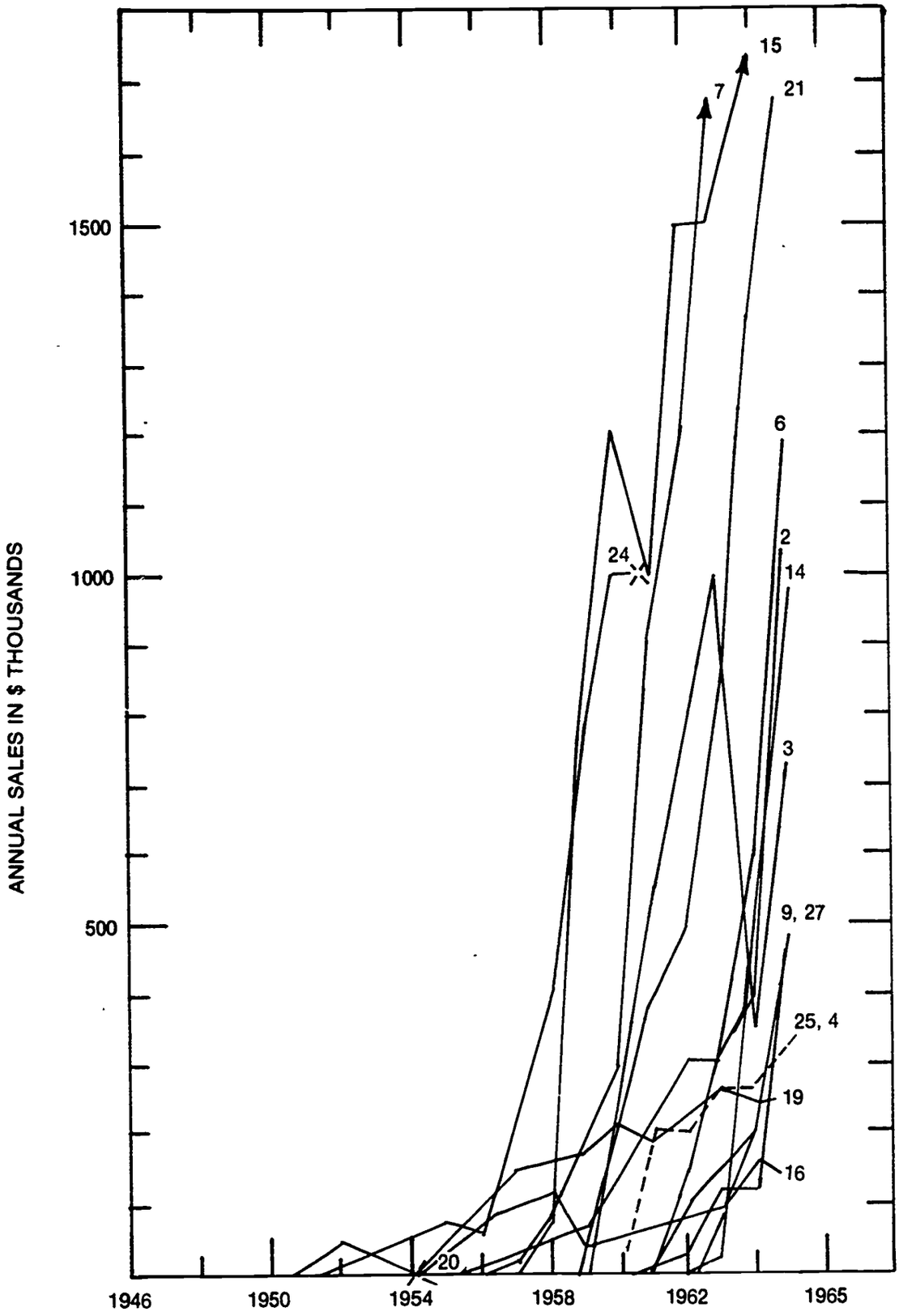
The patterns are different from one source organization to another — that is you'll find distinctions in the range and in the spread. You'll find some differences in how many of them are dropping back down to zero, and you'll find clearly some differences as to the eventual height which some of the companies reach. But, I think that the Instrumentation Laboratory data, based upon thirty companies, is a good base, because there is no spectacular success in that sample. That is, in fact, "typical."

If you get too enamored with the relatively few exceptional cases which really "go for broke," like Digital Equipment Company, then you get misled. Much more typical is the complete representation of the Instrumentation Laboratory spin-offs. Dynamic Research Corporation is probably the largest, and it had sales of about 6-million dollars. These firms did indeed succeed — they survived; 85% of the companies stayed in business past the first five years, and I suspect that most stayed in business beyond that.

Cooper: What percentage of these companies was acquired in this first five years of existence?

Roberts: To my knowledge there was only one in this group of companies in the first five years. Remember, we're dealing with a period through '65; acquisitions and mergers hadn't really started going crazy then. Also, the companies were all relatively small. We haven't done any studies on the question, so this is an impressionistic response.

**Exhibit 1**




CALENDAR YEAR

GROWTH OF THE SPIN-OFF COMPANIES FROM
THE M.I.T. INSTRUMENTATION LABORATORY

If a company was acquired when it was in trouble, we regarded it as a failure for our general statistics. So, when I say 85% survival, I mean 85% of them did not fail, nor were they acquired under conditions that suggested high likelihood of failure in the near term.

Howell: As you recall, most of the failures were in '62. Were they correlated with the decline of the stock market?

Roberts: I don't think there should have been a direct relationship, because most of the companies weren't public companies. Their success was not related to public financing.

The first company we were able to identify coming out of the Instrumentation Labs failed. It was a true case of technology transfer from sophisticated markets to unsophisticated markets. The Instrumentation Lab is the foremost guidance control laboratory in the United States, possibly in the world with the possible exception of its equivalent in the Soviet Union. In this company the founder was adapting control technology to the problems of a type of spinning reel. He started in business producing this product and his sales rose to about $50,000 by the end of the second year; then the sales fell, and he went out of business a couple of years later. His accounting was rather horrendous and he was apparently selling this product under his variable cost. He was overtaken by advancing technology and large companies. Namely, at that point in time all the major sporting goods firms introduced spinning reels.

Shapero: I just want to reinforce your point about the relative growth of these firms. Of the 520 technical companies and formations in our samples, only 66 had over 100 employees. Of those, incidentally, 21 were electronic component companies where you'd have a lot of manufacturing and engineers. We found that it's the occasional firm that exceeds a thousand employees, and it was usually acquired by a major corporation.

A. Bostrom: Were you able to determine whether the successful companies stayed with their original product concept or did they get into business and find that it wasn't quite right . . . and then shift to something else?

Roberts: There's a tendency for small companies to be very flexible and to do lots of shifting. However, there was certainly no trend for successful firms, in particular, to shift away from an original technology or original product field. Successful companies obviously tended to grow and to diversify through adding more products. So, there was always some diversification, but it was very seldom that the company changed dramatically from its original intent.

Now I'll give you the most extraordinary case in our sample. The most successful one is Digital Equipment Corporation and, if you looked at its history, you might be led to believe that Digital became very successful when it changed its goals or changed its business — which is not true. All they really did was to change the specific product which they introduced; they didn't change their intent. Digital Equipment Company started as a packaged, high speed, transistorized digital circuitry company. That was their first product, and they were in that business alone for about a year and a half. Then, they introduced some test equipment for memories, and later they introduced their first computer. Today, their sales are primarily of

computers. You might say that they really took off when they went into the computer business. The founders of the company **knew** that they were going into the computer business and that they were using the component business as an interim measure — as a way into operations. In fact, their approach to the component business was specifically oriented to building themselves a component capability, from which they could assemble a computer. Founders sometimes say, "We're going into business — we're going to do some consulting — we're going to get some money for our backs and our brains and within the next year or two we are really going to move into **that**" — whatever that might be. Very often they never make that transition. It's quite difficult to switch over from a research-consulting-service oriented base to a product manufacturing base, and a lot of the companies which have those very good intentions just never do manage to make it. However, there are some who do change. Some founders are very vague as to what specific thing they are going to do in business, but they know the general kind of thing they want to do.

Now, I want to give you more careful delineation of the forces we studied and those specific things that we found to be correlates of, or factors associated with, success of these companies. I'll also tell you the measures of success that we used so that you'll be able to criticize all of this.

Vesper: Could you say that successful firms have the characteristic of having shifted if something went wrong with their plans?

Roberts: I guess that I would be willing to start with that, as a general characteristic of the small firm. The small firm has a far greater tendency to be flexible than the large firm. It is one of the very few assets that the small company has — flexibility. Certainly, some entrepreneurs are inclined to be rigid. Had we come up with any kinds of tests (which we didn't) for that dimension of personality, it might well be that you'd find what you're searching for — that there is a difference between entrepreneurs who have a rigid style versus those who have a flexible style — and that the more flexible guys tend to win out. It's possible. I haven't got any data that would support it; I also don't have any reason for questioning it.

Dooley: Let me hypothesize that the danger is not so much the man who is overly rigid and sticks too excessively to his original purpose. It's the guy who is overly flexible, so that he stops to pick up too many pennies along the route, and never gets to where the dollar is supposed to be.

Roberts: One kind of founder who was not very successful was the man with the strong technical background who allowed himself to use his technical capabilities to solve everybody's problems as they presented them, and who was willing to be in the systems business as opposed to the product business. He would have a catalog with him and never sell anything in his catalog, because he always sold the variance on what was in his catalog, since the customers' needs didn't exactly match what he had.

I want to show you three things which relate to the growth of spin-off companies. It is a very important aspect of these firms' performance that, although the individual entity may be small, the cumulative impact of these entities is tremendous.

This raises very serious questions for the organization that's spinning off the new firms as to whether its policies and procedures are appropriate. Although we're not talking about it at this conference, I've started to do research on the question of internal entrepreneurship within large organizations. What can a large company do to retain entrepreneurs, to retard spin-offs, and to gain the benefits of spin-off, while maintaining some degree of separation or independence? Here is the cumulative situation for the Instrumentation Lab data. (See Exhibit 2.) The Instrumentation Lab kept building, but the spin-offs sales were also building. The data are aggregated for each given year. The growth is parallel; the Instrumentation Lab kept building because its leader was a remarkable entrepreneur — Stark Draper, who just never let go; he wouldn't let M.I.T. stop his growth.

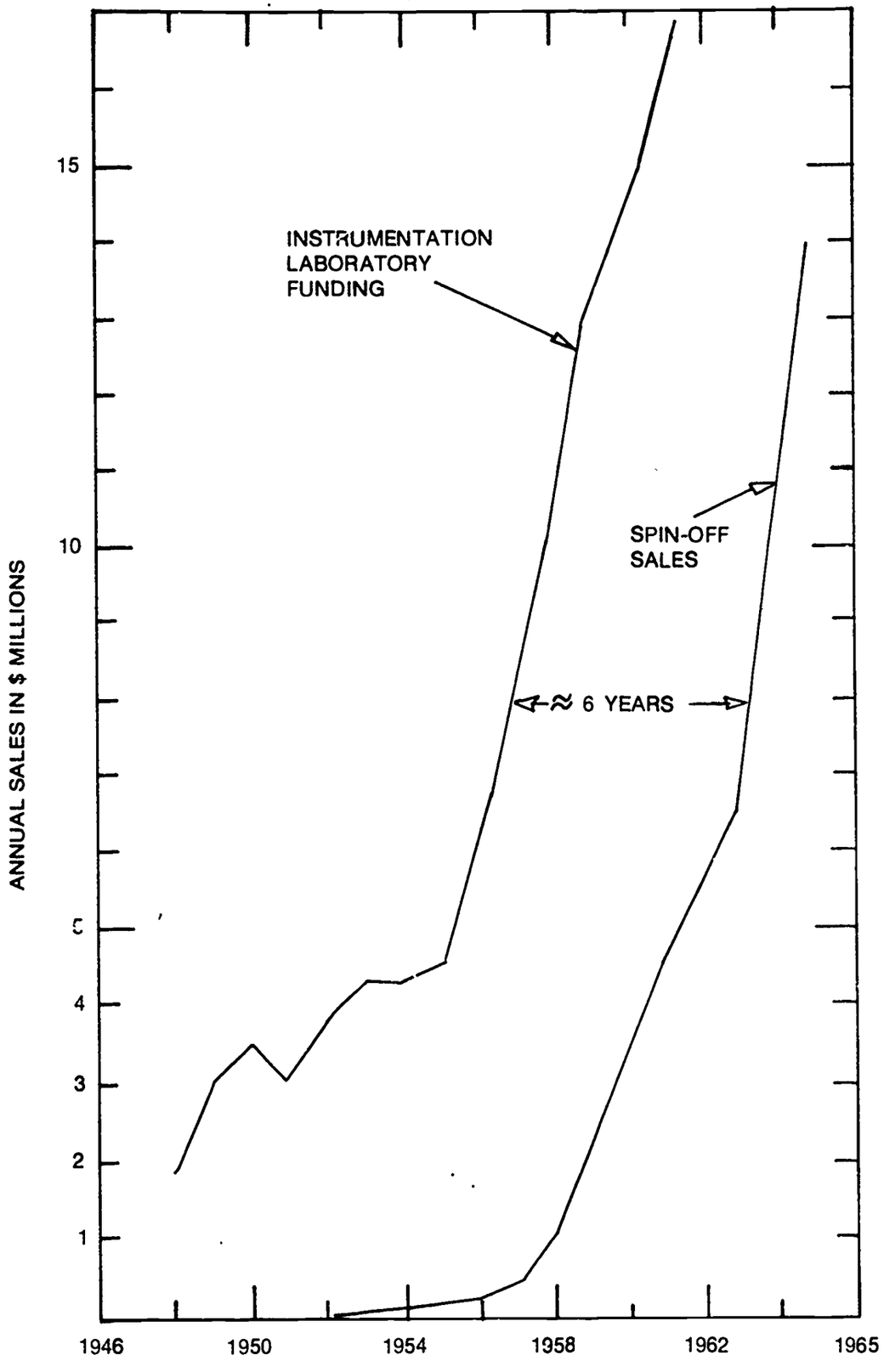
The same kind of thing, using employment data instead of sales data, is shown in the Lincoln Laboratory case — where we studied 50 companies that came out of M.I.T. Lincoln Laboratory. (See Exhibit 3.) Here, the employment of the spin-off companies overshot Lincoln Lab total employment by 1959. The reason for that was that Lincoln Lab was not being run by an entrepreneur; in addition, M.I.T. was attempting not to become overly dependent on the government. This resulted in M.I.T.'s clamping a severe head-count constraint on Lincoln Laboratory; they also pulled the Mitre Corporation out of Lincoln Lab in this time period, as part of the head-count and "non-involvement in production" policy. They then put a severe limit of 1800 total staff, not a terribly small organization, but that was the limit they insisted upon for Lincoln Lab. With that, plus the tremendous growth of one spin-off — Digital Equipment Company — the employment of the spin-offs surpassed Lincoln Lab in 1959. Digital Equipment alone had sales this past year of 130 million dollars, with employment that is appropriate to that. It dwarfs any kind of combination of companies or labs from the M.I.T. scene that we could have assembled. But, again I would stress that that single company is an exception and should be regarded as such.

Exhibit four is another curve of the same sort; this is the current aggregate sales of the remaining companies of the 39 firms that came from the one industrial electronics systems company that we studied. This is comparable in some ways to the Fairchild example of yesterday. We took one large industrial electronics systems organization (it was a division of a national company), and from that organization we traced the companies that had left. We found 39 companies, of which 32 survived by the time we did our study. And again, they had an average life of five or six years to that date, so the same 80% survival was seen there. In 1966 (this study was done in '67), the aggregate sales of those 32 remaining companies was 72 million dollars; the aggregate sales of the organization from which these founders had come was 30 million dollars. So again, in the aggregate, they really make an impact. Here the largest single company did 16 million dollars in sales.

Susbauer: Is your definition of spin-off here the broad one you were using yesterday?

Roberts: Yes, I want to stress it because I apparently used a different way of studying spin-offs than all the rest of you. We traced present or former employees of source organizations. We did not exclude guys who were still there and moonlighting, if there was, in fact, a serious company that

**Exhibit 2**




TOTAL SALES OF THE SPIN-OFF COMPANIES
FROM THE M.I.T. INSTRUMENTATION LABORATORY

they were engaged in. Nor did we limit it only to guys who left the organization and immediately formed a company. We traced them wherever they went. This raises stronger questions as to whether we caught everybody. We couldn't have overstated the number of foundings, but we might not have gotten everybody. However, we really were very careful, and I think we included almost everybody in our sample.

Shapero: From some of the other viewpoints, the spin-off definition of immediate spin-offs makes more sense to me. However, from a viewpoint of tracing what a company has lost through its policies, I think your spin-off measure is absolutely the only one to use.

Roberts: Frankly, we defined spin-offs in this way to demonstrate that NASA's whole approach to technology utilization was all wet. They were stressing information retrieval and dissemination, and we argued that, if you follow the movement of people, you'll follow the movement of technology. Subsequently, I said that I would be interested in studying guys who had left government funded R&D organizations to set up their own companies. In the process, to keep NASA happy, I would look at the technology transfer which took place when these founders left the labs to go out and form their own companies. My **a priori** premise was very strongly substantiated by the research, in that we demonstrated vast amounts of technology transfer.

Because of this orientation, we wanted to look at the founders wherever they went. If a man left Lincoln Lab and went to Raytheon, we're still going to see what happens later because he might subsequently be applying some technology he had stored up while at Lincoln Lab.

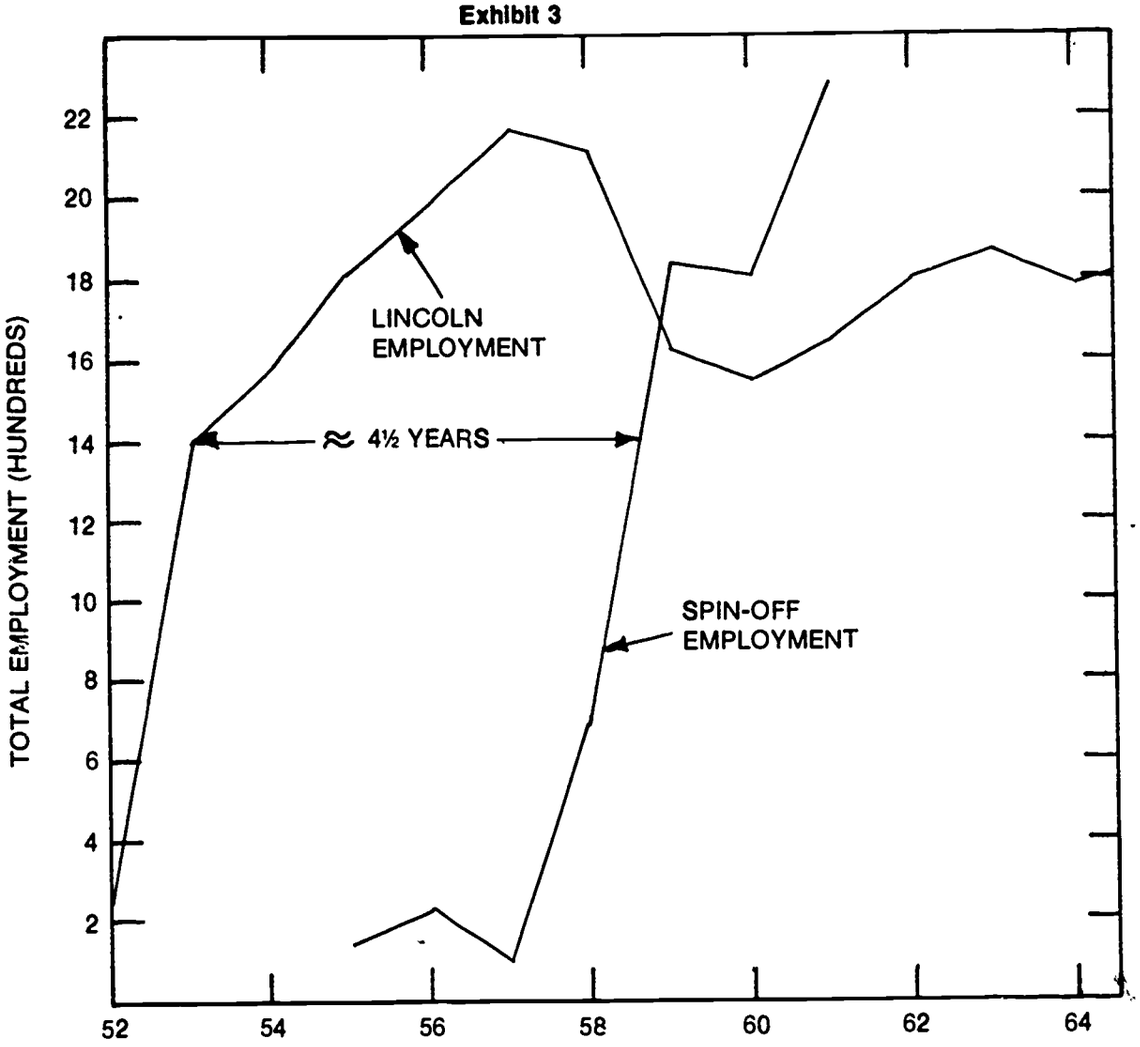
Shapero: You're making an upstream cost benefit analysis that's proper in this case.

Roberts: We found that there is a declining technology transfer over time; this is what we expected. Since there is also a correlate of technology transfer and the success of the companies, we are not contributing very much to a concept of impact by including the later companies.

All of our data are based on structured interviews conducted with the entrepreneur whom we were tracing. The typical interview lasted two hours; some were as short as an hour, but very few were less than an hour; some of the interviews extended up to four hours. A very detailed structured interview form was used, which I think had twenty pages of questions and forms. In addition, we had a number of other studies which were not studies of companies **per se**, but were studies of other aspects related to the process, such as venture capital decision making.

We studied four major M.I.T. laboratories. We studied the Electronics System Lab, which used to be the Servo-Mechanisms Lab; it was formed just immediately prior to World War II and was run by Gordon Brown. We studied the Instrumentation Lab; its predecessor was formed in the 30's, but it was brought back down to two employees in 1945, and started again from that base. We studied Lincoln Lab, which was formed in 1948 in response to a presumed mass bomber threat by the Soviet Union. We studied the Research Laboratory for Electronics, which was formed in 1945 by taking the 45 people who were the basic research group of the Radiation

**Exhibit 3**

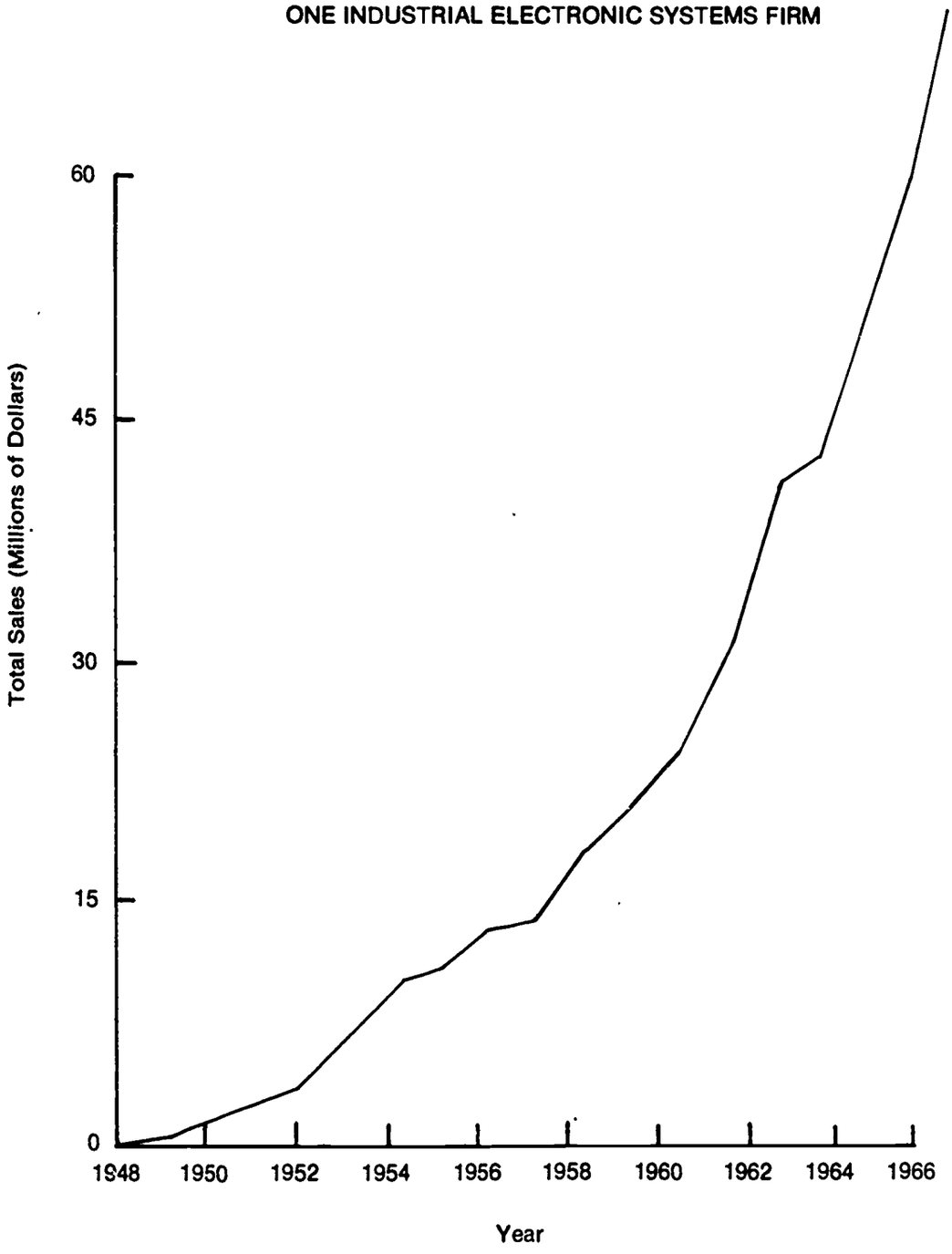



TOTAL EMPLOYMENT OF THE SPIN-OFF COMPANIES FROM
THE M.I.T, LINCOLN LABORATORY

Figure 3

**Exhibit 4**

TOTAL SALES OF THE SPIN-OFF COMPANIES FROM
ONE INDUSTRIAL ELECTRONIC SYSTEMS FIRM



Laboratory during World War II. It became the Research Laboratory for Electronics under J. Stratton, who later became president of M.I.T. This history of the labs is fascinating; the history of the people and the processors are themselves very interesting. One of the things I feel terrible about, in writing a book on this whole thing, is that it is very clear that I'm not able to capture the adventure of the organizations that we studied. I just don't have the personal capability of conveying the excitement of these places and the people who were there.

We studied five academic departments at M.I.T., all in the engineering school — clearly a very limited sample. The five academic departments were aeronautics and astronautics, chemical engineering, electrical engineering, mechanical engineering, and metallurgy. We didn't even do a complete study on engineering, because we left out civil and marine engineering at M.I.T.

Cooper: Were most of these people employed part-time by M.I.T., while pursuing Ph.D. degrees?

Roberts: They held full-time staff appointments. Some were research associates, but the bulk were present or former faculty. At M.I.T. the major labs are separate, are not affiliated with the academic departments, and are independently administered. In one case, Stark Draper is or was the Director of the Instrumentation Lab and the head of the Aeronautics and Astronautics Department. However, there were only five faculty members from Astronautics and Aeronautics who were staff members of the Instrumentation Lab. This was from a department of probably forty people, so we're not talking about high overlap. In the case of the Electrical Engineering Department, there were not very many faculty members who were affiliated with the Research Laboratory for Electronics.

Howell: How did you avoid the double counting of men who worked in two or three of these departments?

Roberts: We just put him arbitrarily in one or the other, usually the first place we had encountered him in our studies.

Shapero: How many cases does this include?

Roberts: Not very many. If we take the total sample it probably includes more than a dozen. It is more than a dozen because of Mitre and Lincoln Laboratory. For Mitre, we show only five companies; what we mean is five new companies. We had previously picked up another half-dozen companies which were direct spin-offs from Mitre; we learned of them when we studied Lincoln Laboratory because they were Lincoln Lab spin-offs indirectly. They had gone from Lincoln to Mitre to forming a company. If we wanted to look at questions relating to incubator organizations, we would have to re-assemble the data. It wouldn't make a substantial difference, except in regard to spin-offs from Mitre.

Cooper: About how many new companies were started by professors who left and went full-time with the new company they started?

Roberts: Hardly any. I would say not more than half a dozen, among the 69 companies which come out of the academic departments.

Dooley: Is this only faculty, or does it include other staff?

Roberts: It's faculty and full-time research staff within the academic department class. Most of the full-time research staff left. The guys who were full-time researchers left the academic departments to go with their companies. The faculty didn't; the faculty started the firms but usually didn't leave. I can give you all kinds of examples. One company was formed by three M.I.T. faculty members in different departments. They started their company with full-time professional employees, before any of them left M.I.T. Eventually, all of them left M.I.T., but they all maintained part-time staff appointments at M.I.T., and still give occasional lectures there.

E G & G was formed by one faculty member, Harold Edgerton, and two M.I.T. staff who were working for Edgerton. They weren't really full-time staff working for Edgerton, because they also were doing some outside consulting. They went full-time with the new company; Edgerton never did. Edgerton never even went more than incidentally part-time in the company. The company kept growing; Germeshausen and Grier did go full-time into the company operations,but, just to show what their loyalties were, when World War II came about, they stopped their company activities to come back to M.I.T. — because they were needed in some of the laboratory activities at M.I.T. When the company was incorporated in the late 40's, Germeshausen and Grier went with it full-time; Edgerton was, I think, still company president, stayed at M.I.T. and is still at M.I.T. as Professor Emeritus. Ray Baddoar, who is now Chairman of Chemical Engineering, was the founder of Abcor, which is a chemical company. Ray Baddoar is chairman of the Chemical Engineering Department and he certainly is an active contributor to Abcor. He was clearly the founder, and prime driver of Abcor; he made the company what it became, but he never went full-time into the company.

Shapero: Ed, I'd like to ask a question here of everybody, including you. In your experience with companies which have faculty associated with them, I wonder if what you're telling us isn't general "across the board." We find that often the faculty member doesn't want to relinquish facuity status; he often becomes sort of the silent partner or consultant. We found that there is sometimes conflict between the research guy and the faculty member, with the former being committed full-time but the latter not wanting to commit fully.

Roberts: Well, I suspect that that's true. The company which I founded, a consulting company, is the same situation; I'm president. Now, the man who was co-founder with me is now nominally full-time in the company; he's still spending a day or two a week at M.I.T. as a research associate, but he is basically full-time. We've now hired some other full-time men. We have constant problems relating to my loyalties and how I should spend my time.

Shapero: Larry, do you find that in your Ann Arbor sample that professors stay with the university?

Lamont: Yes!

Roberts: We specifically asked all of the faculty members who were still at M.I.T., "If you had to make a choice between going into your company or maintaining your M.I.T. job, what would you do?" Since they were being asked by M.I.T. graduate students, answers may have been biased; however, every faculty member, without exception, said he'd give up his company and stay at M.I.T.

Danilov: Of the 69 founders from the academic departments, how is that split between faculty and research associates?

Roberts: I would say probably two-thirds were faculty. There were more faculty than research associates; the departments don't have many research associates.

Danilov: You are talking about 69 companies. I assume that in some cases, there are several founders, so you're really talking about more people than 69.

Roberts: For that reason we'd be talking about more people than 69. I think we would tend to find a preponderance of insiders, with relatively few outsiders. It would be a faculty member and a research associate or a faculty member and a graduate student. By the way, we have never studied graduate-student based entrepreneurship, with the single exception of the Chemical Engineering Department, where we studied the Ph. D. groupings.

Rumbaugh: Did you ever identify what you might consider an administrator who went along with the technical entrepreneur from M.I.T. laboratories or other laboratories?

Roberts: When you say **ever** I'm sure the answer is yes; however, it didn't happen often.

You really have to understand these organizations; they don't have administrators. Their technical people run the organization. Harvard Business School supplies their products to somebody else, not to these places. In the successful cases, management-oriented people were brought in. However, that is not to say that they were founders. Lincoln Lab might have one or two M.B.A.'s out of 1800 people.

We looked at a government Lab in the Boston area, the Air Force Cambridge Research Lab — there were two other government labs we could have looked at, but we decided that this one was closer to the other labs we had studied and might show the differences which might arise due to the government dimension. We traced 16 companies from Air Force Cambridge. We found just about the same survival rate — a little bit lower, maybe 75%. But, we didn't find massive failures. We did find more "oddballs;" we found a beauty shop; we found a radio repair shop. However, principally they are high technology based companies. By the way, we did complete studies of spin-off companies; we did not limit ourselves to companies which by definition were high technology firms. We did limit ourselves to high technology sources.

We then studied a not-for-profit organization. There's only one large one in the greater Boston area, and that's the Mitre Corporation which was spun out of Lincoln Laboratory. As I indicated before, we found five new firms that we hadn't previously found in our other studies. We also wanted to study an industrial firm and that was the most recent large study we did. For comparability with prior samples we wanted a firm dependent on government for its funds; we wanted it in the electronic systems business; we wanted it founded in the post World War II period; and we wanted a reasonably large company — a thousand employees or more. We made up a list of companies in the greater Boston area which would meet those specifications. The list included several individual divisions of Raytheon. That is, we felt this division, this division and this division could each independently meet these requirements. It included several divisions of Sylvania, Tracer Labs, a couple of divisions of Itek, a couple of divisions of Sanders Associates, Laboratory for Electronics — I don't remember who else.

We picked one company arbitrarily and approached it, and eventually did the study from that organization. We might have been wrong, but we had confidence that approaching any one of those firms would have given us a good sample size. We felt **a priori** that we could have identified twenty or more companies from any one of the sources we could have approached. In this one organization, we started by working with the director of personnel and the old-line personnel ladies who supposedly knew everybody from the lab. They only knew of three spin-offs. We had checked our files for duplicates and cross-references and mistaken references that we had picked up, and we gave them four more at the first meeting. So, we had seven at the outset, and we finally talked them into the notion that we would find at least 20, and so it would be worth our bothering with. We eventually found, interviewed, and studied 39 companies. There is a tremendous iceberg phenomenon at work in these organizations.

If you talk to anybody, even the people who boast about the spin-off process like Stark Draper and who are proud of the guys who left to form their own companies, they are unaware of the extent to which this kind of phenomenon has existed. This is particularly so when you use the kind of tracing that we used — when you don't just count the direct spin-offs, but also study men who became founders later.

However, half of the guys typically form their companies immediately upon leaving the organization. There's still a tremendous iceberg effect. Of these 39 companies, I'm sure that approximately 20 of them started their companies right away, upon leaving. And, yet the company only knew of three.

Kohl: What was your technique for locating the other 32?

Roberts: Two techniques were used. One was very extensive interviewing within the organization of people whom we thought ought to know, including group leaders, supervisors, and old-line technicians. The technicians who've been there for fifteen years are the guys who really know. They say, "Boy, I remember a sharp kid that we had around here, and he was great. He left and when he left it really upset my entire work for months, because he was such a great guy to work with." One of the other sources, again interviewed, was the legal department. The legal department knew a lot more about these new companies than did the personnel office.

The legal department had negotiated royalty arrangements and licensing agreements with about half-a-dozen of them, and had brought law suits against about four of them. The legal department had given waivers of rights to about 3 more. So, the legal department was aware of about a dozen of these companies, but personnel only knew of three.

The second source of information was the "leads," the men who supposedly had formed companies. The last question we asked these men in our interview studies was, "Do you know of any other men from your organization who have left and set up new companies?" This was the principal source of information about new companies. It seems that you develop a kinship in the market place. A guy you never really knew, once you're together as entrepreneurs, is suddenly remembered. "Oh, yes, he was on the other side of the lab; I used to see him in the lunchroom." So, you become buddies now as entrepreneurs.

The most recent study we did was of computer firms in the Boston area. It was not a complete study; we used the telephone book as a source listing. We studied 16 companies using the same questionnaires and the same techniques as in the other studies. About five years ago, we did one other major study. We decided that, for control purposes, we ought to look at companies which had some of the characteristics, but not others, of the firms we had been studying. We chose to look at Greater Boston area companies, which were 5 or 6 years of age, but which were not technical companies. We studied consumer-oriented manufacturers, going to the Office of Corporations and Taxations to get the incorporation files for the year 1961 or 1962. We did this study in 1967. We sampled about one out of every ten of the books in sequence, and we took out all the companies which appeared to be consumer-oriented manufacturers. There were 46 new incorporations which we studied in the greater Boston area. Out of those 46, 41 were out of business when we did our study in 1967, which was about five or six years after being founded.

Shapero: The country as a whole has a new business failure rate of about two-thirds failure by the fifth year.

Roberts: We also expected about a two-thirds failure rate, but here we found 91% failure of consumer-oriented manufacturers. I think this must be a little worse than the general situation. It's harder to produce a consumer-oriented product and stay alive; it's easier to run a drug store or a grocery store. This was the most frustrating study that we did. The research assistant who was working on this used to come crying to me each week and telling me how miserable things were. One of the interesting things was that he located one of the entrepreneurs in an insane asylum.

Danilov: I notice the absence of A. D. Little on that list; is that intentional?

Roberts: Why would you include A. D. Little?

Danilov: Why would you? Well you have academic departments; you have M.I.T. labs; you have a government lab, you have a not-for-profit organization. Why not a for-profit research institute which is substantial?

Roberts: We have excellent relationships with A. D. Little. There would be no problem at all, I'm sure, to do that kind of study; I just never thought of it. I'll see if I can get a thesis student to do it this year.

Vesper: It strikes me that probably most of the companies are electronic. I'm curious as to what percentage are. The reason I ask is that, if you're trying to develop an area and hope to have a lot of little companies, do you raise your odds by emphasizing electronics?

Roberts: No, no differentiation by area; the odds are the same, regardless of source. I'd say the way you raise your odds is to find yourself a good situation with growth.

**Exhibit 5**

SOURCES OF NEW ENTERPRISES

| SOURCES | # OF COMPANIES STUDIED | |
|---|---|---|
| M.I.T. LABORATORIES | | |
| ELECTRONIC SYSTEMS LABORATORY | 11 | |
| INSTRUMENTATION LABORATORY | 30 | |
| LINCOLN LABORATORY | 50 | |
| RESEARCH LABORATORY FOR ELECTRONICS | 14 | |
| | | 105 |
| M.I.T. ACADEMIC DEPARTMENTS | | |
| AERONAUTICS AND ASTRONAUTICS | 18 | |
| CHEMICAL ENGINEERING (PH.D.s) | 18 | |
| ELECTRICAL ENGINEERING | 15 | |
| MECHANICAL ENGINEERING | 10 | |
| METALLURGY | 8 | |
| | | 69 |
| GOVERNMENT LABORATORY | | |
| AIR FORCE CAMBRIDGE RESEARCH LABORATORY | | 16 |
| NOT-FOR-PROFIT ORGANIZATION | | |
| MITRE CORPORATION | | 5 |
| INDUSTRIAL ELECTRONIC SYSTEMS CONTRACTOR | | 39 |
| SPECIAL STUDIES | | |
| COMPUTER FIRMS IN BOSTON AREA | | 16 |
| CONSUMER-ORIENTED MANUFACTURERS | | 46 |

In talking about the performance of these companies, one of the problems is data availability. Another problem is to determine what, in fact, is the right way to measure performance. So, what I have here is the listing of the measures we have often employed in past studies. (See Exhibit 6.) I would also like to tell you the measure we used for the most part in carrying out these studies.

It's been easiest to get sales data from these founders. It's been hardest to get profit data. Consequently, something which doesn't even show here is the return on investment or return on assets. To get that you need to have good data on assets and good data on profits. We've never succeeded in

getting good information of that sort from a broad-based sample of companies. We've gotten occasional information, particularly when the firms are public. But, relatively few of these companies were public, so we have used average sales as a measure of performance or sales growth rate measured on a percentage basis or measured on a "fit" of dollars growth per year. For companies less than five years old, we've used a five year projection; for companies more than five years but less than ten, we've used a ten year sales projection.

Susbauer: Are you trying to eliminate mergers and acquisitions from your figures?

Roberts: Yes, they are eliminated. Most often, we used a weighted performance index. The weighted performance index was a function of three things: sales growth, age, and profitability. We took sales growth rates and classified companies into fifteen categories. So, they were rated one through fifteen, on the basis of the sales growth index. The sales growth index was the primary determinant of the weighted performance index; it was modified by company age and profitability. If the company was less than three years of age, we tended to discount somewhat the growth that they showed. We said that regardless of their early growth rate, we should be cynical as to whether that rate would persist. Otherwise, you would find that the highest performing companies would be some of the ones that are one and two and three years of age, and we were just unwilling to make that kind of statement.

In regard to profitability, we didn't expect the three year old company to be profitable, and we didn't hold it against it if it wasn't. So, the fact of non-profitability was not a negative factor affecting the index figure for the youngest companies. The company that was three to five years of age was expected to be profitable; if it wasn't, we were cynical about the likelihood of persistence of the growth that they had shown. Unprofitable firms, three to five years old, were marked down if they weren't yet profitable; if they were older than five years of age and weren't profitable, we cut them more. Even if its growth rate was fine, if it was still not profitable — or if its profits were declining, we regarded that as a negative predictive sign. In terms of the index of performance we attributed to that firm, we marked it down.

**Exhibit 6**

MEASURES OF PERFORMANCE
USED IN RESEARCH ON
NEW TECHNICAL ENTERPRISES

AVERAGE SALES
SALES GROWTH RATE
PROJECTED SALES
WEIGHTED PERFORMANCE INDEX = F(SALES GROWTH, COMPANY AGE, PROFITABILITY)
DUN AND BRADSTREET RATINGS
ENTREPRENEURIAL SELF-EVALUATIONS

Now we did lots of manipulations with these measures of performance to satisfy ourselves. I cannot be positive that we did a good job, but we were careful. We did try a lot of experiments, and this was the one we ended up using as the primary measure. It was determined principally by an index of sales growth, modified to be a bit cynical about the very young companies and their high rates of growth, and modified to be dubious about older firms which had yet to demonstrate profitability.

Let me just tell you the other two measures of performance. We also used Dun and Bradstreet ratings. There are two Dun and Bradstreet ratings available; there is an overall performance measure, and there is a financial credit rating. We used Dun and Bradstreet ratings for a limited sample, getting the available ratings on all of the companies in the sample group, and we used that as a measure of performance.

We also used two different entrepreneurial self-evaluations. We asked the entrepreneur to rate on a 9 point scale the present performance of his company or his satisfaction with present performance. We also asked him to make a projected statement about his feelings as to the likelihood of success of the company at some future point in time. We were not talking to him at the time of the founding of the company, but at a later point in time. So, clearly the number is biased in some way by performance to that date.

We liked the weighted performance measure best; we checked it against all of the other measures individually, and it is very strongly correlated with each of the other measures. It's particularly satisfying in the sense that it correlates with the Dun and Bradstreet ratings, which is a measure of financial strength.

Susbauer: Was a company that was not profitable after five years classified as a failure?

Roberts: No; it got knocked down in its index. I think we knocked down the index by a factor of three. If a company was acquired when it was in an unprofitable condition, we treated it as a failure.

Susbauer: Did you find companies in which the entrepreneur was not seeking large growth, but rather was seeking a very controlled and small operation?

Roberts: We found some entrepreneurs saying that they regarded themselves as very successful when they were in our lowest category of performance. That's not only true of what they said about their future performance, but what they said of their present performance.

I would point out that we should be very careful about the mythology of entrepreneurs. Lots of entrepreneurs do not form their companies for high achievement motivations. Lots of them form their companies for independence alone, as distinct from achievement. Lots of them form their companies for power motives. Some form their companies because they really are interested in finishing a job, not in achieving anything remarkable with it. You have to be careful to distinguish successful entrepreneurs from unsuccessful entrepreneurs. According to our findings, the successful

entrepreneur has a high need for achievement. There are other entrepreneurs who are not particularly successful, who look like every other slob and every other non-entrepreneurial guy. Their motives are quite different.

When I speak of success, I mean in terms of investor-oriented criteria of success. These are the things that we are talking about. In terms of success measures that may relate to personal satisfaction of the entrepreneur, I won't impose any set of standards on that guy. He may find himself most satisfied with a two or three man operation that gives him no more money, maybe less, than what he could have earned as an employed individual. It's up to him to decide whether he is satisfied. There are certainly entrepreneurs very satisfied to have a stable, viable, independent existence, even though they are not making a lot of money. There are also a lot of guys "in the same shoes" with respect to performance, but terribly frustrated because they indeed had the great dream that they never realized.

What are the things that relate to performance? These are the non-personality factors associated with high performing new technical companies. (See Exhibit 7.) They are arrayed in four different categories of factors. We can question what the titles are but the first one I call resources. The higher performing companies had resources of people, that is they had multiple founders rather than single founders at the start. They also had larger initial capitalization. I say larger and not large because, by anybody's standards, they all had relatively small initial capitalizations. The typical firm had $8,000 to $12,000, depending on which sample grouping you were using, as initial capitalization.

**Exhibit 7**

NON-PERSONALITY FACTORS
ASSOCIATED WITH
HIGH-PERFORMING NEW TECHNICAL ENTERPRISES

RESOURCES
- MULTIPLE FOUNDERS
- LARGER INITIAL CAPITALIZATION

ORIENTATION
- HIGH DEGREE OF TECHNOLOGY TRANSFER
- MANUFACTURED PRODUCT

ENTREPRENEUR'S BACKGROUND
- MODERATE EDUCATIONAL LEVEL (NON-PH.D.)

MANAGERIAL BEHAVIOR
- SPECIFIC BUSINESS FUNCTION
- SPECIFIC MARKETING DEPARTMENT
- CONCERN FOR PERSONNEL MATTERS

The successful firms had more money than that, but they didn't have large amounts. They might have had $25,000 or $50,000. The median was $8,000-$10,000. We split the sample at the median, and when we asked

performance questions, considered whether we were talking about companies with less than $10,000 or more than $10,000 initial capitalization. The ones which had more initial capitalization tended to be more successful firms. Now, these things tend to correlate very strongly. The multiple founders and the larger initial capitalization are strongly correlated, among other things because the principal source of initial capital was the founder, his family and his friends. This is not to say that there are not cases of startup companies immediately getting venture capital from the market, or from S.B.I.C.'s, or from banks or manufacturing firms. But, when you look at this sample of 250 technical companies, you find that very few guys, at the time of forming their companies, had $100,000. There were a couple of founders with $500,000, and there were one or two who had a million as initial capital; but, those are the exceptions. Digital Equipment had $70,000 worth of initial capital from a formal source, American Research and Development.

Cooper: It might be of interest to note that the Palo Alto experience was different in that respect. The median of the 30 companies which I studied intensively was $100,000.

Roberts: How did you ask the question relating to capitalization? How did you define it?

Cooper: It's difficult to determine what the initial amount of capital is, because, as you know, often the capital is raised in a series of waves. They'll get started with a certain amount, even though they know that's not enough to carry them through. It did not include bank loans, but it included equity or "near-equity" funds.

Roberts: At what point in time?

Cooper: Basically, I asked them, "How much money did you have when you started?"

Howell: Also, Arnie, your study was later, starting in 1960; I think this makes a difference.

Roberts: That's right; the time period is important.

Shapero: The financial market is a lot different now.

Cooper: One other thing, my initial sample was biased toward larger, more visible companies.

Draheim: Many of the entrepreneurs in the Palo Alto area had made theirs already; so, they had their capital. This compares with these people right out of the labs; they didn't.

Roberts: What was the median starting year of your companies?

Cooper: Well, it's probably about '65 or '66.

Roberts: The median starting year of my companies was around '61 or '60. So the median starting time of my companies is 5 years earlier than yours.

Shapero: The money available in '65 was probably of a different order than in '60.

Roberts: '65 was good on the median; '67 was better; '68 was great.

Shapero: After June '69, it's terrible.

Roberts: Single-founder companies did not perform very well. Single-founder companies typically tended to be research-oriented companies or consulting-oriented firms, not manufacturing-oriented companies. Multiple founders were better, and the more the better. There was a direct linear correlation between number of founders and success of the enterprise. That isn't to say I'd recommend that 8 men start a company. Indeed we had one company in which, for want of anything else, we had to include 99 guys as founders. It was a laboratory involved in an Atomic Energy Commission project. Believe it or not, M.I.T. spun off this laboratory because they didn't want to be involved in classified research. Three-man companies do better than two-man companies, and although the sample gets smaller, so the question of reliability of the data becomes subject to question, 5-man companies do better than 3-man companies.

The companies that were oriented to a manufactured product, initially from time zero, were the more successful companies. They **also** were the companies with a larger initial capitalization **and** with multiple founders. When you think about it from a logical point of view, they all necessarily fit together. If you're going to go into the manufacturing business from ground zero, you need more founders — at least an inside man and an outside man at the minimum. You also need more money; you have to buy production equipment and you have to have funds for inventories, and the like. These three things correlate; but I think the primary driver would be this one — the manufactured product.

The companies which did not start with a manufactured product, even those which had the intention of getting a manufactured product, were less successful. Lots of them dropped out in transit, and never made it. The ones which started to be manufacturers may not have had the product at hand, but they said, "Our business is to manufacture this product which we are still developing." Those guys with the manufactured product orientation were the more successful ones. Now, with success being dominated by sales measures, this is reasonable. You need leverage, and to get leverage you use manufacturing. You can't get much leverage in the service industry, particularly consulting and research.

Now, I want to talk about the high degree of technology transfer. We started our study to show NASA that we had better technology transfer data available than they had, because they were looking in the wrong fields. If you follow people, you find technology transfer. It was very satisfying to be able to prove this, which was very easy to do. By technology transfer we meant the following: To what extent was the formed company technologically dependent upon technical ideas, capabilities, and skills available at that organization we had called the source organization?

Although we used a lot of approaches, we ended up principally using a four-category system — a four-index measure system. One we called direct transfer; direct transfer or direct dependence meant that the company could not have been formed without a specific technical idea or technical capability which came from the source laboratory. In partial dependence or partial transfer, we said that technical ideas, skills and the like from the laboratory were important contributors at the formation of the organization, but were **not** the sole contributors. Other technologies drawn from other sources were also contributors.

The third category we called vague dependence. Vague dependence involved general technical skills — general technology associated with the laboratory. It was important to the formation of the company, but no specific technical idea that is identifiable in the company came from the laboratory.

Finally "no dependence" meant that the founder might have learned something managerial or about organization or about experience building at the lab that was useful, but we could find no technical relationship between what they did at the lab and what they did in this company. That was our four category measure.

Exhibit 8 relates the rate of start-up of companies to the number of years between leaving Lincoln Lab and the setting up of the new company. A little more than a third of the companies started right away at time zero: they left the lab and started their companies. The typical time delay between leaving the lab and setting up the company was 2½ years. They went someplace else and the average guy was there for 2½ years before he started his company. The data string out for as long as nine years. This same curve, which is a decaying exponential, also describes the degree of technological dependence of the companies upon Lincoln Laboratory.

The most technically dependent companies were the ones formed immediately. The longer the guy was away from the lab before forming his own organization, the less technically dependent he was on the laboratory. Now, the curve is also suitable for describing one more thing. If on the vertical axis we plot success or performance and on the horizontal axis we plot technology transfer, the curve is still there. The high technology transfer companies are the most successful, and the low technology transfer companies are the least successful. Those companies that took advanced technology from an advanced **source** of technology and brought it into the marketplace were the most successful firms. When you do partial correlation analysis, the time delay phonomenon washes out. W n that cluster of relationships the principal variable becomes the technol y transfer factor.

Vesper: You're assuming that it isn't some other reason that the companies which happen to leave Lincoln Labs and get formed fast tend to succeed more. You're saying that it's because of technology transfer.

Roberts: We specifically tested using partial correlation analysis whether lag was the primary determinant. Lag w es out in partial correlation analysis. I can't prove it any other way. . ey are all associated and statistically significant when you look at them independently.

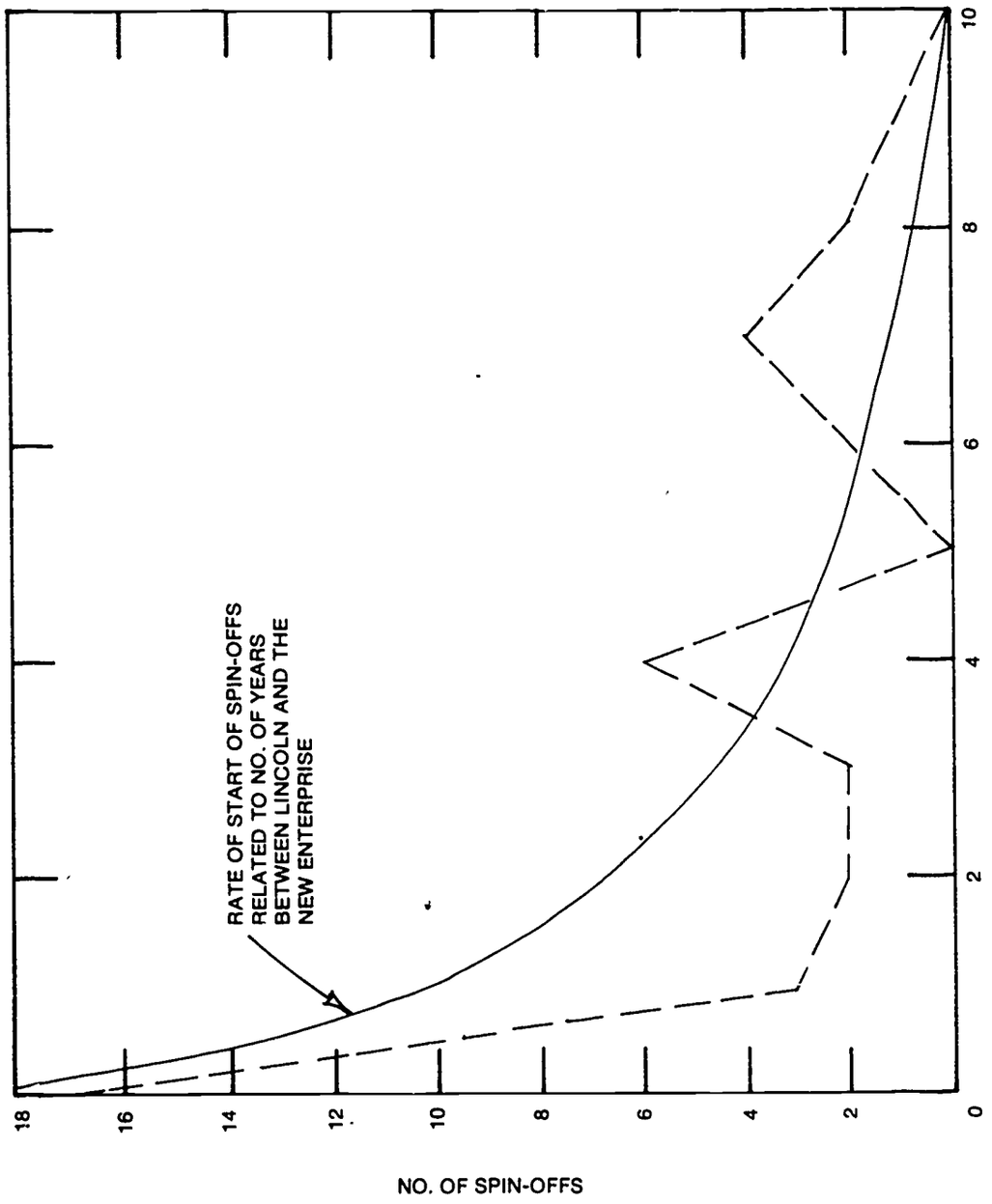

RATE OF START OF SPIN-OFFS
RELATED TO NO. OF YEARS
BETWEEN LINCOLN AND THE
NEW ENTERPRISE
NO. OF SPIN-OFFS
NO. OF YEARS BETWEEN LINCOLN AND THE NEW ENTERPRISE
18
16
14
12
10
8
6
4
2
0
10
8
6
4
2

**Exhibit 8**

Let me tell you why I argue technology dependence. You're all familiar with the Mercantile theory of commerce - that trade among nations follows patterns of comparative advantage among nations. I have the same kind of argument about companies in the marketplace; that strength of companies in the market place tends to follow lines of comparative advantage. Now, follow that notion and think about the young firm. What are the comparative advantages that a young firm has over competitors in the market place? Financial strength? No. Market capability? No. Manufacturing know-how? No. Variety of resources? No. Distribution channels? No. Where are the strengths? One is flexibility; a young company certainly can be a lot more flexible than a larger firm it is competing with. But, flexibility with no substance of support isn't going to win anybody's ballgame. You need some substance. The **only** thing that a young company might have that an old company doesn't have is a technological advantage. It's possible, not necessary; it's possible that a new firm can be technologically ahead of every other competitor that it has. It is not possible within reason that it can be better on any other dimension of functional competence than large competitors.

In terms of the entrepreneurs' background, the Ph.D's don't succeed very well; the guys with master's degrees do. In terms of managerial behavior there are a cluster of things that I think are very critical. We have no evidence which says that experience as a manager or education as a manager is important. But, behavior in a managerially-oriented fashion is important. Bringing in a specific business function, that is bringing in an administrator or controller to handle management problems, is one of the dimensions of managerial behavior that's a correlate of successful firms.

Another correlate of success is setting up a specific marketing department. The unsuccessful companies didn't have marketing departments; the founders didn't appreciate the importance of marketing. The successful ones stressed the marketing.

The successful entrepreneurs listed personnel as an area of major concern. We gave them a whole list of possible areas and asked them to rate the areas of prime concern. They didn't have more people problems, but they had more concerns about people. The unsuccessful entrepreneur was concerned more about a lot of other different things, and in the process I think they didn't get performance.

In terms of personality factors, the high performing founders had a high need for achievement and a moderate need for power, not a high need for power and not a low need for power. (See Exhibit 9.) The **laissez-faire** manager does not make out; also the authoritarian manager is no good. The moderate guy with a somewhat participative oriented style will set goals, but share responsibilities through the organization. That's the guy who is more successful.

**Exhibit 9**

**Personality Factors**
**Associated with Founders of**
**High-Performing New Technical Enterprises**

HIGH NEED FOR ACHIEVEMENT (N-ACH)
MODERATE NEED FOR POWER (N-POW)

## EIGHT / LAWRENCE M. LAMONT

### The Role of Marketing in Technical Entrepreneurship

#### Introduction

My interest in technical entrepreneurship is relatively recent; dating back to 1967. As a research associate at the University of Michigan's Institute of Science and Technology I became interested in the transfer of entrepreneurial talent and technology to form technology-based spin-offs. The opportunity to observe the development of a number of firms suggested marketing as a key problem area.

Published research has also suggested that a major constraint to the development of the spin-off is the failure or inability to develop a marketing capability. The validity of this generalization is difficult to challenge. However, I think the question of interest to most entrepreneurs is, "What role should marketing play in my firm?" The need to answer this question as well as my interest in technical entrepreneurship and the development of technology-based firms provided the motivation for this research. I'm pleased to be able to report the results of my research to you.

#### Scope of the Research

The scope of my research was limited to Michigan spin-off firms founded in the time period 1954 to 1968. This period included a universe of approximately 140 firms, with over 65 percent concentrated in the Ann Arbor-Detroit region. The data used for the analysis was generated through a mail survey of Michigan spin-off firms and personal field interviews with their principal founders. Seventy-six of the firms were included in this study.

All of the firms are spin-offs from large corporations, nearby universities, and other small technology-based firms. New businesses having less than $100,000 of sales are included as well as firms with annual sales of several million dollars. A number of technologies are represented including electronics, computers, optics, engineering materials and electro-mechanical equipment.

The technology-based firms in the study were involved in a variety of business activities. They included consulting, research and development, engineering, and manufacturing on a contract basis and the provision of proprietary products and services. Some of the firms began business by performing only one activity such as contract research and development, while others engaged in a combination of two or more activities. Part of my research focused on relating transferred resources such as technology, entrepreneurial characteristics, business skills, financial resources and market and marketing knowledge to the spin-off's business activity and the type of source organization. The balance of the research examined the marketing programs needed for the different types of business activity.

## A Classification Scheme for Spin-Offs

A major result of the research was the development of a classification scheme for technology-based enterprises. All firms were classified by source organization (the principal entrepreneur's source of employment prior to the formation of his firm). The categories included universities, large corporations and other spin-off firms. Each firm was then classified as either a university spin-off, primary industry spin-off (from a large corporation), or secondary industry spin-off (from another spin-off firm). Among the 76 firms responding to the mail questionnaire, there were 21 university spin-offs, 41 primary industry spin-offs and 14 secondary industry spin-offs.[1]

The Bendix Corporation and Lear Siegler Corporation were identified as the two most important industrial sources for Michigan spin-offs. During the research, 8 spin-offs were identified as employing technology transferred from the various divisions of the Bendix Corporation, while 5 were identified as spin-offs from Lear Siegler. The University of Michigan was the source for 25 of the 28 university spin-offs in the universe.

Spin-off firms were also classified by the nature of their business during the first year of operations and at the end of 1968. My research indicated that three classifications described this activity. These categories comprised a broad spectrum and included: (1) consulting, research and development, and testing at one extreme; (2) custom products and services; and (3) standard products and services at the opposite extreme. You will note that the first two categories consist of contract activities in which the firm is selling a technical capability, while the activities in the last category are proprietary in nature.

After each firm in the study had been classified by source organization and business activity, the two classification schemes were combined to examine the possibility of a relationship between the type of spin-off firm and the firm's initial position along the spectrum of business activity. An interesting relationship was found. As illustrated in Exhibit I, the university spin-offs exhibited a tendency to begin operations in consulting, research and development, and testing and the majority of primary industry spin-offs as suppliers of custom products and services. Most of the secondary industry spin-offs started as standard product-and-service-oriented businesses and tended to occupy the extreme end of the spectrum. This relationship provides the conceptual framework for the rest of the analysis.

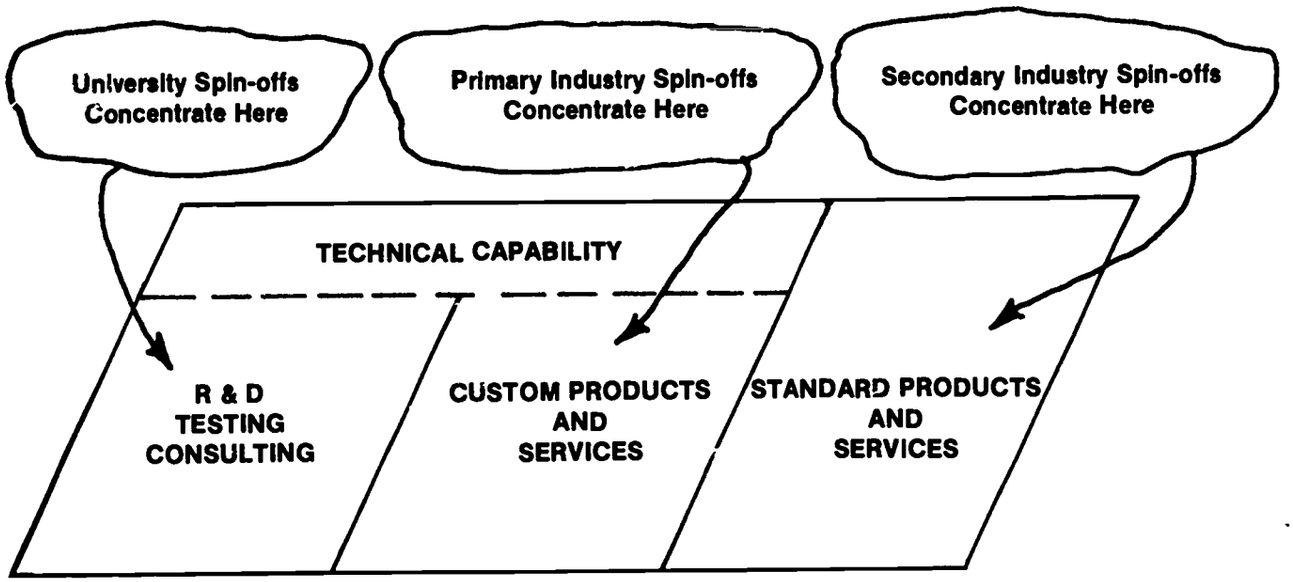
## The Research Findings

The balance of my research focused on: (1) the transfer of resources to the spin-off firm during formation and (2) the development patterns of spin-off firms and the implications for marketing.

## The Transferred Resources

The formation process of the technically-oriented spin-off consists of bringing together entrepreneurial skills, market knowledge, financial resources and technology. Each was examined and related to the conceptual framework.

EXHIBIT 1. Relationship Between the Type of Spin-Off Firm and the **Initial Business Activities.**




**Education and Employment Experience.** Both the educational level and the previous employment experience of the technical entrepreneurs were related to the earlier development of the conceptual framework. In moving from university spin-offs initially having a research and development orientation, for example, to secondary industry spin-offs having a standard product and service orientation, the level of educational achievement declined while the amount of previous job experience increased.

In 90 percent of the university spin-offs, the technical entrepreneurs held a master's degree or better, while 80 percent of the primary industry spin-offs the entrepreneurs had a bachelors or less. The lowest level of educational achievement was reported by the entrepreneurs of secondary spin-offs. About 85 percent of the entrepreneurs reported the educational equivalent of a bachelor's degree or less. I found an opposite trend when employment experience was examined. The entrepreneurs of secondary spin-offs reported holding an average of 2.8 jobs prior to starting their firm compared to 2.5 for the entrepreneurs of primary industry spin-offs and 1.4 for the university spin-offs. This trend should be expected in view of the educational data.

The difference in employment experience is also reflected in the business skills transferred to the new firm by the principal founders and initial employees. As a group, the industry spin-offs had an advantage over their university counterparts. They were more inclined to have production, general management and the other functional business skills such as accounting, finance and marketing initially present in their organization. Similar conclusions are reached when the firms are classified by business orientation. In moving along the business activity spectrum from a research and development orientation to a standard product and service orientation, the percentage of firms reporting the presence of the different business skills at the time of founding increased quite dramatically. I concluded that these different types of business activities require somewhat different business skills for their successful performance.

**Financial Resources.** It was theorized and supported by empirical evidence that both the availability and the requirements for capital were related to the firm's initial position on the business activity spectrum. Research and development firms usually required less capital for initial financing but found it difficult to secure. Standard product and service firms required larger amounts of capital, but by comparison found it easier to obtain. It was the unanimous opinion of all entrepreneurs that their firms were initially undercapitalized.

**Technology Transfer.** Several sources of technology were utilized during the formation process. In addition to direct transfer from the source organization by the technical entrepreneur, technology was also acquired by purchasing the assets of other spin-off firms and by hiring employees knowledgeable in certain fields of technology. Both the nature and extent of technology transferred was related to the firm's initial business activity. The principal founders of spin-offs engaged in research and development, testing and consulting transferred more technology than the founders of spin-offs at the standard product and service extreme. However, the transfer was more likely to consist of general scientific and engineering knowledge. By contrast, the standard product and service spin-offs relied less on the technical contributions of the principal founders (and more on alternative sources), but the technology transferred was usually related to specific products, services and processes.

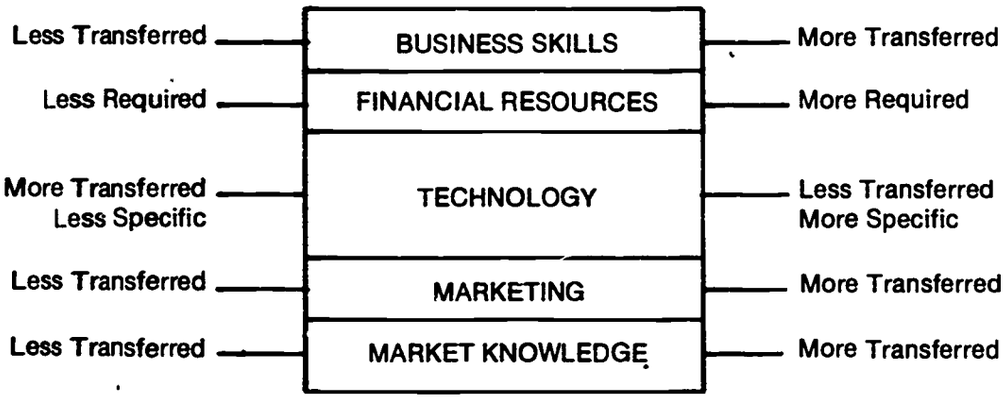
**Market Knowledge.** Market information was of greater importance in the formation process than the existence of prior marketing knowledge. The technical entrepreneurs of over 85 percent of the interviewed firms reported some market contact related to the proposed business venture prior to beginning business. In retrospect, most entrepreneurs felt the amount of information was insufficient and did not adequately define the business opportunity available. This was confirmed by the fact that only about 25 percent of the firms actually obtained business from the prospective customers identified in their prior market analysis. In general, both the quality and quantity of prior market information increased in moving from the spin-off firms at the research and development end of the spectrum to the firms at the standard product and service end.

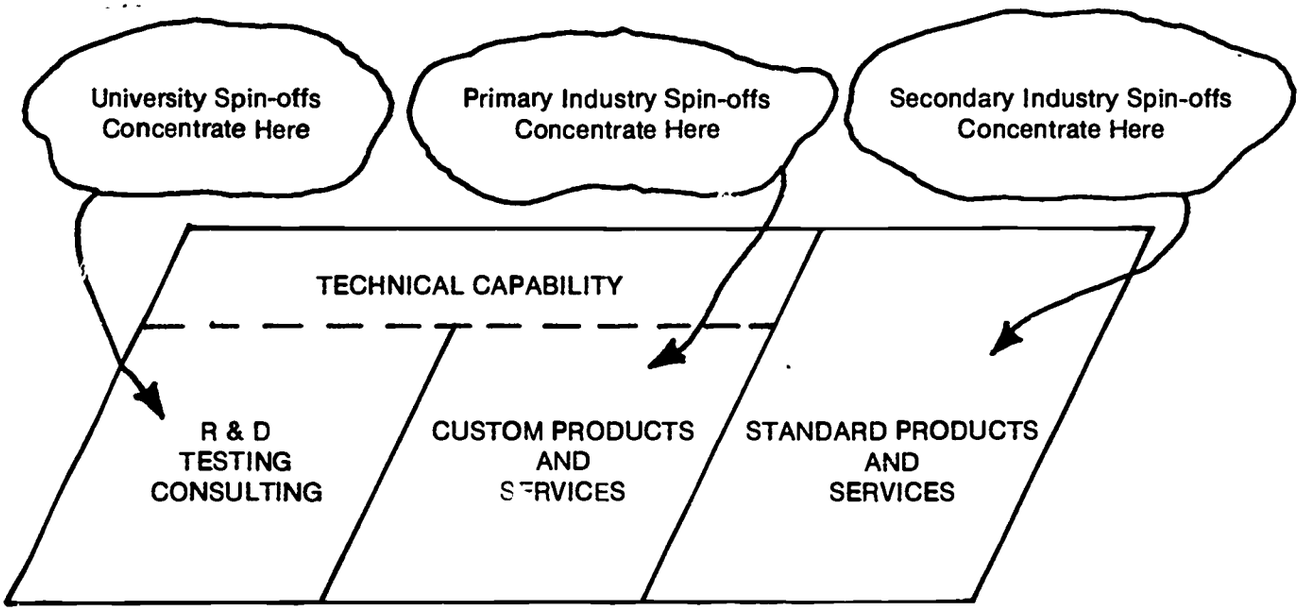
The field interview phase of the research provided an opportunity to further evaluate the significance of marketing in the formation process. I asked technical entrepreneurs how they visualized the marketing requirements for the product, service, or technical capability they planned to sell. Their answers confirmed those of the mail questionnaire. Only about one-third of the firms had really given consideration to the nature of the marketing job that would eventually be required. Answers such as "I didn't," "I thought I would do it," and "We thought we could eventually get someone else to do it," were typical of many firms who started business without even a casual consideration of the requirements for marketing.

I noted that many firms were started without even the intention of developing a marketing capability. A typical strategy in product-oriented firms was to license the manufacturing rights of manufacture for another firm who would assume the marketing responsibility. In many cases, the financial resources available to the firm made this approach necessary. In others it was viewed as the quickest way to put the firm on a profit-making basis.

Exhibit II summarizes the research to this point. It incorporates the analysis of the transferred resources and their importance to the spin-off formation process. The balance of the paper examines some of the development patterns of spin-off firms, the marketing programs and the major marketing adjustments faced by entrepreneurs.

EXHIBIT II: Relationship of the Transferred Resources to the Firm's Initial Business Activities.



## THE MARKETING PROGRAMS

**Development Patterns.** The research indicated that technology-based firms engage in a variety of business activities. Some begin business by performing only one activity such as contract research and development, while others are involved in a combination of two or more activities. As the firms grow, their development is often marked by dramatic changes in the nature of the business.

During the research, I observed a number of development patterns. Some firms began operations with the intention of developing proprietary items, but financed the development cycle by consulting or contract research and development. Others started business by obtaining contracts to design and build custom products and then transferred the technology to the development of proprietary products. Several performed only one activity such as research and development or engineering and resisted the tendency to progress toward a product orientation.[2] In most of the research and development and custom product and service firms there was a dramatic movement toward the standard product and service end of the spectrum.

The changes in the business orientation of many spin-offs made the development of marketing programs a confusing and difficult task. Existing programs were quickly outdated and the need for a changed emphasis was either not recognized or was implemented well after it became apparent. The task of developing a marketing capability was further complicated. I found that depending on the mix of contract and proprietary business, the firm may be involved in several different marketing efforts, each requiring a unique capability. A major portion of my research was devoted to integrating the marketing programs into the conceptual framework previously established.

**Marketing the Technical Capability.** The marketing programs of firms selling a technical capability placed primary emphasis on sales engineering designed to help the prospective customer define his needs. The firm's principal founders performed the selling task, but I found they were often assisted by technical personnel during the proposal formulation phase.

The technical proposal was the primary form of sales promotion. Its complexity and length depended on the nature of the problem, but they usually contained a suggested approach to solving the problem and an estimate of the cost to complete the contract. The successful proposals were pre-sold and reflected the customer's problem and ideas in terms of the firm's technical capability.

Many firms supplemented the technical proposal with a capability brochure. The well-designed brochures contained a description of the spin-off's personnel, facilities and special equipment, areas of technical competence, and pictures of completed projects involving technical achievements. I believe that the capability brochure is of significant value to the marketing programs of the small technology-based business engaged in marketing a technical capability. Not only does the brochure make an intangible capability more meaningful to the customer, but it also helps the firm bridge the credibility gap that plagues new businesses.

Contracts were usually cost-plus-fixed-fee or fixed-price. The perceived risk in the project and the willingness of each party to share the risk determined the specific contractual form. A cost-plus-fixed-fee (risk sharing) contract was used when the risk was high or difficult to estimate. Fixed price contracts resulted when the problem was well defined or the suppliers bargaining position was weak. Most entrepreneurs preferred risk sharing contracts, but because of competition they were not always successful in negotiating them.

Firms marketing a technical capability generally confined their activity to local or regional markets. This reflects the need for frequent contact with the customer. The technical uncertainty in the projects often required modifications in the scope of the contract. When customers were located a great distance away, the process became prohibitively expensive and time consuming. Regional markets also restricted the use of advertising as a part of the marketing program. The use of mass media such as industry trade journals was expensive because of the wasted circulation. In addition, advertising was ineffective because of the difficulty of making specific buying appeals and communicating an intangible capability in limited space.

I found that the failure to effectively market the firm's technical capability was an important reason for poor corporate performance. New firms had a tendency to operate in a technical vacuum. Entrepreneurs believed that a superior technical approach to a problem was all that was necessary to win a contract competition. Because of insufficient market contact, new firms failed to reflect the customer's ideas and preferences in their contract proposals. Some technology-based firms were unable to overcome the credibility gap. Poorly designed capability brochures, weak technical proposals, poor credit ratings and a lack of familiarity with selling techniques contributed to the problem.

Contracts were frequently priced below the cost to complete the work. The absence of historical cost data and the failure to allow for contingencies often meant rapid depletion of working capital. Some entrepreneurs intentionally priced below full costs to generate revenue to cover overhead. My research indicated that many firms operate with substantial losses during the first few years of business.

**Marketing Standard Products and Services.** The marketing programs of the spin-offs selling standard products and services were influenced by a sharper definition of the applications for the items to be marketed, increased competition, and the need to reach markets which were national in scope. Buyers were also more knowledgeable. These factors made it necessary to expand the role of marketing in the firm.

Advertising and sales promotion played a greater role in the marketing programs because of the ability to make specific appeals to national markets. Trade shows, journal advertising, sales literature and direct mail were all used to reach potential customers. In small firms these items were the most important part of the marketing program, while in firms having direct or indirect market representation it balanced and supplemented the sales effort.

The crucial component in the marketing program was personal selling. Products such as computers, electronic instruments, and lasers were typically sold by a direct sales force or through a network of manufacturers' representatives. Most electronic components and minor accessories were marketed through industrial distributors. The specific marketing channel selected depended on the product and the size and financial strength of the firm. In general, small firms used manufacturers' representatives, while larger firms used direct sales or a combination of both.

Because the technical effort of most firms was internally funded, products or services with unique performance characteristics were frequently developed. To some extent this isolated the firms from direct price competition and encouraged a value-oriented approach to pricing. All of the firms reported negotiating fixed-price contracts or quoting standard commercial prices that were fixed by the forces of the market. While price competition was always present, there was less flexibility in pricing because both value and costs could usually be determined prior to the sale. Many of the firms competed on a non-price basis since price variations were usually related to differences in quality or performance.

In developing marketing programs for standard products and services, entrepreneurs failed to realize that the various marketing tools are designed to be used in combination rather than as alternatives. For many firms, the marketing program consisted of a trade show or advertising in a few selected trade journals. These programs were, at best, marginally successful. To market high technology products, personal selling either by a direct sales force or manufacturers' representatives was almost always required. Firms having this basic capability then added sales brochures, direct mail, advertising and trade shows to increase the effectiveness of the marketing channel selected.

In most firms studied, the pricing process for new products tended to be cost oriented. Most entrepreneurs estimated manufacturing costs and added a fixed percentage for profit. Products and services were underpriced using this approach. Technology-based firms having unique items and a strong competitive position missed profit opportunities by failing to price the product as close to its value in use as possible.

## THE MAJOR MARKETING ADJUSTMENTS

Spin-off firms progressing across the business activity spectrum from a research and development or similar orientation to a standard product and service orientation require some major adjustments in their marketing effort. They include obtaining market representation and developing a formal marketing organization to implement the marketing program.

**Selecting Initial Market Representation.** Beginning with the decision to market the first product or service, the firm was confronted with the problem of selecting and developing a method of market representation. The company, the characteristics of the product and the nature of the markets influenced the initial selection decision. Financial limitations and narrow product lines were major constraints to direct selling and most of the firms initially used manufacturers' representatives and industrial distributors. I found that technical entrepreneurs selected these organi-

zations in a haphazard manner. Selection criteria were used by entrepreneurs but they were applied without an understanding of the marketing requirements for the product. Not enough firms probed beyond the initial product and market match to verify the ability and willingness of the representatives to perform the selling job.

The interviews I conducted with manufacturers' representatives provided an interesting contrast to the field research. Most entrepreneurs did not realize that these organizations used well-defined criteria to select the products and firms they would represent. Even fewer entrepreneurs considered the importance of the representatives services such as branch sales offices, clerical help, and facilities for sales meetings, technical seminars and direct mail promotion.

Because of the technical orientation of most of the firms, the representative-principal relationship was not always harmonious. Manufacturers' representatives complained about sales support, poor literature, and a nonprofessional approach to marketing, while the spin-off firms were quick to criticize the representative for his unwillingness to develop a sales territory in depth or perform missionary selling. A better understanding of each others needs and role is clearly required for more effective marketing.

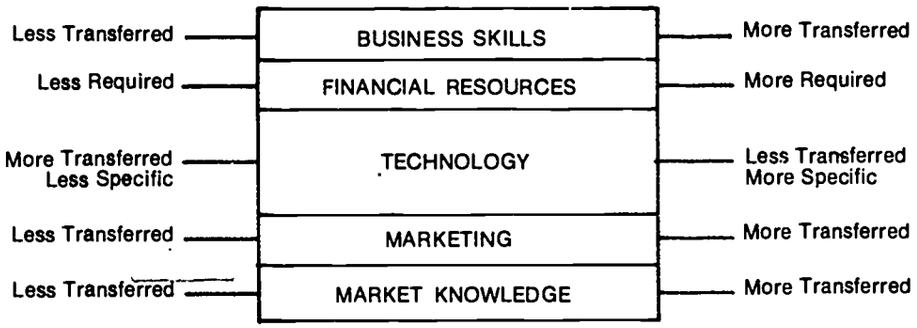
**Organizing For Marketing.** The threat of increased competition and a reduced rate of sales growth were two factors which encouraged firms to formally organize for more effective marketing. Implementing a program of direct selling was the most important marketing adjustment faced by the spin-off firm. The decision was usually made after considering the firm's need for control of the marketing effort, the costs involved, and the number of products available. In general, the spin-offs faced the dilemma of requiring greater control over the marketing of their products, but not having the financial strength or the necessary number of products to conduct an efficient direct sales effort. Some spin-offs obtained products by purchasing the marketing rights of products developed by small manufacturers or forming a sales company which acted as a representative for the products of other manufacturers. Another alternative employed was to license the marketing rights to a large corporation having a national marketing organization.

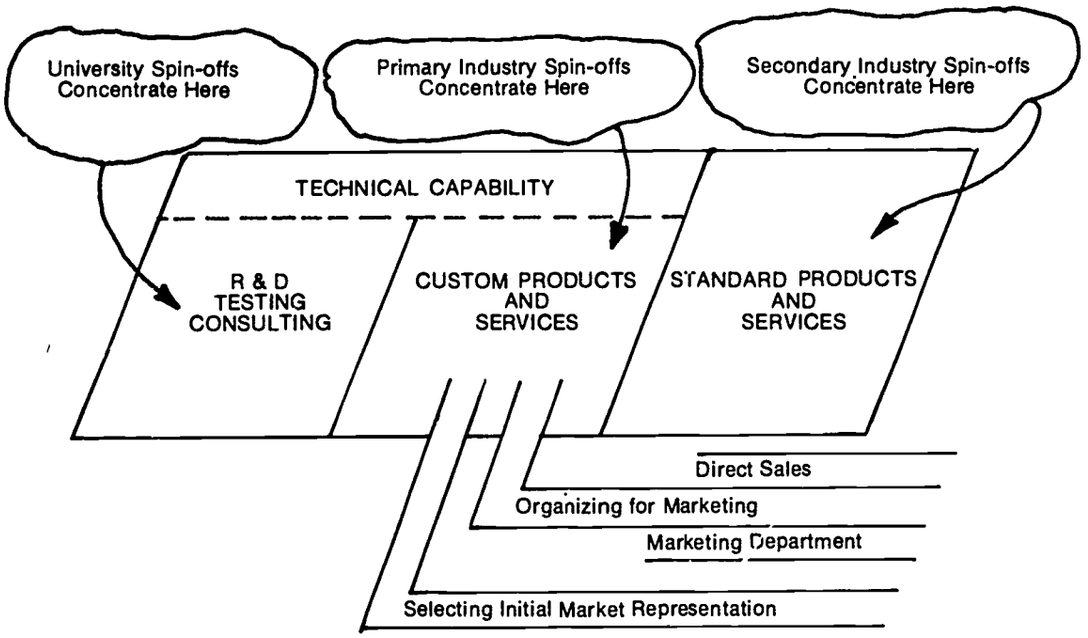
As the firm developed standard products and services requiring national distribution, the need for a formal marketing department to coordinate and direct the marketing program became apparent. The departments were structured along functional lines and began with the addition of a sales manager or vice-president of marketing. This change occurred when the firm's sales were in the $500,000 - $750,000 range. Other functional specialties were then added when the spin-off was able to support them financially. Because of the absence of market planning, spin-off firms were not always able to recognize the need for additional marketing expertise. Generally, the addition of a new marketing function occurred well after the need became apparent.

This completes the conceptual model. The marketing programs and major marketing adjustments are integrated into the development in Exhibit III. Each marketing adjustment is viewed as a constraint to the movement of

**Exhibit III**

Exhibit III: The Completed Model Illustrating the Marketing Programs and Major Marketing Adjustments.




| THE MARKETING PROGRAM | | THE MARKETING PROGRAM |
|---|---|---|
| | MARKETING CHANNELS | |
| Principal Founders | | Principal Founders<br>Direct Sales Force<br>Manufacturers' Representative<br>Industrial Distributors |
| | PROMOTION | |
| Technical Proposal<br>Capability Brochure | | Trade Journal Advertising<br>Sales Brochures<br>Trade Shows<br>Direct Mail<br>News Releases |
| | PRICING | |
| Negotiation<br>Cost-Oriented | | Negotiation<br>Competitive Bidding<br>Commercial Prices |

spin-offs along the business activity spectrum. The model also illustrates the changing role of marketing as the firm progresses from a technically-oriented firm to a market-oriented business.

**Questions and Answers From Presentation:**

Komives: Were all spin-offs from industrial corporations classified as industry spin-offs?

Lamont: Yes, but a further distinction was made. The spin-offs from large industrial corporations such as Bendix were called primary industry spin-offs. You recall that there were also a number of firms that were spin-offs from other small technology-based companies. I called these secondary industry spin-offs.

Howell: Would the fact that spin-offs from a large company (primary industry spin-offs) tended to concentrate in custom products and services, be because these markets were not large enough for the big companies to go after?

Lamont: Yes, many of the firms would design and build custom products for one customer or a limited market. This was often the only way they could get into business.

Shapero: Larry, did you observe spin-off patterns in which an entrepreneur moved from a primary industry spin-off making custom products to a secondary industry spin-off making a proprietary product?

Lamont: Yes, this occurred in a number of cases. Usually the entrepreneur (principal or employee) would stay in the first firm until a proprietary product was developed and then he would leave and start another business using the same or a similar product as the basis for the new business.

Shapero: That's a nice notion of generalization sequence.

Lamont: I found technology to be transferred in a similar manner — starting as general scientific information at the R & D end of the spectrum and after successive transfer between firms emerging as a proprietary product at the other end of the spectrum.

Kohl: What was the distribution of university spin-offs among the different university departments?

Lamont: In my 76 firms there were 21 university spin-offs. Nineteen of the firms were out of the University of Michigan and two were from Wayne State University. They were split about half and half between academic departments and university sponsored research institutes such as Michigan's Institute of Science and Technology.

Kohl: No, I'm interested in the division between engineering and the science departments such as physics and chemistry. You went all the way across the university — am I right?

Lamont: That's correct. Most of the spin-offs from academic departments come out of the engineering school — aeronautical engineering, chemical and metallurgical engineering, electrical engineering, mechanical engineering and engineering mechanics. A few come out of the computer center and one from the chemistry department at Wayne State University.

Komives: Any from the business school?

Lamont: Yes, just last year we had two spin-offs from the business school. One provided consulting services to the other technology-based firms in the Ann Arbor area and the other was involved in the computerized accounting systems. They were not included in my sample because they were formed after the cutoff date of my survey.

Danilov: How about spin-offs from special labs, etc.?

Lamont: A number came out of the University of Michigan's Institute of Science and Technology. I traced about 9 firms that transferred optics technology from this organization. There were also a number of spin-offs with multiple founders representing two or more university academic departments or laboratories.

Roberts: You indicated that all the firms in your study were classified two ways — by source organization and type of business activity. What was the breakdown in the activity category?

Lamont: Twenty-three of the 76 firms were involved in R & D, testing and consulting, 36 in Custom Products and Services and 17 in Standard Products and Services.

Komives: Was the transfer of business skills also a function of the number of entrepreneurs?

Lamont: Absolutely. Two factors explain the differences in the percentage of firms reporting the presence of different business skills at the time of formation; the nature of the business activity and the number of principal founders. The standard product and service firms had the best balance of business skills because of the need in their type of business and because they usually had multiple founders.

Roberts: Did you say that the entrepreneurs of secondary industry spin-offs had been entrepreneurs before or that they had been employed by small companies?

Lamont: In 9 of the 14 secondary spin-offs the entrepreneurs had been principal founders in another technology-based company. In the remaining 5 firms, the entrepreneurs were key members of the management terms of their previous companies. All of the entrepreneurs of secondary spin-offs came to their firms with experience in managing small technology-based companies.

Cooper: Then some of them had not been founders before, but had joined an established small firm.

Lamont: Yes, that's correct.

Roberts: You said that the entrepreneurs of standard product companies transferred less technology directly related to their initial product but that it usually consisted of specific product ideas. It appears to me that your results on technology transfer are contradictory. I would expect the product-oriented firms to transfer more technology.

Lamont: If other sources of technology are considered, I don't think there is a contradiction. While the standard product firms reported less reliance on the founders for technology, they were more inclined to transfer technology by hiring knowledgeable employees of other spin-off firms or acquire the assets of other small firms. Overall, they probably acquired more directly related technology, but the contribution of the founders was not as great as the firms at the research and development extreme.

Cooper: Larry, I wonder if you were getting a response bias there, because those who leave industrial firms are more concerned about being accused of piracy, legal problems and that sort of thing.

Lamont: That certainly could be true.

Cooper: I know in my research, the one question that always touched a raw nerve was when I began to ask them how similar were you to the business you just left. I think I found it very hard to get straight answers.

Roberts: You know, it's interesting. On my measures of technology transfer, I would have rated the research and development firms lower on the transfer and the standard product firms as higher.

Lamont: My definition of direct, was the company could not have been formed without a specific technical idea that was drawn from the source organization. The definition of partial technology transfer was ideas from the source lab contributed to other relevant ideas. The definition of vague was general technical skills and capabilities were important, but no specific technical idea was critical to the formation process. I would have classified the R & D, testing and consulting firms in a vague category and the standard product firms in a direct category.

Draheim: Larry, would you comment on market knowledge with respect to that middle group, because very often, custom products require more specialized market knowledge than the broader markets in your third category.

Lamont: By specialized, I meant market knowledge related to a specific product or group of products. The entrepreneur of the custom product and service firm usually perceives a need only for his technical capability, rather than a need for a specific product. Remember, this type of firm works on a contract basis helping in the development of his customers' products.

Komives: Were these observations on market knowledge made about the first year the firms were in business?

Lamont: Yes.

Komives: Well, then, I would argue that they probably knew a lot less about markets than the standard product and service firms. Because they were doing business with one or two prime contractors and they spent that first year trying to fulfill that contract — and not really exploring other market possibilities.

Draheim: Yes — my feeling would be that you don't start a business unless you see part of a market — and that requires very often, much more market knowledge.

Lamont: In my experience, you see one or two customers in this kind of business. If it is a contract situation, where you are doing a job for one customer that's generally about what you see.

Roberts: It's even less than that in some cases. Some guys say that they are confident that there are customers, because they are smart guys doing great things and they know that once they declare themselves as existent, they will be able to line up some business.

Komives: You mentioned that a number of research and development and custom product and service firms changed their original business by developing products. Do you know what percentage this was?

Lamont: When I classified the firms after their first year of business, only 22 percent were involved in standard products and services. When the same firms were reclassified at the end of 1968, 36 percent were obtaining a majority of their sales from the sale of standard products and services. In total, over 85 percent were involved in some form of proprietary activity — so the change was quite dramatic.

Komives: What was the time span on this transition?

Lamont: Some firms made the change in a year or so, while others took as long as 10 years. A good average would be four or five.

Shapero: You mentioned that the firm's decision to formally organize for marketing often coincided with the decision to seek public financing. This raises the question, which I think is probably so, that the formal marketing organization was suggested or required by the outside financial people as part of getting the money. This was really something that didn't originate with the firm. The investors simply said, "If you want to get money you had better organize a marketing department."

Lamont: That could well be.

Root: Could I make one comment on the spin-off firms in the Ann Arbor area? We now have 98 firms excluding firms involved in consulting and developing a software capability.

Roberts: What about business failures? Do you have any idea as to the numbers that were formed and failed?

Lamont: Only a vague idea. In the 1954-1968 period covered in my study. I was able to identify about 8 firms that failed. I have no idea what percentage this was of formations because I'm sure the failure dates are incomplete.

Vesper: Were the failures included in your universe of 126 firms?

Lamont: No, they are not in the 126.

Bostrom: Were you able to find out if the original founders were able to maintain their position in the company, that is, devoting their time to the technical aspects and bringing in people that were qualified to manage it?

Lamont: In general, they brought specialists in. However, they still managed to maintain control.

Kohl: In the nuclear instruments industry, that isn't so.

Bostrom: Did they have to give up equity to bring in outside talent?

Lamont: No, not that I know of. They had to give stock options and other incentives though.

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[1]It is worthwhile noting that in the last few years an increasing portion of the new formations have been secondary industry spin-offs. This, of course, indicates that the Michigan scientific complex has reached the stage where it should begin to grow rapidly.

[2]It is interesting to note that this group of firms had lower rates of sales growth, but generally achieved profitability at an earlier stage of their development.

## NINE/CARY HOFFMAN

### The Role of the Commercial Loan Officer in the Formation and Growth of New and Young Technical Companies

### Introduction

There are many ways to approach the subject of technical entrepreneurship. One way, of course, is from the standpoint of the technical entrepreneur himself -- his personal characteristics, his educational, academic, and professional background, his psychological motivation, etc. Still another way to approach the subject is from the standpoint of the type of factors and conditions which affect the formation and development of technical firms in an area. A series of recent studies (Shapero **et. al.**, 1964, 1965, 1969; Draheim **et. al.**, 1966) suggest that aside from the entrepreneur himself, one of the most important, if not the most important, factor affecting whether or not technical company formation will occur in an area is the availability of required financial support -- both for initial formation and subsequent growth. This support takes two institutional forms -- permanent investment capital and short-term bank financing.

Though equity capital is more or less available on a regional or national basis to potential entrepreneurs through investment bankers, venture capitalists, stockbrokers, private investing networks, and others, required working capital financing for the new or small company must usually be obtained from local sources. When loan money is not available from the local banks or other local sources of capital due to their lack of experience in financing technical companies, it is not unusual at this point for the applicant to give up the search for necessary capital or to move to an area where capital is made available with a consequent loss to the local economy.

In commenting on the relatively important role that Detroit bankers played in the development of the automobile industry in that city, Thompson (1965) discusses the relevance of adequate working capital financing in the growth of small and young companies:

> While the importance of equity capital is universally recognized, the critical role of commercial banks and other suppliers of working capital loans is not so thoroughly appreciated, especially in the case of new and growing businesses . . . Often the young firm is most sorely pressed for working capital to pay wages and buy supplies and to extend credit to customers, and short-term borrowing of working capital can be very expensive for small, unknown firms. The point is that the speed and ease with which new and small firms can gain access to the larger and lower-cost sources of short-term credit (commercial banks, for the most part) is perhaps just as important to local growth as the more dramatic supply of risk capital.

The loan policies and practices presently found in most regions of the country are strongly affected by local historical influences and are based upon the particular economic history of the region. Consequently, bankers whose loan experience has largely been with such applicants as farmers, miners, land developers, or tourist facility operators are not familiar with or qualified to evaluate the loan application of a company engaged in the development and manufacture of technical products. For example, in a study currently being performed with bankers in west Texas, (Griggs, 1970) it is interesting to note that loan officers who will not loan money to technical companies because of their high risks often approve loans for oil drilling ventures. Few regions have developed a financial community that is entrepreneurial enough or that has institutionalized the ability to readily support new and unfamiliar kinds of ventures.

For providing financial assistance to most types of small business, the application of conventional loan standards serve their purpose adequately. However, in the case of companies engaged in the development and manufacture of technical products, these conventional loan standards are relatively inadequate.

**The Purpose of this Study**

This Study has been concerned with developing a body of information regarding the role of commercial banks and loan officers in the formation, growth, and effectiveness of new and young technical companies.

To determine the attitudes and practices of loan officers towards supporting high technology industry, a loan officer questionnaire was administered and was followed up by interviews with the responding loan officers in various communities selected for comparison. The questionnaire, which required responses to nine carefully varied technical and non-technical company loan requests (see Table 1), was developed using realistic data drawn from the loan files of cooperating banks in the San Francisco area. The questionnaire was tested, revised, and retested in Austin and Waco, Texas, and was administered to loan officers in selected cities in the Ozarks region (Arkansas, Oklahoma, Missouri, and Kansas), Oklahoma City, Tulsa, Dallas, San Francisco, and Los Angeles. In addition, Federal Reserve Bank officials in positions to have an overview of the variations in loan officer behavior in various communities were interviewed.

The data which were collected from the loan officers included responses to the questionnaire loan request cases in terms of:

- -- the loan decision -- to grant or deny the loan
- -- loan security requirements
- -- managerial and financial constraints imposed
- -- estimates of the effect of various factors on the loan decision
- -- explicit identification of the critical item within each factor influencing the loan decision

In total, more than 2,000 loan decisions were made by over 200 loan officers in 80 banks in 6 states. One hundred eighty of the loan officers were from the Ozarks area, Tulsa, Oklahoma City, Dallas, and selected California banks. The remainder were from Austin and Waco, Texas. The total population of usable loan decisions made by all loan officers (except those in Waco and Austin, Texas) to the questionnaire varied from 1208 to 1269 depending on the specific factor being measured. This variation in total loan decisions occurred because not all of the participating loan officers answered all nine loan questions and, in some instances, they did not answer all of the questions concerning personal characteristics, i.e., some loan officers did not give age while others omitted educational background data.

**Propensity to Loan By Region** -- Just under 500 loan decisions were made by the Ozarks region loan officers included in the study. In 71% of these cases the loan request was approved. A little over two-thirds of the Ozarks loan decisions were concerned with the six technical companies in the sample. Of the technical company decisions, 71% were affirmative; in the case of the non-technical companies, 70% were affirmative.

**Table 1**

PROFILE OF LOAN APP `TIONS IN THE QUESTIONNAIRE

| | The Company | | | The Management | | | | The Loan Request | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Age | | Background | | Age | | Type | | |
| | Product or Service | New (Less than 6 months) | Old (2 years plus) | Technical | Non-Technical | Young (Less than 40 years) | Mature (More than 40 years) | Short Term | Inter-mediate Term | Amount |
| TECHNICAL COMPANIES | Optical Components | X | | X | | X | | | X | $100,000 |
| | Integrated Circuits | X | | X | | | X | X | | 315,000 |
| | Instrumentation Components | | X | X | X | | X | X | | 175,000 |
| | Electro-Mechanical Equipment | X | | X | | | X | X | | 75,000 |
| | Computer Software | | X | X | X | | X | X | | 135,000 |
| | Remote Control Devices | X | | X | X | | X | | X | 28,500 |
| NON-TECHNICAL COMPANIES | Marine Equipment | | X | | X | | X | X | | 40,000 |
| | Concrete Blocks | X | | X | X | | X | | X | 550,000 |
| | Soybean Processing | X | | | X | X | | X | | 145,000 |

As can be noted in Table 2, the proportion of positive loan decisions was generally higher in the Ozarks region than it was in Oklahoma City, or Dallas (with the exception of technical company decisions), or the California cities. However, there were substantial differences in the responses received from the cities within the Ozarks region and between Oklahoma City and Tulsa, with Tulsa showing a considerably greater propensity to loan to the new technical companies than Oklahoma City. The responses from the Ozarks region, Tulsa, and Oklahoma City may be categorized into three groups. At one extreme the bank loan officers in Fort Smith, Tulsa and possibly Joplin show a relatively high propensity to loan to the new, young technical companies in the questionnaire. At the other extreme, Oklahoma City, Muskogee, and Hot Springs show a relatively moderate propensity to loan while Little Rock and Fayetteville make up a third intermediate category with a moderately high propensity to loan.

In the California cities, Dallas, Tulsa, and Fayetteville there was a distinctly higher propensity to loan to the new technical companies than to the non-technical companies. In the sample as a whole there was a higher propensity on the part of all loan officers to make loans to the three companies which were at least two years old than to the younger companies. Of the three "older" companies, the two technical companies received more loans than the non-technical company. The relative propensity to loan to each individual company in the questionnaire varied substantially among the various cities. Substantial variations in propensity to loan were also noted among banks in the same city and also among loan officers in the same bank. A study currently being carried out (Griggs, 1970) is examining these differences as a function of the banker's risk-taking propensity and actual, historical loan behavior.

**Loan Security Requirements By Region** -- Although there must be a degree of readiness to make loans to new and young technical companies if they are to form, develop and flourish in an area, the measure of readiness or propensity to loan, in itself provides only a limited understanding of the loan officer's perceptions of new and young companies. Therefore, data were also collected on the collateral requirements and on the managerial and financial constraints imposed by the loan officers as conditions for approving a loan. These data provided critical insights into how the loan officers:

--Perceive the risks associated with each of the loan cases.
--Perceive "security" in regard to new and technical companies.
--Take an active part in explicitly requiring a potential borrower to take certain actions to qualify for a loan.

Loan collateral requirements were examined in two ways. First, the types of collateral required were enumerated and analyzed; second, the number of different kinds of collateral required per loan was considered. The collateral required by the bank loan officers may be categorized into four general groups:

**Table 2**

COMPARISON OF LOAN RESPONSES BY CITIES IN AND ADJACENT TO THE OZARKS REGION

**Percentage of Positive Responses to Loan Requests**

| AREA | All Nine Companies | Six Technical Companies | Three Non-Technical Companies |
|---|---|---|---|
| Ozarks Area: | 71% | 71% | 70% |
| Little Rock and North Little Rock | 64% | 65% | 63% |
| Fort Smith | 78 | 77 | 81 |
| Fayetteville | 65 | 69 | 57 |
| Hot Springs | 64 | 56 | 81 |
| Muskogee | 61 | 60 | 64 |
| Joplin | 75 | 74 | 78 |
| Springfield* | —* | —* | —* |
| Ozarks Area Plus Tulsa and Oklahoma City | 65 | 66 | 61 |
| Oklahoma City | 54% | 55% | 52% |
| Tulsa | 71 | 74 | 66 |
| Dallas | 65 | 76 | 41 |
| California Cities | 60 | 66 | 50 |

*Inadequate number of responses for this purpose.

1. Unsecured loans and/or loans secured by only a personal guarantee -- This category represents the lowest level of explicit requirement for security. The destinction between a personal guarantee and an unsecured loan (which must be signed by the borrower in any case) is usually not a real distinction, particularly with regard to the questionnaire companies since no indication was provided concerning the personal net worth of company owners or managers.

2. Current (or quick) assets. -- Includes receivables (accounts or contracts) and inventory.

3. Fixed assets and equipment. -- Includes plant, equipment and/or real estate.

4. Other security. -- Includes investments (i.e., Treasury bills or marketable securities), SBA guarantees, general pledge agreements, life insurance, re-purchase agreement on equipment and those miscellaneous cases which specified a requirement for some security but did not indicate the specific collateral.

As the data in Table 3 indicate, the Ozarks region loan officers approved loans on an unsecured or personal guarantee basis in only 23% of the cases (both technical and non-technical companies) in which they approved the loan request. For the technical companies, this percentage was 31% and for the non-technical companies, 4%. When the responses of the Ozarks area bankers were combined with those of Tulsa and Oklahoma City, the percentage for all companies increased to 24%, that for the technical companies declined to 29% and the non-technical company percentage increased to 9%. Dallas showed a similar pattern with 23%, 29%, and 7%. The California cities showed a distinctly different pattern with 36% of all loans being made unsecured or with only a personal guarantee. The comparable percentages for technical companies was 44%, and for the non-technical companies, 16%.

The Ozarks region loan officers required current assets as collateral in 51% of all the cases where they made an affirmative loan decision. Current assets were required in 50% of the technical company cases and in 53% of the non-technical company cases. The parallel figures were somewhat higher when the Ozarks area was combined with Tulsa and Oklahoma City, being 55% for all loans, 54% for the technical company loans and 56% for the non-technical company loans. In general, the requirement for current assets was higher in Dallas, being 59%, 60%, and 55%, but much lower in the California cities being 45%, 42%, and 52%.

Fixed assets and equipment were required as security by the Ozarks area bankers in a larger percentage of the cases than by the bankers in the other areas studied. They required fixed assets as collateral in 23% of the loans granted to all companies, in 15% of the technical company cases, and in 41% of the non-technical company cases. The equivalent figures for the Ozarks area, Tulsa, and Oklahoma City were 22%, 15%, and 36%. Dallas required fixed assets and equipment as security in only 17% of the loans made to all companies, in 8% of the technical company loans and in 38% of the non-technical company loans, while the figures for the California cities were 19%, 13%, and 35%. The Ozarks area, Tulsa, Oklahoma City, and Dallas loan officers all required other forms of security, such as life insurance, Treasury buills, SBA guarantees, with more than twice the relative frequency than did the California loan officers.

In all the cities studied the technical companies received loans on an unsecured basis or with only a personal guarantee with much greater frequency than the non-technical companies. Similarly, current and fixed assets were required as collateral for the technical companies much less frequently than for the non-technical companies. Generally, the technical companies that were over 2 years old received the most favorable treatment. In a large number of instances they received

**Table 3**

COMPARISON OF LOAN RESPONSES BY AREA – BY TYPE OF SECURITY REQUIRED*

**Type of Security Required (percentage)**

| AREA | Unsecured Loan and or Personal Guarantee Only | | | Current Assets | | | Fixed Assets & Equipment | | | Other | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | All companies | Technical companies | Non-technical companies | All companies | Technical companies | Non-technical companies | All companies | Technical companies | Non-technical companies | All companies | Technical companies | Non-technical companies |
| OZARKS AREA: Little Rock and | 23% | 31% | 4% | 51% | 50% | 53% | 23% | 15% | 41% | 16% | 16% | 14% |
| North Little Rock | 16 | 23 | 0 | 52 | 53 | 48 | 9 | 0 | 33 | 20 | 22 | 17 |
| Ft. Smith | 17 | 27 | 0 | 64 | 61 | 71 | 24 | 17 | 38 | 12 | 11 | 14 |
| Fayetteville | 44 | 52 | 25 | 29 | 24 | 42 | 12 | 10 | 17 | 24 | 28 | 17 |
| Muskogee | 23 | 31 | 7 | 58 | 62 | 50 | 26 | 10 | 57 | 3 | 3 | 0 |
| Joplin | 20 | 32 | 0 | 46 | 40 | 57 | 46 | 40 | 57 | 26 | 24 | 29 |
| Springfield | 31 | 36 | 20 | 50 | 45 | 60 | 31 | 18 | 60 | 12 | 18 | 0 |
| Hot Springs | 24 | 33 | 12 | 51 | 58 | 41 | 22 | 8 | 41 | 5 | 4 | 6 |
| ADJACENT AREAS: | 24 | 29 | 9 | 55 | 54 | 56 | 22 | 15 | 36 | 14 | 15 | 12 |
| Tulsa | 21 | 25 | 12 | 60 | 61 | 60 | 12 | 9 | 20 | 9 | 9 | 8 |
| Oklahoma City | 24 | 27 | 17 | 60 | 60 | 62 | 19 | 15 | 29 | 14 | 16 | 10 |
| COMPARISON CITIES: Dallas | 23 | 29 | 7 | 59 | 60 | 55 | 17 | 8 | 38 | 13 | 11 | 17 |
| Calif. Cities | 36 | 44 | 16 | 45 | 42 | 52 | 19 | 13 | 35 | 6 | 8 | 1 |

*Numbers for some of the cities are too small to give anything but an indication.

the largest percentages of loans that were unsecured or secured only by a personal guarantee. This was not true for the non-technical companies that were over 2 years old.

Within the Ozarks there was considerable variation between cities in the extent to which loans were made on an unsecured basis or with only a personal guarantee with Fayetteville showing the highest percentage of loans given under these conditions. The highest percentages of loans secured by current assets were made by Fort Smith and Muskogee loan officers while those in Fayetteville and Joplin required current assets in the fewest cases. Fixed assets and equipment were most frequently required by the loan officers of Joplin and Fort Smith.

In terms of the number of kinds of security required for each loan made, the California bankers generally required fewer kinds of security per loan than those in the Ozarks area, Tulsa, Oklahoma City, or Dallas (see Table 4). In 20% of the positive loan responses, the California bankers required no security whatsoever. In 63% of the cases they required one or two kinds (e.g., current assets and fixed assets) of security, and in 16% of the cases they required three kinds of security. In the Ozarks area 7% of the loan officers required no security, 63% required one or two kinds of security, 21% required three kinds of security per loan and 9% required four or more kinds of security per loan. The Ozarks percentage figures are very similar to those for the extended area including the cities of Tulsa and Oklahoma City and to those for Dallas.

**Managerial and Financial Constraints By Region** -- As pointed out previously, the requirements for collateral and the application of managerial and financial constraints as conditions for approving a loan request provided critical insights into loan officer attitudes and their understanding of new, young and technical companies. The managerial and financial constraints imposed by the loan officers in connection with affirmative loan decisions were classified into the following six general categories.

1. No restraints.

2. Management restraints or retention of capital constraints. This category included constraints such as:
   a) Subordination of existing debts,
   b) Limit on salaries, dividends or withdrawals,
   c) Limits on financial management (e.g., maintain a particular debt/equity ratio),
   d) Position on board or approval of management changes,
   e) Requirement for employment of a financial specialist,
   f) Requirement for employment of a marketing specialist,
   g) Reduction of operating expenses.

3. Accounting or control constraints. This includes such items as a requirement for aging of receivables or the periodic inspection of inventory and/or receivables.

**Table 4**

COMPARISON OF LOAN RESPONSES BY AREA –
BY NUMBER OF KINDS OF SECURITY REQUIRED

**Number of Kinds of Security Required Per Loan**
(% of loans in area)

| AREA | 0 | 1 | 2 | 3 | 4 | 5 or more | Totals |
|---|---|---|---|---|---|---|---|
| OZARKS AREA: | 7% | 31% | 32% | 21% | 7% | 2% | 100% |
| Little Rock and North Little Rock | 8 | 25 | 41 | 21 | 3 | 1 | 99* |
| Fort Smith | 6 | 30 | 33 | 21 | 7 | 3 | 100 |
| Fayetteville | 10 | 56 | 24 | 5 | 5 | 0 | 100 |
| Hot Springs | 0 | 30 | 28 | 40 | 2 | 0 | 100 |
| Muskogee | 12 | 29 | 31 | 21 | 7 | 0 | 100 |
| Joplin | 5 | 23 | 28 | 21 | 18 | 5 | 100 |
| Springfield | 0 | 38 | 31 | 25 | 6 | 0 | 100 |
| ADJACENT AREAS: | 6 | 29 | 34 | 23 | 6 | 2 | 100 |
| Tulsa | 4 | 36 | 46 | 15 | 0 | 0 | 101 |
| Oklahoma City | 5 | 21 | 34 | 31 | 6 | 3 | 100 |
| COMPARISON CITIES: | | | | | | | |
| Dallas | 10 | 20 | 42 | 24 | 3 | 2 | 101 |
| Calif. Cities | 20 | 26 | 37 | 16 | 2 | 0 | 100 |

*Does not add to 100% due to rounding.

4. Limits on financial management or use of loan funds. This category included requirements such as giving all banking business to the loaning bank, approval of additional plant or equipment expenditures, restrictions on purchase of treasury stock, a limit on increase in capital stock or on increases in debt, a requirement to pay off current bank loans, and the establishment of a collateral account for the loan.

5. Other. A number of other requirements or special charges were mentioned by some of the loan officers and included such items as payment of origination or commitment fee, closing costs or other special charges.

6. Reporting periods. Another kind of managerial requirement was concerned with the frequency with which the loan recipient must provide reports to the loan officer.

The Ozarks region loan officers showed a very high tendency to grant loans without imposing any managerial or financial constraints on the borrower. As the data in Table 5 show, the Ozarks region bankers placed no constraints on 69% of the loans they approved for all the questionnaire companies (both technical and non-technical). For the technical companies, the percentage was 72%; and for the non-technical, 63%. When the responses of the Ozarks bankers were combined with those of Tulsa and Oklahoma City, the percentage of loans made without financial or managerial constraints for all companies declined to 64%; for technical companies, 64% and for non-technical companies, 63%.

The percentage of loans made by Dallas loan officers without any financial or managerial constraints were much less than in the Ozarks: 58% for all companies, 61% for technical companies, 48% for non-technical companies. The California cities show an even further and more distinctive drop in the percentages of loan cases for which they required no additional managerial or financial constraints. Only 39% of all loan requests approved were given without additional constraints, with 40% for the technical companies and 36% for the non-technical companies. The latter figures contrast sharply with those for collateral requirements in which the California loan officers showed a much higher tendency than the Ozarks, Tulsa and Oklhoma City bankers to approve loans (especially technical company loans) without any collateral requirement or with only a personal guarantee.

In those cases where the loan officers required additional constraints, management restrictions and/or retention of capital were required with greater frequency than other constraints in all of the regions studied. Ozarks region loan officers required these kinds of constraints in 18% of the cases for all companies, in 20% of the technical companies cases and in 15% of the non-technical company cases. For the extended region including the Ozarks, Oklahoma City and Tulsa the percentages were very similar. In general, the imposition of management constraints occurred with greater frequency among the Dallas loan officers: 24% for all companies, 19% for the technical companies and 35% for the non-technical companies. Loan officers in the California cities showed an even further increase in their requirement of management restrictions by requiring them in 33% of all of the loan cases, 37% of the technical company cases and 25% of the non-technical company cases.

**Table 5**

COMPARISON OF LOAN RESPONSES BY AREA — BY ADDITIONAL CONSTRAINTS IMPOSED

**Type of Additional Constraints or Conditions Imposed on Loan**

| AREA | None | | | Management Restrictions or Retention of Capital Constraints | | | Accounting or Control Constraints | | | Limits on Financial Management or Use of Loans | | | Other | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | All companies | Technical companies | Non-technical companies | All companies | Technical companies | Non-technical companies | All companies | Technical companies | Non-technical companies | All companies | Technical companies | Non-technical companies | All companies | Technical companies | Non-technical companies |
| OZARKS AREA: | 69% | 72% | 63% | 18% | 20% | 15% | 10% | 8% | 14% | 8% | 8% | 9% | 12% | 12% | 11% |
| Little Rock and North Little Rock | 71 | 75 | 63 | 15 | 17 | 11 | 10 | 13 | 4 | 5 | 5 | 4 | 17 | 17 | 19 |
| Fort Smith | 66 | 65 | 67 | 24 | 24 | 24 | 3 | 2 | 5 | 7 | 7 | 10 | 4 | 7 | 0 |
| Fayetteville | 81 | 76 | 92 | 12 | 14 | 8 | 0 | 0 | 0 | 5 | 7 | 0 | 2 | 3 | 0 |
| Muskogee | 70 | 88 | 57 | 5 | 3 | 7 | 12 | 10 | 14 | 12 | 10 | 14 | 7 | 10 | 0 |
| Joplin | 28 | 28 | 28 | 41 | 48 | 29 | 5 | 4 | 7 | 10 | 16 | 14 | 43 | 40 | 50 |
| Springfield | 50 | 64 | 20 | 31 | 27 | 40 | 6 | 9 | 0 | 31 | 27 | 40 | 6 | 9 | 0 |
| Hot Springs | 88 | 88 | 88 | 7 | 8 | 6 | 2 | 0 | 6 | 2 | 0 | 6 | 0 | 0 | 0 |
| ADJACENT AREAS: | 64 | 64 | 63 | 18 | 19 | 15 | 6 | 6 | 7 | 11 | 11 | 11 | 11 | 11 | 11 |
| Tulsa | 59 | 54 | 72 | 17 | 23 | 8 | 6 | 7 | 4 | 20 | 25 | 16 | 2 | 4 | 0 |
| Oklahoma | 60 | 63 | 57 | 18 | 18 | 19 | 7 | 7 | 7 | 12 | 12 | 12 | 13 | 11 | 19 |
| COMPARISON CITIES: | | | | | | | | | | | | | | | |
| Dallas | 58 | 61 | 48 | 24 | 19 | 35 | 11 | 10 | 14 | 6 | 3 | 14 | 10 | 10 | 10 |
| Calif. Cities | 39 | 40 | 36 | 33 | 37 | 25 | 13 | 13 | 14 | 17 | 16 | 19 | 29 | 26 | 36 |

The percentage of cases in which restrictions other than management constraints were imposed was relatively low and showed little variation when it came to the Ozarks cities, Tulsa, Oklahoma City, or Dallas. As with management constraints, the California cities showed a somewhat higher propensity to impose restrictions of all kinds than did the bankers in the other regions studied.

In general there was a tendency to impose managerial constraints on technical companies in all areas. The California loan officers, who are more familiar with technical companies tended to impose constraints to a far greater extent on the technical companies, especially managerial constraints. As might be expected, the older companies (more than 2 years old) received the fewest managerial and financial restrictions.

Within the Ozarks region, Tulsa, and Oklahoma City there was considerable variation in the way the loan officers in the different cities regarded the requirement for additional managerial and financial constraints. Joplin, Springfield, and Tulsa loan officers showed strong leanings in the direction of the California bankers, while loan officers in Hot Springs, Fayetteville, Muskogee, Little Rock and North Little Rock all showed a very high propensity to ignore any additional constraints.

**Frequency of Financial Statement** -- An analysis was made of the way loan officers in the various areas requested financial statements from their borrowers in terms of whether statements were required only once a year or more frequently. The majority of the loan officers in all of the areas studied requested financial statements more than once a year. Those in California emphasized this somewhat more (87%) than those in the Ozarks, Tulsa, and Oklahoma City (79%). The Dallas bankers emphasized this most of all (97%). In every region studied financial statements were required more frequently of the technical companies than of the non-technical companies.

**Factors Affecting Loan Decisions**

An effort was made to probe more deeply into factors which influenced the loan decisions made by each of the bankers. For each of the nine loan cases in the questionnaire, the responding loan officer was asked to estimate the extent (in percentage terms) to which each of six factors affected his decision to approve or deny the loan requested. The six factors were the following:

1. The firm's financial condition
2. The firm's management
3. The growth potential of the company's industry
4. The potential value of the company to the community
5. The established loan policies of the bank
6. The bank's financial position

The most important factor was considered to be the one to which the loan officer assigned the largest percentage of influence on his decision. The relative importance of each of the six factors to the loan officers in the cities studied is shown in Table 6.

**Table 6**

MOST CRITICAL FACTOR IN LOAN DECISION*

| AREA | "Yes" Loan Decisions | | | | | | "No" Loan Decisions | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Firm's Financial Condition | Firm's Management | Industry Growth Potential | Firm's Impact on Community | Bank's Loan Policy | Bank's Financial Condition | Firm's Financial Condition | Firm's Management | Industry Growth Potential | Firm's Impact on Community | Bank's Loan Policy | Bank's Financial Condition |
| Ozarks Area: | 60% | 23% | 11% | 3% | 3% | 1% | 65% | 21% | 1% | 2% | 9% | 0% |
| Little Rock and North Little Rock | 43 | 32 | 15 | 6 | 0 | 0 | 68 | 3 | 0 | 3 | 3 | 0 |
| Fort Smith | 52 | 34 | 7 | 3 | 3 | 2 | 45 | 40 | 0 | 0 | 10 | 5 |
| Fayetteville | 68 | 25 | 3 | 0 | 3 | 0 | 61 | 22 | 0 | 0 | 17 | 0 |
| Hot Springs | 82 | 7 | 0 | 0 | 4 | 7 | 56 | 17 | 0 | 0 | 17 | 11 |
| Muskogee | 56 | 20 | 17 | 2 | 5 | 0 | 83 | 8 | 8 | 0 | 0 | 0 |
| Joplin | 57 | 19 | 22 | 3 | 0 | 0 | 83 | 8 | 0 | 0 | 8 | 0 |
| Springfield | 73 | 16 | 0 | 0 | 11 | 0 | ** | — | — | — | — | — |
| Ozarks Plus Adjacent Cities: | 58 | 24 | 10 | 3 | 4 | ? | 59 | 15 | 2 | 2 | 20 | 1 |
| Oklahoma City | 61 | 21 | 8 | 2 | 8 | 0 | 54 | 10 | 2 | 2 | 31 | 1 |
| Tulsa | 54 | 30 | 8 | 3 | 2 | 3 | 59 | 16 | 8 | 3 | 14 | 0 |
| Dallas | 57 | 28 | 10 | 2 | 0 | 2 | 52 | 26 | 2 | 0 | 10 | 10 |
| California Cities | 57 | 33 | 7 | 1 | 3 | 1 | 74 | 12 | 6 | 1 | 7 | 0 |

*Factors to which the loan officers assigned largest share of percentage of influence on loan decision. Where two factors received same percentages, both were counted.
Where no factor received at least 30%, none were counted.

**Insufficient numbers to permit comparisions.

The way the loan officers perceived the relative importance of the six factors in the questionnaire loan cases varied with whether the loan request was approved or denied, and it also varied by region. In almost all cases, the two factors most frequently cited were the firm's financial position and the firm's management.

**Financial Factor** -- The financial factor predominated throughout when the loan was approved, and there was little difference between the regions in the importance of this factor. However, when the loan was not approved, the loan officers in the California cities attributed considerably more importance to the financial factor than did their counterparts in the other regions studied. Interestingly, the Ozarks bankers were more like those in California in this regard than were the Dallas loan officers.

In addition to his estimate of the importance of each of the six factors listed above, the loan officer was also requested to describe in detail the specific item within each of the six factors which most influenced him. For example, within the "management" factor the loan officer might respond with the specific item, "The management does not have sufficient marketing experience."

When the financial factor was the primary one for approving the loan request, the most crucial items listed by the loan officers were the following (see Tables 7 and 8): the current or cash position of the applicant companies (39% of responses); the relationship of equity to debt (41%); and profitability (28%). Of considerably less importance to loan officers in making the study's loan decisions were such financial reasons as: fixed asset position (5%); sales trends (7%); the age of the company (5%); and debt service capacity (3%).

When the principal factor for denying the loan request was financial, more emphasis was placed upon equity to debt relationships (63% of responses); age of company (11%); and debt service capacity (9%). As with the affirmative responses, little emphasis was placed upon fixed asset position (7%) or sales trends (3%).

In summary, where the loan decisions were primarily based upon the company's financial position, liquidity (i.e., current or cash position) was the most important item in the loan officers' decisions. Where there were profits or a trend toward profitability, the equity position was not as important an item as in the case of a new company without a history of profits or one operating at a loss. The fixed asset position of the companies was given little emphasis by loan officers in the regions covered by this study primarily due to the lack of substantial fixed assets owned by most new technical companies. When a loan request was denied, the age of a company was given as an important reason.

**Management Factor** -- An analysis was also made of the loan decisions that were primarily based on the firm's management. When the firm's management was given as the primary factor in approving the loan, the following specific managerial reasons were cited most often: experience, background or qualifications of management (52% of responses); diversity of management talent within the company (20%); education (19%); business accomplishments (14%); and age (11%). (See Tables 9 and 10).

**Table 7**

CRITICAL FINANCIAL REASONS FOR MAKING LOAN DECISIONS -- FOR ALL REGIONS

| Item | "Yes" Responses* | "No" Responses* |
|---|---|---|
| Current | 39% | 17% |
| Profit/Loss | 28 | 7 |
| Equity | 41 | 63 |
| Sales | 7 | 3 |
| Fixed Assets | 5 | 7 |
| Age of Company | 5 | 11 |
| Collateral | 4 | 5 |
| Information | 2 | 4 |
| Debt Service | 3 | 9 |
| Need for Loan | 3 | 6 |
| Financial Statement | 13 | 2 |
| Receivables or Inventory Turnover | 3 | 1 |
| Other Factors | 2 | 2 |

*Do not total 100% due to inclusion of two INCIDENTS/LOAN where the loan officer stated they were both critical to his decision.

Table 8

CRITICAL FINANCIAL REASONS FOR MAKING LOAN DECISIONS -- BY REGION

| Item | "Yes" Responses* | | | | "No" Responses* | | | |
|---|---|---|---|---|---|---|---|---|
| | Ozarks | Ozarks Plus Adj. Cities | Dallas | Calif. Cities | Ozarks | Ozarks Plus Adj. Cities | Dallas | Calif. Cities |
| 1. Current or Cash Position | 45% | 39% | 38% | 39% | 34% | 18% | 17% | 18% |
| 2. Profit or Loss | 29 | 29 | 24 | 29 | 6 | 8 | 13 | 5 |
| 3. Equity or Capital Structure | 30 | 39 | 49 | 42 | 59 | 70 | 67 | 3 |
| 4. Sales Trends | 7 | 7 | 4 | 8 | 4 | 3 | 0 | 3 |
| 5. Fixed Asset Position | 11 | 8 | 0 | 3 | 3 | 4 | 13 | 9 |
| 6. Collateral Provided | 3 | 4 | 3 | 4 | 3 | 2 | 4 | 4 |
| 7. Years of Operation | 4 | 5 | 6 | 4 | 17 | 18 | 17 | 17 |
| 8. Adequacy of Information | 0 | 0 | 6 | 3 | 1 | 2 | 13 | 5 |
| 9. Debt Service Capacity | 1 | 2 | 0 | 4 | 16 | 6 | 9 | 13 |
| 10. Need of Loan | 0 | 1 | 1 | 6 | 1 | 3 | 9 | 9 |
| 11. Financial Statements, Ratios, & Trends | 18 | 16 | 15 | 7 | 3 | 3 | 0 | 1 |
| 12. Rec. or Inventory Turnover | 1 | 3 | 0 | 3 | 3 | 1 | 0 | 1 |
| 13. Other Factors | 0 | 1 | 0 | 3 | 3 | 3 | 4 | 1 |

*Do not total 100% due to inclusion of two incidents/loan where the loan officer stated they were both critical to his decision.

With respect to the denied loan where the decision was based principally on the company's management, most emphasis was placed upon experience, background, or qualifications of management (67%), diversity of management talents (13%), and age (8%). In those cases where the loan was approved, the California loan officers placed somewhat more importance on the company's management than did their counterparts in the Ozarks, Tulsa, Oklahoma City, or Dallas. However, when the loan was denied, the loan officers in the Ozarks and in the adjacent cities placed somewhat greater emphasis on the company's management than did the California bankers.

It is significant that, both when the loans were approved and denied, California loan officers considered the diversity of balance of the management team a critical factor more often than did loan officers in the other regions studied. This stresses the importance placed by a financial community experienced with technical companies upon all management capabilities, i.e., production, marketing and finance as well as technical. New technically-oriented companies which do not have a balanced management team were perceived as particularly vulnerable by the California bankers.

It may be significant that the California loan officers placed more emphasis upon the age of the management team than did the loan officers in the other regions studied. California loan officers tended **not** to make loans to technical companies when the management team was young and lacked experience as operating managers.

**Other Factors** -- In general, the potential growth of the industry and its product markets was not given much weight by the loan officers. However, there were some minor variations in that loan officers in the Ozarks, Tulsa, Oklahoma City, and Dallas placed a far higher value on this factor when approving a requested loan than when denying one. The California loan officers assigned equal importance to this factor both when making and refusing a loan request.

As previously pointed out, both technical entrepreneurs and loan officers willing to support them are necessary for the formation and growth of new technical companies. This was demonstrated in the course of this study when an effort was made to obtain data from the Pittsburgh, Kansas area. Though the number of loan officers and the extent of response to the questionnaire were too small for inclusion in this report, one of the most pertinent insights obtained in this project was received from one of the bank presidents who had recently arrived in the area from another region. He stated that a primary problem faced by the banks in the area was an undesired low loan/deposit ratio (on the order of 29%) resulting from a lack of demand for commercial loans. He cited this as evidence of the lack of local entrepreneurs.

**Table 9**

CRITICAL MANAGERIAL REASONS FOR MAKING LOAN DECISIONS

| Item | "Yes" Responses* | "No" Responses* |
|---|---|---|
| Experience, Background or Qualifications | 52% | 67% |
| Balance of Management | 20 | 13 |
| Previous Business Accomplishments | 14 | 0 |
| Education | 19 | 0 |
| Age | 11 | 8 |
| Equity Position | 0 | 5 |
| Financial Request Presentation | 1 | 5 |
| Other | 2 | 7 |

*Do not total 100% due to inclusion of more than one incident/loan officer where the loan officer stated more than one factor was critical to his loan decision.

**Table 10**

CRITICAL MANAGERIAL REASONS FOR MAKING LOAN DECISIONS--
BY REGION

| | "Yes" Responses* | | | | "No" Responses* | | | |
|---|---|---|---|---|---|---|---|---|
| | Ozarks | Ozarks Plus Adj. Cities | Dallas | Calif. Cities | Ozarks | Ozarks Plus Adj. Cities | Dallas | Calif. Cities |
| 1. Experience, Background or Qualifications | 62% | 51% | 57% | 52% | 33% | 60% | 93% | 60% |
| 2. Balance of Management | 13 | 16 | 8 | 29 | 14 | 9 | 0 | 27 |
| 3. Previous Business Accomplishments | 7 | 12 | 22 | 13 | 0 | 0 | 0 | 0 |
| 4. Education | 13 | 19 | 16 | 20 | 0 | 0 | 0 | 0 |
| 5. Age | 8 | 8 | 8 | 15 | 10 | 9 | 0 | 13 |
| 6. Equity Position | 0 | 1 | 0 | 0 | 0 | 7 | 8 | 0 |
| 7. Financial Request Presentation | 3 | 1 | 3 | 0 | 10 | 7 | 8 | 0 |
| 8. Other | 4 | 3 | 5 | 1 | 10 | 5 | 8 | 8 |

*Do not total 100% due to inclusion of two incidents/loan where the loan officer stated they were both critical to his decision.

## Summary of Regional Differences in Loan Decisions

When the results of the various measurements of loan decision behavior by region were examined together, distinctive regional loan decision profiles emerged. Combining the propensity to loan with the requirement for collateral and the imposition of additional conditions on the loans, three categories of loan officer communities identified themselves. The first category consisted of the loan officers in the California cities which were included in the study because of their long familiarity with technical industries, new, young, and old. The other two categories consisted of the communities that showed unfamiliarity with the particular characteristics of technical companies, but that differed in terms of their propensity to make loans to new companies.

**Category I -- Familiar With Technical Companies** -- This category includes areas in which large technical complexes are found, i.e., the California cities. The California loan officers in this study showed a high tendency to make loans to the questionnaire companies; but when compared to their counterparts in the other areas studied, this propensity was not the highest found. The real distinction between the California bankers from those in other areas studied was their relatively lower requirements for collateral, their higher damand for additional managerial and financial constraints and the differences in the relative weights placed upon factors that influenced their loan decisions. The California bankers approved a distinctly higher percentage of loans on an unsecured basis or with only a personal guarantee. However, the California loan officers required many more additional managerial and financial constraints of their borrowers than did the others. Though all the bankers in the study had a high tendency to require frequent reporting, this was more pronounced among the California bankers. When the reasons for approving or denying a loan were examined, it was found that the California bankers showed a greater concern with management when making a loan and a greater concern with financial conditions when refusing a loan than did those from the other areas.

When considering the particular financial and operating characteristics of high technology companies that differentiate them from other kinds of companies, it is obvious that the attitudes and practices of the California bankers are geared to the special characteristics of technical companies. They recognize that there is a long period between research and development and a marketable product. Therefore, they are not impressed by the future of the potential market unless it is negative. They recognize that R & D oriented firms require substantial working capital for long periods of time to finance labor costs and, thus, propose ways of providing capital that take this into account. They recognize that technically-trained entrepreneurs usually lack business experience and, consequently, require many kinds of managerial and financial constraints. They realize that financial, managerial and marketing skills may be brought into the company. They recognize that the true capital of a highly technical company is its technically-trained personnel and not its fixed assets or equipment (that often cannot be disposed of, such as a wind tunnel); consequently, they require only a personal guarantee or make the loan unsecured. They also recognize the volatility of the short-run, high-value technical business and, therefore, require very frequent reporting by the borrower.

**Category II -- Unfamiliar With Technical Companies, But With a High Propensity to Make Loans** -- This category includes Fort Smith, Joplin, Fayetteville, Tulsa, and Dallas. This group of communities responded to the loan questionnaire with a higher propensity to loan to technical companies (ranging from 69 to 77%) than did the California cities (66%). With the exception of Fayetteville (52%), the Category II cities showed distinctly lower percentages of loans given to technical companies without security or requiring only a personal guarantee (27 to 32%) than did the California cities (45%). With the exception of Joplin (28%), the cities in Category II showed a far higher percentage of technical company loans given without imposing any additional managerial or financial constraints (54 to 76%) than did the California cities (42%).

A high propensity to make loans to technical companies combined with unfamiliarity with their characteristics has historically been a situation combining high promise with a definite possibility of generating a sequence of events detrimental to the development of technical companies in a community. Willingness to finance new technical companies by equity and loan financing is accentuated during times of increased stock-market interest in which "glamor" is associated with particular industries. This is seen in the high positive response by the bankers to the two computer related companies in the study questionnaire, industries currently very high in glamor but very uncertain and volatile in profitability. However, the first, almost inevitable failures or setbacks among the new companies in highly volatile industries results in a strong negative reaction on the part of the financial community. There is a consequent reluctance to support new ventures and existing young companies, thus accelerating and accentuating their financial difficulties.

An example of this situation is found in the history of the development of the high technology complex in Minneapolis and St. Paul (Draheim, **et. al.,** 1966). During the later 1950's and early 1960's, there was a fadlike, almost feverish propensity to finance and support new technical companies in these cities. Between 1955 and 1965 (referred to as the "dollar stock market") 67 technical companies were formed, many in response to the eager encouragement of individual and financial community investors. With the first major failures in 1962, there was a reaction by the financial community which took several years to overcome. Fortunately, the number and variety of companies was such that the resulting negative bias of the local financial community was eventually overcome. This experience might be considered a costly learning process for some local investors and banks. It did result, however, in a better educated financial community.

**Category III -- Unfamiliar With Technical Companies But With Only A Moderate Propensity to Make Loans** -- This category includes Little Rock/North Little Rock, Hot Springs, Muskogee and Oklahoma City. This group of communities showed a lower propensity to approve loans to new and young technical companies (55 to 65%) as compared with the California cities (66%). Category III cities also showed a distinctly lower tendency to make loans to the technical companies on an unsecured basis or with only a personal guarantee (23 to 33%) as compared with 45% for California. In all cases, Category III cities showed a much lower

tendency than did the California counterparts to impose additional managerial or financial restraints on the technical companies to which they made loans (12 to 37%) as compared with 58% for the California cities. With the exception of Hot Springs, the cities in this category showed a very low tendency to make loans to new and young companies that were non-technical.

**Loan Officer Perceptions of Technical Companies and of Their Role As Loan Officers**

When the loan officer responses to various aspects of the questionnaire were synthesized, two general viewpoints were identified. The differences in viewpoint separate the loan officers familiar with new and young technical companies from those who had no opportunity to gain such familiarity. The differences in viewpoint may be described in terms of how a banker perceives the technical company in its environment, and, consequently, how he sees the role of a loan officer in regard to such companies.

In their responses to the questionnaire, both the California and Ozarks bankers sought to identify some kind of guarantee of security. The Ozarks loan officer took as his guarantee of security the traditional banker-identified collaterals such as receivables, inventories, equipment, and fixed assets. He required more kinds of security per loan, and the kinds of tangible securities that "you can lay your hand on." The California loan officer, however, took as his guarantee evidence of the company's ability to respond and react effectively to a dynamic and risk-filled environment. He sought this in two ways. First, he required that the company make operational changes, add capabilities, or modify financial policies that would give it the capacity to respond effectively to changes in its environment no matter what they may be. Second, he leaned heavily on a requirement for current, frequent, on-going, and "on-line" information, exemplified by a tendency to give loans on a shorter term basis thereby requiring more frequent exchange of information, and by a tendency to require financial statements more frequently than the Ozarks loan officer.

The Ozarks loan officer appeared to treat an enterprise as a mechanism that is either good or bad. Once put in place and financed, it is expected to function properly. Therefore, he was much more concerned than his California counterpart with making a proper initial judgement that, once made, he would live with. Thus, the Ozarks loan officer tended to look at a company from the viewpoint of "likelihood of failure." Once a loan was approved, he tended to impose conditions which assured the bank that it would not lose its money, that made certain the bank would be repaid, and that placed the bank in a superior position with regard to other creditors in the event the company would fail. These conditions took the form of subordination of existing debts, limits on salaries, dividends or withdrawals, all the company's banking business, formal loan agreements, and the restriction on purchase of treasury stock.

The California loan officer appeared to treat the enterprise as an organic entity that constantly must adapt, innovate, and, if necessary, be assisted in its development. Therefore, he was concerned with achieving the proper initial conditions, and once he made his decision, he was committed to making it work. Thus, he tended to demand such things as changes in accounting and control records, employment of financial or marketing specialists, reduction of operating expenses, and periodic inspections of inventories and receivables.

Another difference between the two groups of loan officers was the way they apparently perceived their roles. Some bankers went beyond others in suggesting, requiring, or providing for technical, financial, and managerial assistance, advice, or reform. Some bankers merely noted that the financial management of a particular loan case was inadequate and rejected the loan; others required some modification as a condition for getting the loan.

The two groups may be differentiated into one group that may be designated **developmental** and another that may be designated **judgemental.** The developmental loan officer was found to be more heavily represented in the sample of California loan officers than among those in the Ozarks.

The developmental loan officer was differentiated from the judgemental by the percentage of active conditions he imposed per loan given, and by his specific comments on the factors influencing his loan decision. For example, commenting on the sample companies' financial condition, the judgemental loan officers stated:

--"declining position and working capital"
--"sales with a good profit margin"
--"sizeable loss for first six months -- over half of capital and stockholder advances"
--"capital adequate but no proven earnings record"

The developmental loan officers commented:

--"receivables need working"
--"this firm's problem is lack of either an aggressive collection policy or the ability to negotiate payment terms in line with their requirements"
--"current ratio low but could be controlled by term loan agreement and control on expenditures"
--"they do not have to tie up money in capital equipment."

Commenting on the sample companies' management position, the judgemental loan officers remarked:

--"I really doubt if any of them has net worth to speak of but it would be worth a try"
--"no experience in manufacturing or selling"

His developmental counterpart stated:

--"they must get a comptroller"
--"management skill can be purchased"

Discussion with technical company officials in areas that vary in their extent of technical development strongly suggest that the presence or absence of developmental loan officers may be a significant factor in determining whether or not new and young technical companies will develop and prosper in an area. Not only is the loan officer's propensity to make loans to such companies important, but his potential role as a powerful agent in encouraging the formation of a company and getting it into a managerial and financial position that will enable it to survive and grow is crucial.

A bibliography of information sources related to this presentation is available. Please write to me in Austin for details.

Thanks

## TEN / KARL H. VESPER

### Two Approaches to University Stimulation of Entrepreneurship

These comments will differ a bit from what has preceded. First, they will concern some investigations now underway and incomplete, rather than these already completed. A disadvantage of doing so is that there are not yet complete data for presentation on my topics. But an advantage is that by discussing the work now, we may be able to do some collaborating on it while it is going on. A second difference is that the work is concerned more with intervention in the process of entrepreneurship, rather than description of it.

The intervention I have in mind concerns two types to be done by the university. I would have called them two **new** approaches, but I'm not sure they are. There just isn't anybody else using them that I know about. If there are such others I would be greatful to learn of them so we could share experiences and learn faster.

Because regional circumstances appear to be important to entrepreneurial activity, I would like first to say some things about the Seattle area. It has been just over a year since I moved to the University of Washington. Before tnat, most of my life was spent in three areas where tremendous amounts of technological entrepreneurship have been going on; the Los Angeles area, the Boston area and the San Francisco area. The two universities I had worked for, Harvard and Stanford, both had going courses in New Enterprises and these drew enough students to be considered major parts of the curricula. So I was accustomed to an environment heavily laden with entrepreneurial activities and interest.

Seattle was a contrast. At the University of Washington there was no course in entrepreneurship or new enterprise management. The area has no research park. The banks are dominated by old families of the region who, in recent generations, inherited rather than created their wealth, and they have the reputation of being very conservative. None of the banks operates an SBIC, in fact, there are no active SBIC's in Seattle and no MESBICS in the state. Taxes on business are high and numerous; the state offers no financial assistance to new industry. The economy is dominated roughly equally by three industries; forest products, farming and aerospace. Only the last of these, consisting almost solely of one company, Boeing, is very technological and that company has done only a little to spawn new ventures. Even the crime in Seattle appears to be rather petty and non-innovative.

Still, there are the beginnings of new technical industry. There are a few new firms in such things as computer hardware and software, electronics, instrument manufacturers and others. The University of Washington is in town with respectable engineering and business schools which at present, do not try to discourage faculty participation in new business ventures. Admittedly, there are some people who prefer not to see new industry crop up because they prefer the area to be uncrowded and close to nature. But this can be taken as another feature favorable to technical entrepreneurship, attractive geography. (It's the only area I've lived in where I've heard unemployed people complain in despair that if they don't find jobs locally, they might have to move to California.)

Coupled with these advantages is the fact that Seattle now has the highest rate of unemployment for any major metropolitan area in the country, something over 12%. This is because all three major industries — forest products because of housing, aerospace because of government and airline spending cuts, and wheat farming because of bumper crops last year, have been hit recently. Moreover, many of the unemployed are engineers.

So it appears there are many ingredients present which should auger toward more entrepreneurship in the area. For the university professor interested in entrepreneurship, this raises the question, "What can a school do to help?" I won't try to catalog all the possibilities, but it appeared that **Initiation of Small Business** and **New Enterprises** courses to offer training and to attract students with entrepreneurial inclinations, was a logical first step. Initiation of entrepreneurship research, both to bring the university and the local business community closer together, and to learn more about the processes of entrepreneurship, so as to influence those processes, was an obvious second step. But what beyond that?

I'm going to describe two experimentation projects briefly which are now underway. Then, I will suggest how, in the future, the two may be combined for further experimentation and I will also suggest that those of us here might profitably collaborate and collectively learn by experimenting in parallel at several schools.

**Business/Engineering Student Entrepreneurial Design Projects**

A common feature of mechanical engineering departments in this country is the inclusion at senior level of a course in what is called Design or sometimes, more narrowly, Mechanical Design. It is a course somewhat analogous to the Business Policy course in schools of administration, one which students take during their final year and one in which they are supposed to apply what they learned in their preceding, more specialized courses, to do a comprehensive and creative job of formulating plans. The difference between Engineering Design and Business Policy is that the former aims to produce product fabrication plans whereas the latter produces overall business plans.

If we happen to be considering the formulation plans for a **new enterprise** to produce a **new product,** then we are dealing with entrepreneurship, and presumably, both types of plans are needed. The trouble is, engineering students are only equipped for and only have time to work on the technical aspects, and the business students similarly, can work only on the business aspects. Some new enterprises will still result. Hewlett-Packard started on a student engineering design, much to Stanford University's credit and good fortune. More recently, Go-Power Products was started by a Stanford engineering student. Many service businesses have arisen out of business student projects. But integrated technical and business plans an seldom, if ever, formulated by students in school.

A logical remedy then, would seem to be that of coupling business and engineering student planning teams, with engineers developing the

product designs and business students working on design of the enterprise. This might have the advantage not only of acquainting both categories of students with broader pictures of their respective disciplines, but perhaps it would also raise the probabilities of viable enterprises being generated.

Of course, there are difficulties with this scheme. One is that students lack the experience to go into business straight from school. I'll say more about the problem later. Another problem is that students don't have enough time to do a good plan of either product or business. In a ten-week quarter of a four-hour course for instance, a student owes only 120 hours or three full work weeks to the assignment at most.

The answer to this latter problem is to group students into teams of four to six, which should multiply the available manhours by at least two or three, even allowing for the inefficiencies introduced by having to work together. Experience has shown, moreover, that students on such projects tend to give often more than the number of hours formally demanded, so they do in fact, turn out effective work.

This sort of procedure is old stuff both in business schools and in engineering schools. What is less common is to have these two kinds of students working together on new enterprise designs, and there are at least two general ways to go about this.

The first is to have both teams working together in parallel, starting at the same time and ending at the same time. The other is to work them in parallel, with a business team doing market research to pick the best of several ideas the first quarter, and engineering team following through on product design the second quarter, and both types of teams working on implementation the third quarter, after which they might go into action during the summer.

Clearly, there are all sorts of variations on this that might be tried. And there are all sorts of problems that need solving, such as how to seek product ideas, how to divide up the profits if the report is sold or the business, if one is started. How to coordinate the two types of students between schools, arranging course credit, and so forth. I don't have answers for these yet. I am just this quarter starting to try out the approach, and I hope to try it again in spring quarter when, again, I will be teaching classes in both Engineering Design and Business Policy. After that I should be able to comment further on the effectiveness of this approach and how to deal with the problems it entails. If any of you are doing this or know of others who have, I'd be greatful to learn of it so we could swap notes.

Shapero: I tried something like this and found it was a very successful and exciting course. At our school we find that a lot of the MBA students have both bachelor degrees in engineering and also working experience in engineering. Thus, in one class there are both engineering and non-engineering students. I asked such a class to put a company together and present if for financing in a thirteen-week semester. What they did, and very elegantly, was modification of existing products.

Roberts: At M.I.T. we have problems keeping the engineers from dominating the business school because engineering is dying so rapidly they want to get into management. We could have as many as we wanted teaching business-engineering courses. We try to hold them off because, among other things, we get interested in other things than just business-engineering kinds of design.

Vesper: The idea of interdisciplinary design projects is certainly not new. And business-engineering school student collaboration tends to happen more than enough at M.I.T. But I haven't found it happening at other schools. The two departments tend to stay apart as you try to do.

**Symposium/Follow-up Stimulation of Entrepreneurship**

The second approach I would like to tell about is one I can describe in somewhat more detail because it has progressed further, but it, too, will have to run further before it can really be assessed. This approach I will choose to call Symposium/Follow-up Stimulation of Entrepreneurship.

Essentially this approach involves four steps. The first is a one-day symposium, which is open to the public at a charge of $10 per person and during which a half-dozen speakers present talks on various aspects of entrepreneurship. The second step is having each person who comes fill out a questionnaire telling about himself and his interest in entrepreneurship. The third step involves duplicating the information from these questionnaires and sending it out to all the attendees so those who came to the symposium can learn about each other and make contact with those who have common interests. Finally, the fourth step is follow-up, in which each person who indicated on his questionnaire that he wanted to start a business is contacted to find out whether he, in fact, did so and if he did not, why not. After these four steps, the cycle would be repeated with alterations based on what was learned from the follow-up.

Roberts: That is exactly what will be done in the second round of seminars on how to start your own business, being conducted by the M.I.T. Alumni Association.

Vesper: That's great. Maybe this is another subject on which we can learn from each other. I'd like briefly to describe our experience with each of these steps to date, concluding with where we are now and what we see ahead with this approach.

**The Symposium.** Six speakers made up the program of our symposium one Saturday last May, and all of them came from outside the university. Each speaker talked for about 20 minutes, after which there was another 20 minutes of questioning from the audience. Introductions were mimeographed and handed out in advance to allow maximum time for the speakers. Topics included personal experiences by two successful entrepreneurs, licensing new products by a big company representative, legal steps in company formation, by a lawyer, how to obtain financing, by the treasurer of a successful new venture, and how to go public, by a local underwriter.

During lunch, the price of which was included in the $10 admission, there was no speaker, so participants would have some opportunity to get acquainted with each other. The hypothesis operating here was that sometimes companies are germinated when two people with suitably complementary interests in that direction happen to meet. Speakers were asked to hold up their hands as they entered the dining room and then to disperse themselves among the tables so as many participants as possible could meet and talk with them. The purpose of the speakers was threefold: first, to attract to the program those interested in entrepreneurship; second, to disseminate knowledge about how to be a successful entrepreneur; and third, to stimulate or evangelize the participants toward initiating new companies.

Also during lunch each participant was handed a questionnaire which asked about himself:
1) What was his occupation?
2) What was his background?
3) Was he planning to start a company or had he already started one?
4) What help related to entrepreneurship would he like to have?
5) What could he offer others who were interested in entrepreneurship?

After about 15 minutes I began making rounds of the tables picking up these questionnaires and asking those who had not yet completed them, to please do so. By this somewhat forward method it was possible to obtain data from about 96% of the participants, a considerably higher response rate than allowing people to respond by mail or a collection box at the door would have produced.

The purpose of collecting these data was both to tell us about the participants and to tell them about each other so they could get together and hopefully form entrepreneurial conspiracies after the symposium.

**Attendees.** To attract people to the symposium several lines of communication were used, including:
1) Press releases by the University
2) Personal calls to local financial editors
3) Direct mail to about 500 people, including management consultants in the Yellow Pages and parties suggested by the SBA local office
4) Announcements to students in class (at the regular price)
5) A call to the local unemployment office

Later feedback from participants indicated that 64% learned of the symposium from direct mail and 14% from newspapers. Thus mail was apparently the best advertising method.

An additional source of publicity which should have been tried but was overlooked was the local professional engineers union. A further weakness was that the publicity did not go out until about three weeks before the symposium, which didn't leave people much time to plan on it. The symposium was scheduled for a Saturday, and those who came felt that was a good time, since it did not interfere with other jobs.

About 50 people came in addition to the speakers. The sort of things individuals told us about are illustrated in Exhibit 1, which is a page from

the compilation which we sent out subsequently to all who came. This particular page represents a sample of those who said they definitely planned to start companies.

A summary classification of all the responses appears in Exhibit 2. (see page 178) Some observations about the results are as follows:

1) Over half (56%) said they were definitely planning to start their own companies.

2) Over half were presently working for small companies. (58%) A bit over a fourth (26%) said they worked for big companies, with the remainder being students or undesignated.

3) Most of those who had already started their companies or were not planning to start them did not indicate that they had anything to offer.

4) Those who had started companies, showed slightly more inclination to express that they did need something, though there was no particular item that was clearly more needed than others.

5) Those planning to start companies tended more often to express both things they could offer (66%) and needs they had (81%)

6) Most commonly offered were product/service ideas (26% of them) with capital running next (17%).

7) Most often claimed needed was capital (33%) with people to join with (19%), advice (17%), and ideas (17%) following up.

On the face of these expressions it would seem that some people in the group should be able to join forces with each other.

1) Perhaps most interesting is the fact that 9 people said they could offer capital, while only 4 said they needed it.

2) There were 9 who said they could offer product/service ideas for only 6 who said they needed them.

3) 5 people said they wanted to join up, while 4 indicated they needed someone to join them.

4) And there were 4 who indicated they were equipped to offer counsel while 3 indicated they needed some.

Clearly, there are all sorts of reasons why many of these things won't happen. The people with capital will find reasons why those who say they need it are not really offering attractive investments. The product and service ideas of those who offer them will be judged unsuitable by those who are looking for ideas to get rich on. Those who said they want to join up will turn out to be different than the kinds of people the others, who say they need help, are looking for.

And so forth, maybe. But possibly not in every instance. Possibly some of the needs and offerings will indeed match and progress will be added to potential new enterprises. Probably, also, some of the would-be entrepreneurs will find answers to their needs elsewhere than this list, just as they might have if the symposium had not been held.

Thus we are left with a number of things to wonder about.

1) Did others perceive in the list potential alignments such as I mentioned?

2) Did people use the list to contact others on the list and explore possibilities?

3) Did any of the suggested alignments actually work out?

4) Which of those who said they difinitely planned to start new ventures actually did so?

5) If they did, how did the symposium help, how did things work out, and how could the symposium or some sort of follow-on have helped more?

6) If they did not, why didn't they, and how could the symposium or some sort of follow-on help them more? Was it the loan offer?

**Follow-up:** In quest of answers to these questions a graduate student, Mr. John Kurtz, this quarter will contact each of the symposium attendees to find out what has happened in the half year since the meeting was held. From what he learns we expect to determine our future actions, both as to whether and how the symposium is handled and also as to what further follow-up effort we apply in trying to help spawn more new ventures.

We already have obtained some feedback on the symposium itself. From a show of hands during the meeting it appeared that a great majority of those who came would like to come again this year, so we will certainly include them on our mailing list.

From a questionnaire mailed out along with the summary of questionnaire results to each participant we learned that attendees claimed the program was enjoyable and usefully instructive. They seemed to like the presentations by the lawyer on Legal Steps of Company Formation, and the company treasurer on Financial Problems of New Ventures, best. As to what we should have added to the program no two seemed to agree, so we have lots of suggestions to work on in the future. Several people said they'd like the program to add more time for depth in topics and for more discussion. Generally, people seemed to prefer personal anecdotes rather than generalizing from the speakers.

**For the Future.** Earlier I mentioned in connection with the student engineering/business design projects that a short-coming students face is lack of practical experience. Now from the roster of attendees at the symposium it appears that experience is one of the things most attendees had, only 3 of them being students and the rest being from industry. So possibly some complementary teams might be worked out by combining members from these two categories of people.

Any number of other variables might be altered in future experiments with this symposium/follow-up approach to stimulation of entrepreneurship, including the following:

1) Different speakers and/or topics in the symposium.

2) Different format — several days, or discussions, or projects.

3) Organization of follow-up "clubs."

4) Coordination of follow-up SBA or EDA services.

5) Publication of a newsletter to "keep fanning the flame."

6) More research on business opportunities of the area, such as import substitution.

7) Preparation of "incubator facilities" or arrangement for them at established companies.

Exploration of the impact of all such variables is potentially a very large job. And if the rate of experiments is limited by having only one symposium per year, then it will likely take a very long time to do this very big job. Consequently, it would seem attractive to try multiplying the number of experiments by holding them at not just one, but many schools.

You all here represent a number of schools, and my excuse for presenting this approach to you in half-baked form today is that some of you may be interested and willing to initiate symposia series like these yourselves. They should not only cost your schools nothing, but may even be capable of yielding some profit for both you and your schools, both in dollars and in goodwill, not to mention that they may be successful in spawning new enterprises and in advancing knowledge. Besides, they are really kind of fun to run, because both the speakers and the participants tend to include so many lively, stimulating and interesting characters.

So if any of you want to explore this approach further, and better yet, if any of you already know more about it than I do, I would hope we can get together during this conference and conspire about it further.

Shapero: In my course this spring I tried to get away from the typical policy course, typical design course and typical lecture by bringing reality into it. I had told the students they had 13 weeks to start a technical company, find a financial person and present it to him. Then I get out of the way. The students then moved out of the classroom to an office. This all made me an ally instead of an enemy. It struck me a little sad that it never occurred to the students after six years of college to use the library or other professors for information.

The driving function was that the students had a real deadline to meet and something other than a grade. I guaranteed them a grade, but they had to present their work to an outsider and that made a great difference. They picked off one of the biggest financial men in Texas, one I wouldn't have thought of, and now one of their companies looks like it may go on stream

for real. I only guided them on products by suggesting that they think of something that could be improved on, that it not be a consumer product and that it involve a highly technical company.

Kohl: I teach a senior-graduate economics seminar that is open to engineers. In it I've found students teaming up across disciplines — three engineers working on a NASA light plane design, took in an economics major to help plan a firm to make it. Another engineer designing a dust collector for pneumatic hammers, picked up two from economics who thought it was a good gadget to exploit.

Vesper: The test of these courses may ultimately be how many actual businesses are started from them.

Did you accompany your students on their presentation to the capital source, Al?

Shapero: No. I'd have liked to, but I didn't want to take away that entrepreneurial experience. They had to identify the man and figure out a way to approach him. I think that one experience was worth the price of the course. In class, where you try to play both sides in simulation, it's simply not the real thing and students know it. All they have to worry about is grades. But here they want very much not to look bad in front of the professional, and getting an "A" is the last thing in the world they are concerned with.

One team contacted the Korean Government in San Antonio. They traveled to San Antonio and the Koreans brought in a couple of technical specialists to do an evaluation. Another team contacted the president of one of the biggest banks in Austin, a former governor of Texas, who told the students they presented one of the best business plans he'd ever seen.

Cooper: I would suggest that in a situation like this you wouldn't really want the business started by inexperienced students.

Shapero: You can't expect to take a bunch of strangers and have them put a company together in a team. But the students did carry things farther than I expected them to. Some of them spent so much time on the course, it worried me.

Vesper: Sometimes it bothers professors in other courses, too.

Roberts: M.I.T. brings in the financial men to evaluate the students' work, rather than having the students go to them. And some of our student projects have resulted in formation of actual companies.

Vesper: What is M.I.T. planning along the lines of the Entrepreneurship Symposium I described?

Roberts: There will be a voluntary questionnaire used to gather data from which a catalogue will be prepared. It will indicate the interests of alumni, what their backgrounds are and the sorts of situations they are looking for.

When this was proposed as a seminar entitled "How to Start Your Own Business," it raised a lot of eyebrows. People said "You're stealing employees from existing companies."

The first seminar went well, though. They expected 60 people. A mailing was sent to 10 alumni classes, about 15,000 letters. At 300 applications they cut off, turning down another 100 who had sent in requests and many more who phoned in. Based on this interest, they set up other such seminars in other regions, Chicago, Washington, New York, and California. The turnout was better than for any alumni program ever run by M.I.T. before.

The sessions were two days each, with registration costs of $25 to $50, depending on local meal costs. The next round will consist of what are called "Entrepreneurial Workshop Sessions" and these will involve evening sessions once a month for around nine months. As part of that, the directory will be compiled.

Still there have been a lot of people who said "What in the world are you guys doing with something like that? And why is that appropriate for a university?"

Dooley: The semantics of this can get very sticky. In a Small Business Association of New England Sub-Committee meeting, I attended, the matter of an agenda came up and some people felt the word Entrepreneurship wasn't meaningful, outside the field of academicians. So using a mundane title like "How to Start Your Own Business," although it may turn off a few M.I.T. alumni, may not be too high a price to pay for attracting people to the meetings.

Roberts: How many universities would give approval to sponsoring on a broad basis, open to the public, a course with a name like that?

Shapero: Almost all of them.

Roberts: I doubt it.

Kohl: A variation on this occurred in Wheeling, Tennessee. With a group of local entrepreneurs who wanted to stir up more business activity, we sponsored an "Inventors' Day." We advertised by direct mail and local papers, held it at the Holiday Inn, and had speakers, including someone from the SBA and an attorney to answer questions on patents and copyrights. Anyone who had an invention in either physical or drawing form, could bring it and discuss it with others. The city manager and local industrial development man also came. Three projects took off from a one day meeting.

I believe Los Angeles hosts a similar function once a year.

Vesper: I visited such a meeting in San Francisco. Maybe some of the inventions had value, but some where dusty contraptions that had been hauled out year after year. Some of them were hilarious.

Shapero: That's one thing that gets in the way of some companies starting up. It's the inventor who won't let go of his product. He thinks it has a life of its own and it's going to sweep the market. Give me the entrepreneur who can work with somebody else's invention.

Bostrom: . . . and want 50% of the profits . . . .

Komives: . . . and 100% of the ownership . . . .

Vesper: That finishes my talk.

**Exhibit 1**

University of Washington
ENTREPRENEURSHIP SYMPOSIUM
May 23, 1970
**Evaluation Form**

Please complete the following evaluation as it will be of considerable help to us in planning future programs.

1. What is your opinion of the general plan of the program?

   Excellent ____
   Very good ____
   Good ____
   Fair ____
   Poor ____

2. Was the agenda too long? ____ About right? ____ Too short? ____

3. To what extent do you think you gained knowledge of entrepreneural considerations useful to you in the making of decisions concerning your present or contemplated business?

   To a great extent ____
   To some extent ____
   Little or none ____

4. Please rate each session in terms of its value to you:

SESSION:

| | Great Value | Much Value | Some Value | Little Value | No Value |
|---|---|---|---|---|---|
| 9:30 *CHALLENGES AND REWARDS*, H. M. Beatty, Jr. President, Data Planning Corp. | | | | | |
| 11:00 *NEW ENTERPRISE PROBLEMS AND ANSWERS*, James Hayes, Entrepreneurial Venture Manager | | | | | |
| 11:45 *EXPLOITING NEW PRODUCT IDEAS*, Robert T. Franzel, The Boeing Company | | | | | |
| 1:30 *LEGAL STEPS IN COMPANY FORMATION*, George Akers, Attorney-at-Law | | | | | |
| 2:00 *FINANCIAL PROBLEMS OF NEW VENTURES*, Vincent Jolivet, Vice-President of Finance, and Treasurer of Rocket Research Corporation | | | | | |
| 2:45 *GOING PUBLIC*, Robert E, Tavis, Vice-President, Hinton Jones & Co. | | | | | |
| 3:45 *PANEL DISCUSSION*, Prof. Preston LeBreton, Moderator. All Speakers | | | | | |

**Exhibit 1 (continued)**

5. Did the session leaders present enough material to provide for a stimulating discussion?

   Yes _____ No _____

6. What topics **not** covered in the sessions would you like to see included in a subsequent program?

7. How did you hear about the Entrepreneurship Symposium?

   Direct Mail _____
   Newspaper _____ ___ _____
   (name of newspaper)
   Radio _____
   Friend _____
   Other _____ Please specify _____

8. Would you be interested in attending a similar symposium next year?

   Yes _____ No _____

9. Suggestions for improving subsequent programs.

# PLANNING TO START A COMPANY

| NAME AND ADDRESS | OCCUPATION | BACKGROUND | NEED | CAN OFFER |
|---|---|---|---|---|
| Eugene R. Andrews<br>Route 7, Box 65<br>Olympia, Wash. 98501 | Employee,<br>Small Co. | National contracts--useful to establishing marketing organization | Purchase or buying into established business. Join others in establishing new business. | Financial, business and sales experience. |
| William R. Bechtel<br>15349 S. E. 42nd St.<br>Seattle, Wash. | Own Business | Housebuilder, apartment builder | Counsel, capital, contribute effort | Management, profit opportunity |
| Ralph L. Brown<br>1006 S. 206th<br>Seattle, Wash. | Employee,<br>Big Co. &<br>Student | No answer | Ideas; prefer partnership or joint venture | Design experience, high business interest, manufacturing experience, strong desire, young (31), capital |
| Wilbur F. Cosby<br>8019 Calif. Ave. S.W.<br>Seattle, Wash. | Employee,<br>Small Co. | No answer | Lots of help | No answer |
| Don M. Davis<br>1507 - 38th E.<br>Seattle, Wash. | Employee,<br>Small Co. | Associated with building industry all of life. Contracting, sales, service, management. | No answer | No answer |
| Harry Dea<br>3916 - 24th Ave. So.<br>Seattle, Wash. | System Engineer<br>& Real Estate | After much "soul searching," I strongly feel entrepreneurship/syndicator is my "thing." | Practical approach to marketing research (specifically market survery), and administration. Source of venture money, streamlined record system, systems to minimize paperwork time of entrepreneurs (small) so he can devote most of his time to more productive efforts. | All the time it takes, limited amount of money, unique product and service (consistent with "now" and abreast of times), more emphasis on human relations (employees and customers). |

1. Planning to start a company.

Exhibit 2

| NAME AND ADDRESS | OCCUPATION | BACKGROUND | NEED | CAN OFFER |
|---|---|---|---|---|
| Albert J. DeWit<br>1420 W. Lk.<br>Samm. Pkway. N.E.<br>Bellevue, Wash. | Engineer--Manufacturing-Mechanical Electronics, B.Sc. | Sales and engineering experience to embark upon an enterprise | Producing and/or distributing; marketing products for the housing industry. | Product, service, ideas |
| Donald Drew<br>161 - 131 Ave. N.E.<br>Bellevue, Wash. | Own Business, Chemical Engineer, Venture Capital, Marketing Consultant | Former National Sales Manager--consumer products, sales manager instruments. | Meeting persons wishing to form new companies. | No answer |
| C. Eldert<br>4828 N.E. 40th St.<br>Seattle, Wash. 98105 | Electrical Engineer | 18 years in digital computers | Marketing, capital | Time, product/service ideas, design |
| Jeff Ewell<br>3726 E. Madison<br>Seattle, Wash. | Employee, Big Co., Industrial Engineer (Mechanical with Business option) | Presently with the Boeing Co., but have "participated" for many years in sailboat racing, motorboats, power squadrons, etc. | Exchange of ideas, opportunities in marine industry (sales & service, chartering, maintenance, sightseeing, etc.) | Very interested in all aspects of the marine industry for full time investment and monetary investment (partnership) |
| William H. Featherston<br>1851 - 123rd Ave. S.E.<br>Bellevue, Wash. 98005 | Own Business, Employee, Big Co., Chemical Engineer, Materials Technology Consultant | No answer | Finance types--financial planning, when to take on, etc. (Do you have anyone that you can recommend?) | Counsel |
| Dale Fisher<br>4319 - 43rd N.E.<br>Seattle, Wash. | Electrical Engineer | Product development, marketing and long range business planning (MPLS Honeywell, Boeing) | Service ideas, marketing ideas | Time, money, service ideas |
| John L. Kurtz<br>20212 - 62nd N.E.<br>Seattle, Wash. | Student | B.A. University of Wash. Business School, army, small manufacturing, large manufacturing (Boeing), presently MBA candidate at the University of Wash. | Not at the present time, with the exception of creation of ideas that are in the small manufacturing area. | Counse' |

| NAME AND ADDRESS | OCCUPATION | BACKGROUND | NEED | CAN OFFER |
|---|---|---|---|---|
| M.D. Lefcort<br>1142 - 38th Ave.<br>Seattle, Wash. 98122 | Own Business,<br>Mechanical Engineer | No answer | People with venture capital | No |
| Gael Mulkey | Own Business | No answer | Sales people, capital, product, counsel | Products, direct sales market plan |
| Donald W. Olson<br>6216 So. 118th Pl.<br>Seattle, Wash. | Own Business | No answer | Local product availability for export purposes | Counsel aid in import-export business |
| L. H. Overholt<br>14820 Bothell Wy. N.E.<br>Seattle, Wash. | Employee, Small Co., Real Estate | No answer | No answer | No answer |
| Al Pease<br>4725 - 30th N.E.<br>Seattle, Wash. | No answer | No answer | No answer | No answer |
| Ralph Ray Peterson<br>302 N.W. 67th St.<br>Seattle, Wash. | Employee, Big Co.,<br>Student | Technical and 2 year degree foundation in electronics and a management position in food retailing. Now pursuing a degree in Industrial Management. | In process now of gathering academic ideas and deciphering into information tailored for starting a company. | See background |
| John K. Ponath<br>3200 Comanche Dr.<br>Mt. Vernon, Wash. | Employee, Big Co.,<br>Metallurgical Engineer | Metallurgical Eng. from University of Washington | Sources of capital, ideas on how to determine the probable market potential for small iron and/or steel foundry, help on how to predict the likely profit for a company with a certain sales volume | Time, money, 6 years experience as foundry metallurgist-steel castings. Firm belief that there is a need for companies that can provide service plus a product. |

| NAME AND ADDRESS | OCCUPATION | BACKGROUND | NEED | CAN OFFER |
|---|---|---|---|---|
| James T. Sereyka<br>19617 - 64th W.<br>Lynnwood, Wash. 98036 | Engineer--Mech.-Designer (Gizmo's), between ventures | 6 years as draftsman, 1½ years as engr. aide-Tech writer, 2 years ind. model maker. Probably the best color/light organ on the market. | I can set up engr-drafting system; can produce elec-mech, electronic packaging & gen. illuss. dwg's. Imaginative (allowed time for research--will do whatever is required) | Time--product/services, ideas and small production facilities--my goal is marketing for small companies. |
| Hamilton A. Smith<br>2381 W. Viewmont Wy. W.<br>Seattle, Wash. 98199 | Employee, Big Co., Aeronautical engineer, program management | Interested in a manufacturing enterprise or distributorship, either established business or newly formed. Adequate background for General Manager. | Want others to contribute effort, capital and product/service ideas, and counsel. Interested in joining with others having similar interests and goals and complementary skills | Time, money, ideas, management. |
| Slim Sommerville<br>3340 Evergreen Pt. Rd.<br>Bellevue, Wash. | Employee, Big Co., Venture Capital | In sales for 12 years; a) Tidewater Oil Co., b) Johns-Manville, c) Owens Yacht Division Brunswick Corp, d) Sales Mgr. Fairliner Division Western Boat Bldg., Corp., e) Head Ski Co. District Mgr. | 1) Legal for incorporation purposes and organizational advice, 2) accounting regarding best as well as most current methods of business organization capitolization and accounting systems, 3) advice on how and where to put your money | No answer |

| NAME AND ADDRESS | OCCUPATION | BACKGROUND | NEED | CAN OFFER |
|---|---|---|---|---|
| Mrs. Edmund Svilainis<br>2754 N.E. Ballinger Way<br>Seattle, Wash. | Own Business | Airline & aircraft maintenance background and are interested in aircraft maintenance and charter airline service, taxi service; are considering starting aircraft maintenance service. | No answer | No answer |
| John Wheeler<br>3033 - 43rd West<br>Seattle, Wash. 98199 | Student | Work experience in banking, accounting, good skiier and U. of W. M.B.A. Interested in skiing business. | Capital for projects in recreation. | Time, effort, ideas. |
| A. J. Wilkins<br>13817 N.E. 80th<br>Seattle, Wash. | Employee, Big Co. | Getting M.B.A. at Seattle University nights | Ideas, capital | Time |
| Gene D. Yount<br>6516 - 17th N.E.<br>Seattle, Wash. | Security Systems | The Company is made up of engineering and technical people - working in commercial and residential environments. | No answer | No answer |

# ALREADY STARTED A BUSINESS

| NAME AND ADDRESS | OCCUPATION | BACKGROUND | NEED | CAN OFFER |
|---|---|---|---|---|
| A. C. Behrenhoff<br>700 112th Ave. N.E.<br>Bellevue, Wash. 98004 | Own Business, General business consultant (small business sale merger/acquisition; new venture assessment and planning.) | Offering small business consulting service in Seattle area since 1960. | No answer | Assistance in seeking out and evaluating new business ventures. Financial and business planning, market development, venture capital location, etc. |
| Dwight Botkin<br>2815 Federal<br>Everett, Wash. | Employee, Small Co. | Presently General Mgr. American Ice & Cold Storage Co., Everett, M.B.A., Stanford (1953) Retired U. S. Navy Supply Corps Capt. (1964), President Granite Falls State Bank (1965-66). | Recently with 3 others formed a corp. Purpose of company is land investment, resale of land, land clearing & road construction. Corp. holds Wash. State general contractors license. Need ideas. | No answer |
| Tom Brazier<br>2608 - 27th Ave. W.<br>Seattle, Wash. | Employee, Small Co., Plastics Engineer | No answer | Financial consultation and advice. | No answer |
| Howard C. Dahl<br>6420 Nyanze Pk. Dr.<br>Tacoma, Wash. 98499 | Own Business, Mechanical Engr. | In the product development and design end of manufacturing both for a firm as an employee and self-employed. | Main thing is to bring people of various interests together--act as a forum or sounding board | Product ideas, time |
| Harry B. Dye (Mr. & Mrs.)<br>1309 N. 77th St.<br>Seattle, Wash. | Own Business, Employee Big Co., Mechanical Engr. | Business involved in sporting goods manufacture and sales--, duck hunting specialties. | Capital | Product/service ideas |
| Vernon Fisher<br>811 N.W. 60th<br>Seattle, Wash. | Own Business | Own vending co. and have growth problems | Thinking about incorporating | No answer |
| R. M. Fredell<br>543 N.E. 102nd<br>Seattle, Wash. 98125 | Own Business | No answer | No answer | No answer |

2. Already started a business.

| NAME AND ADDRESS | OCCUPATION | BACKGROUND | NEED | CAN OFFER |
|---|---|---|---|---|
| Phillip C. Linwick<br>5012 - 126 Ave. S.E.<br>Bellevue, Wash. 98006 | Own Business,<br>Mechanical Engr. | No answer | More venture capital | No answer |
| Mildred Mandeville<br>P.O. Box 525<br>Kenmore, Wash. 98028 | Own Business<br>(publisher),<br>Book Appraisal<br>Consultant | Sole owner of Price Guide Publishers--started in 1962 (publishes tools for dealers (book), book appraisers, and librarians). | No answer | No answer |
| Sharon O'Brien<br>345 - 107th S.E.<br>Bellevue, Wash. | Own Business | Home economist, taught the subject for several years, am using this experience in handling personnel and the public, and in managing the store; my partners handle business matters. Our success has been due to combined talents. | No answer | No answer |
| Hakkon Ragde<br>1570 N. 115th St.<br>Seattle, Wash. | Own Business | Systems bldg.--low & medium cost residences. | Management | No answer |
| Roger C. Teeter<br>4050 W Lake<br>Samma nish Pkwy.<br>Redmo id, Wash 98052 | Own Business,<br>Employee, Big<br>Co., Chemical<br>Engr. | No answer | Financial planning--interested in contacting any person experienced in financial planning who would like to get involved with a new mfg. co. | No answer |
| D. L. Tomlinson<br>5501 N.E. 61st<br>Seattle, Wash. | Own Business | No answer | Interested in structuring a small business for continued growth--capitalization--incorporation, advantages of public issuance | No answer |

# NOT PLANNING TO START A COMPANY

| NAME AND ADDRESS | OCCUPATION | BACKGROUND | NEED | CAN OFFER |
|---|---|---|---|---|
| Arthur Catapang<br>8018 - 40th Ave. N.E.<br>Seattle, Wash. | Student | Marketing, ground operation for transportation and engineering administration | No answer | No answer |
| Robert Field<br>8103 - 8th S.W.<br>Seattle, Wash. 98106 | Employee,<br>Small Co. | Construction machinery | No answer | No answer |
| J. H. Julien<br>110 - 128th Ave. N.E.<br>Bellevue, Wash. | Small Business development | Consulting on industrial experience | No answer | No answer |
| Ray Lindstrom<br>2441 Interlaken Blvd. E.<br>Seattle, Wash. | Student | Restaurant venture | No answer | No answer |
| J.N.<br>4502 S.W. Seattle St.<br>Seattle, Wash. | Employee,<br>Big Co. | 20 years experience local, regional, national, international | No answer | Promotion, public relations, advertising |
| Ron Sailer<br>3608 - 223 S.W.<br>Mountlake Terrace, Wash. | Employee,<br>Small Co. | No answer | Further information on capital sources | Public relations, and management training |
| Roger V. Wahlman<br>P.O. Box 1200<br>Bellevue, Wash. 98009 | No answer | No answer | No answer | No answer |
| Shoichi Yoshino<br>909 Norton Bldg.<br>Seattle, Wash. | Employee,<br>Big Co.<br>(Rep. from Japan, Nichimen Co., Inc.) | No answer | No answer | No answer |

3. Not planning to start a company.

Exhibit 4

## ELEVEN / ARCH RICHARD DOOLEY

### Graduate Student Views on Entrepreneurship and Courses on Entrepreneurship

I indeed regret that other commitments prevented me from being here to share in yesterday's activities. In a variety of ways since my arrival this morning it has been made clear to me how stimulating you found yesterday's discussions. This verifies, I think, how useful it is for those of us who are concerned with entrepreneurship in technologically based firms to have an opportunity, such as this, to share ideas on the many complex issues confronting us. Let me, therefore, add my words of appreciation to those so many of you already have expressed to the Center for Venture Management, and to Purdue University, for making this Conference possible.

Given the enthusiasm generated by the sessions thus far, the task I am now undertaking is a tactless one. For I am going to ask those of you who — like I — are committed to the **teaching** of entrepreneurship, to turn your thoughts back to home base, back to the classrooms, back to the never-fully-resolved dilemmas of the teacher.

In doing so, I am reminded of the occasion several years ago in which my wife and I, on the last evening of a brief holiday trip, found that the only accommodation available was a studio apartment equipped with a very impressive kitchenette. With the obtuseness so often associated with the male, I — really as idle conversation — commented favorably on the avacado green refrigerator and electric range, the svelte contours of the percolator and the electric toaster, and so on. These remarks generated instant frost from my good wife who — when pressed for an explanation — gave me emphatically to understand that when on temporary leave from stern reality, the last things she liked to encounter were reminders of those things from which she momentarily had escaped, and to which she soon would be returning.

To prove that one does not necessarily learn from experience, I am in essence asking the faculty-participants here today to perform the same kind of distasteful mental transition. That is, I am requesting you to return your thoughts to the classrooms from which you momentarily have escaped and to which you will be returning tomorrow. I do this solely because I am anxious to learn whether your university's recent experiences regarding student interest in courses in entrepreneurship parallel in any way those which we are having at Harvard Business School. If so, I hope to gain the benefit of your views regarding the implications of this development, and regarding the kinds of responses that should be mounted by those of us who have responsibilities for teaching courses dealing with entrepreneurship.

I must at this point note that for the first time in the many years that I have known him, I find Arnie Cooper guilty of an imprecise statement. In introducing me a few moments ago Arnie stated that I was going to describe some research conclusions. I disavow this, Arnie. I am not nearly that far along in regard to the issues which I plan to discuss with you. Instead, I'm here to share with you some very early efforts I have mounted to shed light on a problem that I am not certain I have as yet even fully defined. Final research conclusions — in any precise use of that term — are still substantially downstream. But my hopes are that your suggestions and imputs to me today will help me paddle a few strokes toward the goal.

Let me start by stating a simple fact: at the Harvard Business School we currently are experiencing a major increase in student enrollment in graduate courses dealing with entrepreneurship and with the management of small enterprise. As background, I have sketched on the blackboard diagrams and phases relating to two elective courses which currently represent the only courses in our curriculum dealing expressly and solely with small enterprise and entrepreneurship. Each course is one term[1] in length, each is included in our regular second-year course offerings for MBA condidates, each relies primarily on the study of authentic cases, and each has paticular relevance to the theme of today's seminar. The two courses are entitled:

"Management of Small Enterprises: Starting New Ventures"
(Currently taught by Assistant Professor P.R. Liles)

"Management of Small Enterprises: Operating Problems and Strategies" (Which I currently teach)

Roberts: Isn't there — or wasn't there — also some Harvard Business School Course dealing with the establishment of new enterprise? I remember once visiting a course of this type. . .

Dooley: Yes, Ed. Thank you for raising that question. It's important that for the sake of any of you — like Ed or Arnie or Karl who are familiar with, or at some prior time have shared in, Harvard Business School course offerings dealing with entrepreneurship and venture that I make it clear that the two courses to which I refer are current versions of courses which, under various other titles, have been in our MBA curriculum for quite some time. A course entitled "Management of New Enterprises" (MNE), which emphasized start-ups, was in our curriculum for perhaps 15 years, under, at various times, the leadership of a number of (present and former) faculty members including Lynn Bollinger, Ted Bradshaw, Herb Stewart and Frank Tucker. This is the course to which Ed just referred.

Similarly, a course in the operating problems of small business (predominantly those engaged in manufacturing operations) was founded some 10 to 12 years ago by the late Professor Arnold Hosmer under the title of "Small Manufacturing Enterprises" (SME). This is the course with which Arnie Cooper was so closely associated for several years. Upon Arnold's retirement, Frank Tucker assumed responsibilities for SME, continuing until 1969 when he shifted his career to the administrative sector via an appointment as one of our School's Associate Deans. At this point I was assigned responsibility for the course.

In the spring of 1970 — in an effort to impart more descriptive names to these two courses, and to clarify the close, complementary relationship between them, their titles were changed to those I noted earlier — namely, "Management of Small Enterprises: Starting New Ventures" and "Management of Small Enterprises: Operating Problems and Strategies" (MSE:OPS) and MSE:SNV).

The two courses are independent of each other in any formal sense. Second-year MBA students and doctoral candidates can elect to take

[1]A one-term course customarily entails 30 to 35 class sessions, each one hour and twenty minutes in length, plus a four-hour written final examination.

either, or both, in any sequence or simultaneously. Informally, however, Pat Liles and I strongly urge students to take " . . . Operating Problems and Strategies" first, then " . . . Starting New Ventures," on the grounds that one should acquire realistic insights into the operating problems of running a small business before giving serious thought to the possibility of starting up such an enterprise. Some students take this advice. Some don't. The overall sentiment of our School's Faculty, however, is to allow students considerable freedom of choice in the second year of the MBA. Prerequisites among second-year electives therefore are fairly rare. The two courses in question conform to this pattern.

Harvard Business School also customarily offers a third elective course which also is somewhat germane to the theme of our meeting. This is a one-term, second-year course currently entitled, "Technological Innovation." At one point, not too many years back, the title was "Managing Technological Change." The course was founded, and for many years taught, by Jim Bright who, as most of you know, has now left our Faculty and joined forces with Al Shapero and George Kozmetsky at Texas.

I exclude this particular course from my remarks today because, as its title suggests, it focuses upon technological innovation — whether that innovation takes place in a new entrepreneurial venture, or in an established small firm, or in an established medium-sized firm, or in a giant blue chip corporation, or in a governmental agency, or so on. A portion of the class sessions, of course, do deal with entrepreneurs, or owner/manager/engineers, or owner/manager/scientists, or venture capitalists, in contrast, say to heads of R & D departments in large corporations or directors of major research laboratories. But the primary objective in those instances in which the characters being studied are entrepreneurial in character, is to portray more meaningfully the nature, the risks, and the processes of technological innovation, not the nature of entrepreneurship. In short, the course has an important interface with, but is not four-square related to, the subject of technologically based venture management.

But to return to my main theme, that is of the two courses which are exclusively concerned with entrepreneurship in small or newly formed ventures, the simple fact is that at Harvard Business School both courses currently are experiencing an emphatic upward shift in student demand. Furthermore, it is an emphatic upward shift on what was already a substantial base. We are being confronted, therefore, with a problem that is large not only in relative (percentage) terms, but in terms of absolute numbers. It is a problem, therefore, having implications for such matters as numbers of sections offered, number of classrooms required, faculty manning, and so on.

Let me offer specific data. With essentially the same levels of total enrollment of second-year students (around 725), the combined total of students electing our two courses in entrepreneurship has increased as follows over the past three academic years:

| | Total Enrollment MSE:SNV (MNE) & MSE:OPS (SME) Courses | % Increase Over prior Years |
|---|---|---|
| 1968-1969 | 479 | 2.8% |
| 1969-1970 | 518 | 8.1% |
| 1970-1971 | 765* | 47.7% |

*Includes pre-registration for Spring Semester, 1971

An alternative way of measuring the increase is to note that enrollment for the current academic year (1970-1971) is some 70% in excess of average enrollment for the five-year period, 1964-1969.

Now the knowing (or should I say, the cynical) among you probably are speculating over whether there is not some simple, pragmatic explanation for these results. Isn't it likely, one may ask, that the upswing in enrollment simply reflects the fact that the courses in question recently have become "pushover" courses involving exceptionally easy workloads and/or exceptionally generous grade standards? And/or the fact that the instructors involved are particularly entertaining? And/or student belief the courses in question have particular leverage in terms of good job opportunities after graduation? And so on.

It is at this point that for the first (but not the last time) in today's presentation that I must ask you to accept my subjective judgment, since — except for the indirect evidence provided by student evaluation polls — I do not have definitive evidence on these matters. My sincere conviction, nonetheless, is that a valid explanation for the substantially increased student enrollment we are experiencing is not to be found in any of these hypotheses. I am convinced that the second-year MBA student who is looking for an "easy" course has many better alternatives than to enroll in either MSE:OPS or MSE:SNV. Student evaluation polls, although fluctuating from year-to-year both in the format used and in the conclusions reported, seem to me to substantiate this belief. Similarly, although not wishing to become cloyingly self-deprecating of myself or my faculty colleagues in these courses, my own judgments (and, I believe, the main thrust of the student evaluations) suggest that if one is seeking truly virtuoso instructors, one can do better than to elect either or both the two courses in question.

Similarly, I can see no reason to believe — indeed there seems to be to be strong evidence to challenge — the contention that these particular courses, either singly or in combination, serve as a useful bridge to attractive job offers upon graduation. On the contrary, there are substantial indications that, on our campus at least, the student who aspires to a job in small enterprise immediately upon graduation, or hopes to start his own new venture immediately, experiences extremely "lean-pickings" in contrast to the student who seeks a job in a large organization. Student requests for stepped-up efforts to locate small firms which have job openings for MBA's has long been a continuing "fact-of-life" for the Director of our Placement Office. For a number of years, in fact, our students have mounted and executed their own program to seek job opportunities in small enterprise, supplementing the efforts of the School's Placement Office.

Pursuing this process of hypothesis elimination eventually brings me face-to-face with what some may perhaps see as almost too obvious a possibility, namely that the marked upswing in enrollment in these courses dealing with small entrepreneurial enterprise may, in fact, simply reflect **a genuine, significant increase in student interest in this subject.**

Several factors prompt me to believe that this may well be the most satisfactory, the most nearly valid, explanation.

First, a number of our students are quite vocal in carrying this particular message to us.

Secondly, a steady stream of inquiries from faculty members at other institutions asking about our "MSE:OPS" and "MSE:SNV" courses, and reporting that in the face of rising student demand they are either introducing courses of this type, or giving serious thought to such a possibility, has become a commonplace occurrence.

And lastly (although I suspect none of us would give major weight to such an indicator) the number of publishers' "travelers" who express eagerness to consider manuscripts of proposed texts or casebooks on enterpreneurship suggests that the phenomenon we are experiencing at Harvard Business School is not wholly unique.

But concluding that the most meaningful explanation for increased student demand for entrepreneurial courses may well simply be increased student interest in this topic, does not provide particularly helpful information to a teacher, unless one's concept of curriculum responsibility is confined merely to seeing that the number of sections offered, and the number of enrollments recorded, are kept roughly in balance. It seems to me crucial for educators also to gain insight into what has prompted such an upswing in student interest, some feeling for its intensity, and some ideas of its implications in terms of the career aspirations of students, et cetera. Would we not agree that the implications of any pronounced shift in student interest are likely also to extend beyond the classroom, touching as well on such matters as school placement practices, the course development and research activities of faculty members, faculty recruiting efforts, and so on.

What I am going to report to you today are the results of some initial efforts I have made to seek such additional insights by gathering and analyzing certain admittedly fragmentary information regarding the views of Harvard Business School students who have elected to take one of our courses dealing with small enterprise and entrepreneurship. There is now being distributed to you a paper[2] recording some of the data I obtained earlier this year through a lengthy questionnaire given out to all Harvard MBA students (196 in number)[3] who had elected during the Fall Semester, 1969 to take the course then entitled, "Small Manufacturing Enterprises." (As noted earlier in this presentation, the course since has been retitled, "Management of Small Enterprises: Operating Problems and Strategies.")

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[2]"MBA Student Views on Entrepreneurship — A Selected Sample of Responses . . ." SME 104R (4-371-095) Copyright © by the President and Fellows of Harvard College. This appears as Appendix A to this paper.

[3]Total course enrollment was 207, including 11 cross-registered students from other divisions of Harvard University (Law School, School of Design, etc.) or from Massachusetts Institute of Technology. These non-Business School enrollees were not included in the questionnaire distribution.

Let me emphasize at the outset that the population to which the questionnaire was distributed clearly was a biased one. In no sense did the survey group represent a random cross-section of our MBA student body. Instead, distribution of the questionnaire was limited solely to students who were sufficiently interested in the management of small enterprise to devote at least one-twelfth of their normal[4] second year curriculum, and at least one-tenth of their normal quota of ten second-year electives, to a course dealing expressly with the management of small enterprise. But since the objective of the questionnaire was to gain insights as to why students made this course selection, and to gain information regarding certain of the characteristics and views of such students, a biased sample (that is, students who had made this choice) seemed to me reasonable as an initial effort at data gathering.

Since the topic was broad, my curiosity great, and my self-discipline weak, the questionnaire which I developed turned out to be long and complex. Painfully so. Specifically, it was 19 typewritten pages in length and embraced 51 questions (many of them multi-part and requiring ranked, multiple answers). Pretesting indicated that completion of the questionnaire usually required in excess of an hour. Furthermore, because of the "practical considerations" that so often complicate the scheduling of academic activities, the questionnaire was distributed during the (inevitably distraction-laden) examination period with the request that it be completed and returned early in the (inevitably busy) initial week of the ensuing term.

Please indulge me if — on intuitive rather than statistical grounds — I state my conviction that the 52.5% rate of return which occurred was remarkably good, given the scheduling handicaps under which the questionnaire labored, and the burdensome workload which it represented. Conceivably the return rate may indicate that this is a subject in which students (as well as their instructor) have considerable interest. More importantly, a 52.5% return rate enables me to treat my findings with at least some measure of seriousness, particularly in those fairly frequent instances in which extremely pronounced sentiments were revealed.

The material (Appendix A) which has been distributed to you contains responses to only a selected sample of the topics dealt with in the questionnaire. The excluded items are those which related to detailed specifics of the course (evaluations of specific assignments, specific case studies or readings, specific guest speakers, et cetera). The material which you have received does include the responses to all of the more generalized questions relating to the nature, origin and extent of student interest in this particular course and in small enterprise and entrepreneurship.

As a further prefacing remark, let me acknowledge and accept all of the reservations that can be voiced regarding the semantic fuzziness, and the room for differences of interpretation, which are present in the questionnaire. Let me note, however, that these problems were probably somewhat less severe for the responding students, and for me, than they are likely to be for you or for any other "outside group." The students and I periodically had been face-to-face in a classroom setting for a total of more than 40 hours over roughly a three-month period. Terms relating to entrepreneur-

[4]With permission, qualified students may carry more than the normal 12-course load in the second year.

ship, and to small enterprise, and to venture, et cetera, had been defined. A vocabulary had been developed. At least some basis for effective communication had been established.

For these reasons — although this is yet another area in which I have no hard evidence to support the belief — I am relatively confident that for the most part, the questionnaire results did not suffer too greatly from differences of interpretation as to the meaning or intent of individual questions. To help assure some measure of communication between us this afternoon, however, please do not hesitate to ask me to define terms or phrases used in the questionnaire and to describe what I believe — or hope — that these phrases or terms meant to the responding students in the context of the course they had just concluded.

I would hope that after you return home those of you who share my interest in this topic perhaps will wish to study the entire selected sample of questionnaire responses and write me regarding your interpretations of any or all facets of this evidence.

For the remainder of my time with you this afternoon, however, I shall deal only with a certain few responses which, it seems to me, may have particular significance. In the main, I will concentrate on questions which, it seems to me, shed light on the nature and the extent of student career interests in small venture enterprises, and on some of the implications these may have, particularly in terms of curriculum and of placement activities.

Starting with Question (1)[5], it seems to me significant that 91% of those completing the questionnaire indicated that they were at least as favorably disposed to a career in small enterprise as in large; 65% indicated that by at least a "modest margin" their career interests actually leaned in the direction of either work and/or ownership in small enterprise; and 40% saw ownership in small enterprise as being "by a significant margin" their "primary" career objectives. None rejected outright the thought of a career in small enterprise, and only 6% saw this as a "relative low" career possibility.

If, for the sake of argument, one were to argue that through some strange process not even one of our more than 600 other MBA second-year students had any interests whatsoever in career opportunities in small enterprise — that is to say that the only career interest in small enterprise present in Harvard Business School's entire second-year student body in the fall of 1969 was lodged in the 103 students who completed the questionnaire, (52% of the 196 students to whom the questionnaire was distributed) — the absolute numbers involved (41 who saw some type of career in small enterprise by at least a "significant margin" their "primary" career objective) suggest to me that matter is deserving of thoughtful attention by both faculty and administration. The implications for placement activities seems to be particularly pronounced.

Even if one accepts the (on my campus at least) frequently encountered assertion that business school students only talk of careers in small enterprise (basing their choice on romanticized notions about the simpler, less pressure-laden, less cluttered, more personalized atmosphere they

[5]The numbers used in the text correspond to the number of questions and responses shown in Appendix A.

hope would prevail in small enterprise) but "when the chips are down" actually elect the generally more available, presumably more secure and often — but not always — better-paying job offers from larger firms, it still seems to me that the numbers cannot be dismissed out of hand. If only half — or, for that matter, even one quarter — of the students expressing a career preference for small enterprise are, in fact, making a meaningful analysis of their preferences and an accurate forecast of their career strategies, the absolute number still seems to me to suggest the need for re-examination of certain of the existing emphasis in both curriculum offerings and placement practices.

Responses to Question (4) of the survey also interest me in that they suggest that one cannot validly dismiss the thrust of the student preference as being based on no exposure to "the real world" and thus possibly subject to fanciful illusions. Only 4% of the respondents had no full-time job experience in business, and roughly two-thirds had experienced at least 6 months of full-time employment in some type of enterprise. Indeed, as reflected in Question (13), a third of those responding already had engaged in an enterprise which, in their judgment, entailed some measure of personal entrepreneurial risk.

Also of possible interest to schools which are debating the appropriateness of courses in small enterprise, is the fact that even though the respondents were in the second year of a two-year graduate program in business administration and — to a considerable extent — had had some full-time work experience, some 51% concluded [see Question (5)] that prior to taking a course focused expressly on small enterprise they had not acquired "reasonable insights into the characteristics of small enterprise." And of the 38% who did feel they had previously acquired such insight, only (6% + 4% = 10%) believed that this insight had been provided by the required (first year) section of the MBA Program or by other courses taken before undertaking the MBA [see Question (6e) and (6f)].

Questions (7) and (8) turn our attention once more to the topic of whether student interest in small enterprise is likely to have any real significance in terms of the kinds of jobs actually taken upon graduation. Do students "talk" one game, but "play another" insofar as careers in small enterprise are concerned?

The evidence provided by the survey suggests to me that students perhaps are fairly realistic in recognizing the "practical considerations" which often argue against finding a position in a small firm, or the launching of an entrepreneurial venture, immediately upon concluding an M.B.A. Only 9% of the respondents expressed a certainty [see Question (7a)] that they would take a position in small enterprise immediately after completing their MBA degree. In fact, less than half, i.e., 47% [see Questions (7a), (7b), and (7c)] saw even a .5 or better probability of entering small enterprise immediately. But — and this may be particularly significant — 85% [see Question (8a), (8b), and (8c)] saw at least a .5 probability that they would take a position with a small enterprise **within the first five years following completion of their MBA studies.** Indeed 25% asserted [Question (8a)] that they felt certain on this point. Equally — perhaps even more interesting — is the fact that 91% of the respondents [Questions (10a), (10b), and (10c)] saw a .5 or better probability that **sometime** in their business career, they would be the owner/manager of a small enterprise.

In this context it is interesting to speculate that those who dismiss student expressions of interest in small enterprise on the grounds that relatively few of them take jobs with such firms **immediately** upon graduating from the MBA Program, possibly may be viewing the issue from a more circumscribed time-frame than many students themselves employ in thinking about career interests (and assessing career opportunities). The results of my questionnaire suggest that significant numbers of students — probably due, in large part, to an awareness, and an acceptance, of the patterns of job offers customarily generated by university placement offices — acknowledge that jobs in small enterprise are likely to be rare immediately upon graduation. Many, however, apparently have a firm determination — and expectation — to make careers in small enterprise their medium-range, or long-range goal.

Continuing on the topic of career goals, also perhaps deserving of thoughtful attention are the indications [as reflected in Questions (32), (33), (34), and (35)] that significant numbers of students (58%) see a .8 or better probability that immediately upon completion of the MBA they would take an "otherwise in all respects attractive" job opportunity in a small enterprise even if it entailed a less than [MBA] average starting salary. Indeed, roughly one third (16% + 8% + 7% + 3% = 34%) of the entire respondent group indicated a willingness to incur a salary **loss of 20% or more,** in order to join a smaller firm [see Questions (33c) through (33f)]. And an overwhelming 88% indicated that the willingness to accept a lower salary would be strengthened by reasonable prospects of eventually acquiring some realistic equity position with the firm — 58% stating, in fact, that possible equity opportunities would have "an extremely pronounced influence."

Here it seems to me, is interesting grist for the mills of those who contend that it is futile for the smaller size firm to recuit from the MBA ranks unless it is prepared to match the starting salaries offered by "blue chip" employers.

In terms of curriculum implications, it seems to me that the responses to various of the questions deserve thoughtful faculty attention, not merely at my own campus, but perhaps at others. A decisive 94% of the students who had taken a (largely case-study oriented) course dealing expressly with small enterprise carried away the conviction [see Question (19)] that the characteristics and atmosphere of small enterprise were significantly distinctive from those prevailing in large enterprise, and 83% believed that the other MBA courses they had taken had not provided adequate coverage of these differences. Some indication of the depths of these feelings may be imputed from the fact that over three-fourths of the respondents indicated [Questions (21) and (22)] that they planned to take the other elective course expressly relating to entrepreneurship and small enterprises, or would have done so had heavy enrollment not already filled all vacancies in that course.

Some 41% of those who were going (or wished) to take a second course in the small enterprise area indicated [see Question (23)] that there was a .8 or better probability that they would have taken a third elective had such a course been available; 11% indicated [see Question (24)] that they would have taken a fourth elective; 21% indicated [see Question (25)] that they would have concentrated in small enterprise had such a concentration been available. Furthermore, some 54% of the total respondent group indicated [see Question (26)] that they would direct their required second-year research report requirement (equivalent to a one-term course) toward the field of small enterprise.

Dooley: (in response to a question) I cannot, of course, make direct comparisons with patterns in other schools on which I have no data, but I feel it would be seriously incorrect to assume that significant numbers of our MBAs at Harvard Business School are free of any immediate financial pressures and therefore can easily afford to contemplate the possibly higher risks and/or (at least initially) lower financial rewards that might be entailed by a move into small enterprise or into a small venture situation.

A major goal of Harvard Business School for several decades now has been to assure that an extensive program of financial assistance — in the form of loans or scholarships or fellowships — will be available to permit all students who are admitted to pursue the MBA degree regardless of their personal financial resources. I do not have the exact figures with me, but in the typical year something in excess of 50% of our students are in fact receiving some form of financial aid.

One modest piece of evidence on this point is revealed in Question (36a). Only 29% of the students indicated that they would be in a position to invest any sum of money in an attractive small business opportunity immediately upon graduation, and only 3% indicated [Question (37c), (37d), and (37e)] that their investment capability would be in excess of $25,000. In short, I think it would be misleading in the extreme to try to interpret any of the questionnaire results in terms of HBS being a mecca of "rich students."

The specific questions to which I have referred represent, of course, only a small fraction of the questionnaire. But rather than continue to direct attention to my findings, let me at this point request your inputs. What are the experiences at your schools in regard to student demands for courses dealing with small enterprise and with venture management? Do they in any way parallel the experiences I have just described?

[Ensuing discussion participated in by, among others, Cooper, Kohl, Roberts, Shapero and Vesper, indicated somewhat comparable situations on their respective campuses, characterized by evidences of strong student interest in and enthusiasm for courses dealing with small enterprise and with entrepreneurial ventures.]

## APPENDIX A

Harvard Business School

4-371-095
SME 104R

MBA STUDENT VIEWS ON ENTREPRENEURSHIP
AND ON COURSES ON ENTREPRENEURSHIP

(A Selected Sample of Responses to MBA Student Questionnaire
Small Manufacturing Enterprise Course
Harvard Graduate School of Business Administration,
December 1969)

A. **Population and Questionnaire Response:**

| | |
|---|---|
| Total Course Enrollment (including cross-registrants from other HBS Programs, other Harvard Schools, and other Boston area Universities) | 207 |
| less Cross-Registrants | 11 |
| Total MBA Enrollment<br>Total Questionnaires Distributed | 196 |
| Total Questionnaires Returned | 103 |
| % Questionnaires Returned | 52.5% |

B. **Basis of Selecting Responses for Inclusion in this Sample**

The only questions omitted from this sample are those that dealt with specifics of the SME Course (ratings of various educational materials used in the course; evaluations of written assignments and of subject mix; et cetera).

C. **Selected Sample of Responses***

(1) Please indicate which of the following statements most nearly portrays your career interest in small enterprises:

| | |
|---|---|
| (1a) An ownership position in small enterprise is, by a significant margin, my primary career objective. | 40% |
| (1b) Work (although not necessarily an ownership position) in small enterprise is, by a significant margin, my primary career objective. | 5% |
| (1c) Work and/or an ownership position in small enterprise is, by a modest margin, my primary career objective. | 20% |
| (1d) I am equally open to career opportunities in either small enterprises or in larger enterprises. | 26% |

*Note Unless stated to the contrary, the percentage shown opposite the various responses will be percent of the total respondent group, rather than percent of any subset of that respondent group (for example, the subset answering "yes" or "no" to a preceding question).

(1e) While not beyond consideration, work and/or an ownership position in small enterprise is relatively low in my ordering of career objectives. 6%

(1f) It is almost certain that my career plans will not include work and/or an ownership position in small enterprise. 0%

(1g) I have not yet formulated an opinion regarding the role, if any, of small enterprise in my career objectives. 2%

Non-Replying 1%

* * * * *

*(3) Please rank (#1 = highest priority; #6 = lowest priority) which of the following factors prompted your decision to take or audit SME. (Rank only as many subheadings as you feel are relevant to your situation.)

Model Ranking

(3a) A definite career interest in entering small enterprise 1

(3b) A possible career interest in entering small enterprise 2

(3c) A desire to gain increased understanding of small enterprise to assist my career interest in **other** forms of enterprise (for example, in financial institutions or consulting firms, or large suppliers, or large customers, etc.) which have dealings with small enterprise. 3

(3d) A desire to include a general management course in your second-year program 4

(3e) Other (please specify) (21 additional factors were mentioned by respondents 4

(3f) Other (please specify) (7 additional factors were mentioned by respondents. Those mentioned largely paralleled the factors cited in (3e) above.) 1 and 6

**(4) Please indicate your prior business experience (check more than one blank if appropriate):

(4a) Part-time and/or summer vacation jobs and/or short-term (less than 6 months) assignments in one or more small enterprises. 39%

(4b) Part-time and/or summer vacation jobs and/or short-term (less than 6 months) assignments in one or more large or medium sized enterprises. 38%

---

*Statistical analysis of responses is still in process

**More than one answer per respondent results in total exceeding 100%

(4c) Six or more months of full-time employment in one or more small enterprises. 17%

(4d) Six or more months of full-time employment in one or more large or medium sized enterprises. 47%

(4e) None of the above 4%

(5) Prior to enrolling in this course, do you feel that you had acquired reasonable insights into the characteristics of small enterprise?

(5a) Yes 38%
(5b) No 51%
(5c) Uncertain 10%
Non-Reply 1%

(6) If your answer to Question #5 was "Yes," please indicate, by checking the appropriate blank, the source of your insights into the characteristics of small enterprise. (Check one or more blanks if applicable.)

(6a) Through the business activities of my family or close friends 17%

(6b) Through part-time jobs in one or more small enterprise 15%

(6c) Through full-time employment (including full-time summer jobs) with one or more small enterprises 8%

(6d) Through work with large organization (accounting firm, consultant, etc.) which placed you closely in touch with small enterprise 1%

(6e) Through courses taken in other educational institutions before coming to HBS 4%

(6f) Through first-year MBA courses at HBS 6%

(6g) Other (please specify) _____

_____

(7) In terms of the career goals you will endeavor to achieve, what is your best estimate of the probability that you will be working full-time for a small enterprise (either as an employee or as owner) as your **first** business position after completing your studies at HBS?

| | Probability | |
|---|---|---|
| (7a) | 1.0 | 9% |
| (7b) | 0.9 to 0.6 | 20% |
| (7c) | 0.5 | 18% |
| (7d) | 0.4 to 0.1 | 37% |
| (7e) | 0.0 | 12% |
| (7f) | Cannot Estimate | 2% |
| | Non-Reply | 2% |

(8) In terms of the career goals you will endeavor to achieve, what is best estimate of the probability that you will be working full-time for a small enterprise (either employee or as a full or partial owner) within the **first five years** of your post-HBS business career?

| | Probability | |
|---|---|---|
| (8a) | 1.0 | 25% |
| (8b) | 0.9 to 0.6 | 40% |
| (8c) | 0.5 | 20% |
| (8d) | 0.4 to 0.1 | 9% |
| (8e) | 0.0 | 3% |
| (8f) | Cannot Estimate | 1% |
| | Non-Reply | 2% |

(9) In terms of the career goals you will endeavor to achieve, what is your best estimate of the probability that you will work full-time for a small enterprise (**either** as an employee or as a full or partial owner) **sometime** during your post-HBS business career?

| | Probability | |
|---|---|---|
| (9a) | 1.0 | 48% |
| (9b) | 0.9 to 0.6 | 39% |
| (9c) | 0.5 | 8% |
| (9d) | 0.4 to 0.1 | 2% |
| (9e) | 0.0 | — |
| (9f) | Cannot Estimate | 1% |
| | Non-Reply | 2% |

(10) In terms of the career goals you will endeavor to achieve, what is your best estimate of the probability that you will be the **owner/manager** of a small enterprise sometime during your post-HBS business career? (In answering this question please define an owner/manager as being the individual who exercises control over the enterprise, regardless of whether or not his equity represents 51% or more of the voting shares outstanding.)

| | Probability | |
|---|---|---|
| (10a) | 1.0 | 31% |
| (10b) | 0.9 to 0.6 | 47% |
| (10c) | 0.5 | 13% |
| (10d) | 0.4 to 0.1 | 5% |
| (10e) | 0.0 | 1% |
| (10f) | Cannot Estimate | 2% |
| | Non-Reply | 2% |

(11) If you do have some degree of career interest in small enterprises, please indicate the relative weight (#1 = highest weight, #4 = lowest weight) which you assign to the following considerations:

Modal Rankings

(11a) A belief that a successful career in small enterprise probably would provide a more personalized environment for a business career than could be found in a larger enterprise. 3

(11b) A belief that a successful career in small enterprise probably would provide greater intellectual challenge and opportunities for professional self development than could be found in a larger enterprise. 4

(11c) A belief that a successful career in small enterprise probably would provide greater satisfactions than could be found in a larger enterprise. 1

(11d) A belief that a successful career in small enterprise probably would provide greater opportunity for economic rewards than could be found in a larger enterprise. 2

(12) One definition of "entrepreneur" is, "one who assumes the economic risk for business ventures . . . ." Please indicate -- as an admittedly difficult exercise in introspection -- your self-evaluation of your "entrepreneurial index" on the following (admittedly crude) three-point scale:

"I believe that I am:

(12a) Highly entrepreneurial (that is, in my business career I probably will be willing to incur significant economic risk in exchange for the possibility of high economic rewards); or 30%

(12b) Moderately entrepreneurial (that is, in my business career I probably will be willing to incur only moderate economic risk in exchange for moderate, but relatively certain, economic rewards): or 55%

(12c) Essentially non-entrepreneurial (that is, in my business career I probably will place higher premium on economic security than on the possible achievement of increased economic rewards as a result of moderate or significant economic risk). 13%

Non-Reply 2%

(13) Are you now, or have you ever in the past, engaged in an enterprise which involved personal entrepreneurial risk for you?

(13a) Yes 33%
(13b) No 62%
(13c) Uncertain 3%
Non-Reply 2%

* * * * * *

(16) In your judgment has this course had any significant influence on your definition of career goals?

(16a) Yes 76%
(16b) No 17%
(16c) Uncertain 7%
Non-Reply 1%

(17) If your answer to Question #16 is "Yes," please indicate which, if any, of the following statements comes reasonably close to defining the nature of the influence exerted.

"This course":

(17a) Strengthened my already strong inclination to seek a career in small enterprise 43%

(17b) Lead me, for the first time, to give serious consideration to the possibility of seeking a career in small enterprise 17%

(17c) Lead me, for the first time, to a decision **not** to give serious consideration to the possibility of seeking a career in small enterprise 1%

(17d) Strengthened my already stong inclination **not** to seek a career in small enterprise —

(17e) Other (please specify) _____ 17%

Non-Reply 22%

(18) Case studies relating to small enterprise situations are included in varying degrees in each of the first-year courses, in Business Policy, and in a variety of second-year electives focused on topics other than small enterprises. Based on your experience to date, is it your judgment that these treatments, exclusive of electives (such as SME and MNE) which deal expressly with small enterprises, provide adequate coverage of the characteristics and atmosphere of small enterprise?

| | |
|---|---|
| (18a) | Yes 10% |
| (18b) | No 83% |
| (18c) | Uncertain 6% |
| | Non-Reply 2% |

(19) Do you believe that the characteristics and atmosphere of small enterprise tend to be significantly distinctive from those that prevail in larger enterprise?

| | |
|---|---|
| (19a) | Yes 94% |
| (19b) | No 4% |
| (19c) | Uncertain — |
| | Non-Reply 2% |

(20) If your answer to Question #19 is "Yes," do you believe that the distinctive characteristics of small enterprise are sufficiently pronounced to deserve the availability of MBA electives dealing exclusively with management of small enterprise?

| | |
|---|---|
| (20a) | Yes 91% |
| (20b) | No 1% |
| (20c) | Uncertain 2% |

(21) Are you going to take the [other available elective in the field of small enterprises]?

| | |
|---|---|
| (21a) | Yes 61% |
| (21b) | No 31% |
| (21c) | Uncertain 6% |
| | Non-Reply 2% |

(22) If your answer to Question #21 is "No," would you have taken [this elective] if the two sections were not already filled?

| | |
|---|---|
| (22a) | Yes 16% |
| (22b) | No 13% |
| (22c) | Uncertain 2% |

(23) If your answer to Question #21 or #22 was "Yes," is there a significant probability (arbitrarily assumed to be 0.8 or better) that you would have taken a **third** elective course in the management of small enterprises were it available? (Assume reasonably competent instruction, relevant subject matter and course material, etc.)

| | |
|---|---|
| (23a) | Yes 41% |
| (23b) | No 23% |
| (23c) | Uncertain 17% |
| | Non-Reply 18% |

(24) . . . a 4th elective course?

| | |
|---|---|
| (24a) | Yes 11% |
| (24b) | No 49% |
| (24c) | Uncertain 21% |
| | Non-Reply 18% |

(25) . . . a small enterprise concentration if it entailed a minimum of three small enterprise courses plus the Major Research Report?

| | |
|---|---|
| (25a) | Yes 21% |
| (25b) | No 29% |
| (25c) | Uncertain 30% |
| | Non-Reply 19% |

(26) Is your Major Research Report Requirement[1] in the Spring Term going to deal with a small enterprise situation?

| | |
|---|---|
| (26a) | Yes 54% |
| (26b) | No 31% |
| (26c) | Uncertain 10% |
| | Non-Reply 4% |

(27) If the opportunity presents itself, will you interview for a job in small enterprise?

| | |
|---|---|
| (27a) | Yes 78% |
| (27b) | No 9% |
| (27c) | Uncertain 6% |
| | Non-Reply 8% |

(28) Are you seeking, or do you plan to seek, through your **independent efforts**, to find job opportunities in small enterprises (that is, opportunities not provided by the HBS Placement Office or by SBOIC)?[2]

| | |
|---|---|
| (28a) | Yes 65% |
| (28b) | No 20% |
| (28c) | Uncertain 10% |
| | Non-Reply 5% |

[1]Note: The Major Research Report, a requirement of the last term of the MBA Program, is equivalent to a one-term course.

[2]A student-sponsored placement activity specializing in opportunities in small enterprise.

(29) Based on evidence to date, do you anticipate that the number of small enterprise job opportunities available through the HBS Placement Office will be proportional to the MBA student body's interest in careers in small enterprises?

| | |
|---|---|
| (29a) | Yes 4% |
| (29b) | No 71% |
| (29c) | Uncertain 21% |
| | Non-Reply 4% |

(30) If your answer to Question #29 is "No," do you believe that the efforts of the SBOIC adequately fill the deficit which you believe exists in small enterprises job opportunities available through the HBS Placement effort?

| | |
|---|---|
| (30a) | Yes 15% |
| (30b) | No 30% |
| (30c) | Uncertain 37% |
| | Non-Reply 19% |

(31) Are you using the job placement services of SBOIC?*

| | |
|---|---|
| (31a) | Yes 50% |
| (31b) | No 46% |
| (31c) | Uncertain 2% |
| | Non-Reply 3% |

(32) is there any "significant probability" (arbitrarily placed at 0.8 or better) that as your first position after leaving HBS you would accept an otherwise in-all-respects attractive job opportunity in a small enterprise if the firm felt (rightly or wrongly) that it **could not** match the average annual salary (plus fringe benefits) then prevailing for MBA graduates? (Rule out the possibility that other significant plus-factors — such as being married to the owner's daughter, or being due to inherit controlling interest in the firm at the age of 28, or having been offered lavish stock options — significantly altered the facts of the situation.)

| | |
|---|---|
| (32a) | Yes 58% |
| (32b) | No 26% |
| (32c) | Uncertain 11% |
| | Non-Reply 5% |

*SBOIC is an independent student-sponsored, student-managed job placement activity emphasizing job opportunities in small enterprise.

(33) If your answer to Question #32 was "Yes," please give your best estimate of the level at which the deficit between the annual salary offer (plus fringe benefits) of a small enterprise and the average starting salary (plus fringe benefits) for HBS MBA graduates would become too great for you to accept an offer from a small enterprise (Assume that the HBS average annual starting salary = $15,000 cash + the equivalent of $3,000 in fringe benefits = $18,000 effective total).

| | Level at Which Deficit in Annual Salary (plus Fringe Benefits) Would Become Prohibitive | Check One |
|---|---|---|
| (33a) | 5% (i.e., $900) | 1% |
| (33b) | 10% (i.e., $1,800) | 10% |
| (33c) | 20% (i.e., $3,600) | 16% |
| (33d) | 25% (i.e., $4,500) | 8% |
| (33e) | 33-1/3% (i.e., $6,000) | 7% |
| (33f) | Over 33-1/3% | 3% |
| | Non-Reply | 19% |

Note: 6 respondents who answered question (32) as "Uncertain," responded to question (33). Their responses are included in the percentages shown above.

(34) Would the presence of some reasonable prospects of acquiring a realistic equity position in the firm — assuming that your relationship with the organization proved mutually satisfactory — have influenced your answer to Questions #32 and 33?

| | | |
|---|---|---|
| (34a) | Yes | 86% |
| (34b) | No | 10% |
| (34c) | Uncertain | 2% |
| | Non-Reply | 3% |

(35) If your answer to Question #34 was "Yes," please indicate the relative influence which the possibility of eventually acquiring an equity position would have upon your evaluation of a job opportunity.

| | | |
|---|---|---|
| (35a) | Extremely pronounced influence | 58% |
| (35b) | Moderately pronounced influence | 26% |
| (35c) | Minor influence | 4% |
| | Non-Reply | 12% |

(36) (Optional) Assuming that an attractive opportunity were to present itself to you, would you be in a position to invest in a small enterprise (new or established) immediately upon completing your studies at HBS?

| | | |
|---|---|---|
| (36a) | Yes | 29% |
| (36b) | No | 62% |
| (36c) | Uncertain | 5% |
| | Non-Reply | 4% |

(37) (Optional) If your answer to Question #36 is "Yes," please indicate the approximate level of your investment capabilities:

| | |
|---|---|
| (37a) less than $10,000 | 15% |
| (37b) $10,000 to $24,999 | 10% |
| (37c) $25,000 to 49,999 | 2% |
| (37d) $50,000 to $99,999 | — |
| (37e) Over $100,000 | 1% |

* * * * *

(49) Please indicate your judgment regarding the number of SME classes which should be devoted to presentation by guest speakers (Assume a total of 33 classes available.)*

| | |
|---|---|
| (49a) one class | 2% |
| (49b) two classes | 1% |
| (49c) three classes | 13% |
| (49d) four classes | 17% |
| (49e) five classes | 33% |
| (49f) six to ten classes | 34% |
| (49g) more than 10 classes | 3% |

*Note: Five classes had been devoted to guest speakers during the term just concluded. Two respondents gave two answers. Hence total is in excess of 100%

## TWELVE / JOHN L. KOMIVES

### A Preliminary Study of the Personal Values of High Technology Entrepreneurs

#### Introduction

This paper is a very brief report of some psychological testing data which I obtained on 20 high technology entrepreneurs living and working in the greater Palo Alto area. I obtained their names and credentials from Arnie Cooper as a result of his study in that same area. I was motivated not only by the fact that such a group was available for analysis, but also by the dearth of testing data on entrepreneurs in general. Of course, I was interested in the ultimate question of how, in what way and to what extent do entrepreneurs differ from the usual test norms in our society. After some discussion with Dr. Thomas Harrell at Stanford University and Dr. William Roche here in Milwaukee (who is an industrial psychology consultant and a test advocate), I settled for the following battery. As will be reported in greater detail later on, the tests did discriminate in some useful manner and could be helpful for analyzing relative success patterns within the entrepreneurial group itself, but also to help distinguish entrepreneurs from a normative group of adult males.

**Typical Characteristics of Sample.**
Masters degree, more usually in hard science, (although all had hard science bachelors degrees, some had masters in business administration and/or engineering), age at starting the enterprise averaged 34, but all had started their enterprises in the 1960s thus none were over 40 years of age at test time. Our records are not exactly complete, but all seemed to be married and had families to support. Most were single entrepreneurs, whereas a more normal sample should have included entrepreneurial groups of 2, 3, or 4 men. The companies were relatively successful having survived several years at the time of the tests. There were no females in this sample. Of the 96 batteries sent out, The Center received 20 protocols. Of these 15 were absolutely complete and the remaining 5 were in some way incomplete. We reported as many as possible for each of the three tests.

#### Description of the Tests

The "Study of Values" by Allport-Vernon Lindzey, and "Study of Interpersonal Values" and "Study of Personal Values" by Leonard Gordon were used in the battery. All are paper and pencil, untimed and the Study of Values is self scoring (in fact 13 responses were scored before being returned). The Study of Values has 6 categories — Theoretical, Economic, Aesthetic, Social, Political and Religious. Profiles for college-trained males have been standardized and our entrepreneurial group was compared against this norm. The Gordon test of Interpersonal Values used the following 6 categories, Support, Conformity, Recognition, Independence, Benevolence and Leadership. This and the next Gordon test are forced choice in the sense that the subject picks a statement from a triad of statements which he felt was most important to him and which was least important, and scores were compared to college-trained industrial males. Similarily, the Study of Personal Values had the following 6 categories — Practical Mindedness, Achievement, Variety, Decisiveness, Orderliness and Goal Orientation. Similar normative evaluations were made.

**Additional Comments**

The names of the subjects were culled at random from the list supplied by Arnold Cooper. The 96 names were sent a letter indicating the nature of the research project, how their names were obtained, and requested that they individually take 45-50 minutes in private and complete the enclosed battery of tests. A self-addressed stamped envelope was included for returning the test battery. All were asked to read the simple instructions on the cover of each test and to follow these instructions. Of the unusable tests returned, only a problem of incompleteness occured, otherwise all followed the instructions.

**Discussion of "Study of Values" (Exhibit 1 and 2 pages 210 and 211)**

The normal range of theoretical values for the average population is 43. "N" is 16 here — turned out theoretical was 48 on the average — the range for this group of 16 high-technology entrepreneurs range from a high of 59 to a low of 37. The number that were tied or over the norm were 12 of the 16 that were higher than the norm of **43.** There were 2 of these that were tied with the norm so there were 10 higher than the 43.

The normal range is 39 — 49. There were 7 scoring on the theoretical score higher than that range 1 and score was lower than the range. In terms of the extremes 5 scored higher than the extreme. One of the conclusions that I come to is that the theoretical measurement here is a pretty strong indicator of a high-technology entrepreneur.

The Economic score was 41.2, as compared to the norm of 42 for the total population. Don't forget that I am only dealing with 16 so it may be distorted. The range was 62 high, 15 low which is exceedingly low. There were 10 tied or over 42, 8 over the norm and 2 tied. The normal range 37 — 48, there was one that was higher, two that were lower, that one that was higher in that range was also higher than the extreme range, which is 62. And one was lower. — The economic scale of the "Study of Values" doesn't seem to tell you anything about separating entrepreneurs from the average population.

On the Aesthetic Scale — 35 is the average for the American male and 45.2 is the average for this group. — 68 was the high — 33 the low — the spread was 35 points. 14 of the 16 tied with 45.2 or higher. The normal range of scores is 29 — 41 and ten entrepreneurs scored higher than the range, 6 higher than the extreme range. From what I can see of this test, this is the most meaningful indicator of a high technology entrepreneur.

Shapero: I'm not surprised, this is a creative thing . . . creating a company. . .

Komives: You're right — it didn't surprise me either, but you know, if we can test for aesthetic values here — then we might be able to predict successful entrepreneurs.

Draheim: Will you be able to predict it on a cleaner basis — the higher the score, the more successful are these guys?

Komives: I tried to do that with Arnie's data here during the conference because I have all of these protocols coded and I have their names, and it turns out that it doesn't work. The ones that Arnie could remember that he could identify as being more successful — don't show up higher on my

scoring. But, I don't have the measures of success other than what Arnie felt was highly successful. This should be worthwhile for some future research.

The Social score shows a little lower range 45 — 21. 7 were tied or over the norm and the range is 32 — 42. 3 were above and 5 were below. On the extreme range — nobody was above the extreme range but 2 were below.

I really thought Political scores might be higher because there is a lot of governmental contract dealing and the flow of governmental activity affects these people. I don't find it too high. 8 over the 50%. 2 are above the range and 6 are below the range and 2 above the extreme range and 3 below. In other words there is a real variation. They are all over the map, some of them highly political, and some very low!

Religious comes as no surprise. By the way, the religious measurement here is not in terms of formalized religion. The questions are asked really in terms of belief in God and general religious beliefs, etc. It turns out that the scores are very low. The norm scores for males range between 32 — 44. 11 scored below the range, 6 below the extreme range. So you could argue that a good high-technology entrepreneur is low in the religious values as measured by this particular test.

Roberts: Did you happen to incidentally ask them what their formal religion was?

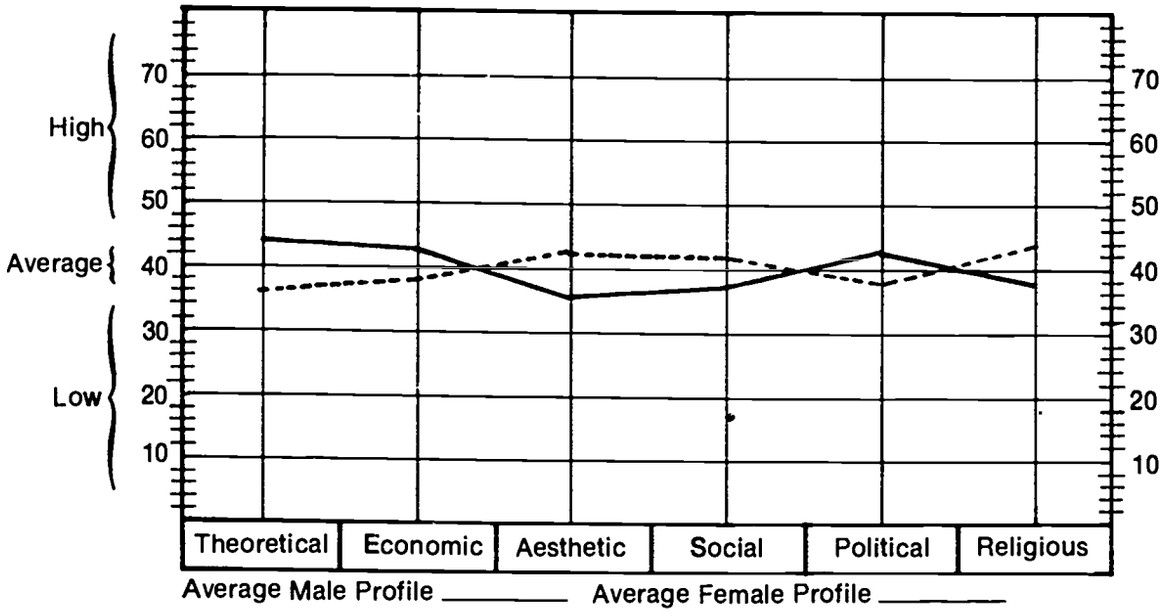
Komives: No, I did not ask them anything other than to fill out these tests and send it back in an anonymous fashion, and I did tell them that I had coded the test so that I knew who they were when they sent it back. I didn't try to hide that.

Roberts: I just wonder if the bias in the religious values thing is merely reflecting the makeup of the religious backgrounds of the groups that you have.

It might be of the assumption that you're comparing it against some national average scale, and I don't know that this is relevant. I can't respond to your observation. I don't know.

Exhibit 1

## PROFILE OF VALUES




### INTERPRETATION

The profile can best interpreted if the scores obtained are compared with the following ranges. (Detailed norms for college students and for certain occupations will be found in the *Manual of Directions.)*

**Men**

High and low scores. A score on one of the values may be considered definitely high or low if it falls outside the following limits. Such scores exceed the range of 50% of all *male* scores on that value.

| | | | |
|---|---|---|---|
| *Theoretical* | 39-49 | *Social* | 32-42 |
| *Economic* | 37-48 | *Political* | 38-47 |
| *Aesthetic* | 29-41 | *Religious* | 32-44 |

Outstandingly high and low scores. A score on one of the values may be considered very distinctive if it is higher or lower than the following limits. Such scores fall outside the range of 82% of all *male* scores for that value.

| | | | |
|---|---|---|---|
| *Theoretical* | 34-54 | *Social* | 28-47 |
| *Economic* | 32-53 | *Political* | 34-52 |
| *Aesthetic* | 24-47 | *Religious* | 26-51 |

**Study of Values**

| Item | Theoretical | Economic | Aesthetic | Social | Political | Religious |
|---|---|---|---|---|---|---|
| Test Norm Male | 43 | 42 | 35 | 38 | 42 | 37 |
| Group Avg. (N=16) | 48 | 41.2 | 45.2 | 35.5 | 41 | 29 |
| N-Tied or over norm | 12 | 10 | 14 | 7 | 8 | 3 |
| N-Tied w/norm | 2 | 2 | 1 | 1 | 3 | 0 |
| Hi-Lo Norm Range (men) | 49—39 | 48—37 | 41—29 | 42—32 | 47—38 | 44—32 |
| Protocol Range ← Hi Lo → | 59 (22) 37 | 62 (47) 15 | 68 (35) 33 | 45 (24) 21 | 60 (28) 32 | 47 (34) 13 |
| Scores Higher than range | 7 | 1 | 10 | 3 | 2 | 1 |
| Scores Lower than range | 1 | 2 | 0 | 5 | 6 | 11 |
| Extreme Hi-Lo Norm Range | 54—34 | 53—32 | 47—24 | 47—28 | 52—34 | 51—26 |
| Scores Higher than extreme range | 5 | 1 | 6 | 0 | 2 | 0 |
| Scores Lower than extreme range | 0 | 1 | 0 | 2 | 3 | 6 |

Conclusion — Hi Aesthetic + Hi Theoretical + Low Religious earmark/Entrepreneur as measured by this test.

Observation — Economic does not distinguish entrepreneur from original male population norm.
— Political (seems to show but not heavily).

Exhibit 2

**Discussion of "Survey of Interpersonal Values"**

I know that we are running out of time here, but there are 2 more tests that I'd like to explore with you in the few minutes we have remaining.

A couple of interesting observations about the scores on these scales. First of all, N=16 high tech entrepreneurs. Thus there is a great possibility for distortion. Secondly, the test norms themselves were made against 1075 college men. I can't tell whether that's a good norm to measure these entrepreneurs against or not.

But it you accept this measure, then the measure for Leadership becomes very significant for identifying entrepreneurs. Secondly, and I was surprised at this, the scale marked Benevolence is next best. I would have guessed that Independence would have been markedly higher but evidently this particular group of entrepreneurs, because of their training and types of organizations and needs, in high technology enterprises, evidentally express high values for benevolence.

**Survey of Interpersonal Values (Exhibit 3 page 238)**

**Description taken from Test Manual**

In personality assessment, an individual may be described by what he characteristically does in particular situations, that is, in terms of the **traits** that typify his behavior. In addition, he may be described in terms of his basic motivational patterns, or the **values** that he holds. In understanding the individual, both types of measures are important.

A person's values may determine to a large degree what he does or how well he performs. His immediate decisions and his life goals are influenced, consciously or unconsciously, by his value systems. His personal satisfaction is dependent to a large extent upon the degree to which his value systems can find expression in everyday life. The presence of strong, incompatible values within the individual, or conflict between his values and those of others, may affect his efficiency and personal adjustment.

One approach that may be used in measuring the individual's values is to determine what he considers to be important. If we know what an individual considers to be important, we know what his values are. By this approach, the **Survey of Interpersonal Values** (SIV) attempts to provide measures within one segment of the value domain. It is designed to measure certain critical values involving the individual's relationships to other people or their relationships to him. These values are important in the individual's personal, social, marital and occupational adjustment. The six values measured are: **Support (S); Conformity (C), Recognition (R); Independence (I); Benevolence (B); and Leadership (L).**

The scales are interpreted in terms of the items contained in them as determined by factor analytic methods. The scales are defined by what **high scoring** individuals value. There are no separate descriptions for **low scoring** individuals. Low scoring individuals simply do not value what is defined by that particular scale. Following are **difinitions** of the scales:

**S — Support:** Being treated with understanding, receiving encouragement from other people, being treated with kindness and consideration.

**C — Conformity:** Doing what is socially correct, following regulations closely, doing what is accepted and proper, being a conformist.

**R — Recognition:*** Being looked up to and admired, being considered important, attracting favorable notice, achieving recognition.

**I — Independence:** Having the right to do whatever one wants to do, being free to make one's own decisions, being able to do things in one's own way.

**B — Benevolence:** Doing things for other people, sharing with others, helping the unfortunate, being generous.

**L — Leadership:** Being in charge of other people, having authority over others, being in a position of leadership or power.

The **Survey of Interpersonal Values** (SIV) is brief, requiring, on the average, about fifteen minutes to administer; yet it has adequate reliability for individual use. Its scales were developed through the use of factor analysis. Every item is keyed on its appropriate scale; no item is keyed on more than one scale. Throughout its development, high school, college, industrial and other adult samples were used. The item content has been found to be meaningful for each of these groups; the scales have been found to have discriminating power within each of these groups.

Forced-choice format is employed in the SIV. The instrument consists of thirty sets of three statements, or triads. For each triad the respondent indicates **one** statement as representing what is **most important** to him and **one** statement as representing what is **least important** to him. Within each triad, three different value dimensions are represented. The three statements within each set were equated for social desirability as far as possible. In this way, the likelihood of the individual's responding to the favorableness of the statement rather than to its degree of importance to him is reduced. The forced-choice method has been found to be only moderately susceptible to faking in the measurement of personality traits (4, 6).

*Previously named *Attention*.

**Survey of Interpersonal Values (SIV)**

| Items | Support | Conformity | Recognition | Independence | Benevolence | Leadership |
|---|---|---|---|---|---|---|
| 1) Test Norms (N=1075 college men) Each category was separately scored and the 50% percentile score - or midpoint for each is as follows | 15+ (50) | 12 (50) | 13 (50) | 20 (50) | 14 (50) | 18 (50) |
| 2) Test Group (N=16 High Tech Entrepreneurs) **Avg.** Score in each category (Avg. Score expressed in percentile) | 12 (30) | 8 (26) | 13+ (55) | 19+ (46) | 15 (54) | 23 (71) |
| 3) Test group (N=16) Score Range Hi Low Expressed in percentile | 26 6 (97) (4) | 13 4 (56) (8) | 19 7 (87) (13) | 32 9 (99) (8) | 26 4 (95) (5) | 31 6 (98) (6) |
| 4) Number of Protocols Scoring over the 50 percentile mark in Item 1 | 2 | 1 | 7 | 8 | 9 | 14 |

Exhibit 3

Furthermore, the value for Recognition showed up quite strongly. Being important and founding your own enterprise may be manifestations of each other.

**Discussion of "Study of Personal Values" (Exhibit 4 page 217)**

Well, let me now come to the second test in my last two minutes here. Again, you can read the meaning of each category in exhibit #5 which I copied directly from the test manual. You'll see quite clearly that the category of Achievement is very strong and Decisiveness is almost as strong. What I'm scoring here is that 14 out of the 15 taking this test scored above the 50th percentile, that is they are in the upper half of the population as measured by 984 males from 13 colleges and universities.

I think it is interesting to note that high tech entrepreneurs are not Goal-Oriented. I suspect that Goal-Orientation is more a mark of a successful administrator as is the Orderliness category. What does surprise me is that Variety is not up there with Achievement. It may very well be that the research director of these companies would be high in Achievement and Variety, but the entrepreneur trades that off for Decisiveness.

Well, this is a start to collecting test items on known entrepreneurs, and I hope to do more later.

**Survey of Personal Values**

**Description**

In personality assessment, an individual may be described by what he characteristically does in particular situations, that is, in terms of the *traits* that typify his behavior. In addition he may be described in terms of his basic motivational patterns, or the *values* that he holds. For understanding the individual, both types of measures are important.

A person's values may determine to a large degree what he does or how well he performs. His immediate decisions and his life goals are influenced, consciously or unconsciously, by his value system. His personal satisfaction is dependent to a large extent upon the degree to which his value system can find expression in his everyday life. The presence of strong, incompatible values within the individual, or conflict between his values and those of others, may affect his efficiency and personal adjustment.

One way to measure the individual's values is to determine the relative importance that he ascribes to various activities. By this approach, the **Survey of Personal Values (SPV)** attempts to provide measures within one segment of the value domain. It is designed to measure certain critical values that help determine the manner in which an individual copes with the problems of everyday living.[1] The six values measured by the **SPV** are **Practical Mindedness (P), Achievement (A), Variety (V), Decisiveness (D), Orderliness (O), and Goal Orientation (G).**

The Survey of Personal Values is believed to be an unusually efficient instrument in that it is brief—requiring, on the average, about fifteen minutes to administer—yet has adequate reliability for individual use. Its scales were

[1]A second set of values, involving the individual's relations with other people, is measured by a companion instrument, The Survey of Interpersonal Values (Gordon, 1960).

developed through the use of factor analysis. Every item is keyed on its appropriate scale; no item is keyed on more than one scale. Throughout its development, high school, college, and industrial samples were used. The item content has been found to be meaningful for each of these groups; the scales have been found to have discriminating power within each of these groups.

Forced-choice format is employed in the SPV. The instrument consists of thirty sets of three statements, or triads. For each triad the respondent indicates *one* statement as representing what is *most important* to him and *one* statement as representing what is *least important* to him. Within each triad, three different value dimensions are represented. The three statements within each set were equated, to a large extent, for social desirability. In this way, the likelihood of the individual's responding to the favorableness of the statement rather than to its degree of importance to him is reduced. The forced-choice approach has been found to be minimally susceptible to faking in the measurement of personality traits (Gordon, 1951; Gordon and Stapleton, 1956; Gordon, 1960; 1963).

**Meaning of the Scales**

The scales are interpreted in terms of the items contained in them as determined by factor-analytic methods. The scales are defined by what *high-scoring* individuals value. There are no separate descriptions for *low-scoring* individuals; they simply do not value what is defined by that particular scale. Following are definitions of the scales:

**P — Practical Mindedness:** To always get one's money's worth, to take good care of one's property, to get full use out of one's possessions, to do things that will pay off, to be very careful with one's money.

**A — Achievement:** To work on difficult problems, to have a challenging job to tackle, to strive to accomplish something significant, to set the highest standards of accomplishment for oneself, to do an outstanding job in anything one tries.

**V — Variety:** To do things that are new and different, to have a variety of experiences, to be able to travel a great deal, to go to strange or unusual places, to experience an element of danger.

**D — Decisiveness:** To have strong and firm convictions, to make decisions quickly, to always come directly to the point, and make one's position on matters very clear, to come to a decision and stick to it.

**O — Orderliness:** To have well-organized work habits, to keep things in their proper place, to be a very orderly person, to follow systematic approach in doing things, to do things according to a schedule.

**G — Goal Orientation:** To have a definite goal toward which to work, to stick to a problem until it is solved, to direct one's efforts toward clear-cut objectives, to know precisely where one is headed, to keep one's goals clearly in mind.

**Survey of Personal Values (SPV)**

| Items | Practical Mindedness | Achievement | Variety | Deciveness | Orderliness | Goal Oriented |
|---|---|---|---|---|---|---|
| 1) Test Norms (Based on Sample of 984 male students from 13 colleges & univ.) Each category was separately scored and the 50th percentile score - or mid-point for each is as follows | 12<br>(50) | 17+<br>(50) | 13<br>(50) | 15<br>(50) | 13+<br>(50) | 17<br>(50) |
| 2) Test group (N=15* High Tech Entrepreneurs) avg. score in each category<br>Avg. score expressed in percentile | 10<br>(35) | 21+<br>(80) | 12+<br>(49+) | 16+<br>(60) | 10+<br>(35) | 15+<br>(44) |
| 3) Test group (N=15) Score range Hi Low<br>Expressed in percentile | 16 3<br>(74) (2) | 27 10<br>(97) (8) | 26 1<br>(94) (4) | 22 8<br>(89) (10) | 18 3<br>(75) (5) | 26 9<br>(92) (10) |
| 4) Number of Protocols scoring over the 50 percentile mark in Item #1 | 6 | 14 | 6 | 11 | 5 | 6 |

*One protocol was incomplete and thus not counted.

Exhibit 4

**Conclusions**

I really don't have too many conclusions in addition to the ones mentioned in the body of this report. Obviously, a factor analysis would be helpful, but with so few protocols, perhaps we had better collect some more data and then do the factor analysis. Secondly, we need to do considerably more testing to determine whether or not the test patterns do predict future entrepreneurial behavior and success patterns. I believe that it does, but not in sufficient degree that I'd bet a million of my own dollars on a guy because he scores particularly high on the three profiles we have here. When we can, in fact, put our money on such a profile-person, we'll have something here that is of great practical value to many people.