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THE ROLE OF COMMERCIAL BANKS IN THE FINANCING OF NEW, TECHNOLOGY-BASED FIRMS

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Factors Determining Location Characteristics of New, Technology-Based Firms

Many studies have illustrated the tendency of new, technology-based firms (NTBF) to develop in geographic clusters--the Route 128 firms in Boston, the Palo Alto-San Francisco Bay firms, and others. These studies have explained the clustering phenomenon in terms of traditional industrial-location factors. Interest in the location question reflects a concern with identifying and providing those environmental factors likely to improve the rate of technology transfer and technological innovation. The benefits of this achievement could result in increased yields from R & D spending, increased productivity and employment, and expanded economic development of certain regions of the United States and the world.

Studies by Roberts [6], Cooper [1], Shapero [7], and Lamont [4] have examined the evolution of specific clusters of NTBF and drawn conclusions concerning the factors which best explain that evolution. Certain factors consistently emerge as both necessary and sufficient for this type of development:

A. A supply of technological entrepreneurs

> A fundamental requirement is the existence in the area of a substantial number of people highly skilled and actively engaged in specific areas of technological research and production. Normally this requires that employment opportunities be available in research-oriented universities, commercial or government-sponsored laboratories, and technology-based companies. Within this group of people there must exist individuals with a combination of technical expertise and entrepreneurial inclinations; it is these individuals, according to Roberts, who cause technology transfer from invention to innovation.

B. A local culture conducive to new-firm development by technological entrepreneurs

Roberts, Cooper, Shapero, and others concluded that a local business culture supportive of entrepreneurial activity and the presence of "success models" may strengthen the incipient entrepreneur's ideas of the relative value of wealth, power, prestige, and independence, thus favorably conditioning his attitudes toward the rewards and risks involved in forming a new company. Such a set of attitudes stimulates new-firm formation and impacts on institutions and providers of support services. It also leads to cross-fertilization between technology-oriented university and industrial personnel.

C. The existence of "incubators" for NTBF

Most NTBF founders start their firms with knowledge acquired through association with other organizations such as universities, research laboratories, and technology-based companies. Cooper found great differences among organizations with respect to the rate at which they generate spin-off firms, namely that nonprofit organizations had very low spin-off rates in comparison to for-profit organizations. The highest spin-off rates were among smaller firms in industries with high-growth rates, rapid technological change, low-capital intensity, and few economies of scale. Both Cooper and Roberts concluded that firms which limited the entrepreneurial opportunities of potential technological entrepreneurs experienced the highest spin-off rates.

D. The presence of supporting institutions

Local research-oriented universities provide a pool of students and faculty, and library, testing, and laboratory facilities which, if made accessible to technological entrepreneurs, offer a stimulus to new-firm formation and development. They may also provide employment opportunities and psychological support to NTBF founders in the early stages of the firm's growth.

The presence of local firms which are users, suppliers, or subcontractors of technology-based products provides a source of services, experience, and advice to new firms. Both Shapero and Cooper concluded that location close to a complex of technology-based firms gave NTBF a competitive advantage over firms not so located.

E. Existence of a local-customer base

Purchase contracts by large and stable customers in the early life of the firm's life-cycle have been the basis for initial development of many NTBFs. In this respect the funding activity of the federal government has been of critical importance. Beyond that stage of dependence, successful firms tend to penetrate other areas of commercial application of their technology. Where local incubator institutions can attract government or private industrial contracts and are willing to subcontract to new and small firms, the rate of NTBF formation and development is increased.

F. The presence of local sources of finance

Where NTBF have thrived there exists a set of active and sophisticated intermediaries and sources of equity capital and credit, generally capable of responding creatively to the financing opportunities offered by NTBF. It is clear from the studies cited earlier that any region, state, or subarea which wishes to encourage the development of NTBF must develop the capability to generate local venture capital and to tap into the nation-wide and international venture-financing market system. The importance of finance was stressed in the Department of Commerce 1967 study of incentives and technological innovation [10].

Financing New, Technology-Based Firms

The term "venture-capital investment" refers to the financing of projects which promise an uncertain opportunity for an unusually high return. When used in reference to NTBF financing, the term encompasses the risk normally associated with small-business firms and the uncertainty attendant to the commercial exploitation of a technological innovation.

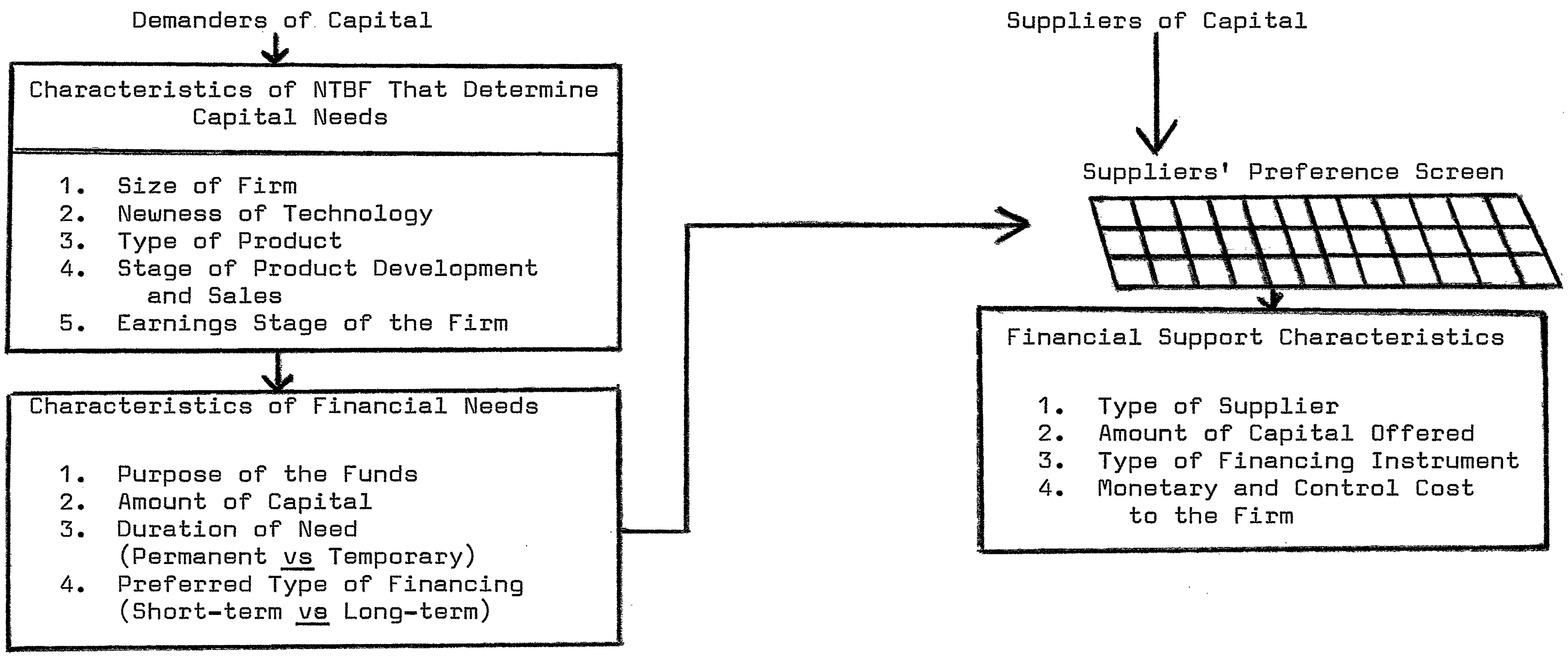
The ultimate sources of venture financing traditionally have been wealthy groups of individuals operating through a low-profile, private-placement system. In recent years the supply of funds available for venture financing has increased markedly due, in combination, to an impressive record of investment success throughout the 1960s and a visible supply of attractive investment opportunities. Presently, financing support for NTBF comes from individuals, banks, pension funds and insurance companies, nonfinancial corporations, and even from state and local government. These funds may be placed directly through venture-capital investment specialists or through purchase of publicly issued securities; the funds may be advanced in the form of debt, equity, or in various combinations thereof.

We believe that the financing needs of NTBF are influenced by the size of the firm, newness of the technology involved, type of product offered, and the life-cycle stage of the firm with respect to sales and earnings (see Figure 1). The investment-preference screens of the suppliers are predicated on perceived links between these characteristics and the expected value and risk of the investment opportunity. As a result of the screening process, the characteristics of the financial support available to individual NTBF or classes of NTBF are determined. These characteristics include the type of supplier most likely to provide the funds (individuals, venture-capital firm, financial institutions, or public offering), the amount of financing offered, the type of investment vehicle used, and the terms of the financing.

Based on preliminary research, we have hypothesized general relationships among these characteristics (shown schematically in Figure 2). Essentially, certain NTBF characteristics influence the financing needs of the firm and signify the degree of risk perceived in the investment by suppliers of capital. Certain suppliers are

Figure 1

Determinants of Characteristics of NTBF Financial Support



willing to participate only at certain levels; when they do offer funds, they impose conditions, terms, and prices. The major contention of our research program is that measurement and testing of these hypothesized relationships will lead to a better understanding of the venture-financing process by both funds-seekers and investors.

This paper reports on one aspect of the research program: the role played by commercial banks in NTBF financing. Our geographic focal point is the Ann Arbor-Detroit area of Michigan. We have tried to discover if the role of Michigan banks in financing Michigan-located NTBF might be expanded to the benefit of the local NTBF, the banks, and the economic development of the state. To do so, we tested whether important regional differences exist in the manner in which banks perceive and perform their role in NTBF financing, and we identified, measured, and explained the differences found. Boston, where NTBF formation and development has flourished over an extended period, was chosen as the control area. The most compelling reason for focusing on the role of Michigan banks is that there are no venture-capital firms in the state; banks are therefore the primary local link to the financial markets available to Michigan NTBFs. The extent to which the banks respond is clearly important to the development of the Michigan cluster of NTBF.

Development of Hypotheses to be Tested

Earlier studies concluded that NTBF in Michigan are disadvantaged in terms of location because of the lack of a supportive local financial community. Chastain and DeVries found that new R & D firms

Figure 2

Hypothesized Relationships Between NTBF Characteristics, Risk Perceived by Financiers, and Characteristics of Financial Support Available to NTBF

I. NTBF CHARACTERISTICS

A. Size of Firm

Small in Assets and Net Worth → Large in Assets and Net Worth

B. Newness of Technology

Breakthrough Technology → Established Technology

C. Type of Product

R & D, Testing and Consulting → Custom Mfg. Products → Standard Mfg. Products → Standard Proprietary Mfg. Products

D. Stage of Product Development and Sales

0 Start-up | First Product Prototype | First Sales | Evident Market Acceptance → Time

E. Earnings Stage

0 Start-up | Break-Even | Sustained Profitability → Time

II. RELATION BETWEEN NTBF CHARACTERISTICS AND FINANCIERS' PERCEIVED RISK

High Perceived Risk → Low Perceived Risk

III. RELATION BETWEEN NTBF CHARACTERISTICS AND NTBF FINANCING NEEDS

A. Purpose of Funds Needed by New Firm

R & D Support → Early Manufacturing and Marketing Support → Major Expansion Needs

B. Amount of Funds Needed by New Firm

Low Initial Needs → High Initial Needs

IV. CHARACTERISTICS OF FINANCIAL SUPPORT OFFERED TO NTBF

A. Type of Supplier

Personal Sources → Informal Sources → Venture Capital Firms → Banks, other Financial Institutions → Public Stock Issue

B. Capital Costs

High Monetary and Control Costs → Lower Monetary and Control Costs

C. Type of Financing Instrument

Equity and Short-Term Secured Debt → Equity, Long-Term Debt, Unsecured Short-Term Debt received significantly less bank financing in Michigan than did new manufacturing firms [2]. R & D firms were forced to employ greater amounts of equity, to turn to leasing arrangements and finance companies, and to raise more of their funds out-of-state than were new manufacturing firms.

Jones concluded that Michigan banks were biased in their new- and small-business financing toward firms related to the state's dominant industrial firms [3]. These large firms provided a financial umbrella for new and small firms through their purchasing and trade-credit policies. Jones argued that since this type of arrangement suited the banks and the new, small manufacturing firms, banks saw no great need or opportunity to establish SBICs; as a result, there are no active SBICs in Michigan today.

Lamont and Melicher studied a sample of Michigan NTBFs and found working capital finance the most critical need in their development [5]. They also noted that liquidity and solvency pressures were greatest during the critical stage in which rapid growth of sales occurred early in the life cycle of the companies.

All this evidence relates directly to the NTBF and the banks, the subject of interest in this study. To the extent that these conditions prevail, the environment for technological entrepreneurship in Michigan is deficient, and it is unreasonable to expect the development of a significant cluster of successful NTBF. Since there are now 180 NTBF in Michigan, it is assumed that some combination of the locational factors noted earlier does exist. The question is this: How can the financial community, specifically the commercial banks, contribute to the development of these and future NTBF?

To reach conclusions regarding differences between Boston and Michigan in the interaction of banks and NTBF, four hypotheses are tested:

Hypothesis 1:

Based on past experience, founders of NTBF in Michigan perceive banks primarily as a source of short-term credit and as poor sources of other financial services important to the successful development of NTBF.

Hypothesis 2:

Bank lending officers in Michigan show less inclination to provide credit to NTBF than do bank lending officers in other selected areas.

Hypothesis 3:

New, technology-based firms in Boston have received credit from commercial banks earlier in their life-cycle, in greater amounts, and at better terms than have comparable firms in Michigan.

Hypothesis 4:

New, technology-based firms in Boston have received more help from commercial banks in finding other sources of capital funds than have comparable firms in Michigan.

Data Sources and Methodology

Information for the analyses was derived from three questionnaires administered by the authors from June to December 1972. The first was a mail questionnaire sent to 300 founders of 65 new, technology-based firms in Michigan. One hundred and ten responded with data concerning the relations of the firm and founders with banks in Michigan and an evaluation of the services obtained from Michigan banks. This information is analyzed to test Hypothesis 1.

The second was an experimental questionnaire of nine authentic but disguised loan applications, six from new, technology-based firms and three from new, non-technical firms. The questionnaire had been applied previously in other areas, and some of the results were obtained for comparison with Michigan results [8]. One-hundred bank lending officers from 30 Michigan banks responded; each respondent approved or disapproved the requested loan and answered questions designed to show the terms, restrictions, added services offered to the firm, and the factors which influenced his offer to the applicant. The results of this questionnaire are used to test Hypothesis 2.

Another phase of the data collection consisted of intensive interviews with 26 NTBF in the Boston area and 26 comparable firms in Ann Arbor-Detroit. These NTBF provided a representative cross section of the NTBF in each area and allowed a fair comparison of the firms' performance and financial experience. The median dates of incorporation were May and July, 1968 for the Ann Arbor-Detroit and Boston firms, respectively. The firms were also matched by product types during their first year after incorporation. (See Table 9.)

Founders of each firm were interviewed from one hour to four hours; each respondent was asked questions concerning his firm's early operating characteristics; its capital-raising activities;

Table 1

Responses From Founders to the Question: "Please evaluate the banks in Michigan in their helpfulness to the firm for the following services".

Services	Degree of Helpfulness										Total Responses	Total Percent
	Much		Some		Little		None		No Opinion			
	f	%	f	%	f	%	f	%	f	%		
Financial Planning	3	2.7	15	13.6	18	16.4	52	47.3	22	20.0	110	100.0
Providing Short-term Credit	28	25.5	28	25.5	19	17.3	17	15.5	18	16.2	110	100.0
Providing Long-term Credit	9	8.2	15	13.6	17	15.5	48	43.6	20	19.1	109	100.0
Selecting an Investment Banker	2	1.8	1	.9	16	14.5	68	61.8	22	21.0	109	100.0
Selecting a Venture-Capital Firm	0	0.0	3	2.7	11	10.0	73	66.4	22	20.0	109	100.0
Finding Individual Equity Investors	0	0.0	1	.9	14	12.7	71	64.5	23	22.0	109	100.0

the terms of its financial support; his own personal and professional characteristics concerning his own and his firm's experience with other NTBF. The interview information was supplemented with data from Dun and Bradstreet reports and from the firms' articles of incorporation and annual statements of financial position to state government. The results are used to test Hypotheses 3 and 4.

Analysis of Results

Hypothesis 1

Preliminary interviews with Michigan NTBF founders, managers, investors, or consultants suggested that the findings of Chastain and DeVries, Jones, and Lamont and Melicher were regarded as true. Studies of the environmental factors necessary for NTBF clustering and development stress that the expectation of financial support may be as important in stimulating new-firm formation as the actual availability of such support; the perception that financing is difficult to obtain may well be an important obstacle to NTBF formation. To determine whether this perception is widely held among Michigan NTBF founders, they were asked in the questionnaire administered to a sample of them to evaluate the helpfulness of Michigan banks in providing a specified number of services. Results are shown in Table 1.

The respondents represented 41 NTBF, of which 31 had obtained loans from Michigan banks and 10 had not obtained loans after the initial purchase of stock by the first investors in the firm. On only one category of service (providing short-term credit) did a majority (51%) of the respondents indicate that Michigan banks had been of "much" or "some" help. Regarding long-term credit, only 21.8% of the respondents indicated that Michigan banks had been helpful.

In all other categories, respondents indicated that they had no opinion or that banks were of little or no help. Since Michigan has no visible, readily accessible venture-capital intermediaries, its banks become the major contact between NTBF and the financial community. Failure by the banks to provide financial counselling and a link to sources of long-term and permanent financing leaves the Michigan NTBF at a serious disadvantage relative to NTBF in areas where such services are available.

We therefore conclude that Michigan NTBF founders perceive Michigan banks as primarily a source of short-term credit and as poor sources of other financial services important to the development of NTBF.

Hypothesis 2

Although existing and potential NTBF founders perceive Michigan bankers as unresponsive to their financing needs, their perceptions may be biased and therefore unreliable as a basis for objective evaluation. To test the attitudes of Michigan bank lending officers, the set of hypothetical loan cases and questionnaires was administered to 100 of them, as described earlier. Results were compared with the results obtained by Shapero [8].

Major Findings Of The Ozarks Study. The Shapero study compared results obtained from bankers in the Ozarks region with those obtained from bankers in San Francisco and Los Angeles. The hypothesis was that important differences in propensity to loan to NTBF in both credit terms and general approach to the lending opportunity would appear between the two groups. The California banks were thought to be better acquainted with technology-based industry and more accustomed to tailoring bank credit to the needs of new ventures; they were expected to show a high propensity to lend. The Ozarks bankers were felt to be less experienced with this type of credit request and less likely to lend. The results (Table 2) showed no difference between the two groups in the percentage of loan applications approved for NTBF; in each group 66% of the applications were approved.

The major differences between the two groups of bankers were in their general approach to the loan problems and in the relationship between banker and borrower implied by the approach.

> The California bankers were really distinguished from those in other areas studied by their lower requirements for collateral, by their higher demand for additional managerial and financial constraints and by the differences in the weight they placed upon factors that influenced their loan decisions [8, p. 7].

The California group approved a much larger percentage of loans on an unsecured basis or with only a personal guarantee than did the Ozarks group. Offsetting this low reliance on collateral were much stiffer requirements concerning managerial and financial constraints and frequency of reporting. Financial condition of the borrower was cited by the California group as the most critical factor in denying a loan in 74% of the cases in contrast to 59% of the cases turned down by the Ozarks group, suggesting a much more analytical and objective approach to the loan. In only 7% of the loan denials did the California bankers cite the vague term "bank policy" as the dominant factor; among Ozark bankers this was cited in 21% of the disapproved loans.

Shapero _et al._ concluded that the geographic-area differences reflected differences in loan-officer attitudes and philosophies. Among officers familiar with NTBF, the guarantee of security was sought in the ability of the firm to react effectively to changes in its environment. These bankers typically made loan approval conditional on operational changes, addition of key people or other resources, or modifications of existing policies. They insisted on frequent reporting and imposed short maturities on their loans so that the periodic loan renewals forced frequent reviews of operating results. This approach implied a committment from the banker to work along with the new company and to contribute actively to its development.

Among loan officers not familiar with the problems of NTBF, the guarantee of security was sought in the tangible assets of the firm and of its principals. Conditions imposed were designed to protect the bank in event of failure.

> Loan officers in the Ozarks group appeared to be much more concerned than their California counterparts with making a proper initial judgement which, once made, they could live with [8, p.8].

In summary, Shapero _et al._ concluded that the group of California banks could be designated as a _developmental_ banker group and that the Ozarks group might be described as _judgmental_. The researchers suggested that the presence or absence of the former group may determine whether or not an area gains new industry.

Findings From The Michigan Survey. In the tables which follow, data developed from the Michigan sample are presented together with data from the Ozarks and California studies. As shown in Table 2, the Michigan banks indicated a lower propensity than either control group to loan to NTBF. The proportional differences in the approval rates (66% versus 60%) suggest that Michigan bankers were slightly more conservative in granting credit to NTBF. But the approval rate is quite high, and there appears little evidence that the Michigan banks have any systematic aversion to granting credits to this type of firm.

Regarding collateral requirements, the Michigan banks compared more closely to the Ozarks group than to the California group in terms of willingness to extend unsecured credit. The proportional difference with respect to the California group is substantial (Michigan 31%, California 44%), (Table 3). In all three groups willingness to take current assets as collateral was evident. The use of current-asset collateral as opposed to fixed assets or other types of collateral was much more common in loans granted to technical companies than in those to nontechnical firms.

Table 2

Percentage of Positive Responses to Loan Requests

Area Where Banks are Located	All Nine Companies	Six Technical Companies	Three Non-Technical Companies
Michigan	61%	60%	64%
Ozarks Area	65%	66%	61%
San Francisco-Los Angeles	60%	66%	50%

Source: Michigan data are original; comparative data from [9, p. 17].

Table 3

Types of Collateral Required In Approved Loan Cases
By Selected Cities and Areas

Area Where Banks are Located	Unsecured Loan			Current Assets			Fixed Assets			Other		
	All Companies	Technical	Non-Technical	All Companies	Technical	Non-Technical	All Companies	Technical	Non-Technical	All Companies	Technical	Non-Technical
Michigan	23	31	8	55	55	53	16	7	37	4	5	2
Comparative Data:												
Ozarks Area	24	29	9	55	54	56	22	15	36	14	15	12
San Francisco-Los Angeles	36	44	16	45	42	52	19	13	35	6	8	1

In terms of restrictive covenents, Michigan banks approved a comparatively high percentage of loans with no explicit conditional requirements (Table 4). The Michigan banks included accounting and control constraints slightly more frequently than either the California or Ozarks banks and imposed fewer constraints on general and financial management of the firm than did the other groups. The most common constraints imposed by Michigan bankers were aimed at protecting the bank in the event of the borrower's failure. Typically, steps were taken to protect the priority of the bank's claim to assets and to remove or subordinate other creditors. For example, asset appraisal and credit and control procedures were commonly required; also used were acceleration clauses, which made the bank's loan due and payable if operating results failed to meet bank standards and bank-approved projections.

Michigan bankers showed slightly more concern for the financial condition of the firm when approving a loan than did the California bankers and somewhat less concern with the firm's management quality (Table 5). These two factors, however, were dominant considerations among all the groups. The Michigan bankers identified those financial and managerial factors which most seriously affected their loan decisions (Table 6 and 7). Among the financial factors they cited, the most important were the current working capital position of the borrower, the firm's debt capacity, and its profit potential. Little critical weight was given to the firm's age, the available collateral, the reliability of its projections, or its need for the loan. When loans were disapproved, debt capacity

Table 4

Restrictive Covenants Imposed on Approved Loans By Selected Cities and Areas

(Percentage of Cases Having Each Type of Covenant)

Area Where Banks are Located	None			Management Restrictions on Retention of Capital Constraints			Accounting or Control Constraints			Limits on Financial Management or Use of Loan			Other		
	All Companies	Technical	Non-Technical	All Companies	Technical	Non-Technical	All Companies	Technical	Non-Technical	All Companies	Technical	Non-Technical	All Companies	Technical	Non-Technical
Michigan	76	76	76	7	9	4	16	14	20	6	6	6	4	4	4
Comparative Data:															
Ozarks Area	64	64	63	18	19	15	6	6	7	11	11	11	11	11	11
San Francisco-Los Angeles	39	40	36	33	37	25	13	13	14	17	16	19	29	26	36

Table 5

Most Critical Factor In The Loan Decision

Area In Which Bank Is Located	Firm's Financial Condition	Firm's Management	Industry Growth Potential	Firm's Impact On Community	Bank's Loan Policy
		I. Approved Loan Decision			
Michigan	62	25	7	2	4
Ozarks Area	60	23	11	3	4
San Francisco-Los Angeles	57	33	7	1	4
		II. Denied Loan Applications			
Michigan	62	15	6	1	16
Ozarks Area	59	15	2	2	21
San Francisco-Los Angeles	74	12	6	1	7

Table 6

Financial Factors Most Critical in Loan Decisions by Michigan Banks

	Approved Loans			Disapproved Loans		
Factors	All Loans	Technical Firms	Non-Technical Firms	All Loans	Technical Firms	Non-Technical Firms
Current Working Capital Position	33	37	24	21	20	22
Profitability to Date	21	19	26	7	7	5
Debt Capacity	33	36	28	40	44	33
Age of Firm	*	*	*	2	1	3
Collateral Available	1	1	1	3	2	3
Reliability of Projections	3	3	3	11	11	11
Need for the Loan	2	2	3	7	7	8
No Response	9	5	16	10	7	15
	100%	100%	100%	100%	100%	100%

*Under 1%
Totals may not add to 100% due to rounding.

Table 7

Managerial Factors Most Critical in Loan Decisions by Michigan Banks

	Approved Loans			Disapproved Loans		
Factors	Loans	Technical Firms	Non-Technical Firms	All Loans	Technical Firms	Non-technical Firms
Proven Relevant Experience	17	19	16	27	20	37
Balanced Management Team	56	60	48	30	37	16
Firms Performance to Date	10	11	8	4	5	2
Equity Position of Management	*	*	*	0	0	0
Education Background	*	0	*	0	0	0
Age of Principal	2	2	2	*	*	*
No Response	14	9	24	39	37	44
	100%	100%	100%	100%	100%	100%

was the most significant factor.

Of the management considerations cited by the Michigan bankers the existence of a balanced management team was the most important. The most commonly cited characteristic was the need for financial, marketing, and management skills to complement the technical skills of the management group. The next most important factor was proven experience relevant to the business being developed. This factor tended to be more important in refusing a loan than in approving one. Neither education, age, nor equity position of the principals was judged the critical issue--suggesting that the bankers looked for direct, referable evidence of functional business-performance capability as the primary criterion by which to measure the borrowing firm's management.

Information was also developed on the maturity and repayment terms offered by Michigan banks on their approved loans. These data are presented in Table 8.

Nearly 39% of the loans made carried a maturity over one year and 12% over two years. The willingness to loan for longer terms was stronger with respect to nontechnical firms and this is judged to reflect the greater use of fixed asset collateral and the lower perceived risk associated with nontechnical ventures by the Michigan bankers.

The requirement of short maturities and rapid amortization at frequent payment intervals is obviously a device which will protect the bank. This is especially true when combined with

Table 8

Loan Maturity and Repayment Terms
Of Approved Loans Made by Michigan Banks

Loan Maturity

	All	Technical	Non-Technical
Demand	25.3	26.2	23.0
1-3 months	13.3	15.1	9.5
3-6 months	4.5	5.6	3.6
6 months-1 year	17.3	19.3	13.1
1-2 years	26.0	27.4	23.8
2-5 years	10.6	5.0	22.6
Over 5 years	2.7	1.4	4.4
	100.0	100.0	100.0

Repayment Terms

	All	Technical	Non-Technical
Monthly	17.4	13.4	25.6
Quarterly	32.6	32.1	33.3
Semi-Annual	10.5	11.2	8.9
Annual	10.5	12.3	6.6
Demand	29.0	31.0	25.6
	100.0	100.0	100.0

acceleration clauses keyed to performance.

It should be noted, however, that these terms are applied evenly to both technical and nontechnical firms, suggesting that they are not unduly harsh with respect to new, technology-based firms. Furthermore, it must be recognized that these are, in fact, very risky firms from the bank's viewpoint. The frequency of repayment dates demands that the bank and the firm maintain close, frequent contact with each other so that a potential exists for cooperation in the ongoing financial affairs of the borrowing company.

Michigan bankers turned down the original loan in 37% of the cases but after changing some of the terms, approved a modified loan. The most common modification involved addition of greater security through collateral requirements and reduction of the maturity. This modification could be interpreted as a conservative and possibly nonsupportive attitude on the part of Michigan's banks. It may also be interpreted as a constructive posture. If a systematic bias does exist against NTBF, bankers might be expected to reject loans which did not suit their standards. But these bankers modified the loan applications to make the credit bankable. They therefore made a positive contribution toward helping the applicant firm.

On the basis of the hypothetical loan applications, Michigan bank lending officers do not differ importantly from the control group in their propensity to loan to NTBF. In their approach to NTBF lending the Michigan bankers fall somewhere between the "developmental" and "judgmental" extremes. They reacted in a way that suggests a willingness to lend but a lack of familiarity with the nature of NTBF financing. This analysis suggests that the hypothesis must be rejected.

Hypotheses 3 and 4[1]

The information from the in-depth interviews of the founders of Boston and Ann Arbor-Detroit area NTBF reveals important differences between the two areas in the support received from commercial banks. We divided the early histories of the NTBF into two periods--the first six months' start-up period and the early period after the first six months; then compared the firms' commercial-bank financial support for each of the periods.

During the start-up period 10 of the 26 Boston NTBF received commercial-bank loans, one from a bank outside the Boston area. Only four of the 26 Ann Arbor-Detroit firms received commercial-bank loans during the start-up period, all from banks in southeastern Michigan. After the start-up period, 26 commercial-bank loans were made to 21 Boston NTBF, three from banks outside the Boston area--compared to 22 bank loans to 19 Ann Arbor-Detroit NTBF, three from banks outside of southeastern Michigan. Over the entire sample time period, 22 of the 26 Boston firms received at least one bank loan, and five received more than one. Of the 26 Ann Arbor-Detroit firms, 21 received at least one bank loan, and three received more than one.[2]

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[1] These results and analyses are derived from dissertation research conducted by William Welch.

[2] Extensions of lines of credit and renewals of existing loans were not treated as new loans unless the amount or the terms of the loan were changed. In such cases the changed portion of the loan was treated as a new loan.

For the Boston firms the median period from incorporation to the first commercial-bank loan was 10 months, compared to 13 months for the Ann Arbor-Detroit firms.

Not all the sample firms, however, actively sought bank loans. It was therefore necessary to examine the success in obtaining bank loans of those NTBF that actively sought them for the start-up period and thereafter. Boston NTBF were more successful. During the first six months of their corporate lives, they made 17 attempts to obtain bank loans; ten were successful for a bank-loan acceptance rate of 59%. During their start-up periods the Ann Arbor-Detroit area firms made 10 attempts at bank loans, and four were successful for a bank-loan acceptance rate of 40%. During their post-start-up phases the Boston NTBF made 36 attempts at bank loans, of which 26 were successful, an acceptance rate of 72%. The Ann Arbor-Detroit firms reported 35 attempts during this period, of which 22 resulted in loans for an acceptance rate of 63%. (See Table 10.) It is worth noting, however, that the firms especially those in Ann Arbor, made few attempts to obtain bank loans during their start-up phases. Many Michigan founders said that had they looked for a bank loan during their first six months they would have wasted their time because they lacked the collateral they thought was required for a loan. Such comments were heard in Boston too but were less prevalent there than in Michigan. Boston NTBF founders were more predisposed to seek bank loans early and were more successful in obtaining loans when they did seek them. Boston-area founders made fewer negative comments and more positive comments about their banks than did the

Ann Arbor-Detroit founders and, in general viewed their banking community more favorably.

The amount of the bank loans received by the firms in the two areas also differed. The median size of the Boston firms' bank loans during their first six months was $28,000; the Ann Arbor-Detroit firms received a median loan of $19,000. After their start-up phases, the median size of the Boston firms' commercial-bank loans was $85,000;[3] the Ann Arbor-Detroit firms' median bank loan was only $25,000. (See Table 10.)

We did not expect to find that all of the firms were equally worthy of bank loans; we did expect to find that a firm which had previously raised a relatively large amount of capital would qualify for a relatively large bank loan. We therefore obtained a measure of the size of the firm's first bank loan relative to the size of the firm at the time of the loan by comparing the amount of the firm's first bank loan to the amount of the capital it had previously raised--giving us the percentage increase in the firm's assets that was financed by its first bank loan. For the 22 Boston firms that received at least one bank loan, the median percentage increase in assets financed by the first bank loan was 68%, compared to 41% for the loans to Ann Arbor-Detroit firms.[4] Our evidence indicates that not only do Boston firms receive bank capital sooner than Ann Arbor-Detroit firms, but they also receive it in relatively larger amounts.

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[3] For bank lines of credit, only the portions of the lines that were actually drawn down by the firms were treated as loans.

[4] Significant at the 10% level.

We studied other dimensions of bank support to NTBF. The firms in both areas were asked the purpose of their bank loans, the interest cost of the loans, the terms or length of the loans, and whether some or all of the original founders' capital was loaned. There was very little difference between the interest rates paid by the firms in the two areas. In most cases the interest rate was tied to the prime rate in the area, usually one to two percentage points above prime. Since the prime rates between the Boston and Ann Arbor areas seldom vary significantly, the interest rates paid on loans at a given time were usually close. Nor did the premium over prime differ significantly between the two areas.

There was only a small difference between commercial banks in the two areas in their propensity to make loans for founders' start-up capital. Six of 25 Ann Arbor-Detroit founders were given such loans, all secured by personal collateral of the founders.[5] Seven of the 26 Boston-area founders received bank loans for founders' start-up capital, and four were secured by personal collateral. This difference in colllateral requirements may be explained by differences in the professional experiences of the founders in the two areas. Two of the three founders in Boston who received unsecured loans for start-up capital had previously founded successful NTBF and had subsequently liquidated all or part of their equity. These founders had track records upon which they could be judged and were wealthy men from whom specific security was not required.

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[5] One of the Ann Arbor firms declined to respond to the question concerning bank loans for founders' start-up capital.

Boston bankers have had more experience with new technically-based firms, and the existence of many successful entrepreneurs in the Boston area explains in part the Boston bankers' larger and earlier financial support of NTBFs.

Most of the bank loans obtained during the first six months after incorporation were for working-capital purposes. Thereafter, although working-capital loans were the most common, Boston firms received relatively more bank loans for other purposes, especially for product development and for refinancing the firms. (See Table 11.) Most of the loans in both areas obtained during the start-up period were short-term loans. After the start-up phase, Boston firms received loans for longer terms than did Ann Arbor-Detroit firms, although the majority of loans in both areas were 90-day loans. After the first six months, six of the 26 loans made to Boston-area firms were for terms of more than three years, compared to only two of the 22 loans made to Ann Arbor firms. (See Table 12.)

The third dimension of bank support studied was the role of commercial banks in the financial-referral networks. Not every NTBF is bankable early in its life; many need equity capital before they can obtain bank loans. Often a financially naive, technically trained entrepreneur will go to commercial banks early in his capital search because they are the most visible financial institution. If the entrepreneur's bank-loan application is denied, the bank loan officer can still help by referring him to other capital sources. Our entrepreneurs were asked to identify who provided the referral

Table 9

Number of Firms by Type of First Product

	NUMBER OF FIRMS Boston	Ann Arbor
Computer-Service	5	6
Computer-Hardware	3	4
Electronics Components	5	3
Instrumentation	11	12
Other	2	1
Total Firms	26	26

Table 10

Commercial Bank Financial Support

	FIRST SIX MONTHS		AFTER FIRST SIX MONTHS	
	Boston	Ann Arbor	Boston	Ann Arbor
Number of Firms Receiving Bank Loans	10	4*	21	19
Number of NTBF Attempting Loans	17	10*	23	21
Bank Loan Acceptance Rate	59%	40%	91%	90%
Median Size of Bank Loans	$28,000	$19,000***	$85,000	$25,000*

*significant at .05 level
**significant at .10 level
***significant at .20 level

Table 11

Purpose of Bank Loans-Number of Loans by Purpose

	LOANS DURING FIRST SIX MONTHS		LOANS AFTER FIRST SIX MONTHS	
	Boston	Ann Arbor	Boston	Ann Arbor
Working Capital	9	4	16	13
Plant and Equipment	1	0	2	4
Product Development	0	0	3	1
Marketing	0	0	1	2
Refinancing	0	0	3	1
Other	0	0	1	1
Total Bank Loans	10	4	26	22

Table 12

Maturity of Bank Loans

	LOANS DURING FIRST SIX MONTHS		LOANS AFTER FIRST SIX MONTHS	
	Boston	Ann Arbor	Boston	Ann Arbor
Ninety Days or Less	8	3	14	16
91 Days-1 Year	1	1	2	2
Greater than 1 Year-2 Years	1	0	2	1
Greater than 2 Years-3 Years	0	0	2	1
Greater than 3 Years	0	0	6	2
Total Loans	10	4	26	22

Table 13

Successful Bank Referrals to Other Capital Sources

	BOSTON	ANN ARBOR
Private Individuals	1	0
Ltd. Investment Partnerships	0	2
SBICs and Private Venture Capital Firms	5	0
Investment Banks	1	2
Insurance Companies	1	0
Other Commercial Banks	1	0
Private Firms	2	0
Other (Including Major Leasing)	1	1
Total Bank Referral to Successful Financings	12	5

Table 14

Referral Source to First Bank Loan

	BOSTON	ANN ARBOR
General Knowledge of Bank	5	10
Net Through Previous Business Foundings	6	3
Previous Investors	7	4
SBIC or Private Venture Capital Firm	2	0
Business or Financial Consultant	2	1
Attorney or Accountant	0	1
Investment Banks	0	1
Total Firms With One or More Bank Loans	22	20

to each of their capital sources; we found that commercial banks in Boston were more active in referring entrepreneurs to other capital sources than were Michigan banks. We identified 12 bank referrals in Boston that led to actual financings; only five of the Ann Arbor-Detroit financings were by capital sources to whom commercial banks had provided the referral. (The types of financial source to whom banks made successful referrals are shown in Table 13.)

The other side of the coin is the degree to which other financial institutions and persons refer the entrepreneur to commercial banks. If banks are an important link in the referral network, we would expect to find them active in making referrals to other financial sources and also to find that other financial sources make referrals to them. We identified the person or institution who made the referral to each of the NTBF first bank loans (Table 14). Thirteen of the 20 first bank loans made to the Ann Arbor-Detroit NTBF did not involve a specific referral by another institution or person. Entrepreneurs either approached the bank without an outside referral or they had had experience with the bank through previous business association. Eleven of the 22 first bank loans made to Boston NTBF involved a referral from another financial institution, compared to only seven of the 20 first bank loans made to Ann Arbor-Detroit firms.

There is another important difference between the Boston and the Ann Arbor-Detroit financial communities. The Boston area has many more SBICs that are active suppliers of risk capital than does southeastern Michigan, and many of the Boston SBICs are owned by commercial banks (Table 13 and 14). For the fiscal year ending March 31, 1970, Massachusetts SBICs made 194 financings for $10,300,000; during the same period Michigan SBICs made only 21 financings for $1,551,000 [9, p. 5]. As of March 1971, Massachusetts SBICs had total-financing, outstanding balances of $27,412,000, compared to $5,460,000 for Michigan SBICs. The sample of Boston firms received five referrals from commercial banks that resulted in SBIC financings; none of the Ann Arbor-Detroit firms received commercial-bank referrals to SBICs that resulted in financings.

We conclude that Boston NTBF received more financial support from commercial banks--larger loans, earlier in their corporate lives and with more liberal terms, and more indirect support in the form of assistance in finding alternative risk-capital sources.

Conclusions, Implications, and Recommendations

These results are part of a continuing research program intended to identify and to suggest remedies for impediments to the effective financing for the development of Michigan's NTBF cluster. It is clear that Michigan's technological entrepreneurs perceive the local banking community as limited in the extent to which it will participate in NTBF financing. The results also suggest that when Michigan's bankers are faced with the question of NTBF in a hypothetical setting they are willing to participate; their problem is a lack of familiarity with the nature and financial needs of NTBF.

When actual cases are reviewed, it becomes apparent that NTBF in Boston receive a higher level of banking services than do Michigan NTBF. Boston banks view NTBF as sufficiently important to the local economy and to their banking markets that they are willing to devote financial and managerial resources to NTBF financing programs; including the establishment of their own SBICs and the development of links with nonbank, venture-capital investors. In view of the absence of established venture-capital facilities in Michigan, the willingness and ability of local banks to be a financial catalyst to NTBF development is critical. In terms of size, Michigan banks are clearly adequate to the task. What is needed is their willingness to approach the level of interest and resource allocation apparent in the Boston (and California) banks.

We are presently working through the university and the state government to develop a set of programs to determine alternative means toward this end. These programs include the following:

1. Exposition of the potential contribution of NTBF to the economic development of Michigan through increased employment and diversification of the manufacturing base.

2. Efforts to increase the familiarity of Michigan's technological entrepreneurs and local and nonlocal financial communities with each other and to provide for continuing contact among them.

3. Exposition of the investment potential for Michigan-based, private, venture-capital intermediaries, including SBICs.

4. Analysis of the role to be played by state and local government agencies.

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