Manufacturing entrepreneurs: An exploratory study of performance

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ABSTRACT

As America's economy has become service-oriented, concern is being expressed for the state of manufacturing and the right strategy to put America's "smoke-stacks" back to work. Many firms are downsizing their operations, retreating from certain markets and returning to a focus strategy. The purpose of this study was to determine the factors, as well as the strategies, that contribute to the success of manufacturing entrepreneurs. The study focused on entrepreneurial manufacturing firms in the Tulsa metropolitan area, and supported the findings of previous research. An interesting finding was that no successful firm used a strategy of differentiation, and all but one successful firm employed a focus strategy.

INTRODUCTION

Manufacturing firms, those with a principal Standard Industrial Classification (SIC) code between 2000 and 3999, are an important segment of the United States' Gross National Product (G.N.P.). In 1988, measured in constant 1982 dollars, manufacturing accounted for twenty-three percent of the $4 trillion G.N.P. and employed 19.4 million people (U. S. Bureau of the Census, 1991). To put the size of the manufacturing segment of the G.N.P. in perspective, one can consider that it is larger than the individual G.N.P.s of all nations on earth, but two: the United States and Japan (U. S. Bureau of the Census, 1991). Why some new manufacturing firms are more successful than others is a question of major concern to these firms' stakeholders and to policy-makers.

The manufacturing industries have suffered substantial job losses and slumping productivity beginning in the early 1970s (Hayes & Wheelwright, 1984; Richetto, 1988). American manufacturers have lost important market share to foreign competitors in a variety of significant industrial segments of the G.N.P. (Dertouzos, Lester & Solow, 1989; Hayes & Wheelwright, 1984; Thurow, 1980). Several industries such as shoes, electronic appliances, textiles, and steel products have suffered more than others. For example, an estimated 500,000 garment manufacturing jobs have been lost in the past 15 years.

The U. S. economy has taken a service orientation in recent years. In 1960, some 16.8 million manufacturing jobs existed along with 33.7 million service positions. Today those figures have changed to 19.4 million and 79.8 million respectively (U. S. Bureau of the Census, 1991). As we have become sensitive to competition from abroad, several changes are being effected in the U. S. educational and manufacturing institutions. Massachusetts Institute of Technology (MIT) and other prestigious universities have recently revised their MBA curriculums to emphasize manufacturing and operations management. With the current low value of the dollar our exports of manufactured goods have increased considerably; therefore, manufacturing as a whole seems to be on a revival course ("Study: U. S. Firms," 1992). Changes in the technical, structural and geographic forms of industrial firms have always been a feature of American industry; however, the pace of the changes has accelerated substantially since the early 1970s (Richetto, 1988).

One measure of the structural change in manufacturing is the shift that is occurring in firm size and employment levels at individual facilities. Small manufacturing firms (those employing less than 100 people) accounted for nineteen percent of manufacturing employment in 1980 and twenty-four percent in 1986. Large firms (those employing 500 or more) dropped from sixty-seven percent to sixty-three percent of total manufacturing employment during the same time period (U. S. Small Business Administration, 1988). One tentative conclusion from these recent changes in manufacturing employment is that people are "migrating" from large firms to small firms in the manufacturing sector. The reasons for this shift in manufacturing employment are not completely known. Perhaps downsizing on the part of the large businesses and the resulting terminations would contribute to such migrations. Also, the inability to compete internationally in some important sectors of the economy has led to reductions in employment at large firms in those sectors (Thurow, 1980). As an example, as car manufacturing plants shut down, skilled laborers join small and newly formed manufacturers.

PURPOSE

This paper focuses on the state of manufacturing in Oklahoma, and therefore examines data from the Tulsa metropolitan area in consideration of the following trends.

In Oklahoma, there were 3910 manufacturing plants, employing 171,391 people in 1985 (Center for Economic and Management Research, 1988). The total payroll for manufacturing in Oklahoma in 1985 exceeded the total payroll for every other major industry group by a substantial margin. In the Tulsa Metropolitan Statistical Area approximately sixteen percent of the wage and salary earners were employed in manufacturing firms at the end of the calendar year 1987 (Economic Development Information Center, 1988). There has been a decrease in both percentage of total employment and absolute employment in manufacturing in Tulsa since 1981 when the percentage was slightly over twenty-one percent and the absolute employment stood at 68,300 (Economic Development Information Center, 1988). Mirroring the absolute decline in manufacturing employment in Tulsa since the early 1980s are two trends of some importance:

1. reductions in total employment in oil industry-related manufacturing firms.
2. the rise in the number of new, small manufacturing firms that are not related to the oil industry.

More than 200 new, small manufacturing firms were founded in the Tulsa Metropolitan Statistical Area between 1980 and 1989 (Oklahoma Department of Commerce, 1989). Tulsa represents a microcosm of the nationwide trends. People are migrating from employment in large manufacturing firms to employment in small, new manufacturing firms.

PREVIOUS RESEARCH

Previous research on success factors for manufacturing entrepreneurs has yielded conflicting results. For example, Hoad and Rosko (1964) tracked the performance of ninety-five small, new manufacturing firms in Michigan for a three-year time period, beginning in 1960. They concluded that the principal causes for failure among the ninety-five were a lack of marketing initiative and a lack of "drive" on the part of the owner-managers. Successful firms - about one third of the sample - had experienced, well-educated managers and were frequently managed by several persons with differing functional skills and experience. Collins and Moore (1970), on the other hand, found that successful manufacturing entrepreneurs were almost always from a lower socio-economic class, had very little formal education and seemed to be strongly motivated by a need for achievement (McClelland, 1961). Sandberg (1984) was unable to find any significant relationship between managerial demographics or background and firm performance. Steiner and Solem (1988), in a study of twenty-two small manufacturing firms in northern Wisconsin, found that successful firms employed newer technology (in the transformation process) and tended to exploit competitive advantages. These conflicting results need to be addressed so that better understanding of success factors can be developed for small, new manufacturing firms.

Various research studies into the educational background of entrepreneurs have also yielded conflicting results. One early study (Collins & Moore, 1970) found that manufacturing entrepreneurs had roughly the same level of formal education as the population as a whole and far less than business managers. Later research (Birley & Norburn, 1987; Hisrich & Brush, 1984; Neiswander & Dollinger, 1986) has found just the opposite. Successful entrepreneurs have significantly more formal education than the population as a whole. One possible explanation for these apparently contradictory findings is that many of the later research studies have tended to focus on the high-tech industries where post-graduate education, for managers, is the norm rather than the exception.

Results of many research studies tend to support the conclusion that a majority of successful male entrepreneurs started their firms between the ages of thirty-five and forty-five (Collins & Moore, 1970; Neiswander & Dollinger, 1986). Hisrich and Brush (1984) found that successful female entrepreneurs are slightly older than their male counterparts.

Functional experience refers to the number of years that an entrepreneur has spent in such line functions as general management, marketing, production, and engineering *prior* to founding a new firm. Functional knowledge and experience has been shown to be related

to firm performance (Aguilar, 1967; Govindarajan, 1988; Hambrick & Mason, 1984). Strategy employed has also been shown to affect firm performance (Covin & Slevin, 1989; Govindarajan, 1988; Hambrick, 1983; Porter, 1980; Sandberg, 1984). The low-cost leadership strategy seeks to open up a sustainable cost advantage and resorts to any preemptive moves that undercuts the competitors' current prices. This results in gaining market share at their expense or earning a higher profit margin selling at the going price.

Differentiation strategy deals with the diversity of consumers' needs. Studying the needs and behavior of the consumer, a differentiator adds one or several features to its products to make them significantly different from the products of rivals.

Focus and specialization strategy starts by choosing a market niche where buyers have distinctive preferences or requirements. What sets a focus strategy apart is concentrated attention on a narrow piece of the total market. Porter's (1980) generic strategy taxonomy includes three distinctly different firm strategies: cost leadership, focus and differentiation, each of which is appropriate depending upon the structure of the industry in which the firm operates. Porter (1983) and others have argued that small firms (the focus of this research) are restricted to a focus strategy in that the capital requirements of cost leadership and differentiation are beyond the capabilities of most small firms.

The intensity of competition, as measured by the number of competitors in an industry, appears to be inversely related to the performance of firms (Porter, 1983). Generally, firms with fewer competitors have an opportunity to exhibit better performance.

The research in entrepreneurship has wrestled with one rather substantial problem: appropriate measures of firm performance. Small, privately-held firms employ some rather unique accounting conventions that make direct comparisons of accounting information difficult, if not impossible. Additionally, they are "notorious for their inability and unwillingness to provide desired information" (Fiorito & LaForge, 1986). Average annual growth in employment has been used in previous research as a measure of firm performance (Davidson, 1989; Miner, Smith & Bracker, 1989). Employment growth is an attractive performance measure for two reasons. Entrepreneurs seem willing to discuss employment levels even if they are unwilling to discuss financial performance. Secondly, growth in employment is an important outcome of entrepreneurship in the eyes of those concerned with social utility - typically policy planners and various government officials.

METHODOLOGY

For this study, one hundred ninety-four firms which fit the criteria for the research study were identified from a State of Oklahoma publication (Oklahoma Department of Commerce, 1989). The criteria were:

1. Principal SIC code between 2000 and 3999.
2. Independent - not owned by another firm.
3. Founded in 1980, or later.
4. Principal place of business - Tulsa, Oklahoma.

A mail questionnaire (available from the senior author) was developed to determine the following:

1. Standard Industrial Classification (SIC) code - four digit (SIC)
2. First *full* year of operation (YEAR1)
3. Total employment in Year 1 (EMP1)
4. Total employment in 1988 (EMP88)
5. Age of entrepreneur at founding (AGE)
6. Functional experience in General Mgt. (GMyr)
7. Functional experience in Marketing (MKTyr)
8. Functional experience in Engineering (ENGyr)
9. Functional experience in Manufacturing (MFGyr)
10. Years of formal education at founding (EDUC)
11. Generic strategy employed by the firm (GSTRAT)
12. Number of direct competitors in Tulsa (COMP)

Three other variables were computed during the analysis:

1. Number of new jobs created by the firm - (NEWJOB)
2. Full years of operation - (YRS)
3. Average number of new jobs per year - (avgjob)

Descriptive and exploratory analyses were performed on all variables, a series of t-tests were used to estimate the relationship between key predictors and the criterion (i.e., average annual increase in employment) and a chi-square test was performed to test for association between strategy and performance categories.

RESULTS

Fifty-two responses were obtained from a single mailing in June, 1989. Of these, forty-six were usable although missing data was a fairly common occurrence in many of the usable responses. Five surveys were returned by the Postal Service as undeliverable and the assumption is that these five firms had ceased operations. The net, usable response rate was 24.3%, a good response rate for a single mailing to small firms. Since this study was not supported by outside funding, the cost of a second mailing was prohibitive. However, on the basis of a chi-square test for association of durable vs. non-durable category frequencies, the sample was judged to accurately represent the original population.

Descriptive statistics for the continuous variables are shown in Table 1.

Table 1. Descriptive Statistics - Continuous Variables

Variable	N*	Mean	Median	Std.Dev.	Range
AGE	45	40.49	40.00	9.54	21-67
GMyr	44	8.91	7.5	8.54	0-35
MKTyr	44	4.32	1.5	5.53	0-7
ENGyr	44	2.75	0.0	4.92	0-4
MFGyr	44	2.07	0.0	4.42	0-20
EDUC	45	15.00	16.00	1.60	12-18
NEWJOB	44	17.05	4.5	28.71	< '> -110
YRS	46	5.2	5.5	1.96	1-9
COMP	43	31.7	3.0	68.80	0-350
avgjob	44	3.27	1.0	5.44	<1.75>-25

* Note: Variations in N throughout this report reflect the fact that many questionnaires had missing data.

Firms were identified by SIC code and the breakdown of firms into two-digit SIC codes (major industry groups) is shown in Table 2. Compared to a state-wide listing of manufacturing firms (Oklahoma Department of Commerce, 1989), the sample distribution of two-digit SIC codes seems to exhibit slight underrepresentation of SIC groups 20, 24, and 25 and slight overrepresentation of SIC groups 27 and 33.

Table 2. Major Industry Groups

SIC GROUP	DESCRIPTION	# OF FIRMS
20	Food	1
24	Lumber & Wood Products	1
25	Furniture & Fixtures	2
27	Printing & Publishing	14
28	Chemicals & Allied Products	2
30	Rubber & Misc. Plastics	1
32	Stone, Clay & Glass	2
33	Primary Metal Industries	3
34	Fabricated Metal Products	7
35	Machinery, Except Electrical	6
36	Electrical Machinery	2
37	Transportation Equipment	2
39	Miscellaneous Manufacturing	1

(Note: Two firms did not report SIC Code.)

For this research, firm success was defined as average annual increase in total employment between the first full year of operation and calendar year 1988. An exploratory Box plot indicated that nine firms could be considered "outliers" with average annual employment increases above the sample mean. These outliers were classified as "very successful." The other firms were classified as "average." Differences in employment increases are shown in Table 3.

Table 3. Differences in Employment Increases

	AVERAGE ANNUAL GROWTH IN EMPLOYMENT		
FIRMS	N	x	s.d.
Average	35	0.84	1.20
Very Successful	9	12.74	5.11

(Student's t: -6.95, p = 0.000, DF = 8)

A series of t-tests was performed to determine the significance of differences between the means of various predictor variables in average and very successful firms. Results of the t-tests are shown in Table 4.

Table 4. Predictor Variable T-Tests

	"Average"		"Very Successful"		P
	x	s.d.	x	s.d.	
# of Competitors	35.5	72.10	2.78	1.99	0.015
Age of Founder	39.88	9.23	43.80	11.30	0.36
Experience-Gen. Mgt.	8.22	8.38	11.22	9.23	0.49
Experience-MKT	4.36	5.58	4.78	6.08	0.86
Experience-ENG	2.27	4.39	3.78	6.28	0.51
Experience-MFG	1.64	3.62	4.11	6.79	0.32
Formal Education	14.88	1.55	15.67	1.50	0.19

Strategy employed was determined by providing a very brief description of each of Porter's (1980) generic strategies and asking the entrepreneur which of the three represented the best description of what the firm's strategy had been between the first full year of operation and 1988. A chi-square test of association was performed on the strategy and success classifications. Results of the chi-square test are shown in Table 5.

Tabnle 5. Cross-Tabs of Strategy and Success

STRATEGY	AVERAGE	VERY SUCCESSFUL	TOTAL
Cost Leadership	10	1	11
Differentiation	7	0	7
Focus	18	7	25
	35	8	43

Chi-Square = 3.715 with DF = 2, p = 0.156

DISCUSSION

Results of this study provide some support for conclusions drawn from previous research of success factors in entrepreneurial firms. The results suggest that the number of competitors, the age of the founder, the acquisition of relevant, functional experience and the amount of formal education might be important to the performance of small, new manufacturing firms in the Tulsa area in the 1980s. Although only one variable (number of competitors, $p = .015$) is statistically significant, and only one variable (amount of formal education) approaches significance, the effects of the age and experience variables are all in the expected direction. The individual importance of each of the predictors is further supported by the fact that Pearson product moment correlations yield no intercorrelation in excess of 0.375, which eliminated concerns of multicollinearity.

Although no significant relationship was found between various functional backgrounds and firm performance, a post-hoc analysis of total reported years of functional experience (i.e., in management, marketing, engineering or manufacturing) was found to be significantly related to firm performance ($r = .304$, $p = .05$). This might be considered a new finding in small firm research, as relatively few articles were identified that considered years of functional experience as a potential predictor.

Industry effects may also be important in that there are *no* successful respondent firms in SIC Group 27 (Printing and Publishing) and only one successful firm of seven in SIC Group 33 (Fabricated Metal Products). We see (in Table 5) that the most effective generic strategy employed in this sample is a focus strategy. Twenty-eight percent of the firms employing a focus strategy were classified as very successful. Only one of the cost leadership firms was successful and no firms reporting a differentiation strategy were successful. This finding supports previous research (Porter, 1983).

There *are* differences between very successful and average manufacturing entrepreneurs (MEs). Successful MEs tend to be older, have more formal education and considerably more functional experience than less successful MEs. Given that the differences are not statistically significant, these results tend to support prior research in modest fashion and further suggest that a larger sample, controlled for industry, has the potential to more fully develop the preliminary hypotheses.

It is of interest to note that number of competitors *is* significantly different between very successful and average MEs. Fewer competitors is clearly related to better performance.

Opportunities to extend this preliminary study are considerable. It would be interesting to consider differences in geographical regions. This study was conducted in the city of Tulsa which, although a nationally-known test market, had a unique historical economic base in energy production and aviation. Testing various hypotheses with small samples is a risky proposition that frequently yields spurious results. For this reason, a larger sample (or multiple samples) would be indicated before any firm conclusions could be drawn.

This study did not consider the psychological predispositions of the entrepreneurs nor did it consider environmental scanning practices. Both Need for Achievement (n Ach) and Locus of Control (LOC) have been shown to relate to managerial and entrepreneurial

achievement. Also, there is a growing body of evidence that suggests that environmental scanning is linked to firm performance. A larger sample would allow the inclusion of additional research-based variables without jeopardizing the statistical power of any hypothesis tests.

In terms of managerial and policy-maker implications, this study suggests several important relationships between aspects of the entrepreneur's background, his environment and later performance of his firm. Clearly, total years of functional experience is positively correlated with firm performance. One should, perhaps, be a bit cautious of investing in a start-up manufacturing firm in which the entrepreneur has limited functional experience. Additionally, this research supports the idea that older entrepreneurs with greater formal education may yield higher performance in firms they found. Finally, although it confirms prior research (Porter, 1983) and ordinary "common sense," this study strongly suggests that one should be very cautious in entering fragmented, highly-competitive industries. The number of competitors is negatively correlated with performance in a statistically significant sense.

In summary, this preliminary study of aspects of the entrepreneur's background and environment suggests that further study of these factors and related factors might prove to be interesting in the research sense and potentially valuable to practitioners and investors.

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Manufacturing entrepreneurs: An exploratory study of performance

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