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FORECASTING AND THE MANAGEMENT OF
MICHIGAN SPIN-OFF FIRMS

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by

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BACKGROUND

The original research reported in this working paper has been sponsored by the Industrial Development Division of the Institute of Science and Technology of the University of Michigan. It is part of an ongoing program of research in entrepreneurship designed to improve the contribution of small business enterprise to the economic development of the state and the nation. Additional information on the Research Program in Entrepreneurship can be obtained from Patricia L. Braden, Program Director; Donald N. Smith, Director, Industrial Development Division, Institute of Science and Technology; or H. Paul Root, Director, Bureau of Business Research.

ABSTRACT

The research upon which this study is based was performed in the summer of 1970. It had been hypothesized that sales forecasting could be used as a crude proxy measure of the "management orientation" of technical entrepreneurs and would separate these entrepreneurs from "caretakers," who do not have a drive to succeed economically (though they may have drives to succeed in product development or research). By means of a questionnaire and data gathered by an independent firm, this hypothesis was explored and found to be valid. It is hoped that the results will prove beneficial to the growth of the firms involved.

INTRODUCTION

This paper is a report of a survey conducted in the summer of 1970 on sales forecasting and spin-off firms in the state of Michigan. The study is a continuation of a project initiated by Dr. Lawrence M. Lamont which investigated the nature of spin-off firms in general and Michigan spin-off firms in particular, with the ultimate goal of developing management techniques, guidelines, and/or seminars beneficial to members of this segment of the Michigan economy. Such aids may have relevance to firms outside this industry segment, though this remains to be seen, since research to date has been largely restricted to defining characteristics of technological entrepreneurs.

Although spin-off firms have been with us for many years the study of them is relatively new because the usual tendency is to lump technical entrepreneurs with all entrepreneurs. While there may be some justification for this in a few areas of entrepreneurial activity (e.g., grouping food store owners with dry goods store owners), it will be seen that such aggregation may hide significant characteristics of the technical entrepreneur. Technological entrepreneurs are not simply entrepreneurs, but are a distinct subset of entrepreneurs

composed of two further subsets--the managers and the caretakers. This study is aimed at the former, the men who have founded businesses which they expect to grow and are willing to use recognized managerial tools to help foster such growth. The latter, the caretakers, are primarily concerned with having their companies generate sufficient funds to enable them to pursue nonmarket-oriented or unprofitable research. The caretakers do not expect their companies to grow financially, and good management is thus irrelevant. From the standpoint of tax revenues, employment, and industrial development, therefore, the manager is more important; thus, it is his firm that we are studying in this phase of the project.

BACKGROUND

A number of studies have been made of various specific aspects of spin-off firms. Lamont^{1/} has studied them from the marketing aspect; Cooper^{2/} has studied them from the standpoint of why they come into being; Rubenstein,^{3/} and Chastain and DeVries^{4/} have studied their financial aspects.

^{1/}Lawrence M. Lamont, Technology Transfer, Innovation, and Marketing in Science-Oriented Spin-Off Firms (Ann Arbor, Michigan: Institute of Science and Technology, University of Michigan, 1971).

^{2/}Arnold C. Cooper, "Entrepreneurial Environment," Industrial Research, September 1970, pp. 74-76, and "The Palo Alto Experience," Industrial Research, May 1970, pp. 58-60.

^{3/}Albert D. Rubenstein, Problems of Financing and Managing New Research-Based Enterprises in New England, research report to the Federal Reserve Bank of Boston, No. 3, 1958.

^{4/}Clark E. Chastain and Marvin G. DeVries, Financing in Michigan (Ann Arbor, Michigan: Institute of Science and Technology, University of Michigan, 1966).

Individually, each of these studies is valuable, but taken together as a sort of "map" of the formation and management processes in spin-off firms, they are considerably more valuable. A firm is not simply a set of marketing problems, financial problems, or control problems, for example, but is a mixture of all of these with one area occasionally dominating. Thus success in coping with one area will not guarantee business prosperity unless the only major problems the company ever faces are in that particular area. In the case of the entrepreneurial firm, especially where one man bears overall operating responsibility, being able to deal with several management areas is a vital skill. To be successful in business the entrepreneur, heretofore a technician, must become a businessman, a manager. This is not to say that he must be instantly an authority in the various business-related fields, but that he must have the ability and the desire to become adequately competent in these fields. McClelland^{5/} would speak of this in terms of having a high degree of "nAch," or need for achievement. The businessman-entrepreneur will do virtually anything to succeed in his business if he has a high degree of nAch. Part of the problem with our attempt to assess the success orientation, business orientation, or nAch of our entrepreneurs lay in trying to discover what instrument one could use to determine the characteristic without resorting to projective techniques (though McClelland uses them with great success). Because it was decided to use a mail survey, the measure had to be

^{5/}David C. McClelland, The Achieving Society (New York: The Free Press, 1961).

simple and therefore somewhat more prone to error than personal interviews and projective techniques. It was decided, because of the exploratory nature of the work, that sales forecasting would provide a simple, relatively crude, but adequate indicator of the entrepreneurs' desire to get ahead. In sum, it was felt that sales forecasting, by providing in some cases inputs necessary for proper plant scheduling, plant and equipment expansion plans, hiring technical and nontechnical people, etc., would be a satisfactory proxy measure and would provide some insight into the operations of the firms as well.

The aim of the project, which is a long-term endeavor, is first to provide an understanding of the firms and the entrepreneurs so that, second, some assistance can be given in the forms of techniques, guidelines, training programs, etc. A knowledge of what and whom we are dealing with is felt to be a prerequisite for effective assistance. To emphasize this point, we quote from a University of Utah study of small businessmen:

...even if he knows he needs counseling, a small business operator may be precluded from getting it because of psychological barriers, lack of awareness of the counseling process, fear of revealing company secrets, and the feeling that asking for help would be an admission of failure or weakness.^{6/}

Obviously, we need to know if we are dealing with such a person before any assistance projects are begun. The phase of the project discussed in this paper did not delve deeply into the assistance problem, but some insight was gained into the

^{6/}Bureau of Business and Economic Research, College of Business, University of Utah, Small Business Counseling: An Evaluation of Technique. Report prepared for the Small Business Administration. (Salt Lake City, Utah, 1964.)

degrees of maturity and willingness to participate, which may be indicators of willingness to be helped.

Why study spin-off firms?

One of the primary activities of the spin-off firm is to apply advanced technology to problems faced by business. The technology may have been developed by a large firm which did not feel that it represented sufficient commercial potential to bring to market, or it may have been developed independently by the scientist. Either way, the entrepreneur must then decide whether the development has commercial possibilities, if so then leave his employer and form his own firm. Thus certain technologies are transferred from laboratory to industry by these technology-oriented entrepreneurs. This function is of itself important.

In addition to their technology-transfer function, spin-off firms contribute to the economy through sales and employment. Some, of course, contribute considerably more than others. The smallest firm in our sample has annual sales of \$3,000. One firm not in our sample (a fairly young firm) has sales of approximately \$60 million. Obviously, from an economic standpoint the latter firm is the more successful. While there is no implication that the smaller firm could, in any reasonable time period, grow to the size of the larger, there are several firms in the \$500,000 to several million dollar range which, given proper management, could conceivably attain \$60 million in sales. The benefit to the state's economy (we

are here thinking specifically of Michigan) would be enormous if several of these firms would show more dynamic growth. We have sales data on 70 small firms out of a sample of 97. These 70 firms have aggregate annual sales of approximately \$50 million--less than the single, highly progressive firm. The growth of the large firm was, of course, due to a combination of factors--management experience, management orientation (dynamic vs. static, high nAch vs. low nAch), product, timing, and so forth. Not all, or even any, of our small firms could be expected to have such a favorable mix. But there is no reason why they should not experience higher growth rates than they have, especially for the large number of firms that are essentially stagnating. Such growth has obvious benefits for local, state, and national economies, since the potential growth of the firms is obviously considerable. It is definitely a segment of the economy which should be fostered.

The sample

The sample of 97 firms was selected by updating files generated for a previous study and editing them to meet our criteria of technological orientation (the firms had to be in technically advanced fields) and size (our largest firm has sales of \$6,330,000). These firms have been in existence from less than one year to over 36 years, the average being 7.6 years and the median 7 years ($\underline{n} = 93$).* They have annual sales ranging from \$3,000 to \$6,330,000, with an average of \$702,400 ($\underline{n} = 70$).

*
 \underline{n} = number of respondents.

The firms produce a fairly broad range of technologically advanced products, from computer systems to advanced testing equipment and electro-optics. In several cases these products are not the primary product line, since some of the devices are still in the research and development stage or are in the very early stages of marketing and do not produce sufficient income to keep the firm operating. Therefore, more mundane products are produced as bread-and-butter items until the technologically advanced products achieve sufficiently wide acceptance to become the primary product.

While the product orientation is broad, the entrepreneurs' backgrounds are remarkably consistent: 51 of our 97 entrepreneurs (53 per cent) had degrees in engineering and had practiced engineering with other firms before starting their own. Because the data were suspected to be incomplete (our source material, gathered by a nationally known firm, has some inaccuracies in it) the figure may be much higher. The figures are consistent with the findings of Cooper^{7/} who found that at least one of the founders of most spin-off firms was in engineering.

The selection of firms on the basis of size may seem arbitrary, but this criterion was used for two justifiable reasons. First, the larger a firm is, the more resources it has available to solve any given problem. It should have less trouble than a smaller firm in obtaining capital, manpower, or

^{7/}Cooper, "The Palo Alto Experience."

equipment if any is needed. Thus a solution to a larger firm's problem may well be impossible for a smaller firm. We therefore dichotomized the firms into larger and smaller. With our emphasis on ultimately aiding the firms in their growth, the study is concerned with the smaller firms and their unique and sometimes critical problems not faced by the larger firms. Lamont^{8/} suggests such a dichotomization, though we have arbitrarily raised his point of demarcation between "large" and "small." Firms in the \$6 million annual sales range (our point of demarcation) can have the same problems, and the same difficulties in solving them, as firms having only \$500,000 in sales (Lamont's point of demarcation).

Our second reason has already been alluded to above. Considering the high mortality rate of new firms,^{9/} it is primarily necessary for the firm to survive its first critical years and then begin its growth stage. We hope that our studies will aid these firms in their establishment and expansion.

Forecasting as a measure of the manager

Beginning with our forecasters' demographics, it was found that the forecasters had an average age of 5.6 years with a median age of 4 years ($\underline{n} = 34$). It will be recalled that the sample as a whole had an average age of 7.6 years

^{8/}Lamont, Technology Transfer, pp. 112 ff.

^{9/}Danilov (Victor J. Danilov, "The Spinoff," Industrial Research, May 1969, pp. 54-58), however, notes that there are substantially more successes than failures in the spin-off firms surveyed by the MIT and the Stanford Research Institute.

and a median of 7 years. It was further found that our non-forecasters had an average age of 8.6 years and a median of 7 years (n = 23). While the difference between the ages of the forecasters and the nonforecasters was not found to be statistically significant, our forecasters are, on the whole, younger than our nonforecasters. We have hypothesized one reason for this: There is a growing emphasis on management techniques, and forecasting is now more acceptable as a business practice than it was several years ago. Also, the younger firms, being more flexible (habit patterns should not have been as firmly set), were able to react to the liquidity problem of the late 1960s by implementing new techniques such as forecasting to aid in overcoming cash-flow problems. Older companies, being at least marginally successful, might well have asked, "Why tamper with success?" and, despite potential assistance from a series of sales forecasts, would have felt them to be unnecessary. Furthermore, there is the possibility that the nonforecasters are, in general, more set in their ways and hence are less ready to change even without using the stability of a successful business as a rationale. Some evidence for this comes from the following: "There is an obvious need for counseling in the field of small business, but the operator of a small business often lacks an awareness of this. Such a man is so closely associated with the day-to-day problems of his business that he is often unable to see the overall picture including opportunities for improvement and the possible pitfalls if wise decisions are not

made."^{10/} (Emphasis supplied.) While we are certainly not at this time engaged in counseling, the emphasized portion stressing the lack of interest in change is important. If a management activity is not made part of an entrepreneur's set of skills early in his entrepreneurial career, it is unlikely that it will be incorporated later on in his career. There is some evidence from social psychology^{11/} that a stress situation may cause the incorporation of behaviors necessary or at least beneficial to survival. Thus, if a firm were to encounter serious difficulties, the entrepreneur might be more likely to incorporate modern management techniques into his set of skills. This, however, assumes that the entrepreneur is aware of and believes in the effectiveness of these techniques, and that the firm is sound enough to weather the transition period from old to new management styles. At any rate, it seems improbable that older firms which have retained their original managements will employ modern management techniques. If change does occur, it will probably be somewhat slower than for younger firms (younger firms being more flexible). It was found in 15 of 23 forecasting firms (62.5 per cent) for which we have complete questionnaire data that forecasting was begun within one year of the firms' inception. This tends to support the point that firms are more flexible and innovative when young.

^{10/}Bureau of Business and Economic Research, College of Business, University of Utah, Small Business Counseling, p. 3.

^{11/}Warren G. Bennis; Kenneth D. Benne; and Robert Chin, The Planning of Change, 2nd ed. (New York: Holt, Rinehart, and Winston, Inc., 1969), chapters 7-9.

In addition to the tendency for the forecasters to be younger than the nonforecasters, they also tend to be larger. (Because of the reluctance of some entrepreneurs to provide sales data for their firms, our n's are less than the total sample, nevertheless, there are still substantial differences between forecasters and nonforecasters.) Average sales of forecasters ($\underline{n} = 19$) are \$1,257,000, with a median of \$350,000, and average sales of nonforecasters ($\underline{n} = 18$) are \$504,000, with a median of only \$150,000. Despite the small sample sizes, the direction of the tendency is clear. Forecasters are generally larger than nonforecasters. The forecasters might be larger because of their use of advanced management techniques (as indicated by their use of forecasting). This is the hypothesized direction. or the larger firms, having more in the way of resources, are more capable of spending some of these resources on forecasting. While this is just as possible from an intuitive standpoint, given the data on size it appears improbable. Almost 60 per cent (11 out of 19) of the forecasters have sales of less than \$500,000. It is not likely that they are so much larger than the nonforecasters that they would have the additional resources which the nonforecasters do not have. Whether we are speaking of the forecasters or the nonforecasters, we are speaking about small firms (generally). But the forecasters are relatively larger small firms than are the nonforecasters.

Turning to the questionnaire-generated data, we first find rather tenuous, but extant, evidence supporting our use

of forecasting as a proxy for management orientation of the entrepreneurs. Two of the nonforecasters volunteered information which was not requested. If this information is common to the other nonforecasters, it tends to support this use of forecasting. One respondent stated that it was "too early" to start forecasting. This company has been in business for six years and has sales of \$600,000. The other volunteer has sales of \$720,000 and has been in business for nine years. His comment was: "Ultimately we hope to forecast. But right now we have many other areas, which present real problems, which must receive our attention and reorganization. The lack of forecasts at this time is not in any way harmful to our organization." From the evidence of sales versus time in business, it may well be questioned whether the failure to forecast has "not in any way [been] harmful" to their organization. Neither firm is large, nor has either firm shown a particularly dramatic growth in sales. Both appear content in their positions.

Contrast this with the forecasting firms. These firms report wide use of forecasts (see Table 1). The most frequently mentioned use was for projecting future capital needs--20 of 24 respondents (83 per cent) mentioned it. This finding is not in keeping with our expectations of the orientation of our entrepreneurs. Bolstering the position that finance (or at least capital budgeting) is a major concern of the forecasting firms is the finding that 18 out of 24 firms (75 per cent) use sales forecasting to aid with

Table 1.

Question 4

Use Sales Forecasting for:	Number Responding	Percentage
a. Purchasing raw materials	10	42
b. Purchasing capital equipment, planning plant expansion, or other capital decisions	18	75
c. Projecting future capital needs	20	83
d. Modification of existing products	7	29
e. Introduction of new products	13	54
f. Hiring of production, clerical, or other nontechnical personnel	11	46
g. Hiring of research, engineering, management, or other profes- sional personnel	16	67
h. Scheduling plant and equipment	15	63
i. Other (cash-flow projection and/or business planning)	9	37.5

n = 24

their capital expenditures. As a more powerful indicator than the responses checked on the questionnaire, it will be noted that 9 firms (37.5 per cent) reported that sales forecasts were used for cash-flow projection and/or business planning. Since the other questions required merely that the respondents check items, a bias would be introduced if one or more respondents should become overly enthusiastic in checking responses. Since 9 firms felt strongly enough to append other uses and these other uses were financial, there is added validity for the preceding statements regarding the importance of finance among these entrepreneurs. Granted, we are dealing only with those who forecast, and we are assuming that these are managerially advanced firms. This seems to help justify our thought that there is an identifiable subgroup of spin-off firms which is interested in the financial aspect of management in addition to other aspects of management.

Sixteen of 24 respondents (67 per cent) reported that they used sales forecasting to help them hire technical personnel, thus making this use second in frequency of response. Such a high percentage was not expected, though the estimation was based solely on subjective grounds. Unfortunately, the questionnaire did not distinguish between managerial and nonmanagerial personnel. Thus it is possible that a favorable sales forecast would call for the employment only of new management personnel to help take care of the increased work load, but would require no new technical personnel to aid in product design or refinement. Alternatively, forecasts could predict

changes in the product mix which would require engineering or scientific personnel but no new management personnel. Even though we do not know which interpretation was used by the respondents, the results were interesting since they show a rather high degree of sophistication in the use of sales forecasting which seems to permeate a number of decision areas in the forecasting firms.

As would be expected, plant and equipment scheduling ranks high on the list of uses. Fifteen out of 24 respondents (63 per cent) mentioned that they used sales forecasting for this purpose. This is a relatively common use for sales forecasts in industry in general, but nonetheless illustrates an attempt on the part of the forecasters to improve their management practices.

Next in frequency of use (13 out of 24, or 54 per cent) is the introduction of new products. It is not known at what stage(s) in new-product introduction the forecasts are used (which is perhaps a deficiency in questionnaire design), but we did not intend to probe deeply into this aspect of forecasting.

The remainder of the uses are employed by fewer than 50 per cent of the respondents (which would be expected given their nature), except for the first item--purchasing raw materials. This use seems to have as much potential as does plant and equipment scheduling, yet 50 per cent more firms use forecasts for scheduling than for raw materials purchasing. Forecasting would seem vital for intelligent inventory control,

yet is used by only 42 per cent of forecasters for that purpose. This seems somewhat anomalous.

Preparation and use of sales forecast

Though 67 per cent (16 out of 24) of the respondents reported that sales management prepared the sales forecasts (see Appendix 1 and Table 2), it was surprising that the figure was not still higher. The sales managements, being closest to the raw data, are intuitively those who would produce the forecasts.

Nine firms (37.5 per cent) reported using corporate planning staffs. This figure was somewhat higher than expected, since such staffs are expensive. The use of the staffs shows that a substantial minority of spin-off firms perceive significant benefits from the use of sales forecasts. Whether the staffs have other functions or whether they are full-time forecasters was not determined.

The remaining groups preparing the forecasts (salesmen, accounting department, and "other") involve only four firms apiece. The major finding in this group has to do with the responses to "other." In all four cases, at least some member of top management either prepares or assists in the preparation of the sales forecasts. This indicates that at least some firms take the process of forecasting very seriously.

The question of which group actually uses the sales forecasts (Table 3) was designed in part to determine whether the

Table 2

Question 5

Who prepares the sales forecasts?	Number Responding	Percentage
a. Sales management	16	67.0
b. Salesmen	4	16.7
c. Corporate planning staff	9	37.5
d. Accounting department	<u>4</u>	16.7
<u>n</u> = 24	33*	

*Total is more than 24 because some firms use more than one group to forecast.

Table 3

Question 6

Who uses the sales forecasts?	Number Responding	Percentage
a. Sales management	15	62.5
b. Salesmen	2	8.3
c. Purchasing department	10	41.7
d. Production management	14	58.3
e. Top management	<u>24</u>	100.0
<u>n</u> = 24	65*	

*Total is more than 24 because some firms use more than one group to forecast.

sales forecasts appear to be taken seriously. The data indicate that they are. All 24 of our respondents to this question reported that top management uses the forecasts. Next in frequency, with 15 out of 24 (62.5 per cent) of the respondents reporting it, was sales management, followed by production management with 14 out of 24 respondents, or 58.3 per cent. Ten respondents (41.7 per cent) listed the purchasing department as a user, while only two respondents (8.5 per cent) stated that their salesmen used sales forecasts.

Of considerably more interest than simply who uses the forecasts is what does each user do with the forecasts. This, in essence, is the next question asked (question 6a--see Appendix 1). Top management predictably has a wide range of uses for sales forecasts, ranging from cash-flow management to personnel projections. The most frequently mentioned use is for projecting future capital needs. This was mentioned by 14 of the 24 respondents to this question (58.3 per cent). Next in frequency of top management uses was purchasing capital equipment, planning plant expansion, or other capital decisions, mentioned by 10 respondents (41.7 per cent). As was reported earlier, the emphasis on finance was somewhat unexpected. The objection may again be raised that the respondents were too eager in checking uses. However, 9 respondents did voluntarily write down uses not mentioned in the questionnaire, specifically the use of cash-flow projections and/or budgeting and planning. The fact that these uses--all financial in orientation--were mentioned without prompting by the questionnaire

indicates that finance is a major concern of our forecasting firms.

This is not to say that the forecasting entrepreneurs are exclusively interested in finance. Nine firms (37.5 per cent) reported that their top management used sales forecasts to plan the introduction of new products. Parenthetically, this demonstrates a somewhat more advanced approach to new-product introduction than might be expected from Lamont's work,^{12/} though his findings on the neglect of marketing by entrepreneurs as a whole are quite probably correct. It must be kept in mind that we are dealing with a select subgroup of technological entrepreneurs when we talk about those who engage in forecasting.

Sales management is reported to use sales forecasts primarily for setting sales quotas for salesmen. This is a predictable use, but nonetheless a valuable one, though, as will be noted in Appendix 2, the number of firms reporting salesmen's estimates as an input into their sales forecasts sheds some doubt on the utility of this usage. If a salesman knows that his estimate will be incorporated into a forecast and that his quota will be based upon that forecast, then he naturally has considerable incentive to provide a low estimate so that he will be able to exceed the quota with little strain.

Nine firms' top managements also use sales forecasts for the hiring of research, engineering, management, or other technical personnel. This use has already been commented upon

^{12/} Lamont, Technology Transfer, pp. 2 passim.

above. Production management uses sales forecasts for scheduling production runs, while the purchasing department uses them for assisting in the proper timing of raw materials purchases to obtain quantity discounts and to maintain suitable inventory balance.

While the list of uses and the statements of who uses the forecasts for what tends to give a picture of fairly sophisticated management, there are two factors which could have jointly or severally interfered with the correct recording of information. First, the questionnaires were not anonymous. The respondents could thus have attempted to "impress" the survey staff with their sophisticated management by checking more uses than are actually made of the forecasts. This bias, whether intentional or unintentional, is not uncommon in surveys of this type. And second, the ease of response (simply having to check off responses rather than having to generate them) makes it much easier to inflate claims than it would be otherwise. While these possibilities are present, the general seriousness with which the questionnaires were filled in and the justifications for responses given by many of the respondents tend to indicate that any respondent bias is minor. Naturally, further study, preferably using an interview situation, needs to be done to determine this, but the indications are present in the current data.

Forecasting methodology and accuracy

Partly as a matter of curiosity, partly to determine by proxy how seriously the forecasts were taken, and partly to

determine whether any of our forecasting respondents had found a new and improved method for forecasting new product sales, the respondents were asked to explain their current method of forecasting (question 7). Appendix 2 gives an edited, and in some cases slightly abridged, list of the responses. Probably the most significant finding here is the wide use (14 out of 24 respondents, or 58 per cent) of management experience as the main input and technique for sales forecasting. This is at best a somewhat vague response, though one which is valid--in our eyes--as a forecasting method. The person who stated "We guess like everyone else" was expressing somewhat of a truth, at least when applying it to the forecasting of new products. Most formal forecasting techniques rely, at least partly, upon previous sales data to generate the trends for the future. With the new product, and especially the unique product, there is no historical sales information. If a device is to be used as an attachment to a piece of equipment, then knowing how many of the pieces of equipment are in use would be valuable. Since, however, not every owner of the equipment is a prospective purchaser of the device, some judgment--quite possibly a subjective one--has to be made as to how many of the units will ultimately be fitted with the device. This is only one of the potential forecasting problem situations faced by the producer of a unique product. Other problems may be more complex, but all have as a characteristic the fact that one or more of the critical forecasting variables is unknown and may be undeterminable with any degree of accuracy. Because of the

indefiniteness of the data, subjective forecasting may be the best method available. Since many entrepreneurs have spent at least several years with firms in which they would have come into contact with potential customers and their needs,^{13/} such a method might well have some accuracy as well as practicality.

Three respondents used computers for their forecasting, in contrast to the remainder who presumably used either intuitive or pencil-and-paper techniques. The use of a computer does not guarantee greater accuracy; but considering the time and money required to program and run a computer, there is a high probability that more attention will be paid to validating methodology and estimating inputs than will be paid when non-computerized methods are used. The three respondents using computers reported these accuracies in these ranges: 85-115 per cent of actual, through 95 per cent accuracy, to "95%+." These figures are quite high; but it seems improbable that, even if they have been inflated by the respondent, they have been inflated more than those of the other respondents. They therefore retain their relative superiority. This seems to support the use of a rigorous approach to forecasting, though it must be stressed that the firms have used their techniques for a relatively short period of time, and that there is thus some question whether the techniques will hold up in the long run. It should also be mentioned that a number of our sample firms cannot use computers because of their cost, and the firms must use less

^{13/}Cooper, "The Palo Alto Experience."

sophisticated techniques than are available to our larger firms. Some degree of accuracy may thus have to be sacrificed, but judging from the responses of the firms not using computers, not a great deal will have to be sacrificed. Removing the three computer-using forecasters from our calculation of the average, we find that the average drops from 87.7 per cent to 86.8 per cent of actual, a minor drop.

As would be expected, a majority of the forecasters (56.5 per cent, or 14 out of 24) foresaw no changes in their forecasting techniques. This is predictable given the high level of reported accuracy. A substantial minority, however, did report that changes were expected in their procedures. Five of the respondents essentially state that they intend to update their forecasting methods to take into consideration changes in the market or otherwise generally improve their methods of forecasting. Three reported that they want to forecast using different time-spans, two reporting a desire to make monthly forecasts, and one expressing a desire to make five-year forecasts (though he acknowledges the fact that such is an almost impossible task, given the constantly changing nature of the industry). One respondent, whose accuracy is already excellent (90 per cent accuracy on less than 6-month forecasts), intends to introduce a mathematical model. One respondent wanted to go to more frequent forecasts because of the difficulty of "seeing" 12 months in advance, as he is currently attempting to do. He also is planning to introduce a probability weighting, giving "optimistic/most likely/pessimistic" inputs to arrive at

a weighted forecast. This is a particularly desirable technique to use when dealing with uncertain situations. Finally, one respondent reported simply that his new technique was "under investigation." Perhaps the most important finding of these questions (9 and 9a) is that a large proportion (43.5 per cent) of the firms recognize the need for change despite current accurate forecasts. They perceive their markets and the economy as dynamic rather than static and see that dynamic models need to be built and static models need periodic updating to keep in tune with current activities. This represents a rather sophisticated understanding of the natures of their various environments.

Fifteen of 24 respondents to questions 8 and 8a (62.5 per cent) reported that their current method of forecasting did not differ from the method they previously used, but in only 3 of the remaining 9 cases did the new technique differ in a major sense from the older method. There are two potential problems with this question (number 8a) in that it is an easy question to "get out of"--the respondent can simply check "No" and not answer it, and it also comes after the question about current sales forecasting, an answer which in many cases took much time and which looks much more important than question 8a. These factors could have contributed to the small number of respondents who reported that their current method differed materially from techniques used in the past. The major factors, of course, is that for most of our firms the current technique used is the first technique used, and that

it has not even been tried out thoroughly yet, much less had a predecessor. At any rate this question generated little new information.

The question of forecasting accuracy (question 10) also gives rise to the greatest qualms about respondent accuracy. Table 4 shows the reported accuracies by forecast time-span. The extremely high accuracies reported seem somewhat optimistic, to say the least. Referring to our previous statement that the questionnaires are not anonymous, we can hypothesize that this is one reason for the unexpectedly high reported accuracies. Alternatively, we can hypothesize that, in fact, the forecasters are achieving very high accuracy levels with their forecasts. An average overall accuracy of 87.7 per cent for forecasts of one year or less does seem rather high, but may not be impossible. Further probing would have to be done to determine the validity of the figures.

Conclusions and suggestions for further research

This study was an exploratory one, as has been stated, and no concrete conclusions can be drawn from the findings. However, there are definite implications about the nature of the forecasting entrepreneurs.

First, it was surprising to note how sophisticated the forecasting entrepreneurs seem to be. Their acceptance of forecasting and detailed planning indicates a willingness and, judging from the sales figures, an ability to utilize modern management techniques effectively. Somewhat more resistance

Table 4
 Question 10.
 Time-span of forecast and reported associated accuracy in percentages:
 Periods: Less than 6 months to

Method:	6 Months		1 Year		1 to 5 Years		Over 5 Years	
	Current	Previous	Current	Previous	Current	Previous	Current	Previous
85-115		50		50		50		
90		80	80	70				
80+			80		60			
85		60	80	50				
			126					
			85					
90		25	85		80			
90			80					
			110					
101							94	
					85			
93	95		40	85				
	89		85					
95	70		90	70	80	70	75	
100								
95+	85		90	60	80	50		
90			85					

n = 19

Note: Several respondents reported that it was too early to tell what accuracy to expect from their current method, which reduced the n for this table.

to the management technique would have been expected judging from the previously mentioned works by Lamont, Cooper, and the University of Utah's Bureau of Economic and Business Research. We cannot speak for the potential receptivity of the nonforecasters, but there may be a good possibility of success if a program of assistance were started. Certainly, more work needs to be done in the area of differences between forecasters and nonforecasters, or managers and nonmanagers.

Second, the sales figures suggest that there is a major difference in success between those firms whose entrepreneurs are management-oriented and those which are caretaker-oriented. This is a valid conclusion only if one accepts gross sales as a satisfactory measure of success. The caretaker may be perfectly content to run a stagnant business if it supports his experimental research. Further study should be made to determine whether the caretakers can be separated, by tests or otherwise, from the managers. The ability to identify the managers high in nAch could be quite useful to bank loan officers and others dealing with entrepreneurs who have a need for this sort of information. It could go far in reducing risk in dealing with spin-off firms.

Third, there seems to be some justification for using sales forecasting as a proxy for receptive and progressive management. It at least seems to exclude, to a large extent, those who are not receptive and progressive. Naturally, it does exclude management-oriented firms which, for one reason

or another, do not use sales forecasting in their business management. The sales and age differences between forecasters and nonforecasters tend to indicate that relatively few management-oriented firms are in the nonforecaster group. The study did indicate that there are differences between two types of entrepreneurs--the manager vs. the caretaker--and that the former is more dynamic. This ex post identification is not conclusive, and further research should be conducted along the lines of Palmer,^{14/} using psychological tests to determine nAch.

^{14/}Michael Palmer, "The Application of Psychological Testing to Entrepreneurial Potential," California Management Review, Spring 1971, pp. 32-38.

Appendix 1

- A. First cover letter
- B. Questionnaire
- C. Second cover letter

INDUSTRIAL DEVELOPMENT DIVISION

Institute of Science and Technology
Telephone 313-764-5260

The University of Michigan
2200 North Campus Boulevard
Ann Arbor, Michigan 48105

The Bureau of Business Research has started a long-range program of research into the forecasting and planning techniques employed by Michigan's technologically-oriented business firms. The purpose of this program is to develop a set of models to be used by firms marketing technologically advanced, novel products so that these firms can define their employment, equipment, and capital needs.

The first phase of the program deals with sales forecasting. The enclosed questionnaire asks you to state your current method, and to give a general measure of its accuracy. Naturally, all responses are completely confidential, and the names of no participating firms will be mentioned in the final report, which will be distributed to all participants upon its completion in the fall. It will include specific recommendations for improving sales forecasting, and should prove very useful to firms selling unique products in nonconsumer markets.

In addition to the report, the results of this study and others will be presented at a conference to be held in Ann Arbor in the fall. Invitations will be mailed later in the summer.

A self-addressed, stamped envelope is enclosed for your convenience in returning the questionnaire.

Thank you for your assistance.

Sincerely,

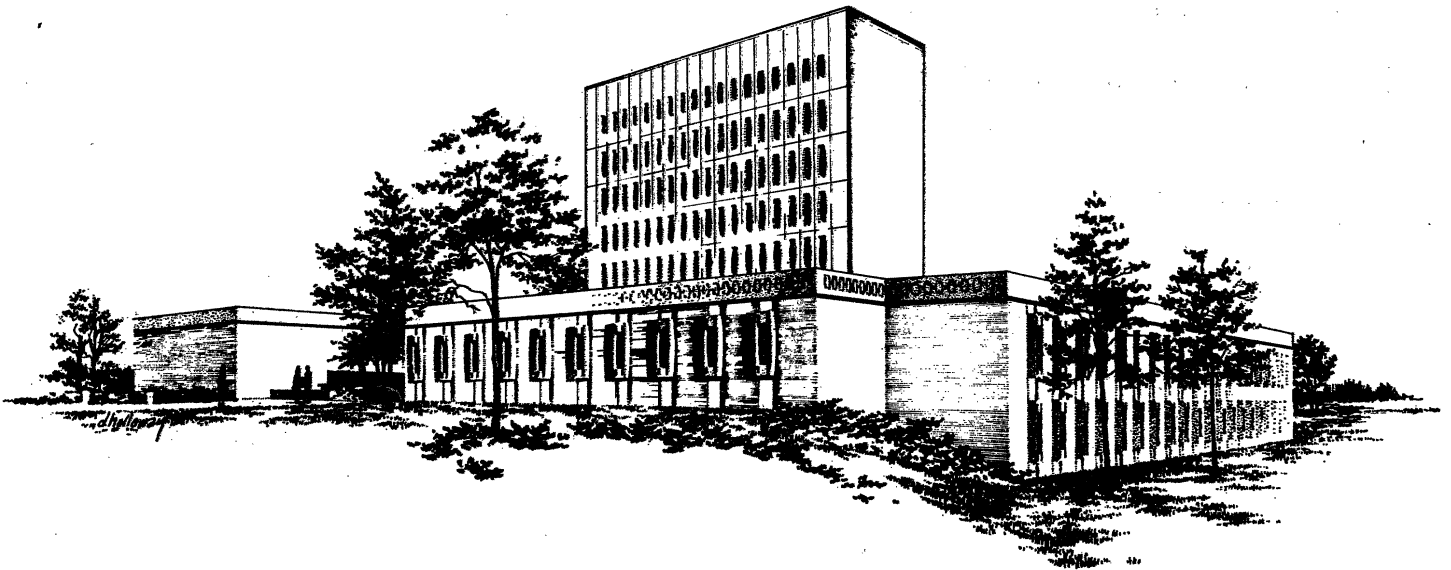
Arthur J. Riggs
Research Fellow

AJR:mac

Enclosure

INDUSTRIAL DEVELOPMENT DIVISION
INSTITUTE OF SCIENCE AND TECHNOLOGY
THE UNIVERSITY OF MICHIGAN

SURVEY OF
SALES FORECASTING TECHNIQUES



INSTRUCTIONS

It is intended that the answers to this questionnaire be based on your immediate knowledge of your organization. Where percentages are requested, please use reasonably accurate estimates if exact figures are not readily available. Please answer all applicable questions. If you feel that a question is not applicable to your firm, please so indicate by placing N/A by that question. Additional sheets may be attached if required.

For assistance or additional forms, contact:

Industrial Development Division
Institute of Science and Technology
2200 North Campus Blvd.
Ann Arbor, Michigan 48105
Attn: Arthur J. Riggs
Telephone: 313/764-5260

Name of President
Name of Firm
Firm Address

(Please make any necessary corrections in the above.)

1. Does this firm currently engage in any form of sales forecasting? YES NO
- 1a. If "NO," please return this questionnaire in the envelope provided; no further questions need be answered.
2. Approximately how long has this firm used sales forecasting? _____ years
- 2a. How long has the firm used its current sales forecasting technique? _____ years
3. For what future periods are sales forecasts prepared? (Check one or more.)
- a. Less than six months _____ b. Six months to one year _____
- c. One to five years _____ d. Over five years _____
4. What use is made of the forecasts? (Check one or more.)
- a. Purchasing raw materials
- b. Purchasing capital equipment, planning plant expansion, or other capital decisions
- c. Projecting future capital needs
- d. Modification of existing products
- e. Introduction of new products
- f. Hiring of production, clerical, or other nontechnical personnel
- g. Hiring of research, engineering, management, or other professional personnel
- h. Scheduling plant and equipment
- i. Other (please specify) _____
5. Who prepares the sales forecasts? (Check one or more.)
- a. Sales management
- b. Salesmen
- c. Corporate planning staff
- d. Accounting department
- e. Other (please specify) _____
6. Who uses the sales forecasts? (Check one or more.)
- a. Sales management
- b. Salesmen
- c. Purchasing department
- d. Production management
- e. Top management
- f. Other (please specify) _____
- 6a. Would you briefly describe the use made of the forecasts by each user mentioned above:
- _____
- _____
- _____

9. Do you currently plan any changes in your forecasting methods? YES NO

9a. If "YES," please explain the nature of the planned changes:

10. Using the formula $\frac{\text{Forecast Sales}}{\text{Actual Sales}} \times 100$, estimate the accuracy of your firm's current and past forecasting techniques. Approximate figures may be used in the calculation. Use the latest figures available.

Period for which forecast was prepared	Current Method	Previous Method
Less than 6 months	_____	_____
6 months to 1 year	_____	_____
1 to 5 years	_____	_____
Over 5 years	_____	_____

Name of person to contact regarding this questionnaire: _____

Telephone No. _____

Date completed _____

Thank you for your assistance in filling out this questionnaire. A copy of the final report will be mailed to you upon its completion.

INDUSTRIAL DEVELOPMENT DIVISION

Institute of Science and Technology
Telephone 313-764-5260

The University of Michigan
2200 North Campus Boulevard
Ann Arbor, Michigan 48105

A few weeks ago we mailed a sales forecasting questionnaire to your firm. We have received responses from many firms in our sample, but find that your firm's questionnaire has not been returned. Since this study is designed to assist firms such as yours in the development of effective sales forecasting techniques, we would like as complete a return as possible.

A second questionnaire and return envelope are enclosed. Please fill out as much of it as you feel applicable to your firm. We feel that the report which will result from your responses to this questionnaire will be worth the few minutes of your time required to answer the questions. This report will be sent free to all participating firms, and will outline current forecasting methods employed and make specific recommendations for improvement.

As stated in the previous letter, all responses are strictly confidential. No participating firms or individuals will be mentioned in the final report or in any materials prepared using this study.

Thank you for your attention.

Sincerely,

Arthur J. Riggs
Research Fellow

AJR:mac

Enclosures: 2

Appendix 2

Methods of Forecasting

Question 7: Please explain your current method of forecasting, including sources of information, methods of analyzing data, models used, etc.

Firm:

1. Estimated market size derived from competitors' advertising cycles, internal information about competitors, and general product category growth trends [for established products].

For unique products, largely seat-of-the-pants judgment is used except for measurement of product need as generated by field problems currently without solutions.

2. Computerized analysis of current sales data modified by trend analysis.
3. Management experience. Trade journals. Advance data inquiry rate.
4. Management knowledge and salesmen's inputs.
5. Analysis of contract proposals multiplied by probability of success plotted as a function of time [for established products].

For new products, we are entering new biochemical sales area. Lack of viable market information prevents a useful volume forecast, so will approach conservatively, necessarily, to avoid high inventories.

6. Obtains information about regional users from allied businesses, newspapers, government offices and publications, and chambers of commerce. Uses management experience to analyze.
7. Analyzes competitors' sales and general economy. Analyzes using management's experience, keeping an eye on allocation of money and equipment.
8. District sales managers assess their geographic areas at six-month intervals by product line, customer, and area geography. Must analyze potential for new products. Corporate marketing staff assembles forecasts and submits them to top management and the corporate planning staff.
9. Order backlog, advance notification by established customers of their estimated future needs. Blanket purchase orders, and discussions with sales representatives and others to gain insight into general business outlook.

10. Management experience is principal tool, using interviews with current and prospective clients as main inputs. Trade journals are also used, and found quite useful.
11. Salesmen evaluate each potential account for probable purchase date and dollar volume. Dollar volume is then multiplied by a probability factor, and the results of all weighted estimates are summed to a forecast total. Found effective for six-month forecasts.
12. Project sales on the basis of past four three-month periods, modified by analysis of outstanding quotations, pending orders, and feedback from salesmen.
13. Combination of historical sales data, management experience, share of market change, and input from field salesmen.
14. Discuss present customers' future needs, get input from sales department about new business expected. Analyze using management experience.
15. Management's judgment.
16. Follow-up on quotation requests. Get information also from sales representatives, trade associations, trade journals, etc.
17. Preceding year's sales are broken down by models and territories. Sales representatives and trade magazines are used as inputs. In analyzing the data, comparisons are made between the sales representatives' previous forecasts and actual sales. Company and industry growth rates are studied and an estimate is made for sales increase as a result of the dropping of old products and the addition of new ones.
18. We guess like everyone else.
19. Management's experience.
20. Forecast each product group by units and dollars for one year--by quarters. Sum product groups to arrive at total. Forecast is based upon "normal" primary and secondary data sources plus management's "feel" for the marketplace.
21. Management experience used to analyze similar or related products' growth figures.
22. Use computer for what seems to be a moving-average forecast.
23. Identify potential market; eliminate companies in the potential market who have the product, have no major need for the product, or who cannot afford the product; evaluate the remainder on the basis of geographic proximity, ease of contact, etc.; evaluate penetration potential.

24. Uses computerized systems approach.
25. Present method is based on back orders, customers' letters of intent and customer estimates. Also evaluate previous usage.

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