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## Forecasting Methods for Marketing: Review of Empirical Research<sup>1</sup>

J. Scott Armstrong  
The Wharton School, University of Pennsylvania

Roderick J. Brodie  
University of Canterbury, New Zealand

Shelby H. McIntyre  
Santa Clara University, CA

**Abstract:** This paper reviews the empirical research on forecasting in marketing. In addition, it presents results from some small scale surveys. We offer a framework for discussing forecasts in the area of marketing, and then review the literature in light of that framework. Particular emphasis is given to a pragmatic interpretation of the literature and findings. Suggestions are made on what research is needed.

**Keywords:** Bootstrapping, Econometric models, Expert systems, Intentions, Judgment, Market forecasting, Market share, Uncertainty.

### 1. Introduction

Casual observation indicates that forecasting is important to marketing practitioners. This is supported by Dalrymple (1987) in his survey of 850 U.S. companies. Of the 134 companies that responded, 98.6% prepare formal forecasts when they prepare formal marketing plans. This is in concert with the 93% of companies in an earlier survey who reported that sales forecasting was “one of the most critical,” or a “very important” aspect of their company’s success [Dalrymple (1975)]. Cerullo and Avila (1975), in a survey of the “*Fortune* 500 Largest Industrial Companies,” found that 98% of the respondents thought that forecasting should be taught at business schools. Also, sales forecasting was the most common of the nine activities in a survey of 353 marketing directors in British textile firms [Jobber, Hooley and Sanderson (1985)].

However, practitioner interest in forecasting is not matched by academic attention in the marketing discipline. A content analysis of 53 textbooks on marketing management and marketing research revealed that forecasting was mentioned on less than one percent of the pages. (The sample included all relevant books that could be found at the University of Pennsylvania library). Perhaps this is because forecasting is a new area for research. Or perhaps it is because forecasting has not been explicitly addressed, though it is implicit in academic work. Another possibility is that forecasting is more practical than theoretical and, as such, is looked down upon by some academics.

This difference between academic and practitioner interest was also found in a 1986 survey of the members of the International Institute of Forecasters (IIF). Among practitioners, marketing people represented the largest group of respondents out of seven categories (27% of 115 practitioners). In contrast, they were next to last in size among academic groups (10% of the 87 academic respondents). This difference in apparent interest is significant at

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$p < 0.01$ . (An alternative hypothesis is that marketing academics respond to questionnaires relatively less frequently than do other academicians.)

Forecasting is an important area for research. As evidence of this, consider the fact that papers in the *Journal of Forecasting* ranked seventh among the 84 journals in management, business, and planning, with respect to the citation impact factor for the years 1982 and 1983 (as reported in *Journal Citation Reports*, 1984, 1985). The work done to date, much of it by academics outside of marketing, has had important implications for marketing decision makers, as will be shown.

Makridakis and Wheelwright (1977) described various forecasting techniques and tried to show how they were relevant to marketing. Our aims are a bit different. We hope to (1) summarize the more important empirical research that relates to the choice and application of forecasting methods in marketing, (2) show how the research from this special issue links with the existing research on forecasting, and (3) provide an agenda for future research. The paper is organized to provide a framework for forecasting and then to examine research contributions within that framework.

## 2. A Framework for Marketing Forecasting

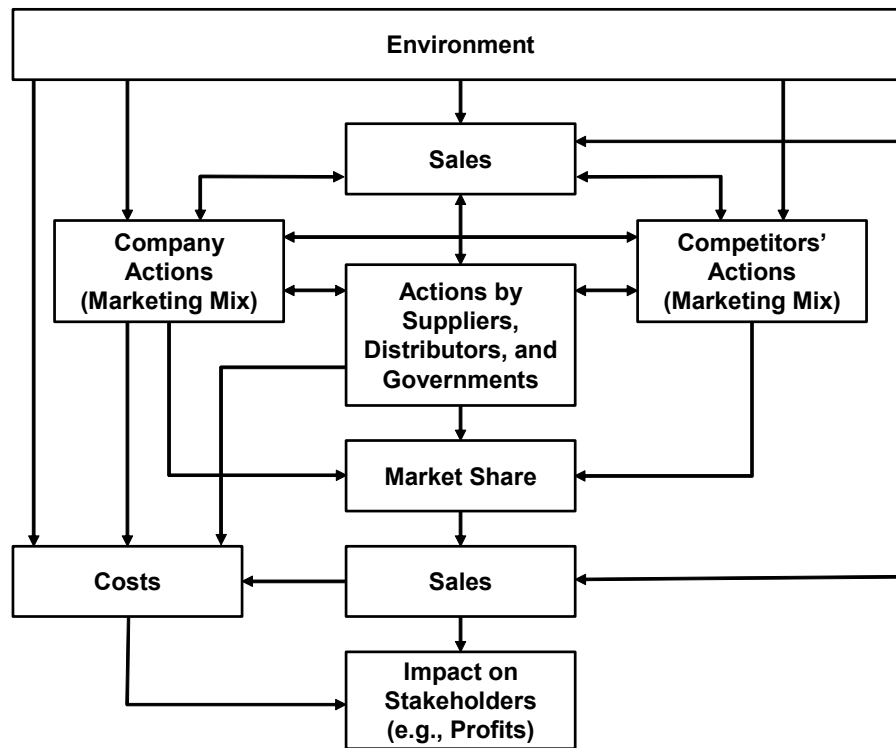
There are many factors to consider when forecasting for marketing decision-making. For instance, one could consider:

- (1) What forecasts are needed (e.g., sales, market share, competitive reactions, marketing costs)?
- (2) What situation exists (e.g., stage of the product life cycle, state of the economy, degree of regulation in the industry)?
- (3) What forecast horizon is appropriate (e.g., current status, short-, medium-, or long-range)?
- (4) What data are relevant and available?
- (5) With what frequency must the forecast be prepared?
- (6) Who will prepare the forecast, and how much time and resources will be committed to the task?
- (7) Who will use the forecast, and in what manner?
- (8) What process is to be used (e.g., how are the data to be gathered and analyzed, and how is the forecast to be presented)?
- (9) When is the forecast needed?
- (10) What uncertainty measures are needed?

Certainly there are other relevant factors, but these serve to illustrate the complexity involved. The list implies thousands of different circumstances. For example, one could examine a judgmental forecast of the long-range expected market sales for a new product with few data, where the intent is to assess the effect on stockholders. In such a situation, one might then consider various forecasting methods.

Although a comprehensive review of the literature was attempted, space does not allow discussion of the research relevant to all of these aspects of forecasting. Instead, we have generated a framework for discussion and hope to highlight an important subset of research contributions. This paper is centered around the first item in the list of factors: "what forecasts are needed." These needs are listed as "A Framework for Marketing Forecasts" in Exhibit 1. The arrows indicate the normal relationships among the factors in the analysis. One would start with the tasks at the top and move down the page. The discussion below examines the boxes in that sequence.

**Exhibit 1. A framework for marketing forecasts.**



### ***Environmental Forecasts***

Can one make better forecasts of the organization's external environment (the economy, population, social trends, technological change, or government legislation)? If yes, will this significantly improve the ability to make better market forecasts? The answers to these questions seem to be "probably," and "only in certain situations," respectively.

Substantial resources have been devoted to obtaining better forecasts of environmental factors such as population, weather, resources, income, technology, and government controls. Ascher's (1978) historical review of forecast accuracy in many of these areas suggested that large errors are common and that, in practice, little improvement has been achieved over the past few decades.

Improved environmental forecasts should lead to more accurate market forecasts. Surprisingly, research in this area indicates that highly accurate environmental forecasts are not required. Consider the following findings:

(1) Measurement error in the causal variables (e.g., the environmental inputs to a market forecasting model) had little impact on the accuracy of an econometric model in the few studies done on this topic [Denton and Kuiper (1965), Denton and Oksanen (1972) and McDonald (1975)].

(2) Conditional econometric forecasts (those made with actual data on the causal variables) generally have not been found to be more accurate than unconditional forecasts (where the causal variables themselves must be forecasted). In fact, of 18 studies to date, only three have shown conditional forecasts to be more accurate, five showed no difference, and ten showed them to be *less* accurate [Armstrong (1985, pp. 241-242), Rosenstone (1983) and four studies from Fildes (1985)]. This inferiority of conditional forecasts is statistically significant ( $p < 0.05$  using the sign test). A possible explanation for these strange findings is that the comparisons may not be fair. The unconditional forecasts often include subjective revisions that may reduce the error in estimating the starting value; such adjustments were not typically used for the conditional forecasts. However, the same perplexing result shows

up in the carefully done study by Dhrymes and Peristiani (1987). Other explanations are possible. Nevertheless, one would not argue for less accurate forecasts of the causal variables.

The above results are useful. They imply that for many situations (typically those involving short-term market forecasts) it is not fruitful to devote a large portion of the budget to obtaining highly accurate environmental forecasts. These conclusions probably would not apply to situations involving large changes (e.g., long-range forecasts). Additional research is needed in this area.

Still, much of the research has been valuable, particularly with respect to econometric methods. Econometric methods have been widely used for environmental forecasts. To date, most econometric researchers have devoted their efforts to short-term forecasting, an area that has yielded unimpressive or contradictory results [Armstrong (1985), Fildes (1985)]. Econometric methods would be expected to be more useful for long-range forecasting because the changes in the causal variables are not swamped by random error, as in the short run. In fact, econometric methods *are* more accurate. Armstrong (1985, chapter 15) reported seven empirical comparisons of methods used in long-range forecasting. In all comparisons econometric methods were more accurate than extrapolations. Also, there was a 3 to 0 advantage for econometric versus subjective forecasts. Fildes (1985) located 20 studies on long-range forecasting; he coded them as 15 showing econometric to be more accurate, 3 ties, and 2 showing econometric to be less accurate than other methods.

Surveys have also proven useful in forecasting environmental trends. For a summary of some of the more successful consumer surveys (e.g., the Conference Board Survey), see Linden (1982) and Curtin (1982).

When forecasting environmental factors that are related to market prices, it is important to remember what might be called Adam Smith's Rule for Forecasters: "Forecasters cannot beat the market." (Some people refer to this as the rule of efficient markets.) In other words, when an active market of buyers and sellers is at work (such as in stocks, bonds, money, commodities, land, and football), forecasters have not had much success at finding methods that can improve upon the market's forecast of prices. This rule assumes that the forecaster lacks inside information, so the market price is a reflection of available information. Thus, the market forecasts prices as effectively as can any existing forecasting method [for an example, see Brandt and Bessler (1983)]. To our knowledge, Adam Smith's Rule for Forecasters holds up rather well. This is one area where further research is not a high priority.

Organizations should have a system for scanning the environment to be sure that they do not overlook variables that may have a large impact on their market. These variables can be tracked in a firm's marketing information system. Periodic brainstorming with a heterogeneous group of experts should be sufficient to identify which variables to track. The key is to identify the important variables and the direction of their effects. Once identified, only *crude* estimates of the coefficients of these variables are typically sufficient in order to obtain useful forecasts.

When large shocks are encountered, more sophisticated approaches may be useful. Leone (1987) examined "intervention analysis" to assess the impact of an environmental shock such as the American Dental Association's endorsement of Crest toothpaste in 1965. His analysis showed that this model was more accurate than several naive models in forecasting market share.

### ***Market Forecasts***

Research on market (industry) forecasting has produced a number of useful conclusions. This research enables substantially more accurate forecasts today than 25 years ago. This section describes some of that research.

One of the major sources of error in forecasting, especially in short range forecasting, is estimation of the current status. For example, in trying to forecast beer sales for next year, it is important to know the current level of beer sales. Here are some conclusions:

(1) Since the most recent information is the most useful [e.g., Ash and Smyth (1973), Pashigian (1964)], it follows that more frequent updating can improve forecasting accuracy. Computer information systems allow for inexpensive and frequent updating of the current sales estimates from detailed data bases. This means that the size of the aggregate market and the various submarkets can be estimated more

quickly and with greater precision. For instance, in the packaged goods industries, marketers can use weekly scanner data at the Standard Metropolitan Statistical Area level delivered within a week, whereas a few years ago they used two-month aggregates delivered six weeks after the fact and covering only 32 regional breakdowns.

(2) Structured judgmental methods apparently improve the estimate of current status [Armstrong (1985, p. 237)]. For an example, see Best's (1974) use of the Delphi technique to estimate current demand for the *Oregon Business Review*.

(3) Econometric methods for the estimation of the current status produce modest improvements in accuracy in comparison to using only trade and production estimates [see Armstrong (1985, p. 236)]. An interesting issue is how much expertise is needed for judgmental forecasting. Surprisingly, research to date [Armstrong (1985, pp. 91-96)] indicates that high expertise in the subject area is not important for judgmental forecasts of *change*. It is, however, important for assessing current levels. An important conclusion, then, is not to spend heavily to obtain the best experts in the field to forecast change. But one should avoid people who clearly have no expertise.

Extensive research over the last two decades has examined biases that occur in judgmental forecasting. [For summaries, see Kahneman, Slovic and Tversky (1982) and Hogarth and Makridakis (1981).] Among these biases are optimism, conservatism, anchoring, and an overemphasis on easily available data. While some sources of bias have been identified, little knowledge exists as to how these biases affect marketing forecasts. For example, how much bias might one expect for a new product forecast? Tyebjee (1987) identifies several sources of this bias, and Tull (1967) provides evidence on the amount of such bias. These findings might be used to adjust new product sales forecasts.

One of the most important findings about judgmental forecasting is that there is safety in numbers. It is useful to combine judgmental forecasts. For this, only five to 20 experts are needed [Hogarth (1978) and Libby and Blashfield (1978)]. But how should these forecasts be combined? Advice to date, based on limited research, has favored the use of the median rather than the mean [Agnew (1985), Larroche and Moynpour (1983)].

In the previous section, it was noted that causal methods provide more accurate long-range environmental forecasts. This applies also to market forecasts. These causal models need not be complex. According to the empirical research, the accuracy of the forecast is not highly sensitive to the estimates of the relationships [Armstrong (1985, pp. 225-232) reviews this evidence]. For example, the accuracy of a forecast of automobile sales is not highly sensitive to estimates of the income elasticity. However, it is important to identify the key variables and the directions of their relationships with the forecasted variables. Crude estimates can then be made of the size of the relationship. The estimates of the magnitudes are likely to be important for very large changes in the causal variables but, as yet, there is little evidence to support this viewpoint. In spite of the failures of prior work, much current research is being devoted to the search for better estimation procedures. Yokum and Wildt (1987) report some improvements due to sophisticated estimation procedures in rapidly changing and complex markets.

Econometric models are especially useful for markets undergoing large changes. The evidence on this [from Armstrong (1985) and Fildes (1985)] was described in the section on environmental forecasts. However, there is need for further research on the conditions under which econometric models are useful in market forecasting.

An interesting consideration is whether marketing principles and concepts, such as the product life cycle (PLC), enable better judgmental or econometric forecasts. Kotler (1984, p. 358) says: "A firm that is considering a new product should forecast the PLC shape based on factors that influence the length of each stage." But evidence to support this statement is difficult to find [Rink and Swan (1979)]. Research using diffusion models may produce some evidence in this area. For a discussion of the state of the art, see Mahajan and Wind (1986).

### ***Company Actions***

Company plans typically require the cooperation of many people. For example, if the organization decides to implement a given marketing strategy, will it be able to carry out the plan? Often the organization fails to do what it intends to do because of a lack of resources, misunderstanding, opposition by key stakeholders, or a lack of commitment to the plan by key people. The need to forecast organizational behavior is frequently overlooked. Better forecasting here might lead to more realistic plans and to plans that are easier to implement.

Surveys of key stakeholders may help to assess the likelihood that a given strategy can be implemented. Because those who are not committed to a plan may be reluctant to admit it, projective questions may be useful when asking about intentions.

The actions of a member in the organization are likely to depend on what others in the group do. For this reason, group depth interviews may be helpful in assessing the commitment to implementation.

Sometimes people are unable to predict their own actions because they lack sufficient experience. For example, how would someone behave if asked to implement a proposed strategy that requires learning a new job? Simulations of this new situation, using techniques such as work samples or role playing, may be useful.

Actions by those outside the firm also affect decision-making. Role playing is well-suited to forecasting how people will respond to these pressures. For example, accurate forecasts have been obtained by role playing (vs. unaided opinions) in forecasting how a company would respond to government pressure to remove a product from the market because of safety considerations [Armstrong (1987)].

In summary, little research has been aimed at forecasting company actions. These suggestions for projective tests, group depth interviews, work samples, and role playing are based mostly on speculation.

### ***Competitors' Actions***

Competitors may alter their actions in response to changes in the environment, actions by other firms, or dissatisfaction with their own past performance. To what degree is it possible to forecast the actions of competitors? The development of a successful marketing strategy often depends upon having a good forecast of the actions and reactions by competitors. Most of the research on market share forecasting has assumed that these actions are known [e.g., Brodie and de Kluyver (1987)]. After forecasting competitive actions and reactions, one must then try to forecast the impact of these actions upon market share. This latter task has been the primary concern of the research published to date. We think the problem of forecasting competitive action deserves more attention than it has received to date.

A variety of techniques can be used to forecast competitive actions. These are summarized in Exhibit 2. This exhibit also indicates the frequency of usage based upon those respondents who identified themselves as practitioners (from various fields) in the survey of IIF members. There were 59 usable responses. Some respondents indicated that their organization used more than one technique. Expert opinion was the most frequently used method (85% of firms), followed by extrapolation with 58%. At the low end of the scale, only 7% of the firms reported using role playing.

Little evidence exists on the predictive validity of the methods in Exhibit 2. One way to assess relative accuracy is simply to ask experts. We surveyed marketing experts at the European Marketing Association Conference in Helsinki in June 1986. We also surveyed forecasting experts at the International Symposium on Forecasting in Paris in June 1986. The results, in Exhibit 2, show much diversity of opinions. The role playing approach, which was in last place among marketing experts, was the second most frequently recommended approach by the forecasting experts.

## Exhibit 2. Methods to forecast competitive actions.

Method	Practitioners' usage (%) (n = 59)	Preferences of experts (%)	
		Marketing (n = 15)	Forecasting (n = 18)
Expert opinion (experts who know about the situation)	85	100	83
Extrapolation (statistical analysis of analogous situations)	58	53	50
Intentions (ask the competitor)	22	60	33
Experimentation (trying the strategy on a small scale)	17	60	22
Game theory (formal use of game theory)	8	47	22
Role playing (formal acting out of the interactions involved)	7	20	61

One obvious area of interest with respect to forecasting competitive action is that of competitive bidding. Edelman (1965) reported substantial improvements for RCA's bidding when a model was used instead of unaided judgment. The model, which used managers' judgments as inputs, was superior on six of seven bid submissions. Replications or extensions of this research have been difficult to find.

Research on conflict situations suggests that role playing provides substantially more accurate forecasts than can be obtained from expert opinion [Armstrong (1987)]. This evidence consists of comparisons between unaided opinions and role playing in seven situations. Predictions from a low cost role-playing procedure were correct on 70% of the occasions, while opinions were correct on only 20%. However, none of these situations involved conflicts among competitors.

Game theory offers another way to forecast the actions of competitors. Eliashberg et al. (1986) compared game theory and group decision theory in predicting the price selected in a simulated bargaining situation. Game theory did well in this comparison. Hopefully, further work will test game theory versus current predictive methods in realistic situations.

### *Actions of Suppliers, Distributors, Government, and Other Stakeholders*

It is often important to forecast the reactions of suppliers, distributors, and government in order to develop a successful marketing strategy. On occasion, one might also need to forecast the actions of other interest groups, such as "concerned minorities." A range of techniques similar to those for forecasting competitors' actions appears useful, but little research investigates the relative accuracy of these techniques. As with forecasting competitors' actions, different techniques may suit different situations.

In an attempt to forecast the decisions by supermarkets, Montgomery (1975) developed a model of a supermarket buying committee. Predictions were made about the shelving of a new product. The model, based on information such as advertising for the product, reputation of the supplier, margin, product novelty, and retail price, provided reasonable predictions for a hold-out sample.

In Armstrong (1987), role playing was used to forecast relations between suppliers and distributors. In the role play, Philco (called Ace Company in the role play), a producer of home appliances, was trying to improve its share of a depressed market. Philco had developed a plan to sell appliances in supermarkets using a cash register tape discount plan. Secrecy was important because Philco wanted to be first to use this strategy. Implementation of such a plan depended upon the supermarket managers. Would the plan be acceptable to them? In this case, a simple role playing procedure produced substantially more accurate forecasts of the supermarket managers' responses (8 of 10 groups were correct) than did unaided opinions (1 of 34 groups was correct). In the actual situation, the supermarket managers did accept the plan proposed by Philco. (Incidentally, the change in distribution channels led to substantial losses for Philco.) The superior accuracy of role playing relative to opinions seems to be due to its ability to provide a more realistic portrayal of the interactions.



## ***Market Share***

Marketing practitioners and researchers have devoted considerable effort to assessing how marketing variables such as product, price, place, and promotion affect market share. This assessment is often based on the market share theorem [Bell, Keeney and Little (1975)]. The theorem states that market share is proportional to the marketing effort of the brand divided by the sum of marketing effort of all the brands in the market. The market share theorem gives rise to a number of alternative model specifications [see Brodie and de Kluyver (1987)]. However, until recently, studies using this theorem have tended to describe applications without testing forecast validity.

Various approaches to predicting market share are examined below. These include judgment, expert systems, and econometric models.

*Judgment:* In practice, market share forecasts have been arrived at judgmentally, so it is useful to examine ways to improve this process. Formal processing of judgmental forecasts has been attempted with respect to the allocation of the effort of salespeople across accounts [Lodish (1971)] and also to improve profits from better advertising budget levels [Little (1970)]. A field experiment by Fudge and Lodish (1977) identified an 8.1% improvement in sales for an experimental group of 10 salespeople as compared to a control group of 10 salespeople who did not use the formal or “bootstrapping” model (named CALLPLAN) to do their forecasting and thereby plan their calling strategy.

However, in general, the value of these models has been hard to demonstrate. For instance, Chakravarti, Mitchell and Staelin (1979) found that managers in a game simulation did not benefit from an advertising model (ADBUDG). The managers’ intuitive judgment would have provided better forecasts than the model, and an econometric approach would have been best of all [Chakravarti, Mitchell and Staelin (1980)]. McIntyre (1981b) used a setting that did not involve carryover effects, and did not deal with determining the budget level, but only with the allocation of a fixed budget across activities. In that experiment, the model (a modification of CALLPLAN) helped users in comparison with a non-using control group. Apparently the value of judgment-based models depends upon the situation and the question being addressed. The key issue is probably how well the decomposition of judgments in the model matches the knowledge and abilities of the manager (user). Decomposition seems especially appropriate where uncertainty about the forecasted variable is high [Armstrong, Denniston and Gordon (1975)].

The forecasting of large changes in strategy, as with the introduction of new products, introduces an additional dimension: it is often necessary to forecast without relevant historical data. Intentions surveys are widely used here. For an early application, see Payne’s (1966) validation of the use of intentions to forecast sales of a new type of television set.

*Expert Systems:* In general, an expert system involves converting a judgmental process to an objective process. One approach is to ask the forecaster to describe the rules that she uses, a process referred to here as “direct bootstrapping.” For example, one might ask: “How would market share change if you increased the quality control for your product so that consumer complaints would be cut in half? ‘What would happen to market share if you added feature x, while your competitors did nothing?’”

Another approach to expert systems is to infer the rules statistically. Typically, this is done by regressing various marketing strategies against the market share as predicted by experts, referred to here as “indirect bootstrapping.”

Bootstrapping has been widely applied in marketing [see Huber (1975a and 1975b) for early reviews on this topic]. Occasionally it has been used with experts, but typically it is consumer intentions that are modeled. Over 1,000 marketing applications had been made by indirect bootstrapping of consumer intentions by the early 1980s [Cattin and Wittink (1982)]. These applications have been done under the umbrella term “conjoint analysis.” Cattin and Wittink lament the lack of validation studies in marketing. Most of the validation has been done by psychologists.

Bootstrapping is nearly always more accurate than judgment [Camerer (1981)], though the gains are usually small. This conclusion is true for both direct and indirect bootstrapping. One explanation for this is that the model applies the judge's rules in a more consistent manner.

Leigh, MacKay and Summers (1984) and Neslin (1981) compared direct and indirect bootstrapping of consumer preferences. Minor differences were found in accuracy, the Leigh, MacKay and Summers' study favoring the direct approach, while Neslin's favored the indirect. If the decision makers have little awareness of their process, indirect bootstrapping is preferred. Typically, however, the choice between direct and indirect bootstrapping will be based on relative costs.

One would expect that bootstrapping of consumers and experts would each provide useful information. Research on the relative accuracy of each approach would be useful. The bootstrapping of marketing experts is typically less expensive and faster.

In our opinion, bootstrapping (including related approaches such as expert systems and conjoint analysis) is one of the more important advances for forecasting in marketing over the past quarter century. In comparison to unaided judgments, it allows for systematic, inexpensive, rapid, and accurate forecasts of alternative marketing strategies. It also enables the decision makers to examine simultaneously the effects of different strategies (e.g., price, product design, sales efforts, and advertising) on market share.

*Econometric methods:* When one has access to historical data, econometric models are relevant for predicting market share. This has been an area where substantial efforts have been made in marketing. This research has produced generalizations about the effectiveness and relative importance of price, advertising and other elements of the marketing mix [Aaker and Carman (1982), Leone and Schultz (1980) and Simon and Arndt (1980)]. The research has also led to the development of methods to analyze competitive response [Clarke (1973) and Hanssens (1980)]. However, little research has been done on predictive validity. Brodie and de Kluyver (1987) found only four studies that evaluated the ex ante predictive ability of econometric models. While the econometric models showed no overall superiority, it must be remembered that these studies examined only short-range forecasts.

We believe that the research on econometric models in marketing has focused on areas that are unlikely to show returns. For example, much attention has been given to developing theoretically pleasing functional forms such as the logit and probit [e.g., see Naert and Weverbergh (1985)]. Experience in fields other than marketing has shown that the functional form is seldom important to the accuracy of forecasts. This finding has also been obtained in marketing studies [e.g., Shocker and Srinivasan (1979), Reibstein and Traver (1982), Brodie and de Kluyver (1984), Dalrymple and Haines (1970), and Ghosh, Neslin and Shoemaker (1984)], although Wilton and Pessemier (1981) found that the functional form did affect accuracy in predictions of the purchase of an electric automobile. The functional form is most likely to be important when large changes occur in the dependent variable.

The lackluster performance of econometric methods may result from their being used in situations involving small changes. Econometric methods are most relevant for assessing the impact of large changes in strategy. Theoretical support for this position is provided by Hagerty (1987) and empirical evidence is provided by Parker and Srinivasan (1976). For example, site selection models should lend themselves to econometric modeling because of the large differences in market response to the potential sites.

The preceding discussion of market share has emphasized the *analysis* of data. Significant gains have also been made in the *availability* and *accuracy* of data [e.g., Neslin (1974)]. Data are becoming more timely, more detailed, and more accurate. Better data on the variable to be forecasted are of particular importance. Interestingly, however, "more" and "better" information (beyond a certain minimal level) on causal variables has typically produced only modest improvements in forecast accuracy. This result pertains primarily to judgmental methods, though similar findings have been obtained with econometric and extrapolation methods [Armstrong (1985)].

Other areas where research would be relevant for market share forecasting relate to more specific marketing decision areas. Some key research questions are:

- (1) How can one select the best salespeople? Research from personnel psychology has produced promising results recently. Of particular interest is the use of "job samples." Prospective applicants are trained on

key elements of the job for an hour or so, and then are judged by how quickly they master these elements [Reilly and Chao (1982)].

- (2) How should salespeople be assigned to regions? Forecasting of regional sales can help with these decisions. As early as 1939, Wellman (1939) and Weld (1939) suggested the use of econometric models to forecast regional sales. Armstrong (1970) found supporting evidence, but little research has been done in recent years to validate this approach. However, the data have improved immensely in this area.
- (3) How should one forecast sales when the salesperson's compensation is based on performance relative to the sales forecast?
- (4) In the area of distribution, what is the best way to make forecasts for site selection? Although firms obtain extensive data, they often process these data in traditional group meetings in order to forecast the profitability of a given site. Substantial investments are made on the basis of these forecasts, so improvements in the accuracy of forecasting would be valuable. One would expect such techniques as judgmental decomposition, Delphi and consensus-seeking to be important here. Quantitative methods are also relevant. For example, Armstrong and Andress (1970) found that segmentation (using AID) provided more accurate forecasts than did regression analysis for the volume of gasoline sold at service stations. The state of the art in site selection is reviewed in Craig, Ghosh and McLafferty (1984).
- (5) In the area of pricing, questions might be addressed such as how would a specified negotiation strategy affect the final price?

### ***Sales Forecasts***

If one approaches the forecasting problem as outlined in exhibit 1, it is necessary only to multiply the industry sales and the market share forecasts to calculate a company sales forecast. Often, however, attempts are made to forecast sales directly. An interesting research question, then, is under what conditions is it useful to go through all of the steps of exhibit 1 instead of forecasting sales directly? [See Naert and Leeflang, (1978), Chapter 8], for a discussion of this issue.] Dalrymple's (1987) survey shows that this direct approach to sales forecasting is widely used. The direct approach seems most appropriate for short-range sales forecasting in situations where one is not concerned about assessing the effects of alternative strategies.

Opinions studies are widely used in sales forecasting. In particular, opinions are often obtained from the sales force [Wotruba and Thurlow (1976)]. It is important to learn more about how to pose the questions, how to aggregate the responses, and how then to adjust for biases in the responses. Staelin and Turner (1972) demonstrated how bias can be isolated from other errors. In their analysis of forecasts from a sales force, the bias was responsible for up to 60% of the forecast error.

Some improvements in accuracy might be obtained by using bootstrapping of the experts who make sales forecasts. This was done successfully for catalog sales forecasting by Michael (1971). Intentions surveys are commonly used for short-range forecasting. The validation research supports this practice. Continuous improvements have been made on the methodology for intentions surveys over the past half century. Perry (1979) showed how intentions surveys have become more accurate in forecasting political elections in the U.S. Much has been learned about how to reduce sampling error, non-response bias, and response bias. Current work is directed toward how to word the question properly in order to reduce response bias. Kalton and Schuman (1982) review the research in this area. Warshaw (1980) shows how to improve measures of purchase intentions. Kalwani and Silk (1982) provide evidence of bias in purchase intentions. They address the bothersome question of how intentions are related to behavior (e.g., what percentage of those who report a 60% probability of purchase actually purchase in the given time period).

New product forecasting is a particularly important area for marketers, especially in view of the large investments and the likelihood of large forecasting errors. Tull (1967), in a survey of new product introductions by companies, found a median absolute error of 26% and a median optimistic bias of about 22%. Conjoint analysis and expert systems are useful here, as are consumer intentions surveys. However, expert surveys are probably the most commonly used method for new product forecasting. They are subject to numerous biases, especially for situations

where, as in new product sales, the growth rate is expected to be exponential [Wagenaar and Timmers (1979)]. Diffusion models, based on estimating trial and repeat functions, have become widespread in commercial use, particularly in the packaged goods industry. ASSESSOR, BASES, NEWS and LITMUS are four such models. These models are used both for pre-test-market and later for after-test-market to estimate ultimate market share. Over 1500 pre-post validation assessments have been performed with these models and the results appear to be impressive, though their validity may be questioned because the assessments were performed by the organizations that are selling the services. Also, little is known about how the models compare with one another using comparable test situations, or how well they compare with judgmental forecasts by management. Wind, Mahajan, and Cardozo (1981), Urban and Katz (1983), Meade (1984), Assmus (1984) and Shocker and Hall (1986) reviewed the state of the art. After doing so, they lamented the lack of systematic and unbiased forecast validation studies.

Some recent validation work has been done on diffusion models. Rao (1987) tested the forecasting ability of six diffusion models as compared with five extrapolation models for sales of dishwashers, room air conditioners, clothes driers (1949-1961), and color TVs (1963-1970). Forecasts for each of the models were prepared for one-, two- and three-years ahead. Surprisingly, the diffusion models were less accurate as a group than the extrapolation models. For example, over all product groups and all forecast horizons, a simple linear trend had a *MAPS* of 18.5. Contrast this with the diffusion models where the *MAPS* ranged from 42.9 to 81.0. Unfortunately, the forecasts were all made from a single point in time, 1961.

A substantial amount of research on extrapolation methods, beginning with Winters (1960), leads to the conclusion that, beyond a modest level, additional sophistication is detrimental - it does not improve accuracy, but it does increase costs and reduce understanding. For evidence on this, see Makridakis et al. (1982), Armstrong (1985), and additional evidence from Schnaars (1984) for manufacturers' sales, and Geurts and Kelly (1986) for retail sales. These results were contrary to expectations. For example, Dancer and Gray (1977) found no gain in accuracy when using adaptive parameters to extrapolate sales of liquor products. There are three important areas, however, where added complexity improves accuracy. First, seasonal adjustments are important. Second, it helps to use a trend and to dampen it [Gardner and McKenzie (1985)]. Third, combine forecasts from different extrapolation methods [Makridakis and Winkler (1983)].

It is difficult to imagine a product that does not have a seasonal factor. As expected, then, seasonal factors have proven to be of great value in marketing forecasting. *Dalrymple's* (1987) survey results are consistent with the hypothesis that the use of seasonal factors improves forecasts: the mean reported forecast error for those companies using seasonal factors was 8.4% vs. 11.7% for those not using seasonal factors. Perhaps seasonal factors should also be dampened, but no direct tests have yet been made.

Interestingly, some controversy exists as to whether mechanical extrapolations will do better than judgmental extrapolations. A study by Lawrence et al. (1985) concluded in favor of judgmental or "eyeball" extrapolations, but Carbone and Gorr (1985) and Mabert (1976) concluded the opposite. Of course, mechanical extrapolation methods are *less expensive* when a large number of forecasts must be made, such as for inventory control.

Another issue is whether to combine subjective and quantitative approaches to extrapolation, and, if so, how? Moriarty and Adams (1984) discuss the use of such combinations. Mathews and Diamantopoulos (1986), in a study of short-term quantitative sales forecasts for 281 products, found that subjective revisions led to improved accuracy; however, these results were based on only one company and one starting point, and the results were mixed. Conversely, Adams (1986) found substantial reductions in error when quantitative adjustments were made to judgmental forecasts; these reductions averaged 30% for three of the five series he examined.

The combination of forecasts from alternative methods is useful. Baker et al. (1980), in a study of the effects of offshore nuclear plants on visits to recreational beaches, showed how alternative methods can yield forecasts that differ substantially from one another. Sewall (1981) provided evidence that a combination of expert opinion and consumer intentions was more accurate than either one alone in forecasting mail order sales of women's clothing. Lawrence et al. (1986) concluded that combined judgmental and statistical forecasts are more accurate than either one alone.

Finally, Schnaars (1986) has begun a promising line of research by examining various rules to select which extrapolation model is most appropriate for sales forecasting. Rules that involve dampening the trend and combining

alternative forecasts led to substantial improvement in accuracy in comparison with the rule “pick the model that provides the best fit to the historical sales.”

### ***Marketing Costs***

The forecasted level of marketing costs can affect the marketing plan. For example, costs may be so high as to render a plan unprofitable.

Costs depend upon the environment, the expected level of sales, and the actions taken by the company. How can these costs be forecasted? A logical starting point is the use of extrapolation. Typically, unit costs decrease, but at a decreasing rate. Thus, a learning curve is often appropriate. The learning curve, a concept that originated in educational psychology was adopted by industrial engineering in the early 1900s. It is in widespread use today. Its use in marketing dates to the early 1970s. In marketing it is referred to as the experience curve and has been extended to incorporate fixed costs [Day and Montgomery (1983)]. Despite the popularity of the concept, its direct application as a forecasting tool is limited to industries characterized by high growth, high levels of value added, continuous-process manufacturing, and capital-intensive industries [Aaker (1984, p. 184)]. Under other circumstances the concept needs to be used with caution, as factors other than experience may have a more important impact on costs.

Large changes in costs will typically be forecasted by judgment, such as engineering estimates, or by the use of econometric models. For example, costs for servicing different types of accounts or different geographical regions lend themselves well to econometric forecasting. Given the availability of relevant historical data, econometric models are especially relevant for very large changes in costs, such as those created by strikes, government edicts, or shortages.

### ***Results: Impact on Stakeholders***

Forecasts from each area in exhibit 1 can be used to examine how each of the stakeholders will be affected. In fact, it may be useful to start the forecasting process with the analysis of stakeholders because this indicates how the forecasts are to be used. For example, we might want to forecast whether a proposed plan will benefit the consumers or the possible impact it might have on the local community.

## **3. Assessing Uncertainty**

Estimates of uncertainty of the forecasts are needed in areas such as finding new retail sites, deciding how much inventory to stock at wholesale and retail levels, or deciding whether a new product venture is too risky. Good estimates of uncertainty, by providing better information on which to base inventories, can help to reduce overstocks as well as stock-outs. The reduction in stock-outs, in turn, yields better data about demand; this can help to produce better forecasts in the future.

With good estimates of forecast distributions, decision-makers facing non-symmetric loss functions can improve (even optimize) their actions in light of the expressed uncertainty [McIntyre (1981a)]. For example, if a manufacturer suffers \$1 of expense per unit if he overproduces vs. \$2 of expense (or “regret”) if he underproduces actual demand, then he should produce more than expected demand. But how much more? The forecast distribution information allows an optimal answer to be calculated for this question.

Much work has been done on judgmental estimates of uncertainty. One of the key findings is that judges are typically overconfident. Fischhoff and MacGregor (1982) found that 95% confidence ranges that are estimated judgmentally typically fail to include the true value. This bias occurs even when subjects are warned in advance about the overconfidence phenomenon. Nevertheless, judgmental expressions of uncertainty have been found to be useful.

One way to assess uncertainty has been to examine the agreement among judgmental forecasts. For example, Ashton (1985), in a study of forecasts of annual advertising sales for *Time* magazine, found that the agreement among the individual judgmental forecasts was a useful proxy for accuracy.

Williams and Goodman (1971) provided one of the earliest studies on uncertainty with extrapolation methods. In their study of short-range telephone forecasts, the statistically estimated 95% confidence intervals contained the true value for 90% of the forecasts. This represents rather good calibration. But, typically, measures of fit provide a poor guide to uncertainty in the forecast. Makridakis et al. (1987) show that statistically estimated confidence intervals are misleading even when based on the one-period-ahead forecast. These authors present tables demonstrating the extent of this overconfidence for different forecasting methods and different forecasting horizons.

Probably the best way to assess uncertainty is to follow the track record of a given forecasting method in actual use. The survey by Dalrymple (1987) found that 54% of the 134 surveyed firms maintained records of forecasting accuracy on a cumulative basis. In our survey of members of the IIF, 62% of the 21 marketing practitioners said that their organizations maintained a track record. Lacking such a record, one should try to simulate the forecasting situation. These approaches should overcome the problems noted in Makridakis et al. (1987).

One way to assess uncertainty in a forecast is to try to develop a model of the uncertainty. This was tried by More and Little (1980) in assessing uncertainty for new products. They examined such factors as buyer risk and distribution difficulty.

Even if we could provide good assessments of uncertainty, it is not clear that they would be accepted or used by the decision makers. Rush and Page (1979) found a decreasing use of measures of uncertainty for metals forecasts from 22% during the period 1910-1939 to only 8% during 1940-1964. Tull's (1967) survey noted that only 4 of 16 (i.e., 25%) respondent companies provided confidence intervals with their forecasts. In our 1986 survey of members of the IIF, 24% of the 21 marketing practitioners claimed that their firms did not provide confidence intervals when forecasts were presented, while 19% said that they "usually did so." Dalrymple (1987) found that 48% did not use confidence intervals, and only 10% "usually" used them. In summary, confidence intervals are not widely used.

It seems worthwhile to build confidence measures into the forecasting packages used by marketers. Moriarty (1985) suggests operational procedures for incorporating information on mean error and bias from earlier forecasts.

#### **4. The Use of Forecasts\**

Surveys provide information about which forecasting methods are used by practitioners [Dalrymple (1987)] and the criteria used to evaluate them [Mentzer and Cox (1984, p. 33-34)]. However, it is also important to consider how the methods and criteria impact marketing decisions.

Decision-makers often ignore forecasts that are surprising or unpleasant. Griffith and Wellman (1979), in a study of forecasts for hospital beds in six Michigan hospitals, found that the forecasts were ignored if they conflicted with management's prior beliefs. Decision makers may be subject to various biases that lead them to revise the forecasts. Tyebjee (1987), for example, discusses the *advocacy and illusion of control* biases in new product forecasting.

Perhaps managers are reluctant to accept forecasts because they do not understand the methods used to obtain them. In our survey of the members of the IIF, 37% of the 19 marketing practitioners who responded to this item said that the users of forecasts in their organization seldom understood the forecasting methods that were used. Of the other respondents, 37% said the users "often" understood, and 26% said that they "almost always" understood.

The problem cannot be overcome simply by better communication of the forecasts. For example, deSanctis (1984) reviewed a substantial number of empirical studies and was unable to find evidence that computer graphics led to better decision-making. Wagenaar et al. (1985) found that elaborate TV weather forecasts did not communicate more effectively than did the much simpler radio reports.

If managers do not ignore forecasts, they may revise them. Knowing this, the preparers may also bias their forecasts. Again, referring to our survey of members of the IIF, 44% of the 21 marketing practitioners who responded said that the forecasts were subject to “politics.” In other words, the forecast is often manipulated for such reasons as motivation or payment.

Some useful research has been done on how to gain acceptance of forecasts. Of particular interest is the research on scenarios. These studies, almost all by psychologists, yield suggestions on how to make scenarios seem more likely and thus, to gain attention and acceptance. For example, you could link events with plausible causal explanations [Tversky and Kahneman (1983)], or you could ask the decision-makers to project themselves into the situation and to predict how they would act [Sherman (1980), Anderson (1983)]. Applications of these findings to marketing situations would be helpful. Schnaars and Topol (1987) test some of the propositions about scenarios for short-range sales forecasts; interestingly, scenarios that do not make unexpected outcomes seem less surprising in their study.

Another area of concern is whether the decision maker can use the forecasts properly, given that the forecast is accepted as valid. Prior research has shown that subjects have difficulties in revising their estimate when they receive new information [Lyon and Slovic (1976)]. Thus, decision makers may not revise their forecasts properly when a quantitative forecast differs from their initial forecast.

Computer software may have a significant impact on the use of forecasting. For example, might decision makers have more confidence in a forecast that comes from a computer? Or, might there be a blind reliance on complex forecasting models?

## **5. Conclusions**

Significant gains have been made in forecasting for marketing in the past quarter century. Advances have occurred in the development of qualitative methods such as Delphi, role playing, intentions and opinions surveys, and bootstrapping. They have also occurred for quantitative methods such as extrapolation and econometrics. The challenge now is to build up experience in applying these methods so generalizations can be made about which methods are most appropriate in the different areas where forecasts are needed in marketing. The evidence and research needs discussed in this paper are now summarized.

### ***Environment and Market Forecasting***

For these areas there is empirical evidence to support the use of econometric methods rather than subjective methods for long-range forecasts. There is also some evidence to show that the accuracy of forecasts of environmental variables is not as important as is identifying the key variables to include in the market forecasting model. More research is required to investigate this latter issue.

For short-term forecasting and the estimation of the current size (status) of markets some empirical evidence supports the combining of judgment with extrapolation and econometric methods. However, further research is required to clarify under what conditions econometric models are useful and when and how to combine these results with expert judgment. Special attention should be given to the increasing availability of detailed data bases such as those derived from store scanner systems. Finally, for predicting prices, it is important to be aware of the case of “efficient” markets. Here Adam Smith’s Rule for Forecasters holds; that is, “Forecasters cannot beat the market.”

### ***Actions by Company, Competitors, Suppliers, Distributors, and Community***

There is little published research on forecasting in any of these areas, although suggestions can be made about which methods to use. Research needs to be aimed at discovering which methods are appropriate in which situations.

For forecasting company actions, the most appropriate methods are qualitative methods such as projective tests, group depth interviews, work samples, and role playing.

For forecasting competitors' actions, the methods suggested range from objective methods such as extrapolation, experimentation, and game theory, to more subjective methods such as the use of expert opinion, intentions surveys, and role playing. A similar set of candidate "methods" appears appropriate for forecasting the actions of suppliers, distributors, and the various publics that might affect the marketing activity of the organizations.

### ***Market Share***

While considerable research effort has been directed toward modeling and analyzing the factors that affect market share and sales, far less has been directed at examining the predictive validity and forecasting accuracy of the models. The limited evidence that is available fails to show the superiority of econometric methods over extrapolation for short-term market share forecasting. Further research is necessary to examine conditions where econometric methods are likely to perform well. For example, it is expected that these methods seem more relevant for forecasting the effects of large changes in the marketing mix variables. When historical data are not available, or where they are expensive to obtain, bootstrapping (including expert systems and conjoint analysis) appears to have considerable advantages over unaided judgment. While these methods have been used extensively by academics and practitioners in other areas of marketing, their performance in forecasting market share has yet to be evaluated.

### ***Sales***

For sales forecasting, there is considerable evidence to support the use of less sophisticated extrapolation methods for short-term forecasting. However, controversy exists about whether extrapolations are better than judgment or whether it is better to combine extrapolation with judgment. An area that has received considerable recent attention has been forecasting new product sales using growth curves. Here again there has been a lack of validation work.

### ***Marketing Costs***

This area has received little attention. Of importance is the question of when it is appropriate to use extrapolation or judgmental methods. For discrete changes in costs, the research question is whether to rely on current information and judgment or to also use econometric analyses of past costs.

### ***Assessing Uncertainty and the Use of Forecasts***

These areas have also received little attention in forecasting research and, more specifically, marketing applications.

### ***Summary***

Exhibit 3 summarizes directions for further research. In the areas of environmental, market, market share, and sales forecasting, the need is for extensions of existing research. In the other areas, basic research is needed.



### Exhibit 3. Summary of research issues.

Area	Question
Environmental Forecasting	<ul style="list-style-type: none"> <li>• Why aren't conditional forecasts more accurate than unconditional ones in short-range forecasting?</li> <li>• What are acceptable levels of forecast errors for environmental inputs to market forecasting models?</li> </ul>
Market Forecasting	<ul style="list-style-type: none"> <li>• What is the best way to forecast the change in size and structure of markets?</li> <li>• Under what conditions does expert judgment help to forecast change?</li> <li>• How can biases in judgmental forecasting be corrected?</li> <li>• Do marketing theories lead to better forecasts?</li> <li>• What is the best way to assess uncertainty?</li> <li>• Under what conditions do econometric models improve accuracy?</li> </ul>
Company Actions	<ul style="list-style-type: none"> <li>• What are the relative abilities of projective tests, group depth interviews, work samples, and role playing to forecast behavior of key stakeholders in the organization?</li> <li>• How to forecast resistance to a company's actions?</li> </ul>
Competitor's Actions	<ul style="list-style-type: none"> <li>• What is the best way to forecast competitors' actions (e.g., expert opinion, game theory, analogies, or role playing)?</li> </ul>
Actions by Suppliers, Distributors, Government and Community	<ul style="list-style-type: none"> <li>• What is the best way to forecast the actions of these groups? (e.g., can role playing forecast conflicts among channel members?)</li> </ul>
Market Share	<ul style="list-style-type: none"> <li>• How can judgmental biases be controlled or assessed?</li> <li>• To what extent do improved data lead to more accurate forecasts?</li> <li>• Under what conditions is bootstrapping (expert systems) most useful?</li> <li>• What is the most effective way to use bootstrapping?</li> <li>• Under what conditions are econometric models useful?</li> <li>• How can improved forecasts lead to better decisions? (e.g., How can one forecast success of sales personnel? What is the best way to make forecasts for site selection?)</li> <li>• What is the best way to forecast market share and sales by region?</li> </ul>
Sales Forecasting	<ul style="list-style-type: none"> <li>• How can biases in judgmental forecasts by sales and marketing personnel be reduced?</li> <li>• How can bias in consumer intentions surveys be reduced?</li> <li>• When and how should one dampen the trend factor?</li> <li>• When and how should one dampen the seasonal factor?</li> <li>• How should one combine judgment and extrapolation?</li> </ul>
Costs	<ul style="list-style-type: none"> <li>• Do econometric models provide improvement over judgment?</li> <li>• Do econometric models help to predict large changes?</li> <li>• When is it appropriate to use experience curves?</li> </ul>
Assessing Uncertainty	<ul style="list-style-type: none"> <li>• Should "safety factors" be used to adjust for overconfidence?</li> <li>• What methods are most effective in estimating confidence intervals in forecasting?</li> </ul>
Using Forecasts	<ul style="list-style-type: none"> <li>• What guidelines will help to effectively use forecasts in decision-making?</li> <li>• How can scenarios be used to gain commitment?</li> <li>• Can computer based expert systems help managers to use forecasts more effectively?</li> </ul>

Underlying the research topics outlined in exhibit 3 is the need for objective validation research. Advocacy research is expected to be inefficient; researchers tend to find what they hope to find. While the method of multiple hypotheses is preferred, it makes a difference how we pose the research questions. Rather than trying to disconfirm hypotheses, it seems easier for researchers to state the problem in terms of which hypothesis (or method) in a set of reasonable hypotheses is most useful; that is, try to find supporting evidence for each hypothesis [Tweeny, Doherty and Mynatt (1982)]. Another useful procedure is to ask under what conditions a hypothesis (or method) is most useful.

Clearly, the quantity of research has been growing. As a crude measure, consider the references cited in this paper. Only two citations were for work done prior to 1960. The average number of papers cited per year for the 1960, 1970s, and 1980s was 0.6, 3.7 and 10.8, respectively. In our opinion, the quality of research on forecasting in marketing has also been improving.

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