THE IMPACT OF TECHNOLOGY ON MARKETING RESEARCH

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There is much discussion of the impact and use of new databases but little normative information has been offered about how new technologies affect research and decision making processes. In this paper, a model is presented which outlines the steps of a statistical study. If used properly, new and emerging technology can help close the gaps inherent in statistical studies and therefore improve the effectiveness of marketing research. The key to understanding how to best apply new technologies is a thorough understanding of the gaps inherent in statistical studies and the assumptions used to bridge those gaps in market research.

INTRODUCTION

A major national consumer beverage manufacturer was concerned about a dramatic decline in frozen orange juice sales. Information purchased from a major scanner data supplier indicated that "distribution" had been holding firm at 97 percent over the last few years. The sales force apparently was doing its job maintaining retail accounts. No changes had been made in the marketing efforts in support of the juice, prices were stable and no major competitor activity coincided with the sales decline. The manufacturer expected some random fluctuation in juice sales, but these declines measured in the double digits for three successive quarters. What was the problem?

The orange juice brand manager decided to do some old-fashioned field research through the sales force. She instructed each sales person to inspect the freezer shelves three times a week in several randomly selected stores in each sales district. She was shocked to learn that her brand was not on the shelves in about one-half of the stores visited by sales people. The manager then contacted the scanner data supplier to reconcile the difference in the field-collected data (50 percent distribution) and the scanner based data (97 percent distribution). To her surprise, she found that scanner data suppliers deemed an item to be in a store if one or more sales were made in a week. A store, therefore, could easily have "distribution" and still be stocked-out of an item much of the time.

How could this information void happen at a sophisticated, successful, widely respected global marketer? Fifteen years ago the firm would check for distribution and stock-outs by using brute force—an army of field researchers periodically checking the shelves. When the company went to measuring such variables as inventory movement, sales, distribution, and market share using scanner data, the focus of sales people and marketing management changed. Obviously, management got much more current data much more frequently. Not understanding what the numbers represent and what they can and cannot do, however, became a slippery slope for mismanagement. Even with sophisticated data collection technologies and reams of data, the presence of stock-out problems eluded managers. This example illustrates a common situation: a manager relying heavily on data that she does not completely understand and making poor decisions based on her misconception of the data.

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Advances in information technology have caused dramatic changes in the amount and form of information available to marketing managers to aid in decision making. Computer aided telephone interviewing and speech recognition, scanner technology, Internet data acquisition, improved physiological measurement methods, remote data collection by sales and service staff, virtual shopping, and virtual groups and reality all have changed the face and nature of marketing information acquisition (see Green 1992; Malhotra 1992; Burke 1996; Cook and Dunn 1996; Donato 1996).

The most significant advance undoubtedly is the widespread use of UPC-based scanner data to measure inventory movement and sales levels. As the above example indicates, a major outcome of this change is that marketing managers can now perform almost immediately studies that once took months to complete. Perreault (1992, p. 373) summarizes: "At a minimum, it's faster, cheaper and easier to do the types of studies that marketing researchers have been doing for years." A functional result of these advances is that marketing managers can perform more studies, reach more subjects, and collect more data than ever before. But without proper application, these technologies can be just enough rope with which to hang oneself.

New methods of data acquisition have increased the quantity and quality of data available, and have helped eliminate some of the problems of inference and estimation associated with previously used methods. Marketing managers must be aware of the impact that the new data collection methods have on the research process, statistical relationships, and assumptions. Specifically the marketing manager needs to know and understand:

1) the information technologies currently available;
2) the advantages these new technologies bring to data acquisition;
3) how the new technologies change or eliminate the gaps that existed with previous marketing research methods; this assumes a knowledge of the research process and an understanding of the gaps that exist in more traditional marketing research methods;
4) the problems and limitations associated with the new technologies.

This paper attempts to shed light on these four issues by first describing some advantages and shortcomings of the new information technologies. The paper then outlines a typical model for statistical studies and points out where traditional data collection methods come up short—what we describe as the "gaps" in marketing information acquisition. The ability of the new technologies to help bridge these gaps is then illustrated. The fundamental argument presented is that if technology can be used to reduce or eliminate these gaps then marketing research studies can be more effective. Improperly applied technology, however, can lead to a new set of problems, concerns and limitations. Others have described the trends and implications of new technologies at a practitioner level (e.g., Perreault 1992; Burke 1996; Cook and Dunn 1996). This paper goes a step further and provides a descriptive framework that shows the implications for specific stages of a statistical analysis and provides normative recommendations to practitioners.

NEW INFORMATION ACQUISITION TECHNOLOGIES

Information acquisition technologies can be characterized in four ways: data entry technology, Internet measures, physiological measures, and simulation (See Table 1). Table 1 also summarizes the major benefits and potential pitfalls of each technology.

Data entry technology refers to a family of methods designed to collect and codify data through automated methods that reach large numbers in target populations. Data entry technologies use computers and automation to collect data about consumers as they engage in consumption behaviors (e.g., purchase [UPC scanners], search [speech recognition]). Although these technologies allow fast efficient collection of huge quantities of consumer behavior data, they can increase measurement error (e.g., speech recognition or optic mark readers that misread

ambiguous input) and be plagued by non-response (e.g., shoppers may shop at stores lacking scanner technology or pay cash and be untraceable).

TABLE 1
A Summary of New Data Collection Technologies

Type of Technology	Technology	Benefits	Potential Pitfalls
Data Entry	CATI	High speed, Low cost, Reduced measurement error	Few or none
Data Entry	Speech recognition CATI	High speed Low cost	Increased measurement error Increased non-response rate
Data Entry	Optic Mark Readers	High speed Low cost	Increase measurement error, Increase non-response rate
Data Entry	UPC Scanner Data	High Speed Larger sample size	Increased measurement error, Increases in missing data, Non-random samples
Internet	Internet Surveys	High speed Low cost	Non-random samples Non-representative frames
Internet	Virtual Groups	High speed Low cost	Non-random samples Non-representative frames
Physiological	Brain-wave	Minimal	Measurement effects
Physiological	Pupilometrics	Minimal	Measurement effects
Physiological	Eye Movement Reader t-scope	Minimal	Measurement effects
Physiological	Hidden Cameras	Eliminates measurement effects	Non-random samples Non-representative frames
Physiological	Microchip Implants	Reduces measurement effects	Non-random samples Non-representative frames
Simulation	Virtual Reality	Reduces measurement effects	Does not eliminate measurement effects
Simulation	Laboratory Experiements	Reduces measurement effects, Easier to collect random samples, More representative frames, Indicates causation as opposed to simply correlation	Does not eliminate measurement effects

Internet measures refer to making use of the Internet to collect data. Data can be either behavioral (e.g., counting how many times users access a web site) or cognitive (e.g., collecting responses to surveys or questions of Internet users). Internet use is increasing in popularity because of the pervasiveness of the medium and its low cost and simplicity. Chat rooms provide much qualitative information from customers and curious future adopters. Counts of web site "hits" can provide information on interest and popularity. Obviously, marketers must be cautious about how Internet data are used and interpreted because of undefined sampling frames and the non-random, self-selected samples used.

Physiological measures attempt to eliminate error associated with subject response (e.g., paper and pencil measures) and use technology to improve the measurement of physiological responses to stimuli. Physiological measures such as brain wave, pupilometers, eye tracking machines, heart rate monitors, and galvanic skin response all have potential in marketing research, but are often considered unacceptable because of measurement effects, non-random samples or questions of exactly what is being measured.

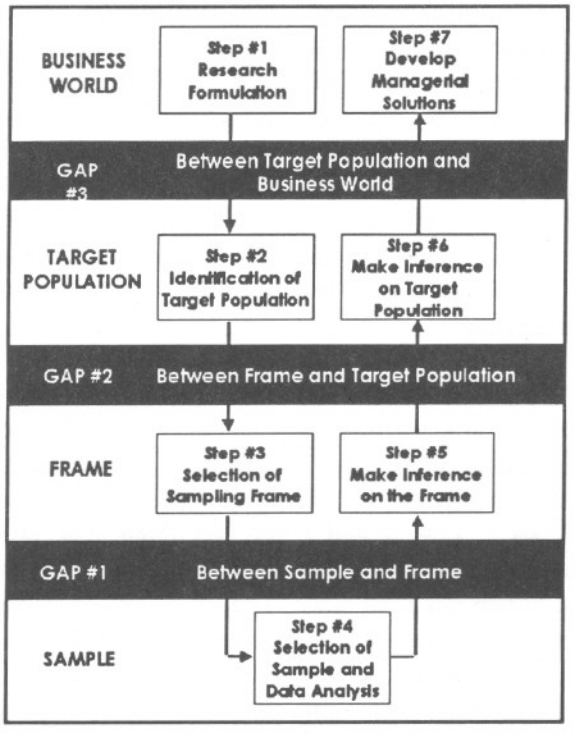
Finally, simulation technologies allow marketers to exert greater control over a respondent's environment and then measure responses to certain conditions created by the researcher. Virtual reality provides the most exciting new opportunity to explore simulated consumer behaviors in controlled environments. More control allows the researcher to eliminate alternative explanations for behavior while maintaining some degree of realism. Alternatively, virtual reality research such as virtual shopping can be expensive, can still be plagued by demand effects, and can produce data that are difficult to analyze with inferential statistics.

These new technologies are all well-established tools available to the marketing researcher. The challenge now becomes one of understanding how these methods exacerbate, diminish or eliminate the assumptions or "gaps" inherent in the research process. Below is outlined a typical research process for sample-based statistical studies. The model also illustrates that incorrectly applied technology can widen gaps, and in some cases, including our earlier example, actually lead to false conclusions and bad decisions.

THE RESEARCH PROCESS FOR STATISTICAL STUDIES

In order to answer many marketing-related questions researchers must simplify reality. This simplification requires that we also make assumptions about things that are unknown or unknowable. If our assumptions are flawed, or represent oversimplification, our results may be meaningless or misleading, leading to poor decisions. To make better decisions marketing managers must understand the simplification process and the assumptions made at each stage of a research project. Numerous articles have been published regarding the use of new and emerging technologies in marketing research; however, none has addressed their impact on the process by which statistical studies are performed. Toward this end, we present a seven-step model for using statistical studies in marketing research (See Figure 1). A significant danger to marketing decision makers results when the steps and links between the steps in statistical studies are not well understood.

FIGURE 1



The seven steps in Figure 1 represent distinct stages through which a statistical study moves. The spaces between the steps are called gaps; marketing managers and researchers use assumptions to span the gaps. The steps are distinct conceptual stages encountered when using sample data as an aid in decision making. Starting in the upper left-hand corner of Figure 1, as you move down the left side of the model, gap size is a function of the frame definition and sample selection. After collecting data, we move up the right side of the model where previously defined gaps are bridged by our statistical assumptions or "leaps of faith." Until recently, the steps often took place days or weeks apart. Today, however, technology allows the marketer to move from one step to another almost instantaneously. The speed of performing these steps does not necessarily narrow the conceptual gaps, nor lessen our need for theoretically sound bridges. For example, electronically capturing a sample in real time does not alter the conceptual difference between a sample and a population and therefore does not reduce the necessity of making certain assumptions in order to make inferences on the population from the data captured about the sample.

Users of marketing information need to understand the steps researchers go through when performing studies involving statistical inference. The steps exist for all parameter estimation research, whether inferences are drawn from traditional individual custom survey research or from one of the newer methods described in Table 1.

Step #1: Research Formulation

This step involves clarifying the problem, reviewing existing information, identifying the research objectives, formulating the propositions or hypotheses of the research, and recognizing the type of data needed to provide information to make a decision (e.g., one time survey data, physiological measures, on-going tracking data).

Step #2: Identification of Target Population

When estimating parameters using statistics, the researcher must identify the population of interest.

The population should be defined by the characteristics of interest to the researcher *and* for a relevant point in time. For example, if "patrons of the arts in Albuquerque" are of interest, three tasks must be completed. First, a "patron" must be defined; second, Albuquerque must be defined (city boundary, metropolitan area, or other boundary); and third, at what point in time the researcher is interested in patrons in Albuquerque must be defined. The time dimension has become increasingly important with the proliferation of methods that increase the frequency of data collection (primarily scanner technology).

Step #3: Selection of Sampling Frame

The frame is a listing of the units available for study. In some rare instances the frame is a complete listing of the target population. For example, if the target population is the households in a particular city with listed phone numbers; the frame could be a phone book. If the target population is all households in that city, then the phone book provides a frame that is only a subset of the target population.

The target population and the frame often differ dramatically in longitudinal studies. The target population might be consumer wants in August, and the frame available for study might be a consumer list compiled in June. The frame, therefore, is not a subset of the target population but a second, separate population. What the researcher hopes for in this situation is that the two populations are very similar. Unfortunately, marketing managers infrequently question the frames used by researchers and, therefore, frequently ignore this "gap" in a research study.

Step #4: Selection of Sample and Data Analysis

A sample of the items listed in the frame is selected and statistical analysis of the sample data occurs. The sample taken could be a random sample, a judgment sample, a convenience sample, etc. Numeric statistical measures are then calculated, (e.g., descriptive statistics, test statistics or confidence intervals). Again, a significant "gap" exists if the sample does not have the characteristics necessary (randomness) for inferential statistics. Unfortunately, nonrandomness is the rule rather than the exception.

Step #5: Make Inference on the Frame

Based on the information contained in the sample, inferences are made on the frame. Statistical inferences are statements concerning characteristics of the items in the frame, and contain a measure of certainty in the statements made (the probability value in hypothesis tests and confidence statement in confidence intervals).

Step #6: Make Inference on the Target Population

Based on the knowledge gained from the study of the frame, inferences on the target population are made. How closely the inferences on the target population parallel the inferences made on the frame depends upon the extent to which the frame matches the target population. The inferences made on the frame can be viewed as bounds on the degree of certainty we have on the target population. When there is little theoretical or empirical evidence linking the frame and the population, the inferences on the frame are useless.

Step #7: Develop Managerial Solutions

The researcher reports the conclusions of the statistical problem and makes recommendations concerning the marketing problem. The recommended actions are the result of multiple criteria decision making using the inferences on the population and all pertinent business knowledge. How closely the statistical formulation of the problem matches the marketing research formulation helps determine the weight given to the statistical inferences.

All statistical studies should include some version of the seven steps discussed above. In many cases, individual steps are broken down into several intermediate steps. Much has been written about Steps 1, 2, 4, 6, and 7, but less about those steps involving the frame, i.e., Steps 3 and 5. Even less attention has been devoted to the progression from one step to the next, and the assumptions necessary to do so. Unfortunately, rather than bridging the gaps, managers sometimes simply ignore the fact that the gaps exist, moving merrily from one step to the

next unaware of the leaps of faith that have been taken.

BRIDGING THE GAPS

Below we describe: 1) the assumptions made to bridge research "gaps," 2) the impact of technology on eliminating or diminishing the "gaps," 3) new "gaps" and assumptions created by technology, and 4) suggestions on how to deal with these new data problems.

Gap #1: Between Sample and Frame

This gap has been historically bridged by the rigid assumptions of classical statistical inference. These assumptions are the basis of classical statistical theory and can be found in many statistics and marketing research textbooks. For instance, statistical methods often require that a probability-based sample of the frame be taken. If for some reason a convenience sample is taken instead, generalizations to the frame cannot be made. Frequently used statistical methods also require that no measurement error exists. Other statistical methods require additional assumptions regarding the probability distribution function of the characteristics of interest (e.g., parametric statistics require normality).

In practice, the assumptions required to make inferences will seldom, if ever, be met entirely. It is the job of the researcher to see how closely each situation satisfies the assumptions of the associated methodology. If the researcher believes that only minute violations of the assumptions are present, then strong inferences on the frame are possible. If mild violations are believed to be present, the inferences are less powerful and the degree of certainty we attach to the inferences should be lowered. With more serious violations, any inferences are dangerous.

Reducing Gap #1: Between Sample and Frame

Extrapolation from sample to frame is problematic not only because we are working with a subset of the frame, but also because the sample is frequently non-random, there is missing data, or measurement error exists. When applied correctly, technology can reduce the gap present between the sample and the frame by making it easier to: collect larger samples, collect samples that more closely resemble probability based samples, reduce the amount of missing data, and reduce measurement error. In general, larger sample sizes produce less error in parameter estimates and therefore increase the degree of belief in statistical inferences. The increased size is an obvious result of increased scanner usage and the proliferation of computer networks. The marketer needs to recognize, however, that larger is not necessarily better, as with our earlier orange juice example where the larger data set also contained more measurement errors.

Most statistical methods require a probability sample of some type: random; cluster; stratified; etc. Usage of non-probability based sampling schemes, such as judgment or convenience samples, introduces bias into the study. UPC scanner data, even though it may come from several thousand stores, are biased toward those stores with the technology in place and with the willingness to be included in a panel. For some products, the stores that make up the retail panels may be nearly random, for other products the stores may be an adequate representation of the population. Certainly, the collection of stores cannot be a random sample for all products, for all companies, for all industries. Likewise, consumer panels are biased toward those consumers who wish to participate. Moreover, marketing analysts need to realize that in both retail and consumer panels, the longitudinal data sets represent repeated measures and not a series of random samples because the same experimental units are measured repeatedly.

There is often a tradeoff between the amount and quality of data that can be collected. More data can be collected if easy-to-measure units are included. Larger stores are often preferred because they produce more data than smaller stores and frequently possess more advanced data collection technology. Furthermore, it may be easier to sample from a whole chain of stores, rather than sample stores from many different chains. In almost all cases, sampling only the large, easy to include stores results in a non-probability sample. Obtaining a probability sample would provide less data, but in the end might produce

the best results because the extrapolation from sample to frame can be made with more certainty. To avoid non-probability-sampling biases, technology needs to be consistently applied in a manner that will produce probability samples. This requires data capture techniques that are relatively inexpensive and easy to implement in many different retail and wholesale environments. When purchasing scanner data, marketing managers should know how the sample was chosen so that possible biases in the data can be identified.

Contemporary technology does not always produce clean data. Researchers must be concerned with missing data and data heavily laden with measurement error. Gold (1990, p. 34-35) reports that, "Among the problems occurring when retailers provide scanner data are missing, unreadable, irretrievable and incomplete data." Gold goes on to report that in some markets, up to 25 percent of the data may be missing. Goodstein (1994) and Sethuraman and Tellis (1991) argue that errors in scanner data also produce bias in academic research. Klose and Ball (1995) report that optical mark read (OMR) surveys have a lower quality response rate than traditional mail surveys due to measurement error and related problems. Advances in scanning and OMR technology to remove such problems could greatly improve marketing research. Again, technology can help improve a study's effectiveness by producing higher quality data, not just more data.

Technology now makes possible census data, as compared to sample data, in some situations. For example, The Limited retail chain uses point-of-purchase computers to track daily sales and infer consumer preferences (see Perreault 1992, p. 369). Technology will make census data increasingly available to decision-makers. The added cost of such systems may not be warranted, however, if cost-effective probability samples can be obtained.

Gap #2: Between Frame and Target Population

Although overlooked in many statistics and marketing research textbooks, at least two assumptions are needed to bridge this gap. Managers must realize that the quality of statistical results is influenced by (1) the frame from which the units were sampled and (2) the environmental and economic conditions present at the time of the test (see Deming 1975, p.148).

The first condition, that the results are dependent on the frame from which the units were drawn, is not a problem if the frame is a complete and accurate listing of the target population. In marketing practice, however, this is rarely the case. Typically, the frame is a partial listing of a population at a specific point in time, and the target population is a set of similar units, but at a later point in time. Moreover, the frame is sometimes a self-selected subset of the target population which may or may not be representative of the entire target population.

The second condition, that the statistical inferences are influenced by the specific economic and environmental conditions in which the measurements and analysis took place, highlights another problem associated with many frames. In test market studies and other designed experiments, the marketer often exercises extreme care in an attempt to replicate the same conditions which will be present in the target population. The marketer must recognize, however, that even in the best designed experiments, the environmental and economic conditions found in the frame will not be exactly replicated in the target population. This is particularly obvious when the target population exists at a later point in time than the frame.

Reducing Gap #2: Between Frame and Target Population

Emerging technology, and the widespread acceptance of today's technology, can help create frames that closely resemble the target population. This advance, plus the reduced time needed to collect and transmit the data to the marketing manager, can greatly alleviate the problems associated with extrapolating from the frame to the target population.

To illustrate, a frame for a retail scanner panel would be a list of the stores with the technology in place that are willing to participate. During the early stages of retail scanner panels, only a few large chains comprise the frame. Standardization and cost

reductions in scanning technology will allow more retail outlets across the globe to adopt computerized systems. Therefore, the frames available for marketing research will grow, and subsequently the frame will become more and more representative of the target population.

Technology can also narrow the gap between the frame and the target by collecting and transmitting data faster. With this added speed, data that were previously available only in monthly installments are now broken down weekly and, in some cases, daily. Advantages of daily over weekly collection depend upon the objective of the study. When one monitors volume and share, day-to-day variation within each week makes daily reporting difficult to interpret. For some tactical decision making activities, however, daily reporting may be very helpful. By analyzing daily reports, marketing managers can gain knowledge in such areas as coupon redemption rate, price reduction activity, and promotional time lags. A major advantage of obtaining data more frequently is that it can be used to create longitudinal data sets. These data sets can then be analyzed for trends, cycles, interventions, and a host of other patterns. This knowledge makes for more effective extrapolation from the studied population to the target population.

Widespread acceptance of the home multi-media information center will provide frames that can result in huge amounts of data. Data will be available almost instantaneously as these information centers allow two-way communication. Members of a consumer panel will be able to see multi-media presentations on their color monitors and electronically respond. The Internet also allows two-way communication via personal microcomputers. For high-tech products, panels selected from a list of on-line consumers might easily be extrapolated to their target population. However, the extrapolation from such frames to the target population is still too problematic for most products and the use of the new technology would actually widen the gap between the frame and the target population. In the future, home multi-media information systems may provide marketers with effective frames for study.

Gap #3: Between Target Population and Business World

The marketing manager needs to assess the relevance the statistical solution has in solving the marketing research problem. Now that the study has been completed and new knowledge about the subject has been gleaned, the marketer must critically review the method of investigation. Do the questionnaire or the test method, the measurement methods, the methods of analysis, and the inferences made meet the marketing research objectives? Perhaps the solution to the statistical question identifies more appropriate questions or measures, a better method of data collection, a better frame, or even a different target population. Also, changes in the marketplace since the original formulation of the statistical problem may alter the value and validity of the statistical study.

A marketing manager needs two types of expertise to be able to assess the validity of extrapolating the statistical results to the marketing research problem. First, she/he must possess a thorough understanding of the statistical methods, their assumptions and drawbacks, and how to interpret the results. Second, the marketing manager must possess extensive product and market knowledge to be able to assess the validity of the results when extrapolated to a market setting. Gap #3 is often very large and troublesome because the decision-maker lacks either extensive domain knowledge or statistical expertise.

Reducing Gap #3: Between Target Population and Business World

The gap between statistical solutions and marketing research solutions can never be closed completely. This reality is in contrast to the other two gaps that in some cases do not exist (i.e., a census can eliminate the need to extrapolate to a frame, and a frame can be a full and accurate listing of the target population) or can be reduced by properly applying appropriate technologies. To reduce gap three, organizations need careful and thorough communication between those with statistical expertise and those with market knowledge. Technology also can play a role by providing more

realistic research settings, more reliable data collection and better measures. However, translation of statistical findings into marketing action will still require the interpretive and analytic expertise of decision-makers.

Extrapolation from the statistical solution to the marketing research solution requires the assumption that what was observed and measured corresponds exactly to what truly happens in the marketplace. When, as in most cases, this assumption is not fully met, the marketing manager must judge how to apply the research findings. For example, even using the most sophisticated models to predict future buying behavior, the consumer can and will react differently than predicted in the market place and the marketing manager must try to anticipate those differences. Technology can improve this situation in two ways. First, in laboratory settings experimental situations can be made more realistic through technologies such as computer-based virtual reality simulators. Increased realism may help to reduce gap three and make lab studies more generalizeable (Dellacare 1996). However, Weinblatt (1994) argues that no simulation approach, regardless of the sophistication, can completely bridge the gap between the simulated and real worlds. Second, by using scanner technology and direct electronic communication between stores and central offices, pricing, promotion, and product introduction studies can be conducted quickly, easily and at relatively low cost. The experimental conditions as well as the results and analysis of such studies can be communicated electronically between the central headquarters and the test sites almost instantaneously and provide data based on behavior rather than less reliable intentions or attitudes. New technologies, however, may invoke interest and arousal in subjects creating measurement effects (e.g., The Hawthorne Effect) while older technologies may prove less obtrusive and make it easier for the marketing manager to narrow gap three (Urban, et al. 1997).

In all studies we must seek measures that truly address relevant questions and help us make management decisions. Technology can help immensely in this effort by providing ways to more accurately and reliably measure straightforward constructs such as behavior, and by providing new ways to measure more elusive constructs such as feelings, emotions, and arousal.

SUMMARY

Although decisions facing the modern marketing manager are complex, statistics can provide a powerful aid to decision making. Using the data contained in a sample, statistical analysis allows us to make inferences regarding a frame, a target population, and finally, a real world situation. Gaps exist, however, between the sample, the frame, the target population, and the decision-making situation. The effectiveness of statistical studies depends on the size of these gaps and the validity of the assumptions used to bridge the gaps. In this paper, we argue that new and emerging technology can be applied to decrease the size of the gaps and to collect data that increase the validity of commonly used assumptions. By doing these two things, the effectiveness of marketing research can be greatly enhanced.

Technology should be applied to capture and collect data which are more accurate and more representative, not necessarily more abundant. Specifically, to aid in the extrapolation from sample to frame, technology should be developed to collect data with less measurement error and with stronger safeguards against missing data. Furthermore, technology needs to be applied in a manner in which one can validate assumptions concerning probability-based samples.

To help extrapolate from the frame to the target population, technology must be developed which is portable and relatively inexpensive so that the frame can be expanded to match as nearly as possible the target population. Extrapolation from the frame to the target population can also be greatly enhanced by creating longitudinal data sets collected in short time periods. Technology can close the gap between the statistical solution and the marketing research solution by replacing survey studies and laboratory studies with field studies and through the creation of better measures.

The conceptual stages in a marketing research study historically were separated in time by weeks or even months. Although technology can alter the speed to complete the steps and the time required to move between steps, the conceptual gaps between the four worlds still exist. Improper application of new and emerging technology can actually widen the size of these gaps and ultimately lead to less effective studies than traditional ones. Marketing managers must not allow the speed and wizardry of technology to blur the theoretical foundations of statistical studies used in decision making.

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