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Full Length Research Paper

Quantitative Models in Marketing

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In today's competitive world, marketing managers face various problems that call for rational decision making, for example, when and how to influence the choice process of consumers, what should be the price of the product, how much to advertise, what type of promotional offers to be made, when to launch a new product, how to make the product available, etc. All these problems if dealt with guess work can give misleading results. In order to be successful in this competitive world, there is a need for reliable solutions. Quantitative models fulfil the required need in an efficient manner.

Keywords: Marketing, quantitative models, choice process, successful, reliable solutions.

INTRODUCTION

Marketing is pervasive in market economies around the world. Generally it is said that marketing is only about the advertising and personal selling of goods and services. But however these activities represent only a small part of the functions of marketing. In general, marketing activities refer to all those activities that are associated with identifying the particular wants and needs of a target market of customers, and then satisfying those needs and wants better than the competitors. The American Marketing Association has defined marketing as, 'an organisational function and a set of processes for creating, communicating, and delivering value to customers and for managing customer relationships in the ways that benefit the organisation and its stake holders' (Kotler *et al*., 2007). Thus market place can be actually recognised as a battlefield between sellers and buyers and between suppliers and consumers. Consumers satisfy their needs with the help of exchange process. In modern economies, both customers and businesses take steps to initiate desirable exchanges and exchange relationships in the marketplace. In this context the ultimate decisions are made by consumers through their various abilities to exercise the choice of whether and what to buy or not to buy (Wright *et al*., 2006). Hence consumers intervene in every task of marketing, which makes it a complex function. Further the suggestions of the consumers should be welcomed while designing the products to give the consumers a sense of belongingness so that they could understand themselves as an indispensable asset of the business. But intervention of the consumers in every task of marketing also gives rise to some problems. The consumers are always unpredictable. Thus they also make the marketing function as unpredictable or complex one. The success of a business hampers if this complex function is not performed efficiently. This article concentrates on listing down the various problems that a marketing manager has to face, further the various methods that helps in founding reliable solutions for these tedious problems and finally the benefits of using these methods are discussed. This article proceeds further as per the figure 1 below.

Marketing: A Complex Function

A business runs a large number of functions such as planning, purchasing, producing storekeeping, financing, research and development, staffing and marketing. If one looks carefully, all the other functions are dependent on the functions of marketing to a great extent. If a business is not able to reach its customers then there is no use of other functions. But in this competitive era, every now and then marketing manager face a lot of complex problems which makes marketing a complex function. The complexities in marketing are as follows.

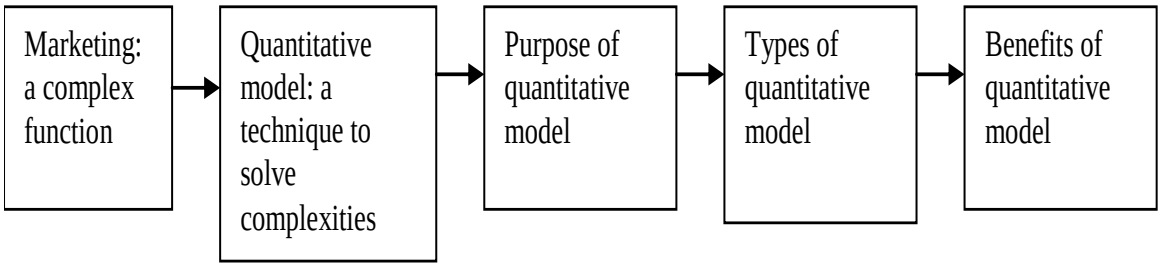

Figure 1: Quantitative models in marketing

Consumer Choice

In this competitive world, for every product, a large number of alternatives are available to the consumer from which he/she chooses only one alternative. In order to decide what to choose, every consumer passes through five stages: 1) problem recognition; 2) information search; 3) evaluation of alternatives; 4) actual purchase and 5) post purchase process. In order to launch a new product or to reposition the existing product, marketing managers need to know about the information search behaviour of the consumers. While developing a new brand or while setting up the location/layout of outlet, marketing managers must understand the evaluative criteria of the consumers for brand/store. To build up a loyal customer base, they must analyse the whole post purchase process of the consumers. Thus a detailed analysis of consumer choice process will help the marketing managers to better understand the consumers so that product or service of the company thus designed exactly fits the needs of the consumer and gets converted into profitable sale.

Pricing of Products

Price is the most important element of the marketing mix. It is the only marketing variable that directly determines the revenue (Lilien *et al*., 1992). The price should be set in such a manner that it is totally compatible on one side and on the other side, covers cost of the company and also provides profits to it. Besides setting up of the prices, they need to know how increase/decrease in price will affect sales volume.

Amount of Advertising

Advertising is that tool of marketing management that presents information to potential buyers. Tellis (1988) explains that advertising reinforce preference for brands. Marketers also need to determine how much advertising should be made, what should be the extent of its repetition, what other sources of communication are and how effectively they work.

Promotional Offers

Consumers may prefer such brands that are available to them on discounts, with free gifts, etc. But it is not necessary that they will buy those promoted brands on their next purchase occasion. Guadagni and Little (1983) observe that repeat purchase probability of on-promotion items was lower than the repeat purchase probability of non-promoted items. Thus marketing manager has to decide whether promoting offers should be made and if made, to what extent and for how much period so that brand equity may not be diluted in the eyes of the consumers.

Launch of a New Product

In order to have a long term and healthy survival rate, today's competitive era demands that new innovations in products must be continuously made. But it is a well-known fact that innovation carries high cost as well as high risk. Marketing managers are required to be careful while deciding the type of a new product that should be made or what changes should be made in the existing product.

Distribution

The most important decision is how to reach the ultimate consumers that is, how to distribute the products. The marketing manager has to decide whether he should sell his product directly or indirectly through middlemen. No doubt, every option has its pros and cons. Perreault and Russ (1976), in a survey of industrial purchasing managers, find that physical distribution services are more important than price in influencing industrial purchase decision. Thus how to make the product available is again a matter of discussion.

High Volume of Data

As compared to five years ago period, thousand times more the volume of data can be seen in every industry in present time age. This data is available due to the growth of e-commerce and data base marketing. The companies have also combined internal and external sources of information, which has improved the quality and quantity of data. Human brain cannot manage all these details. More data cannot lead to better decision making unless the managers learn how to use that data in meaningful ways.

Information Technology

Information technology has driven the organisation with fewer employees and large opportunities. To cope up with changing trend, marketing managers are required to leave their traditional mechanism of doing work and adopt the new system.

Severe Competition

In today's world, there is a cut throat competition everywhere. If once the consumer is not satisfied, he/she can easily switch to other alternative. Hence, marketing managers are required to update themselves as per their competitors.

Above discussed is not an exhaustive list of problems faced by marketing managers. Several characteristics of marketing environment make the marketing a complex function.

Quantitative Model: A Technique to solve Complexities

In order to deal with this complex function, marketing manager may use various approaches like *experience,* which is suitable in case of routine and non risky ventures; *intuition,* which is a sort of gambling; *standards*, which is suitable in case of few circumstances like advertising; and last but not the least approach is quantitative model. The best approach that helps the marketing managers to make reliable plans, actions and strategies is the use of quantitative models in marketing. These models are discussed in detail as below.

A model describes a part of real life in an approximate way by a number of relations between the relevant variables. These relations are simplified and idealised forms of the most essential and elementary features of reality (Leeflang and Koerts, 1973-74). Basically model is used to predict and to explain or to understand the required situation. Two classifications of the models are generally used: Verbal and Mathematical.

Verbal models are described in words. Most of the models described in marketing are verbal models. For example, Howard and Sheth (1969) verbally describe the processes and variables affecting an individual's behaviour prior to and during a purchase. This model starts when a stimulus is given to the consumer. Any ambiguity about stimulus leads to information search. The consumer forms an attitude, which is made by combining choice criteria and brand comprehension. When he/she becomes certain about his/her understanding of different brands, he/she decides whether to purchase. If he/she purchases and the alternative meets his/her expectation, he/she may remember it for the next buying occasion. A general example of verbal model is explained as under:

Increase in Price → leads to Reduction in Sales

This model says verbally that there is reduction in sales if a company adopts a strategy of increasing prices, other things remaining the same. Verbal models do not give a quantitative measurement of change that is, in the given example of verbal model, it cannot be ascertained that if the price increases by one rupee then by what amount the sales will fall. Often, verbal models are explained graphically in the form of graphs, pictures or charts. Examples include road maps, organisational charts and flow diagram. These models describe the overall phenomena so that viewers can grasp the whole relationship. Figure 2 shows the inverse relationship between price and sales. It says that when price increases then the amount of sales decreases.

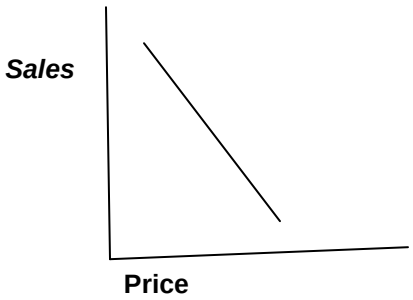

Figure 2: Sales Price relationship

Mathematical models use symbols to denote marketing variables and express their relationship as equations or inequalities. For example,

$Y = \alpha + \beta X + \mu$ .....(Equation -1)

Where Y is sales (dependent variable), X is price (independent variable), α is known as intercept, which gives the value of dependent variable (Y–amount of sales) when independent variable/variables (X–price) is zero. Thus in equation 1, value of α represents amount of sales when price is zero. It can be inferred that the

value of $\alpha > 0$ that is, positive since who will not want to buy when price is zero. Often the intercept has no particular economic meaning (Gujarati, 2004). In equation 1, since the price can never be zero, α has no relevance for decision-making. β is known as slope, which measures the rate of change in dependent variable for a unit change in independent variable. In equation 1, if price (X) increases by one rupee, then the amount of sales (Y) will be changed by β amount. Now as per economists' theory, there is an inverse relationship between price and amount of sales, it can be inferred that $\beta < 0$ that is, negative which means that if there is an increase in price by one rupee then amount of sales will fall by β amount. μ is random error term that represents all those forces besides price that affect the sales and can also be accounted for but have not been included in the model for determining the amount of sales. These forces can be the income of the consumer, promotional offers, substitutes' prices etc. μ also includes purely random forces which cannot be included in model for example, inherent randomness in human behaviour, errors of measurement.

Purpose of Modelling in Marketing

Clearly, the essential purpose of modelling in marketing is to have accurate, reliable and affective plans, actions and strategies that reduce the chance of wrong decision to a large extent. This is done first by measuring, then by decision making and finally by building a theory. These three purposes of modelling in marketing as provided by Lilien *et al*., 1992 are discussed as under:

Measurement

The very first purpose of models is to measure the 'demand' for a product as a function of various independent variables. The word demand does not always mean the units demanded rather it could be related to the units demanded (Lilien *et al*., 1992). For example, in a stochastic utility model proposed by Punj and Staelin (1978), college chosen by graduate business school applicants is considered as demand or dependent variable.

In case of measurement models, the independent variables can be marketing mix elements, attributes of choice alternatives, demographic variables, and competitor's actions. What should be taken as independent variables depend upon the given situation. For example, In Punj and Staelin (1978), model of college choice behaviour, no demographic variables are considered rather only attributes related to the college are taken like cost variable, quality variable, distance variables, work experience variables, size of the class, location and some dummy variables. Further in order to analyse the choice behaviour of the consumers for FMCG product category, Banerjee *et al.,* (2005) use three categories of independent variables like marketing mix variables (price, promotion and distribution), demographic variables (age, education, marital status, occupation, income, knowledge of English and mother tongue) and psychometric variables (economy, performance and usefulness).

Decision Making

After measuring the demand process of consumers, marketing managers take decisions. They incorporate measurement models as building blocks, but go beyond measurement models in recommending marketing mix dimensions for the managers (Lilien *et al*., 1992). Measurement models helps in analysing (measuring) the behaviour of the market. After understanding the prevailing position of the market, marketing managers frame their plans and strategies according to the move of the market. For example, by studying competitor's actions and consumer behaviour, it could be determined that advertising of the competitors impresses the consumers and they are moving towards their products. But however with this analysis it could not be estimated that how much we should advertise. Decision models sort out this problem. The ADBUDG model (Little, 1970) is designed primarily to help the managers to arrive at good advertising budgets.

Theory Building

The purpose of theoretical models is to explain marketing phenomena. Theoretical models can be verbal or mathematical. A theoretical model is a set of assumptions that describe the marketing environment. Some of these assumptions will be purely mathematical designed to make the analysis tractable. Others will be substantive assumptions with real empirical content. Theoretical model is simply the setting in which the inquiry (work) takes place. Once a model has been framed, the researcher analyses its logical implications for the phenomena being explained. Then another researcher builds another model, substantively different from the first, and then its implications are tested. The same process may continue with third and fourth model. By comparing the implications of one model with those of another, and by tracing the differences to the different assumptions in the various models, the researcher develops a theory about the phenomena in question (Lilien *et al*., 1992). For example, Coskunoglu *et al*., (1985) develop a new model of consumer decision making by criticising the assumptions of the existing model. They contend that existing model assume that utility of an alternative is a function of that alternative only. They relax this assumption and allow utility function to be dependent upon the preferences of all the brands in the evoked set of the consumer. Ching *et al*., (2006) propose a new model of brand choice that is price consideration model (PC model). Though multinomial

logit model and nested multinomial logit model are considered to be the best choices while examining consumer behaviour but they compared the results of these two models with the price consideration model and find that PC model allows more flexibility in the relation between purchase incidence and brand choice probabilities.

Types of Quantitative Models

A large number of mathematical models are there which deal with specific marketing problems. Some of these models are discussed as under:

Choice Modelling

A choice modelling approach is used in order to analyse and track customer's preferences and action so as to determine that which feature/attributes of product are most important to the customers, accordingly targeting and segmenting decisions are made. For example, Gensch and Recker (1979) analyse the customer's preferences for grocery stores. The dependent variable is actual frequencies of trips to store. Independent variables are various attributes of store. The choice of the consumers is examined by using multinomial logit model. In choice modelling, the various models that are generally used are logit, probit, multinomial logit model, multinomial probit model, generalized extreme value model, etc.

Yield Management

Every industry wants to maximise its revenue. But these can be maximised only if optimum service is provided rather than maximum. Optimum service means product according to the taste and requirement of the consumer and also the price should be in their range. Yield management serves the organisation by setting such mix of resources that fully utilises the capacity of the company and also earns maximum revenues.

Syngen

In order to have long-term growth, there is a need of efficient deployment strategy in every department so that right employee serves the right job and also towards the profitable product and market segment. Syngen is used to serve this purpose.

Assessor

Every firm is interested in predicting the likely success of their new product. Traditionally firms relied on test marketing to examine the likely success of the new product. However, test marketing is expensive and it is also transparent to competitors (Lilien and Rangaswamy, 2003). An alternative approach called Assessor (Silk and Urban, 1978) is used to pretest market measurement and to evaluate that whether a product should be launched or not.

ADBUDG

Firms generally make heavy expenditures on advertising. The role of advertisement in success of business cannot be ignored. But on the other hand, advertising is also an expense for the business, as a large amount of company's financial budget is used for advertising. ADBUDG model (Little, 1970), which is designed primarily to help managers arrive at good advertising budgets, is used in order to determine how much amount of money should be spent on advertising.

Conjoint analysis

Conjoint analysis is used to maintain growth by having such product planning that is suitable for not only consumers but is also effective for company.

Benefits of Quantitative Research in Marketing

The whole task of the marketing manager has changed because of the change in business environment. Companies compete with more efficient technologies. Customers have better options and they also communicate with each other in the ways that are not conceivable in prior period like emails, mobiles, etc. Because of the changed scenario, businesses need their marketing managers to make such plans and strategies that boost the sales, position the product more effectively, and catch more loyal customers. Thus a marketing manager requires a model based analyses to take the effective decisions since it will be very costly to ignore them. Marketing is such a system that has to respond most quickly to the current situation. Any guesswork used in this situation can give misleading results. The demand of the current market is to use quantitative approach in the marketing function. As prescribed by Lilien and Rangaswamy (2003), the benefits of using quantitative models in marketing is discussed below:

- These techniques help the marketing managers to make more consistent decisions by facilitating more precise formulation of functional relations among a number of variables. Consistency is essentially desirable in decisions that are often made. Value of consistency ensures more accurate predictions.
- In some situations, such a large number of options are available for marketing professionals that it becomes physically impossible for them to evaluate each and every option. Quantitative techniques help them to select that option out of all options, which gives maximum utility.

- In some of the situations, the number of options may be few but the variables that might affect the decision may be numerous. For example, while launching a new product, the product may be considering only two decision options – withdraw the product or introduce it. Many variables that influence this decision are competitor's action, dealer reaction, competitors promotion, brand name, availability of other substitutes at shelves, consumers' reaction, etc.
- Quantitative techniques strongly support that why a particular decision is made rather than saying, that particular decision is convenient or preferable.

CONCLUSION

Thus, quantitative analysis provides efficient functioning as compared to qualitative analysis. This is not to assert that better results always occur when quantitative approach is used but one is more likely to achieve superior results. In order to deal with complex problems of marketing, there is a need to capture the essence of marketing phenomena in well-specified models. These quantitative tools teach us how the whole market is operating and what step of the managers will lead to the success. We are more likely to obtain correct answers to questions and better solutions to the problems. No doubt use of this approach makes the whole process very complex and requires skill on the part of the marketing managers but it also promises big rewards to those who accomplish it effectively.

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