



## Applications of Operations Research in Marketing and its Various Aspects

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### Abstract

The objective of most OR studies is to develop "decision rules" for evaluating the overall profitability of multiple courses of action in decision problems characterized by complexity, conflict, and uncertainty. It also involves the analysis of relationships which are likely to influence the future effects of management decisions.

Marketing is a dynamic activity interlaced with a high level of risk. This makes it difficult to make models for marketing issues because (a) there is uncertainty about the customer's reaction and (b) consumer behaviour depends on product performance and convenience which are very tough to quantify. In marketing the company's strategies will be influenced by its competitors, so any OR model which is being made should take in consideration the competitor's activities as well which is not easy to obtain.

**Keywords:** Operation Research, Marketing, Total Quality Management, Marketing Strategy and Online Marketing

### Introduction

In the early 1900s there was not much need of OR in marketing. Then came the marketing concept and marketing mix. The concept stated that consumers' every need must be kept in mind while making business decisions and the marketing mix included the four Ps – product, price, place and promotion. Marketing mix introduced variables,

i.e., for what values of marketing mix do we gain the highest profit. Therefore, the need for optimization was required. The changeover from marketing, to marketing management and increasing popularity of research management moved people towards a more quantitative approach.

When marketing started involving quantitative science, many researchers tried to adapt various OR techniques to develop a model-oriented viewpoint. Between 1960 and 1965 about 15% of the articles in the Journal of Marketing examined and applied Operations Research/Management Science concepts. The main reasons for the decreasing interest in applying analytical techniques to marketing after a very enthusiastic decade were the lack of appropriate data, the complexity of marketing decision problems and insufficient common understanding between researchers and analysts. Because the marketing scene was ill structured for OR, even if someone tried to get the results, they would have been highly dubious. And there were other problems like complex settings, limited information, qualitative data and irrelevant variables.

Now OR has come a long way in the field of marketing. There are various problems being investigated and have ongoing developments.

#### Literature Review

**Hildebrandt, Lutz & Wagner, Udo. (2000)<sup>14</sup>,** explained the last decades the quantitative research based on Operations Research and Management Science (OR/MS) approaches has become one of the leading research paradigms in marketing. The aim of this article is, to give the reader of this special issue an overview of recent publications in OR/MS based marketing research. Its basis is a literature review of quantitative marketing publications with OR/MS orientation in the leading journals of marketing and management. The review reveals general differences in the quantity of the publications and the domain of research between those journals published in English and those in German. The review also provides an overview of research publications during the recent years and shows possible future trends in quantitative marketing research.

Operations research is used in marketing as it evaluates the cost-benefit and ideal alternative decisions which can be considered in relative to given constraints. Quantitative methods in marketing are selectively reviewed. The focus is on data-based models that can be used for internal decision-making and measurement techniques that can be used to support such models.

**Companysa and Ribas(2015)<sup>15</sup>,** suggested us to write about our point of view on the current use of Operations Research techniques applied to the Operations Management and about its future evolution. With some of unconsciousness we accept it, but it is obvious that our vision, even though we try to do our best, will be partial and biased. Hence the title chosen shows signs of prudence. More caution have been applied to the development where, after a glance at the past and reflection on the abundance of new denominations without content, we consider five aspects that, nowadays, acquire increasing importance and that will strongly influence in future developments. Among the five aspects two correspond to trends in the field of operations research techniques, one is a philosophy in the field of operations management, another to an area of the company and the last one to an industrial sector in which operations management, supported by operations research methods, is taking a predominant role.

There has been substantial evolution of data and interface of marketing and operations research. System skills and concepts of operational research are a useful complement to functional skills of marketing. The system skill is used in the field of inventory control and management.

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To get the needed results researchers came up with a technique by combining quantitative modelling with psychometric methods, economic theory and information processing.

This is best evident in *the books of Lilien, Kotler and Moorthy (1992) on marketing models and Eliashberg and Lilien (1993)<sup>(1)</sup>*

Another footprint was the transfer from econometric and extended to marketing applications like predicting consumer behaviour on the basis of data from retailing.

The Operations Research field can assist in designing product distribution systems to capitalize on changing technology to meet marketing needs. One such example is how “The sun oil company” come up with a new Gasoline distribution system.

(10)



With the help of Stern's law, a sales manager gets a chance to optimize the selling strategy keeping in mind the other variables such as market potential and expected revenues. (7)

OR models appropriate for one type of market may not be useful for another. Even if there is limited and qualitative information, researchers are trying to get new OR techniques and methods in the marketing field.

Taking into consideration such situations, we have further explained the solution and analysis of the problems in the field of marketing which are relevant to Operation research.

#### Problem Statement

Marketing involves consumer reaction, market competition, convenience of the customers such factors are difficult to quantify. It suffers from lack of accurate OR models and since each model varies from market to market it is not possible to use one common model for all.

What are the current methods of operations research used in marketing?

Half of the money spent on advertising is wasted and the problem is we don't know which half. It is crucial to find out optimal ways of investing money to get maximum benefits. How can advertising problems be approached by OR?

How does OR seem to have unrealized potential for developing and appraising sales strategies?

How can developments be made in the future to make the use of operations research easier in the field of marketing?

#### Current Methods of Operation Research used in Marketing

Two most widely used models in which outcomes to processes are subjected to change just like in marketing problems are Stochastic and Hybrid models. These models provide flexibility and simulation when applied which shows that they can be used in various problems where other models fail to give a satisfactory result. More models exist which are used only for very specific areas in marketing and are accurate for those areas only like Queuing theory, network planning, transportation model. These Models are useful for identifying the characteristics that are most important to change in customers for directing marketing action, to identify the numbers to be measured by survey or

experiment and to interpret experimental results to work out sales budgets and allocation.

Just in Time (JIT) and Total Quality Management (TQM) are used as practical methods for addressing cross-functional interactions between marketing and operations research.

JIT is an inventory management technique that makes the manufacturing sector more responsive without engaging with traditional regulating methods. It is considered a good marketing requirement technique.

TQM method is used to identify the customer at every step of manufacturing process, create chains through the identification of customer expectations and supplier responsibilities.

With the help of operations, and these techniques manufacturing processes are designed on the basis of aggregate demand projections. A design which tries to minimize unit cost with maximum capacity utilization.

#### Operations Research Tackling Advertising Problems

Due to Cut throat competition companies rely heavily on effective marketing and advertisement to reach their target customers. There are several channels available to reach out to their customers to fulfil their goal. Help from OR is sought to figure effective the mix of what media channels to use for advertising at minimum cost and how much money to invest to get its maximum benefit.

Linear Programming is a mathematical modelling procedure in which a linear function is either maximized or minimized when exposed to various constraints. This technique has been useful for guiding quantitative decisions in media scheduling, advertisement budgeting and selection of media for communication to have augmented and compelling attainment of the targeted market segment.

First, we have to formulate a marketing decision as a mathematical program. Here the marking decisions are the variables which are to be maximized within a set of constraints. The variables can be market shares, profit, sales, etc.

In our case we will allocate funds on selected platforms and try to get maximum return on investment. The factors taken into consideration are the market size, potential and existing

consumers, budget and the efficacy and outreach of the media platform.

Linear programming enables them to find the most effective combination of various advertising channels such as print, OTT, social media, radio with the most effective scheduling that is in frequency with time and continuance. Regression\* is applied as it seeks to offer a quantitative relationship of variables with different budgets allotted to different media. They provide flexibility in decision making by providing various alternative feasible solutions.

These models are very helpful by using them to allocate budget amongst many products based on the demand and consumer perceived effectiveness.

### **Optimization of Selling Strategy through Operations Research**

The potential of OR for aiding the analysis of selling strategy and assisting the sales manager in making strategy decisions can be seen by examining the basic steps in the selling strategy decision process and by examples of studies which apply at each step. Optimization techniques are important tools in the operations researcher's kit, and several studies have dealt with the problem of determining the optimum level of selling effort. Waid, Clark, and Ackoff analysed historical and experimental sales results for the Lamp Division of the General Electric Company and recommended a reduction in the level of selling effort to existing accounts. This study analysed historical sales and cost data, formulated a model of market response, and used calculus to determine the most profitable sales force size. An example of an application of OR to this stage of the decision process is Stern's model for determining the optimal number of sales offices. Using some estimates of market potential and expected revenues (contingent on alternative levels of selling effort), the sales manager must allocate sales effort to control units territories, branches, districts, regions-or among customer types, etc. Also, to be considered in this process is the "workload" as defined by territory geography, customer concentration and dispersion, and the work a salesman is expected to do on an "average" call.

Data on current performance are compared to standards, variations between what is desired and actual results are observed, and elements of selling

strategy are adjusted respectively. It seems highly likely that such use will become more common as the advent of marketing information systems creates the need for analysing large amounts of data as an aid to more effective day-by-day decision making. The attempts by Hughes to measure the impact of sales presentations on buyers' awareness and attitudes also show promise at this stage in the decision process.

There are four decision areas in the determination of sales strategy where OR has potential usefulness: (1) determining sales force size and selling budget, (2) allocating sales effort to control units, (3) developing call strategies for specific account categories, and (4) designing systems for monitoring and customizing sales strategy.

### **Future of Operations Research in the Field of Marketing**

There have been some ongoing developments of OR/MS techniques in the field of marketing. A few are mentioned as follows:

#### **Simulation**

The latest era of marketing is customer centric. Simulation has been proven to have the highest potential amongst all operations research method to solve marketing related problems. Simulation has been used to probe the behaviour of complex marketing subsystems such as distribution, customer behaviour and competition as well as the management of important marketing decision areas such as pricing, advertising, personal selling and new product research. In these areas simple algebraic models can be designed as more complex modelling and simulation. Many firms have already developed or are developing marketing models. The need to specify and quantify relationships among marketing variables has proven a substantial stimulant to theory construction and fresh data collection in marketing. When simulations are run, they in turn produce output whose analysis can lead to interesting new findings. The major areas where simulation could find application in the future are:

- Marketing planning simulation (through a development of the marketing game).
- Test market simulation, where a computer model based round a test area could replace or help interpret test



marketing and save a considerable amount of money.

- Marketing organisation behaviour simulation (the decision-making process can be simulated, and perhaps improved, and the information channels moulded to fit the needs of the managers).

#### **Development of customer relationship management (CRM)**

Analysing customer behaviour and optimization of marketing decisions with the data (company-customer contacts and purchase history) in CRM systems

With use of the data in CRM systems, questions such as: which customers should we acquire, which customers should we retain, and which customers should we grow can be clarified.

OR methods can help here to allocate marketing budgets in an optimal way. With preferences of the individuals known, offers and messages can be sent to individuals to be cost effective.

#### **Online Marketing**

E-commerce creates new opportunities for interfacing marketing with OR. By linking OR and E-commerce we can optimize the most efficient logistical operation to get the purchased products to the consumers. This will lead to joint optimization of marketing and physical distribution.

Some interesting segments with researches in progress are consideration of unobservable structures, integration of multiple methods and use of neural net approaches.

Conclusion, Limitations, Recommendations

Operations Research has been contributing greatly in the field of marketing in recent times. The most common methods of OR are linear programming, transportation but besides that there are more techniques such as game theory, simulation, queuing theory, inventory control, etc. OR is used to make the correct information available based on various data analytics techniques combined with search engine optimization. This has led to more efficient, customized advertising which is extremely effective. With the difficulty to quantify marketing problems in OR there has not been extensive use of it in marketing but that is now changing with new and better models.

Since linear programming is based on quantitative parameters it can be difficult to come up with functions as certain coefficients which are qualitative in nature cannot be accurately estimated which leads to complexity. such decisions are also subjected to certain constraints.

- Stochastic and Hybrid models might not be optimal at all times but they give only a good enough result.

More experience and knowledge about simulation procedures involving extensive computer time will help in solving complex models and achieve similarity between the model and real-life scenarios.

The dynamic models explained in this paper as models whose parameters can be changed to take into account the changing behaviour of the consumer who are subjected to a wide variety of advertising, these models promoted the development of total marketing models which help marketing personnel to make overall decisions. Many firms have already developed or are developing marketing models.

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