

Markov Decision Process in Marketing and Customer Relationship Management

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Abstract: In this paper, the importance of using and utilizing technical methods to improve marketing and customer relationship management is presented. Among the many patterns, theories and programs, the decision support system processes are proposed by Markov. Finally, discuss the use of the Markov model in marketing and customer service

Keywords: Portfolio Optimization, Customer Lifetime Value, Monte Carlo, Markov Decision Process

I. INTRODUCTION

In this paper, companies are trying to improve their marketing plans as one of the most important components of the organization and its impact on the organization's growth and profit rate. Institutions face difficulties in improving the management of their marketing strategies and do not have a reliable way to determine whether their funds have been effectively spent, and investment return is often not systematically assessed. Thus, there is an urgent need for computational tools that help companies to improve their planning and strategies. Many researches have tried to propose many models and add some tools and programs to contribute to the development of marketing by developing new methods to keep pace with the development of modern times, but so far have not taken into account the scientific context studied, which is important to bear in mind if we are to achieve satisfactory results and produce efficient plans And high effectiveness, and that's what we're trying to do in this paper.

II. RELEVANT MODELS AND STUDIES

Our research lies within the scope of Marketing-based IS development and techniques-based decision process analysis. As such, we first review the definitions of the main concepts of this research scope. Afterwards, we discuss the results of a preliminary "Systematic Literature Review" of works that are interested in techniques-based decision process analysis according to Marketing service.

Description of Relevant Notions:

A. Markov Decision Process: An MDP has a group of conditions, conducts, potential changeover, as well as value purposes. When a conduct is being carried out on certain condition, the process transit in a stochastic trend to alternative condition as well as generation of a value like flow of cash [3]. Potential of transition to the aimed condition (knowing the original condition and the conduct being carried out) and the prospected values is a part of model specification. In this manner, an arbitrary series of conditions, conducts and values are modeled, and the prospected collective value related to the given condition under certain regulations, i.e. a routing from condition to conducts, can be determined [1].

B. Simulation of Monte Carlo: Simulation of Monte Carlo is considered to be a computerized and arithmetical technique that enables individuals to assess menace in numerical breakdown, help with decision-making and estimating multidimensional integrals. Specialists in such extensively dissimilar arenas as economics, project management, and the environment use such methodology. [5]. Simulation of Monte Carlo equips the people who are assigned to decide on a certain circumstance with a variety of probable consequences and the likelihoods they will ensue for any option of conduct. It demonstrates the thrilling potentials—the consequences of going for overdrawn as well as for the furthestmost conventional choice—along with all likely outcomes for middle-of-the-road decisions.

C. Lifetime value of a consumer: Lifetime Value Of a Consumer (CLV) is explained as the summation of the reduced money streams that a purchaser produces throughout his association with the business. This explanation can be demonstrated systematically with the subsequent formulation; Where i denote the client being assessed, ($r_{i,t}$ & $c_{i,t}$) the return and the cost produced by purchaser j in time t , r is the fixed reduction rate considering the time value of money,

$$CLV_j = \sum_{t=0}^T \frac{r_{j,t} - c_{j,t}}{(1+i)^t}$$

and T is the period of the association with the corporation. The lifetime value tactic considers customers as assets, which produce cash flows along time and computes these assets using the reduced cash flow technique, which is a typical procedure for the monetary assessment of assets [2]. Systematic Literature Review: Preliminary Results. To elaborate this thesis proposal, we conducted a preliminary literature review of works related to our research question (see Introduction). To do so, we followed the Systematic Literature Review approach. Thus, we first refined our main research question to identify the following three sub questions:

RQ1: What is the importance of Marketing over the time?

RQ2: How to assess the efficiency of Marketing act?

RQ3: How to improve the Marketing planning and strategy?

Secondly, to find works that dealt with the above questions, we identified the set of key words shown in Table 1, which we used to query the most popular scientific databases: IEEE Explorer, ACM, Springer, and Sciences direct. We restricted the search to journal and conference papers published between 2014 and 2017. (We went back to visit earlier pertinent works that were referenced in survey papers we examined in detail.) We further refined the returned results based on their rank in the result lists and considered the top 20 results at most. We next overview the examined papers according to the three research sub-questions.

Table 1. SLR results

Key words	IEEE Explorer	Sciences Direct	Springer	ACM digital Library
Markov Decision Process	9	23	33	140
Customer Relationship Management	678	123	1290	190
Customer lifetime Value	30	83	16	100
Monte Carlo Simulation	30	12	22	17
Planning Optimization	988	377	278	300

A. Works related to RQ1: Importance of Marketing

Recent researches started to describe the importance of marketing within enterprises, e.g. [4], [7], [12], [14].

In [4], the research describes marketing as being whatever a company carries out to put its merchandise or services in the hands of likely purchasers. To do this in an improved manner rather than competing, they must recognize everything about their clients starting by what their requirements are and how they can fulfill them, to what necessity can they additionally form. Writer also emphasizes on the variances between the conventional marketing and digital marketing in the present economy. Upon this market inclination, planning and strategies have been extensively realized to be significant foundational tactic to shape long-term lucrative association with definite customer. However [7] described analysis for marketing administration focused on demand (revenues), costs, cost-effectiveness and the use of conventional financial investigations to find the point at which peripheral cost equals peripheral revenue and profit is increased. In [12], Market research and dissection demonstrates the market aiming conclusion. Market aiming infers chief assurances to fulfilling the requirements of specific client clusters over the advance of explicit abilities and speculation in dedicated resources. According to [14], it establishes an abstract context that eases an enlargement of our comprehension of the task that marketing is carrying out in the scope of the business that form value of the client and, consequently, stockholder value. The aim of the agenda is to highpoint how marketing should be pervaded as a contribution to corporate procedures and how it causes yields that form and maintain client and stockholder value.

B. Works related to RQ2: Measuring the efficiency of Marketing Performance

Current works have projected the embracing of metrics to assess the effectiveness of marketing. In [1], researcher introduces used retaining based model as performance measures of marketing. The retaining frequency is the proportion of clients that keep devoted to the business each year, while [2] use the dissection model by defining metrics to assess devotion, then defining list of grouping (partitioning) principles, that can be separated to couple of sorts: scoring-based group and static-based group. In [5], it develops measurement-based model to measure the extent to which the corporate unit fulfilled its purposes as our assessments of acts. While in [13], author suggests a novel conceptual model to decide if commerce's marketing goings-on are prearranged in manners that permit the application of its policy and the influence this has on acts necessitates the concurrent attention of several features of the commercial facility. According to [15], authors suggest study emphasis on systems of MPA as gatherings of performance metrics that indicate marketing efficacy, competence, and adaptableness. In [16], research sightsees two hypothetically dissimilar characteristics of MPM capability: the capability to measure performance across a variety of marketing events (like advertising, trade promotion and direct mail) and the capability to measure marketing performance using an inclusive group of financial and non-financial metrics.

C. Works related to RQ3: Improving the marketing planning and strategies

Recent researches have anticipated the implementation models and contexts to develop marketing. In [8], researches create a modest model to direct marketing decision through Markov decision process by employing foretold possible client values and make estimate through a regression-based model. While [2] employs MDP as an artificial intelligent practice to progress marketing and planning strategies in airline business (case study). In [10], authors articulate a classified Markov decision process with three stages representative of the decision process. The model contemplates choices associated with feeding and marketing, and finds the optimum decision knowing the present condition of the pen, while [11] identifies a new technique for construction of effectively brainy human-interaction called "Bayes Act". Bayes Act is expressed as a noticeable Markov decision process or POMDP. In [9] researcher suggests a framework of client lifetime value investigation. This context involves elementary fundamentals for CLV computation for collected data to advance marketing and client relationship in banking sectors. However, besides their lack of supportive tools, the so-far proposed metrics-based methods focus on particular purchasers or marketing acts, or the grouping upon the purchasers' favorites and familiarities, purposes of purchasing, fulfillment of customers' needs and their devotion to the business, & merchandise mantelpiece space [2]. More specifically, they do not examine the impact of the role decision process plays on the improvement of marketing plan and strategies along with allocation of the enterprises' resources in systematic manner, which is expected to have positive impact on the marketing plan with markov decision process.

III. DISCUSSION

Various development models and techniques have proposed to support marketing development in enterprises. However, developers still lack tools and techniques to assist with the verification of the efficiency of making the appropriate decision and utilize the available resources efficiently, and effectively to improve the marketing plan and strategies. Given the pivotal role of decision making and its impact on enterprises development, recent researches have proposed several measures and techniques to improve the marketing plan in enterprises, but focus was given mostly to theories that do not keep up with the evolution of technology or consider profitability more than quality and accuracy in decision making. Nonetheless, this paper focused on using a model for improved marketing planning and strategies in accordance with Markov's decision process.

IV. CONCLUSION

In this paper we reviewed some of the theories, models and some techniques used to improve planning and management in marketing services and products, which increases the efficiency of productivity and management of financial resources & discussed the use of decision-making systems using the Markov algorithm & suggested its use in the field of marketing in future research. Markov's algorithm in improving marketing & increasing research in the field.

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