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MEASURING MARKETING EFFICIENCY AND OPTIMISING MARKETING PROGRAMMES

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Abstract. Measuring the marketing efficiency and optimising marketing programmes has been a long standing discussion and as a result a number of models have been developed. However, optimising the marketing programme still remains a challenge. The models developed focus purely on optimisation task but fail to present a holistic picture covering all the steps necessary to optimise the marketing programme. This paper aims to develop a conceptual model to optimise the marketing programme. The proposed model enables to perform the following tasks: to measure the marketing efficiency (including measurement of the return on marketing and marketing costs) and finally – to optimise the marketing programme. The research is among the first to present such a holistic approach and to offer an original conceptual framework, providing both a theoretical foundation for the calculations and as a managerial tool, allowing performing the intended calculations.

Keywords: measurement, marketing cost, return on marketing, marketing efficiency, marketing programme, marketing optimisation, mathematical programming.

Jel classification: M300, M310, C000, C010.

1. Introduction

Companies heavily invest into marketing and these investments continue to grow. Also, many firms have invested considerable resources extending and improving their marketing performance measurement systems (Homburg *et al.* 2012). Thereof, companies' seek to maximise the return on their marketing investments. The importance of optimal marketing communications mix decisions is well-recognized by both marketing scholars and practitioners (Raman *et al.* 2012). According to K. Raman and colleagues (2012), "optimal allocation of marketing spending can significantly enhance a firm's profitability, sometimes by as much as 400%". Following the study performed by J. Shang and colleagues (2009), "distribution network redesign based on optimality decisions at the studied firm reduced the total distribution costs by $1.99 million (6%) per year". However, much can be said against the desire to optimise the marketing programme to come first. For the purpose of this research, it is important to define marketing programme and optimisation of marketing programme. Marketing programme, at least in terms of this paper, means a set (package)

of the marketing tools. Optimisation of marketing programme means selection of the most effective marketing tools, i.e. those which have the best ration of return on marketing compared to marketing cost. Thus, while discussing optimisation issues it will be often referred to measurement of return on marketing as the key parameter within the optimisation model, as well as marketing costs. Although, optimisation of marketing and measuring the return on marketing is an outstanding discussion and so the literature is full of the methods/models, statistics shows marketing measurements still remain a challenge within organisations. With regards to general marketing, 28% of marketers use ROI metrics to assess a portion of their marketing investments, while 36% use some financial metrics and the remaining 36% use only traditional, non-financial metrics (Marketing ROI and Measurement Study 2011). According to the CMO Council 2009 survey results, cited in D. Steward (2009) "80% of the marketing executives responding to the survey were unhappy with their current ability to measure performance. Only 17% of the respondents reported that their organization had a comprehensive system, but these companies appeared to outperform others in … profitability". Therefore, a new shift in marketing is sighted – marketing should be more accountable than ever before (Seggie *et al.* 2007; Gao 2010; Marketing ROI and Measurement Study 2011; Mirzaei *et al.* 2011). According to S. H. Seggie and colleagues (2007), senior management is now demanding that marketing actions are rendered in terms of financial impact and that marketing investments overcome the same financial hurdles as other types of investment. However, to the best of our knowledge there exists no such optimisation model which covers all the steps within a model including measurements of all required parameters with explanations. Therefore, the aim of the paper is to develop an all-inclusive model to optimise the marketing programme covering all these steps. The following tasks shall be accomplished to achieve this aim:

1. To ascertain tools for assessment of marketing efficiency and optimization.
2. To create the model, which would allow to optimise the companies marketing programmes.

For this purpose, the authors use logical abstraction, synthesis, systematic approach and content analysis methodologies. The paper is structured as follows: first the most relevant literature to the studied problem is reviewed, starting with methods/models to measure the return on marketing and continuing with methods/models for optimisation, and based on that a conceptual model to optimise the marketing programme is created, the paper is ended with the conclusions including discussion and limitations of the proposed model.

2. Determining of tools for assessment of marketing efficiency and optimization of marketing programme

Scholars admit that optimising the marketing programme and/or measuring the return on marketing is very difficult and complex (Khan *et al.* 2009; Ai *et al.* 2011; Brooks, Simkin 2011; Malthouse *et al.* 2012; Raman *et al.* 2012) and all provide a

number of reasons. After review of the literature in terms of methods/models applied for measuring the return on marketing and optimisation of the marketing programme, a stream of the main problems regarding data (what), tools (how) and people (who) is identified.

Data (what?). Marketing involves a lot of intangible figures, so while measuring the return on marketing there are difficulties in quantifying the tools (i.e. in quantifying the time of advertisement allocated per customer; leaflet number per costumer, etc). Therefore, problem of measuring marketing being so complex becomes difficult to solve.

Tools (how?). There is a general discontent with traditional metrics to measure the return on marketing and optimise marketing programme (Seggie *et al.* 2007; Gao 2010; Ai *et al.* 2011; Brooks and Simkin 2011; Mirzaei *et al.* 2011; Brooks and Simkin 2012; Raman *et al.* 2012; Salzberger and Kotler 2012, Streukens *et al.* 2011; Xu *et al.* 2012).

People (who?). The literatures express strong critique for marketers due to their poor knowledge in financial technology and hence their inadequacy to measure accurate returns on marketing and optimise marketing programme. (Ryals *et al.* 2007; Seggie *et al.* 2007; Gao 2010; Kommisarova and Grein 2011; Lapointe 2011; Woodall 2012).

2.1. Measuring the return on marketing

In order to optimise the marketing programme, the cost of marketing should be measured and the return on marketing as a key parameter within the optimisation model should be evaluated at first. Therefore, a literature review is performed by starting an analysis on return on marketing as being the core element within the optimisation model. After our review of the literature on measuring the return on marketing (Rust *et al.* 2004; Reinartz *et al.* 2005; Seggie *et al.* 2007; Lacey 2009; Palmatier *et al.* 2009; Nath *et al.* 2010; Chimote, A. Srivastava 2011; Streukens *et al.* 2011), it can be concluded that in terms of the methodology the data for measurement is mostly collected from the surveys; factor analysis is used to group highly correlated variables into the factors and regression analysis is used to measure the return on marketing. As the dependent variable usually a return on marketing or other related parameter such as customer profitability, financial performance or marketing investment revenues is chosen. While choosing independent variables marketing tools, customer loyalty determinants, financial performance indicators, etc. are considered. To generalize, it can be concluded that still subjective measures are considered as usually, data comes from a survey. Moreover, there is still a lack of researches where the impact of the number of marketing tools (objective measures) on the customer profit for a company would be measured. In the cases when marketing tools as independent variables are chosen, only a few marketing tools are included into the model. The other problematic issue is that of linear func-

tionality to be involved, however the impact of marketing tools on customer profit for the company may take any of these forms: square, logarithm, exponent, etc.

2.2. Marketing programme optimisation

After review of the literature on optimising marketing (Ryals *et al.* 2007; Khan *et al.* 2009; Shang *et al.* 2009; Even *et al.* 2010; Krishnamoorthy *et al.* 2010; Schön 2010; Ai *et al.* 2011; Nobibon *et al.* 2011; Sun *et al.* 2011; Sundararajan *et al.* 2011; Xiao *et al.* 2011; Xu *et al.* 2012; Malthouse *et al.* 2012; Raman *et al.* 2012; Sadjadi 2012), it can be concluded that in terms of the methodology internal data is more often assessed than survey. In order to optimize marketing, mathematical programming methods are applied whereof the predominant are those of dynamic or integer programming. Also, more often authors consider nonlinear equations. However, some authors continue to ignore assessing the nonlinear function (C. Schön 2010; R. Sundararajan *et al.* 2011). Amongst dependent variables, mostly maximization of profit is chosen. In some models authors aim to minimize spending (Ryals *et al.* 2007; Shang *et al.* 2009), more rarely – to minimize risk (Ryals *et al.* 2007). In terms of independent variables, roughly a half of models analysed consider marketing tools within the model. However, authors analyse only limited number of marketing tools, i.e. 1 to 3 marketing tools are considered. As stated by S. Ai and colleagues (2011), "There are pricing models, advertising models, and many other marketing models that characterize the budgeting problem with only one marketing tool. However, most of these marketing models do not consider marketing persistence". Moreover, as stated by K. Xuand colleagues (2012), "However, in practice, there could be multiple different marketing actions, and these actions have different cost and may have different effects on different customers". From the other side, S. Ai and colleagues (2011) also adds that "the problem of determining optimal budget allocations to multiple marketing tools is more difficult". Furthermore, the most models consider only binary variables as solutions to the model. However, this is quite limiting from organisation's perspective because companies need to decide on marketing tools to be chosen and also the optimal amount of the tools to be applied. Referring to boundary conditions, they are quit typical such as budget of the marketing or maximum amount of the marketing tools applied. However, these models compromise on the maximum amount of different combinations of the marketing tools applied.

As it was stated above, the predominant methods employed are those of dynamic and integer programming. Basically, the difference between integer (discrete) and dynamic programming is that the latter involves time parameter. However the ability to properly evaluate the time aspect could be questioned due to the following reasons: historical data is not appropriate for statistical projection for few periods in the future; only limited time period within the models is considered, for example, S. Ai and colleagues (2011) considers only two periods. Others assume that some parameters are constant over time, for example, S. Ai and colleagues (2011) states

the promotion component has the same return function. E. C. Malthouse and colleagues (2012) do not consider the variability of the estimated expected revenue for each type of audience member. K. Raman and colleagues (2012) supports: "However, models for dynamic marketing resource allocation typically assume that marketing efficiency is constant over time" and "Existing research, however, provides little guidance on the implications of time-varying efficiency and costs for marketing mix allocations over short and intermediate term horizons (e.g., 2–3 years)". The models proposed also have limitations in terms of applicability to individual level – according to R. Khan and colleagues (2009), "more importantly, the dynamic optimization technique used to develop the promotion policy is fairly complex and computationally burdensome when implemented at the individual level". Although the models analysed still present quite a comprehensive process to optimise the marketing programme and have a strong statistical justification, however there are a number of assumptions made or remain unexplained how to measure the main parameters needed for the model. To be precise, it is not accurately disclosed neither how to measure the return on marketing (Ryals *et al.* 2007; Khan *et al.* 2009; Krishnamoorthy *et al.* 2010; Ai *et al.* 2011; E. C. Malthouse *et al.* 2012), nor authors reveal how to measure the marketing costs. To sum up, previous literature has focused on fragmented issues. The models analysed do not cover the whole approach from the beginning to the end and so marketers struggle when trying to optimise the marketing programme. Moreover, despite a numerous methods/models being introduced there is a lack of understanding regarding how apply them in practise. Thus, in the next section the conceptual model to optimise the marketing programme by explaining how to measure each of these parameters for the optimisation task to be comprehensively solved is proposed.

3. Model to optimise the marketing programme

Although there is no generic tool for measuring marketing performance, it is suggested that a better use should be made of the existing measures, rather than devising new ones (Gao 2010). Therefore, the most appropriate methods out of the existing potential of the methods/models in the literature are selected and it is showed how they could be applied when optimising the marketing programme (Fig. 1). The detail process to perform calculations following the model is described below.

1. Setting the goal by the company. Firstly the company should set a goal. By using the model the company is able to perform one of the following functions:

1) Measuring the marketing tools efficiency (the ratio of the return on marketing and marketing cost). Marketing efficiency is calculated by using analytics.

1.1.) Measuring the marketing cost. At this point both direct and indirect marketing costs are considered. Direct marketing costs are included in the company's financial statements. However, indirect marketing costs are not. Indirect marketing costs consider the working time marketers and all other colleagues dedicate to the marketing process. Marketing costs are calculated by using analytics.

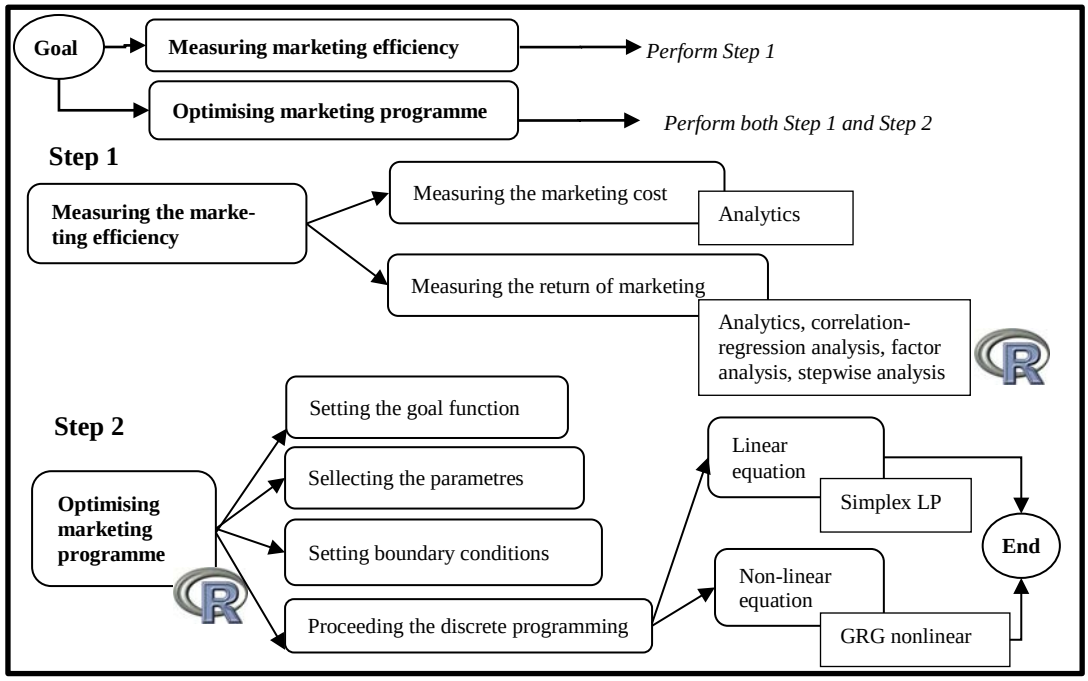

Fig. 1. Conceptual model of marketing programme optimization

1.2.) Measuring the return on marketing. A number of statistical methods is employed.

2) Optimising the marketing programme. Optimising the marketing programme involves choosing the most effective marketing tools. This is the main phase of the model as it integrates all the mentioned steps. Only after marketing costs and return on marketing is measured, the marketing programme could be optimised which is the focus of this paper.

2. Collecting the data. Firstly the company should decide on the segments it wants to perform calculations on and then the time period of the data. Ideally, a longer time period should be considered so that better calculations can be performed. Reliability of the model is based on the quality of the data entered, therefore data accuracy is of high importance while collecting and entering information. Problems occur when marketers ignore the importance of data collection and adequate internal reviewing. Therefore, as inaccurate data is entered, changes while performing the calculations will be required.

Independent variables. Marketing tools as independent variables are considered in the model. Marketing tools are measured by quantitative figures based on their application. Data is collected at the customer level i.e. the quantity of the marketing tools applied to a particular customer. However, companies may lack the

data. Therefore, a few options introduced. Independent variables may be the following:

1. Dummy variables. At this point two options are possible – a particular marketing tool was applied or it was not (1, 0).

2. Continuous variables. In case of continuous data marketing tools are precise quantitative figures, e.g. frequency of visits, value of gifts, the number of emails sent to a customer over a period, etc. In terms of this paper, continuous variables may be accurate or extrapolated. Accurate continuous data means that the company has precise information about the quantity of marketing tools applied for the particular customers. However, this is not a typical. Extrapolated continuous data is when a company has both information about the marketing tools expressed as "dummy variables" and valuable information about the customers' characteristics. In essence, this would allow for an accurate estimation of the quantity of the marketing tools applied, therefore the data would be transformed into an extrapolated continuous data. Here a new component named as customer weight coefficient is introduced. Basically, the customer weight coefficient transforms dummy variables into continuous data according to the customers' characteristics given.

3. Mix of dummy and continuous variables. Mix of dummy and continuous variables means that you can simply mix the data by including both dummy and continuous variables in the model. A data set which cannot be expressed as continuous stays as dummy variable within the model.

Dependent variables. Customer profit for the company is considered.

3. Measuring the customer weight coefficient. Formula for customer weight coefficient is as follows.

$$y = P_i * C_i * CT, \tag{1}$$

where, P_i — (products) = 0.3*Number of products (by categories) + 0.6*Value of the products + 0.1Last shopping date. 0.3, 0.6 and 0.1 are assumed and may be changed case by case. Let's assume that each of the parameter may be from 1 to 5. 1, 2, 3, 4, 5 are chosen in proportion, taking into account the array data (20% of the highest scores will be assigned to 5, the other 20% – 4, etc.; in terms of last shopping date the highest score will be given to the oldest day of shopping). C_i — (credit facility) = 2 if the customer has credit; 1 if the customer does not have credit. CT_i — (customer type) = 5 in case of new customer, 1 in case of existing customer.

4. Measuring the marketing tools efficiency.

4.1) Measuring the marketing cost. In order to reveal the true cost of the marketing tools, both direct and indirect marketing costs should be measured.

4.1.1.) The function for measuring direct marketing costs.

$$y_d = f_d\left(d_i, d_{im}, d_t, d_m\right), \tag{2}$$

where, d_i – cost of creation of the marketing idea. d_{im} – cost of implementation of the idea (manufacturing, testing, etc.). d_t – all taxes to be paid. d_m– cost of monitoring the marketing tool.

4.1.2.) The function for measuring indirect marketing costs.

$$y_{ind} = f_{ind}\left(ind_t, ind_s, ind_{tx}\right), \tag{3}$$

where, ind_t – the time allocated by people from the organisation: marketer, manager (-s), etc. While measuring time consider pre-serving (preparation time, the travelling time to customer office), serving (time spent with customer, travelling time) and after-serving time (entering information into the system, etc.). ind_s – cost of salary. Ind_{tx} – taxes applied for salary and to be paid by the company.

4.2) Measuring the return on marketing according to the process given.

4.2.1) Removing the outliers.

4.2.2) Ascertaining the relationship between variables. This step allows performing the primary analysis.

4.2.2.1) Calculating the correlation coefficients between independent and dependent variables. When performing this step consider different forms of independent variables: linear, square, logarithm, exponent, etc. Different forms of the dependent variables could be also considered.

4.2.2.2) Performing the pair regression analysis.

4.2.2.3) Verifying the assumptions of the pair regression analysis.

4.2.2.4) Estimating the multicorelation between independent variables. In case of high multicorelation between independent variables, factor analysis could be used. As the result of factor analysis, independent variables (marketing tools) are to be grouped into factors. The factor analysis equation is as follows.

$$F_i = a_{i1} * x_1 + a_{i2} * x_2 + \ldots + a_{in} * x_n, \quad i = 1,\ldots,m, \tag{4}$$

where, F_i – factors. $a_{ij}, i = 1,\ldots,m; j = 1,\ldots,n$ – factor‘s coefficient of the marketing tool. $x_{1,2,\ldots,n}$– marketing tools.

After factor analysis is performed, review the logical sense of the results given. The review of the data, however, may be caused by inaccurate collecting and entering the data at the very start point.

4.2.3) Creating a model to measure the return on the marketing.

4.2.3.1) Performing a stepwise analysis. After the primary analysis is performed and marketing tools are grouped into the factors, a stepwise approach to figure out the variables which are suitable for a multiple regression model could be

used. For better results use all the approaches forward, backward or mixture of both. It will allow comparing the results and chose the most appropriate one.

4.2.3.2) Performing a multiple regression analysis. In the multiple regression model only the independent variables which were selected as suitable by a stepwise approach (if used) are to be considered.

The equation of multiple regression analysis in case factor analysis applied:

$$y = \beta_0 + \beta_1 F_1 + \beta_2 F_2 \ldots + \beta_m F_m + \varepsilon, \quad (5.1)$$

where, y = company's profit. β_0– intercept. F_i – factors. $\beta_{1,2,\ldots,m}$– slopes associated with F_1, F_2, ... Fm.

The equation of multiple regression analysis in case factor analysis is not applied:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 \ldots + \beta_n x_n + \varepsilon, \quad (5.2)$$

where, y = company's profit. β_0– intercept. $X_{1,2,\ldots,n}$ – marketing tools. $\beta_{1,2,\ldots,n}$ – slopes associated with X_1, X_2, ... X_n.

4.2.3.3) Verifying the assumptions of the multiple regression analysis.

4.2.3.4) Interpreting the results:

4.2.3.4.1) Factor analysis has not been involved. In this case, β coefficient of the regression indicates the impact of increase of marketing tool on customer's profit.

4.2.3.4.2) Factor analysis has been applied. In this case, β coefficient shows the impact of the factors on customer's profit for the company. However, the aim is to find the return coefficients of each of the marketing tool not factors. Therefore, β coefficients of the factors could be simply transformed into the return coefficients for each of the marketing tool. The return coefficient of each of the marketing tool is extracted according to the formula.

$$Y = \beta_0 + \left(\beta_1 a_{11} + \beta_2 a_{21} + \ldots + \beta_m a_{m1}\right) x_1 + \ldots + \left(\beta_1 a_{1n} + \beta_2 a_{2n} + \ldots + \beta_m a_{mn}\right) x_n, \quad (6)$$

where, $\beta_{1,2,\ldots,m}$– slopes associated with factors (F_1, F_2, ... F_m). $a_{ij}, i = 1, \ldots, m;$ $j = 1, \ldots, n$ – factor's coefficient of the marketing tool. $x_{1,2,\ldots,n}$– marketing tools.

5. Creating a model to optimise the marketing programme.

5.1) Setting the goal function. The first is the specification of an appropriate objective function. In terms of this paper, the focus is on maximisation of the customer's profit for the company.

5.2) Selecting the parameters for the model. In order to optimise the marketing programme, the following parameters are needed: the list of the marketing tools you would choose from, cost of each of the marketing tool and return coefficients of each of the marketing tool. All the calculations were performed prior.

5.3) Setting the boundary conditions. Set some boundary conditions such as marketing budget, maximum amount of each of the marketing tool applied, maximum amount of the combinations of the marketing tools applied, the required re-

turn coefficient of the campaign, etc. Also, x≥0, x – integer. In case of dummy variables within the model x∈{0;1}.

5.4) Performing discrete programming. In case of linear equation, the method of Simplex LP is to be chosen, in case of nonlinear equation – GRG nonlinear. The objective function is the maximization of gross profit received from the customer minus the cost of marketing tools.

$$\max \sum_{i=1}^{n} r_i x_i - \sum_{i=1}^{n} c_i x_i, \tag{7}$$

where, x_i– marketing tools. r_i– return coefficient of *i* marketing tool. c_i– cost of *I* marketing tool.

Subject to:

$$\sum_{i=1}^{n} c_i x_i \le b, \tag{8}$$

$$x_i \le m_i, \ \ i = 1,\ldots,n, \tag{9}$$

$$\sum_{i=1}^{n} a_{ki} x_i \le m_k, \ \ k = 1,\ldots,l, \tag{10}$$

where, *b* – budget allocated to the marketing. m_i – amount of the *i* marketing tools applied for the customer. a_{ki}– indicator of the *i* marketing tool in the combination *k* {1;0}. m_k– amount of the different combinations of the marketing tools applied for the customer. x_i– ≥0, integer; In case of dummy variables x ∈ {0;1}.

5.5) Evaluating the results of the optimised marketing programme.

Techniques to perform calculations. As a useful tool to perform calculations the R software can be employed. The R is a language and environment for statistical computing and graphics which is certified. The R statistics is to be used for both measuring the return on marketing and optimising the marketing programme.

4. Conclusions

The model proposed contributes to the science and practise by providing the comprehensive approach to optimise the marketing programme by including all the steps following with the explanations. However, the has the following limitations: only financial issues are considered; time lag between application of the marketing tool and the time it starts to generate income, as well as that the length of income generated is not considered; the order of the marketing tools applied is not taken into the consideration; synergy of the marketing tools is not measured; threshold points in a curve of customer loyalty are ignored.

Finally, results of the model are as follows. Measuring the marketing cost – direct and indirect marketing costs are measured. Measuring the return of marketing – the return of each marketing tool is measured. As well as that, variables (marketing tools) that can be represented as factors are found. Therefore return of the factors is measured. Measuring the marketing efficiency – efficiency coefficients for each of the marketing tool or its factors are found. Optimising the marketing programme – the marketing tools which should be included into the marketing programme are found; the amount the marketing tools to be used is explored; the possible company's profit generated through applying these marketing tools is measured. Future research should attempt to solve limitations proposed.

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