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Model in Order to Make Effective Decisions in Selecting Advertising Media by Goal Programming(GP)

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Abstract. In recent years according to the growing companies and products supplied, and competition between them has intensified. Products and diversity, one of the main concerns of commercial institutions. Therefore, selecting the media to introduce and is important the relationship between customers' products. Given the multiplicity of media in promoting and marketing the products, they are the optimal choice and allocation of funds to each of their hard work and decisions has difficult in this field. The main objective of this study provide a model for allocating advertising budgets of a variety of media including television, newspapers, radio and organizational approach is to reduce spending. The model by goal linear programming, with respect to the three ideals is provided, so that the ideal first indication of a total of 15 ads in TV media, cause the 4 ads in newspaper pages (located on the front page) and finally cause the third 30 advertising radio is considered Thus, the efficiency of the model of data a manufacturing company are used in the field of ceramic tiles. Finally model has been implemented by Operational Research software LINGO 11. The results of this study indicate that it is the realization of the goals of the first and second and

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third goals, 4 deviation of less than the limits defined and the model is to be realized.

Keywords: Select media, budget allocation, propaganda, marketing, goal linear programming (GP).

1. Introduction

Today advertising can't just be considered as a medium for increasing the company's sales. The main objective of ad-vertising is to give a better understanding of a product features and its services. The fast development of media and the addition of the new media to advertising media, will present the advertisement as the main factor in success or fail of companies. Considering the intense rivalry between compa-nies and the fast growth in business and sudden changes in consumers' behavior, advertising have become the main tool for informing the consumers of the products and their services (Nahidi and associates, 1389). One of the most challenging responsibilities of commercial is to persuade people to choose and have the mentioned product. The advertiser should make a connection with customer. In order to achieve this goal he should know how the customers think. Then the advertisement should be able to convince the customer that the product he is going to buy will meet his expectations (Belch & Belch, 1998). Nowadays the success of every company is dependent on its customers and knowing their interest and the expectation of an organization is the main concept of marketing (Roli 3, 1388). One of the implementations for introducing the products in these times is the usage of different media such as television, newspaper, magazines and radio for advertising and marketing. Social media are being used as a mean to improve the business and creation of an online commercial brand. Unfortunately most of the trade owners have doubts about starting and choosing the best media. Of course regarding advertisement some of the medias cost nothing such as electronic trade, which have made it easier and more accessible for these cases which include electronic data interchange (EDI), electronic mail (e-mail), electronic funds transfer (EFT), barcode, fax, electronic leaflet, data bank exchange, internet, spreadsheet internet and ... (Mottaghi, 1387). Re-

garding these aspects the main goal of this research is the representation of the best model for attribution of the budget of advertising in manufacturing companies. Commercial is a dynamic science which takes new forms according to changes in society, politics and economics, and also in different environment and their conception, belief, tradition, and also culture and religious (Arbabi, 1350). Ad-vertisement is the main factor of recent culture in developing country (Mcdonough, 2003). The goal of advertisement shouldn't just be controlling the market, it should also create a sense of trust and belief in company's future products (Anonymous, 2010). Advertisement is not just for television, it also consist of other media. Radio, newspaper, magazines, advertisement in the city, internet and so on are some of the important advertising media. Since every commercial have a different effect on the audience, the audience will react in different ways. Most important discrepancy between media is broadcasting media (radio and television) and press media newspapers and magazines). Broadcasting media are better for conveying the symbols and imaginations, while press media are better for detailed explanations (Mohammadian, 1385). One of the necessities for someone who is going to plan the media is having an active and open mind, because he/she needs to find the best media between all the varieties for their advertising purpose (Russell & Iane, 1999)

2. Literature Review

Many researches have been conducted in regard to media and its role in advertising of the products of organizations and companies, which shows its importance. In this research we highlight some of these cases. In a research called "the analysis of commercial media's influence and their ranking from customer's point of view based on A.I.D.A model in Akhavan Jam manufacturing company", researchers started with studying the importance of media and its role in adver-tising company's products. Then resumption their research in studying the effects of advertising media on AkhavanJam manufacturing company and their ranking from customers point of view by assembling information and questionnaire. In the mentioned research the statistics included customers of a

company in Tehran (600 customers). The result has shown that TV has the most and internet has the least effect on customers (Nahidi and association, 1389). In another research called "monitoring social media and their part in marketing" while mentioning the daily increase in usages of media especially internet in advertising, it talks about social media and their role in people's ability to talk about their ideas and feeling with each other and in groups. The research emphasizes on benefits of the ability of connecting people without needing the direct contact. Also in the research it has been pointed out that people would be talking about their personal ideas and some of the misleading information might affect company's credibility. At the end the research suggests to the marketing managers to monitor this information (individually and in group) in order to improve their marketing, and it also mentions the role of social media in marketing and monitoring the aforementioned data (AhmadiNadushan, DavarpanahJazi, 1390).

In another research named "a model for rating and ranking base on Roshgan analysis of social networks", it has been tried to rate and rank social networks by customers' ability to connect in the network. The result have shown the customers who have a good connection and relation in a network are better candidates to convey the successful experience of the company and absorb new customers (Babaie, Sepehri, 1389).

3. Methodology

The goal of this research is more applicable and is more of an experiment, and also uses an overall descriptive-field method. The utilized data in the research have been formulated so they can show the efficiency of goal programming. In this research the manufacturing company have presented three goals, the first goal is 15 requested advertisement in television (one minute per day), second goal is 4 designated advertisement in newspapers (in the first page), and last goal is 30 advertisement in radio. The case study in this research is a tile and ceramic manufacturing company in Yazd, finally the model has been implemented by Operational Research soft-ware LINGO 11.

Goal programming models in advertising is an efficient means in the

selection of respective advertisement. In some cases this method is used because of financial reasons and the variety of advertising media such as radio, TV, newspapers, direct correspondent, magazines and etc. the objective can be the coverage of customers and specifically the audience of commercials. In order to help marketing managers dedicate a constant budget to different kind of media such as TV, radio, newspapers and magazines, a linear programming have been designed. The purpose of this model is to increase the number of people whom the advertisement affects or decrease the cost of advertisement considering different quorum of the number of times an advertisement is broadcasted, taking into account the limitation of budget, number of media and company's policy.

Maybe we can call GP one of the oldest models of decision making considering its vast usage. Charnes and Cooper pub-lished the first paper on GP in 1955, they analyzed the mi-nimization of deviation from the absolute value of personal gains. in GP it's been tried to take into account the logical mathematical models considering the DM in securing personal gains in different goals (Asgharpour, 1390). In a linear programming query, one can summarize the goals of the organization in one whole format, for example maximize the whole profit or minimize all the costs. But this is not always the case in the real world. In truth we discuss the matter in details, studies have shown that the managing of big compa-nies expenditure themselves for other goals such as having a stable profit, increase (or at least preservation) of their share in the market, variety of products, stable prices, increase employees morale, giving the control of the company to a family and finally raise the face of the company. Statistical programming shows us the way to move toward all these goals at the same time. The base is to set a number as an ideal and a function will formulize for each goal.

Then an answer will be sought which is the total (scale) of deviation of each goal compared with the set goal. In a ma-thematical sense, imagine that $x_1, x_2, ..., x_n$ is the va-riables in question and K is the set goals.

If C_{jk} is the ratio of g K goal, then $(j = 1, 2, ..., n)$ in the func-tion K $(K = 1, 2, ..., K)$ and also g K the set goal for this func-tion, then we are looking for an answer to reach all the fol-lowing goals.

$$\sum_{j=1}^{n} c_{j1}x_j = g_1 \tag{1}$$

$$\sum_{j=1}^{n} c_{j2}x_j = g_2 \tag{2}$$

$$\sum_{j=1}^{n} c_{j3}x_j = g_n \tag{3}$$

Since the achievement of all these goals is not possible, it is necessary to close the equations to the goals. In the simplest way when the deviation of goals have the same value, the function of linear goal programming can be formulated as follow.

$$z = \sum_{k=1}^{k} |(\sum_{j=1}^{n} c_{jk}x_j - g_k)| \tag{4}$$

As usual the two vertical lines represent the absolute value of quantity between the two. But how can we solve such a complex function? This is the main key of goal programming. By using the formulation model mentioned above, the variables with positive and negative root, Z, can be simply added in the chart.
First is the definition of new variables.

$$k = 1, 2, 3, ..., k \quad \text{So that:} \quad y_k = \textstyle\sum_{j=1}^{n} C_{jk}x_j - g_k \tag{5}$$

$$z = \textstyle\sum_{k=1}^{n} |y_k| \tag{6}$$

Because can have negative and positive amount, we define their negative and positive elements y_{k^+}, y_{k^-}, which result in the following formula:

$$|y_k| = y_{k^+} + y_{k^-} \quad \text{for all} \quad k = 1, 2, 3, ..., k \tag{7}$$

$$y_k = y_{k^+} - y_{k^-} \ , \ y_{k^-} \geqslant 0 \ , \ y_{k^+} \geqslant 0 \tag{8}$$

$$minz = \sum_{k=1}^{k} (Y_{k^+} - y_{k^-}) \tag{9}$$

$$\sum_{j=1}^{n} C_{jk}x_j - (Y_{k^+} - y_{k^-}) = g_k \quad , \quad \text{k=1,2,3,...,k} \tag{10}$$

$$y_{k^-} \geqslant 0 \quad , \quad y_{k^+} \geqslant 0 \quad , \quad (j = 1, 2, 3, ..., n) \tag{11}$$

And any other deviation in linear programming that was define about x_j from the start. Now by using a simplex me-thod we can find an appropriate answer for all this deviations (even). After that we omit y_{k^+} , y_{k^-} (Javadian, Gola-bian, 1386).

Detailed description of ideal model for allotment of the or-ganization's budget in advertisement in media:

In this research in order to decide the budget allotment of the organizations and manufacturers for advertisement and the amount of budget allotted to each media, and in order to minimize the cost, a linear programming model with a func-tion has been used. Hence for model's efficiency a numerical model in the form of data of a manufacturing company has been used.

4. Findings

The research by marketing department of a company has suggested three media, radio, TV and newspapers in the next month. At the end of each month a new research will be held to determine the perfect media for next month. The chart below shows the information gathered upon advertising.

This company considered the maximum of 50,000,000 toman for advertisement in tv. In addition the following figures are being set as company's advertising policy:

At least 10 times advertise in tv and at least 70,000,000 po-tential customers to be informed about the product. The op-timum advertising for minimizing the cost is as follow.

$$MinZ = 1425600 * x_1 + 1800000 * x_2 + 202000 * x_3 + 460000 * x_4 + 1000000 * x_5$$

Table 1

The medias	Number of customers who will be informed by the ad	Cost of each advertisement (tomans)	Maximum number of advertisement in each month	Decision's variables
Tv (one minute ad in each day)	50,000,000	1,425,600	15	x_1
Tv (30 seconds ad at night)	70,000,000	1,800,000	10	x_2
Newspapers (ad in the middle pages)	15,000,000	202,000	25	x_3
Newspapers (ad in the first page)	25,000,000	460,000	4	x_4
Radio (30 seconds between 8o'clock to 1′	3,000,000	1,000,000	30	x_5

Since there are three goals in this research and tv advertise-ment is more important than the other two goals, we have used prioritize goal programming. In this case the amount of P_1, P_2 and P_3 function will define as minimum of the whole deviation. The linear goal programming for attribution of budget between advertising media is as follows:

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$$MinG = P_1 \ * \ d_1^- + P_2 \ * \ d_2^- + P_3 \ * \ d_3^- \tag{12}$$

$$x_1 - d_1^+ + d_1^- = 15 \tag{13}$$

$$x_2 \leqslant 10 \tag{14}$$

$$x_3 \leqslant 25 \tag{15}$$

$$x_4 - d_2^+ + d_2^- = 4 \tag{16}$$

$$x_5 - d_3^+ + d_3^- = 30 \tag{17}$$

$$1500000 * x_1 + 3000000 * x_2 + 10000 * x_3 + 50000 * x_4 + 100000 * x_5 \leqslant 50000000 \tag{18}$$

$$x_1 + x_2 \geqslant 10 \tag{19}$$

$$x_1 + x_2 \leqslant 25 \tag{20}$$

$$x_3 + x_4 \geqslant 4 \tag{21}$$

$$x_3 + x_4 \leqslant 29 \tag{22}$$

$$50000000 * x_1 + 70000000 * x_2 + 15000000 * x_3 + 25000000 * x_4 + 3\text{-}7000000$$
$$x_5 \geqslant 70000000 \tag{23}$$

$$x_i \geqslant 0 \quad i = 1, 2, 3, ..., 5 \qquad d_1^+, d_1^-, d_2^+, d_2^-, d_3^+, d_3^- \geqslant 0$$

The first equation is the function of goal programming model, this function is the minimum of deviation from defined goals. In this equation the amount of P_1, P_2 and P_3 are 0.6, 0.3 and 0.1 that is the importance of goal models which are the number of advertisement in tv, newspapers and radio and their total should be 1.

d_1^-, d_2^- and d_3^- parameters show less deviation than the set goals in goal programming model. The restriction (2), is the first goal and shows that the number of advertisement in tv should be 15 per month. The restriction (3) and (4), are the maximum number of advertisement in tv's at night, and middle pages of newspapers per day. The restriction (5) is the second goal and guaranty that the company should have 4 advertisement in the first page of advertisement per month. Restriction (6) is the third goal of this research which is 30 advertisement in radio. Restriction (7) is the maximum budget of the company for advertisement by toman for tv commercials (days and nights), newspapers (first and middle pages) and radio (30 seconds between 8 and 17) per month.

Restrictions (8) and (9) show the sum of number of requested in advertisement which should be at least 10 and at most 25. Restriction (10) and (11) determine the sum of advertisement in radio between at least 4 and at most 29.

And finally restriction (12) confirm the prediction of at least 70,000,000 audience who watch the advertisement from different media.

The model has been implemented by Operational Research software LINGO 8. Considering the previous research in LINGO 11, the output models are consisting of 9 variable I goal programming, in this research it has been attempted to calculate the function multiplication restriction

of the goal based on real information and experience and minimize the false information.

The model has been executed for a one month period and considering the maximum budget for advertisement in one of advertising companies in Tehran. The amount of variables and functions are as follows:

Table 2

The variables in goal programming	Description of variables in goal programming	Number of variables calculated by LINGO8
x_1	Number of advertisement in TV (one minute per day)	15
x_2	Number of advertisement in TV (on minute per night)	0
x_3	Number of advertisement in newspapers (in middle pages)	0
x_4	Number of advertisement in newspapers (in the first page)	4
x_5	Number of advertisement in radio (30 seconds between 8 o'clock and 17)	26
d_1^-	The amount of deviation less than first goal	0
d_1^+	The amount of deviation more than first goal	0
d_2^-	The amount of deviation less than second goal	0
d_2^+	The amount of deviation more than second goal	0
d_3^-	The amount of deviation less than third goal	4
d_3^+	The amount of deviation more than third goal	0
G	The amount of function of goal programming representing minimum deviation of set goals	0.322
Z	The amount of function of goal programming representing minimum cost of advertising	49224000

5. Conclusion

Considering the importance of advertisement for organization and manufacturing company, this process will effect introduction of new products, production expansion, devel-opment of products and cause profitability of products in the long term. Finally efficient advertisement will guarantee the improvement and introduction of products and also survival of the organization and manufacturing company. During the conducted researches it has been clear that organizations and manufacturing com-

panies have limited budget for adver-tisement, hence the models used in this respect cost minimum amount.

The goal of this research is to present a helpful model for advertising to company managers and manufactures consi-dering the budget and number of respective advertisement in different media, which media and how many advertisement needed to reduce the budget to minimum.

The result of the research has been implemented by Opera-tional Research software LINGO 11 and based on linear goal programming, it shows that the number of advertisement for TV for one minute at day (x_1) is 15 case per month and this goal has been achieved and the number of advertisement in TV for one minute at night (x_2), number of advertisement in newspapers in middle pages (x_3) equals zero. Since the second goal in this research was representing the number of advertisement in fist page on magazines (x_4) , it has substantiated to 4 cases and finally third goal which is the number of advertisement in radio (x_5) with 4 derivations less than designated goal (d_3^-) equals 26 cases.

We suggest that considering the set budget in advertising process and other limitations in linear goal programming model in this research, the manufacturing company follows our result. For further researches we suggest the researchers consider the variables and use other methods such as (game theory) and (dynamic programming) and compare and placate the results with real situations.

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