INTEGER GOAL PROGRAMMING FOR MEDIA SELECTION IN THE INDUSTRIAL ELECTRONICS MARKET: AMELIORATING CONFLICTING MANAGEMENT PREFERENCES

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Abstract

Integer Goal Programming is shown to be an effective tool for media selection in a firm where conflict exists among marketing, sales and other executives in terms of media preferences and perception of market segment importance. A multiple stage iterative use of integer goal programming is presented.

A very important part of the marketing function is to decide on the best media channels for carrying the advertising message to the intended audience. The advertising media selection decision involves the allocation of limited advertising dollars among alternative vehicles in an attempt to achieve the goals of the company. Thus, to maximize the return on advertising expenditures the advertiser must create the "best" messages and place them in the "best" media on the "best" schedule of media placements. Every introductory advertising textbook devotes one or more chapters to advertising media evaluation which is aimed at determining what available media alternative is best for a particular purpose.

The fact is that major advertisers selling similar products may often have quite different ideas as to the most effective combination of media. Traditionally advertising managers or media planners have been guided by previous experience, personal knowledge, and industry convention. The early work on the application of quantitative techniques to this area was done by the advertising agency Batten, Barton, Durstine and Osborne (Buzzell, 1975), and others (Day, 1962) (Engel and Warshaw, 1964) who all applied linear programming to the question of how to achieve an optimal media selection decision. Linear programming was at first enthusiastically received as a pioneer practical breakthrough in the application of quantitative techniques to media selection. Although linear programming does offer advantages in solving media selection problems, its inability to deal with many of the complexities of the real world has limited its use. Several specific criticisms: the possibility of fractional solutions, failure to consider audience duplication, the assumption of constant media costs, and a misleading impression of definiteness have been developed (Engel, Wales, and Warshaw, 1975). These criticisms encouraged several theoreticians to advocate the application of integer goal programming to the media selection problem. (Charnes et.al., 1968) (Lee and Bird, 1970) (Lee and Nicely, 1974) (Keown and Duncan, 1979). These advocates consider that the technique offers advantages in allowing the advertising manager to consider multiple, conflicting goals in optimization problems. Also, the use of integer programming in conjunction with goal programming can allow consideration of interactive media effects, decay effects, threshold levels, and quantity discounts in media selection decisions.

The purpose of this paper is to extend these discussions by describing the use of integer goal programming as a tool for assisting media selection decisions by one specific firm in the industrial electronics industry (television equipment). This paper illustrates several modifications in the implementation of the technique that make the results especially amenable to use by practicing executives. Specifically, this paper illustrates the addition of a multiple stage iterative process involving the resolution of certain goal conflicts. The specific step-wise process allows for a concensus decision among marketing and sales executives who, although in the same firm, address different markets with different, but sometimes overlapping, print media coverage.

The company in this example is a publicly held firm with gross sales for the year in question of $15,000,000. The company manufactures equipment for broadcast television, cable television (CATV), and closed circuit television. In addition, the firm operates a sales company to sell its closed circuit television products in several geographic market areas. Manufacturing activity accounts for 40% of the firm's gross revenues and 70% of the firm's profits. The firm employs three separate and different marketing channels, one for each of the markets its addresses:

Broadcast Television:	A broadcast sales manager reporting to the Vice-President of Marketing sells directly to networks and group owners, and assigns other accounts to the company branch offices in their territories. This division also handles accounts in distributor territories directly.
Cable Television:	A CATV sales manager with one assistant reporting to the Vice-President of Marketing covers all accounts directly. This division allows branch offices to participate on specified accounts.
Closed Circuit Television:	For the territories where the company does not have branch offices, a distributor sales manager, who reports to the Vice-President of Marketing, sets up distributors and dealers. In the territories where the company has branch offices they operate as exclusive distributors. All branch managers report to the Vice-President for Sales.

The company's branch offices are in many major cities, although several key territories are handled by distributors.

Both the Vice-President of Marketing and the Vice-President for Sales report to the President, who is the CEO of the firm.

The Advertising Manager and the Product Promotion Manager report to the Vice-President of Marketing and organizationally are on the same level as the sales managers. An advertising agency is used, but only for ad copy preparation and placement. All media

scheduling is done by the Advertising Manager in cooperation with the Product Promotion Manager.

The dual sales organization for the most part worked well. However, there was a basic conflict in sales goals. The marketing channels reporting to the Vice-President of Marketing sold the company's manufactured products exclusively. The branch offices also sold vendor supplied products. In fact, company manufactured products accounted for only 30% of their sales volume.

Table 1 summarizes the percentage of manufacturing output, revenue, and profit that each marketing channel generates.

TABLE 1

OUTPUT, REVENUE, AND PROFIT
BY MARKETING CHANNEL

	Broadcast	CATV	Closed Circuit
Output	5%	10%	85%
Revenue	10%	40%	50%
Profit	15%	25%	60%

Source: Internal Financial Records of Subject Firm

The Vice-President for Sales, although he would agree with the goal of emphasizing the sale of manufactured products, was, along with his branch managers, compensated on a sales volume basis. This resulted in the company branches having high overall revenue, but with a low percentage of company manufactured products.

This represents the core of the conflict in goals: the Vice-President for Sales prefers an advertising schedule that favors the closed circuit market, the Vice-President of Marketing expresses no preference but rather wishes to use advertising dollars to promote the company's products to the markets where sales return a higher profit, namely broadcast and cable. It is also recognized that the distributor network is provided by language in the franchise agreement with a promise of advertising directed toward their market (closed circuit). The President favored the broadcast market heavily owing to its greater perceived prestige over the other markets, and preferred to direct advertising accordingly.

This all led to a conflict regarding promotional preferences, as can be seen in Table 2.

TABLE 2

PROMOTIONAL PREFERENCES BY MARKETING CHANNEL

Channel:	Branches	Broadcast Sales	CATV Sales	Distributor Sales
Market:				
Broadcast	3	1	2,3	3
CATV	2	2,3	1	2
Closed Circuit	1	2,3	2,3	1

Source: Interviews with responsible executives

All distributor channels preferred a media exposure in the closed circuit market, with the cable market second. This no doubt reflects the revenue opportunity of these marketing channels. The market segments with dedicated sales managers preferred that exposure be concentrated in their respective markets.

The media budget for print media was $45,000. This is a small part of the total advertising and promotion budget of the company. The company was a major exhibitor at trade shows, and a moderate user of direct mail advertising.

The company considered nine controlled circulation magazines to be important relative to the lines of business of the firm. These publications are presented in Table 3, which identifies the circulation by relevant market, the frequency of appearance, and the cost for a one page black and white ad at the rate for which a quantity discount is earned.

TABLE 3

PREFERRED PRINT MEDIA DATA

Title	Frequency	Circulation			Page Cost
		Broadcast		CCTV	
Broadcast	52	8,000	1,000	nil	$1,200
BME/CME	12	9,200	4,000	1,000	1,030
Broadcast Engineering	12	8,000	3,000	2,500	375
Cablecasting	12	nil	5,000	nil	500
CATV	52	nil	3,000	nil	445
TV Communications	12	100	6,000	500	740
Actual Specifying Engineer	12	nil	nil	20,000	1,020
Education & Instructional Television	12	2,000	nil	15,000	800
Educational Broadcasting	6	1,000	nil	15,000	890

Source: Business Publications Rates and Data

The firm's advertising agency specialized in industrial accounts, but did not participate in media selection for this firm. However, the agency did rank the nine publications for the firm based on reader service return, and also upon the results of surveys taken in the respective markets. The following represents the agencies ranking:

Publication	Rank
Broadcasting	8
BME/CME	5
Broadcast Engineering	7
Cablecasting	4
CATV	6
TV Communications	1
Actual Spec. Engr.	2
Educ. & Indust. TV	3
Educational Broadcasting	9

The company advertising manager also had a ranking of market preference priorities of the various responsible executives and also of himself and the Product Promotion Manager.

TABLE 4

MARKET PRIORITY PREFERENCE

Market	Pres	VP-Sales	VP-MKT	Advt Mgr	Prod Prom Mgr
Broadcast	1	3	3	2	2
CATV	3	1	2	3	3
Closed Circ.	2	2	1	1	1

Source: Interviews with the indicated executives

This variation in priorities can partially be explained by the background of several of the individuals, particularly the President and the Vice-Presidents who came from the market areas where their number one preference is noted. The priorities expressed by both the advertising manager and the product promotion manager reflect the profit potentials of the various markets.

The advertising manager in the midst of all of the apparent conflicts had the duty of formulating a media schedule that would be acceptable to all concerned parties and that would also fulfill several goals. The following goals were recognized and are listed in priority order:

1. The $45,000 media budget was to be 100% spent
2. The media budget could be exceeded at most by 10%
*3. Advertise in a way to stimulate sales in market segments in relation to profit potential
4. Maximize advertising exposure
5. Minimize media overlap
6. Maximize quantity discounts

*This goal is not clearly definable due to the different rankings by the executives who must buy-off on the media schedule.

Integer goal programming was used to develop a media placement schedule that would minimize the under achievement of these goals. The first round of the process utilized the market priorities of the advertising manager. This meant that publications addressing the broadcast market received second priority, publications addressing the CATV market received thrid priority. This put a heavy emphasis on the manufactured products of the company as well as the area for greatest sales growth. This priority scheme also provided for necessary product identification advertising to the distributor network including the owned branch offices.

Since an integer solution was required an established basic methodology was followed (Keown and Duncan, 1979). Audience duplication was explicity dealt with as was any possibility of overexposure. A tested algorithm (Lee and Morris, 1977) was utilized on a CDC Cyber-172 computer.

The results of the first round solution was not presented to the responsible executives. The executives were shown, instead, the resultant media placement deviations from goals relative to each market. They were then asked, considering the achievement of the first goal and under achievement of the second goal, if they wanted the underachievements modified.

The resulting desires to have under achievements modified were then utilized to modify goal priority number 3, which would now show preference for a different priority among the publications. This then allowed the model to be reoptimized.

The second round results in terms of the underachievements were again presented for possible modification. These modifications allowed further change in goal 3. After the third optimization the responsible executives desired no further changes.

This procedure permitted the various executives to allow their different perspectives to be converged into a mutually agreed upon media schedule.

In each round each executive responded to all of the deviations, that is to say for each of the nine publications, and they were free to request that it be raised or lowered. Table 5 presents the third round solution in terms of the decision variables, the publication insertions.

TABLE 5
PUBLICATIONS AND NUMBER OF PLACEMENTS

Variable	Number of Placements
Broadcasting	13
BME/CME	6
Broadcast Eng.	6
CATV	0
Cablecasting	0
TV Communications	13
Actual Spec. Engr.	6
Educ. & Ind. TV	6
Educational Broad.	3

The final optimization provided the following results:

Goal	Status
1	Achieved
2	Under achieved by $2,260
3	Achieved
4	Under achieved by $4,320
5	Over achieved by $1,650
6	Achieved

This method of combining integer goal programming with an interactive multi-stage process of decision maker interaction provides a useful tool for mollifying the apparent conflicting goals of multiple executives who must approve media placement schedules. This technique made the process go a lot smoother than when the selection process was done on the former more intuitive process.

References

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