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Using the AHP in Marketing Decision-making

Many marketing planning and evaluation tasks involve making multicriterion decisions, sometimes involving groups. The analytic hierarchy process (AHP), by building a customized hierarchy to represent each problem, leads to the likely identification of all key components affecting decision-making, which contrasts with "seat of the pants" decisions. The most important objectives and alternatives at each hierarchical level are determined through trading off preferences. This can also help reconcile group conflict. Data collection using AHP involves each decision maker determining their relative intensity of preferences by uniquely combining quantitative and qualitative data on to a single scale. To reduce tedium, appropriate software can significantly speed up results. Furthermore, the ability to calculate and present results at each decision level can be used to support, persuade and justify proposed outcomes to top management. This is important for marketing managers fighting for scarce resources.

Introduction

Javalgi (1989) remarks that a hierarchical representation serves as a useful decision-making paradigm, enabling a better understanding of complex problems. Conceptually, the analytic hierarchy process (Saaty 1977, 1980) or AHP is applicable to the modelling of any decision choice which can be represented hierarchically by at least two levels or sets of criteria: objectives for evaluation, and activities or alternative courses of action. Marketing management is frequently faced with such multicriterion problems in planning and evaluation, requiring trade-off decisions between conflicting objectives competing for scarce resources. These decisions can often be represented hierarchically in to several alternating levels of objectives and alternative courses of action. Both AHP and conjoint analysis are based on a trade-off concept. But in conjoint analysis, the respondent is confronted with the given problem: the trade-off task, whereas the AHP allows those who are closest to the problem (the decision makers directly involved, or DM's) to identify and structure a customized hierarchy representing their multicriterion problem, from which a trade-off of relative preferences takes place (Wind and Saaty 1980). The AHP rests on the assumption that behaviour is explained, in part, through subjective judgements as well as objective reasoning. Since the structure is built up by the DM's, it incorporates their intuition and experiences. This is uniquely combined with more objective data, using a single scale of measurement. There are two ways of customizing the decision hierarchy.

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Forward Process

Any attempt at planning what is likely to happen in the future is referred to as a forward process. For example, the DM may wish to examine which from a range of new products is most likely to succeed, given the objectives, capabilities and policies of the firm.

Backward Process

Alternatively, management may evaluate what can or should be done to achieve a desired or ideal outcome. This is called a backward process. Imagine selecting an advertising agency. Agencies are likely to hold varied combinations of strengths in account management, copywriting, media and administration functions, demanding a trade-off to make the best choice. Upon examination, these functions could be refined in to specific skills, from which a number of alternative agencies could be evaluated. Davies (1991) shows how such a multicriterion problem can be represented by a simple hierarchy. Marketing management is frequently faced with making complex decisions involving both forward and backward processes. (See Saaty and Alexander (1989) for more details).

Since 1980, there have been a number of marketing applications using AHP. These include the following.

Consumer purchase choice determination, (Bahmani *et al.* 1986; Bahmani and Blumberg 1987; Javalgi *et al.* 1989), industrial buyer behaviour (Vargas and Saaty 1981), forecasting (Cook *et al.* 1984), marketing mix strategy and new product development (Wind and Saaty 1980), site location (Tone and Yanagisawa 1989), advertising budgeting (Mazanec 1986) and advertising creativity (Davies and Saunders 1990). Although the method is becoming more established, many of the benefits of AHP are not widely appreciated. Firstly, this paper aims to show how AHP can be used to resolve many of the special, complex problems that confront marketing management. These complex problems addressed include:

(a) how to reconcile a range of conflicting objectives, under scarce resources;
(b) managing a plethora of data;
(c) dealing with subjective and objective data to make a decision; and
(d) managing to resolve conflict amongst multidisciplinary teams (referred to as multiperson problems).

Secondly, the basic method is outlined. Thirdly, some marketing applications, benefits and limitations are presented to aid further appreciation of its versatility. Fourthly, potential avenues for further research are discussed.

Addressing Marketing Problems

Using AHP to resolve complex problems requires building an initial hierarchy. Consider a strategic planning problem facing marketing management. The relative importance of *criteria* (the collective name given to the components at each level of the hierarchy) for making future decisions will depend upon uncertain conditions. The aim, in achieving the overall well-being of the firm, is to produce the correct product mix for a new car line faced with an uncertain future. This will be guided by positioning and marketing mix strategies. Simplified, this might be represented in Figure 1.

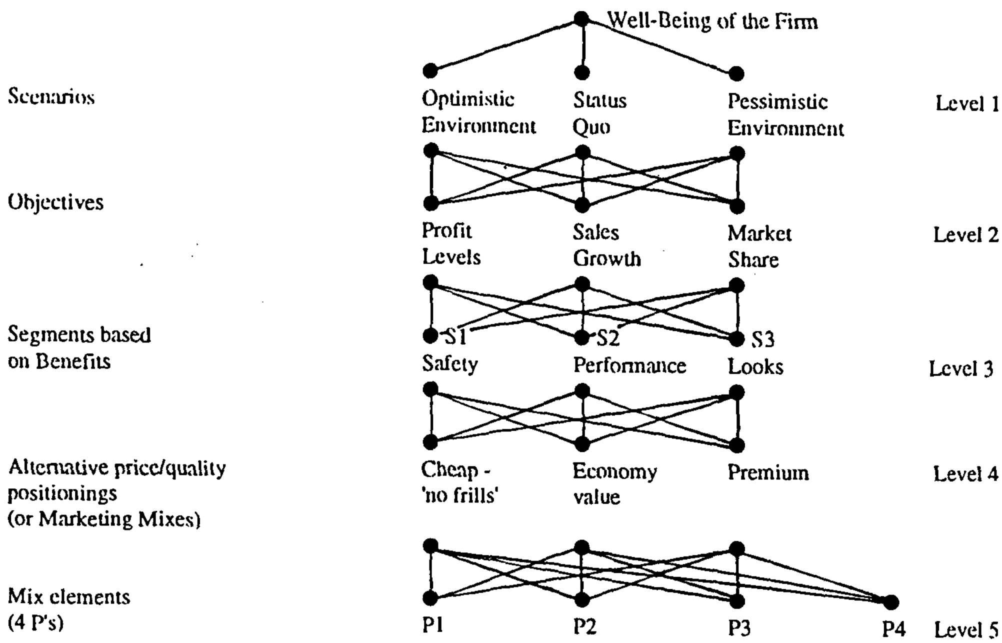

Figure 1. Hierarchy for developing the best positioning for a new car line for the well-being of the firm.

This involves making decisions on the following. The likelihood of each environmental scenario arising, and the relative importance of:

—each objective, relative to the alternative scenarios;
—each customer group or market segment alternative (in this case, using benefits segmentation of safety, performance and "looks" (i.e. aesthetics), relative to each objective;
—each price/quality positioning alternative, relative to each segment; and
—each aspect of the marketing mix in terms of achieving the intended positioning alternatives.

Trading off Conflicting Objectives

Upon examining the components or elements at each hierarchical level, management must base resource allocation upon trading off conflicting criteria. For example, referring to the hierarchy in Figure 1, although sales and profits might contribute toward the well-being of the company, segment 1 might best serve sales whereas segment 2 might best serve profits. The relative importance of each segment would then be influenced by the importance attached to each of the objectives, in terms of serving the well-being of the company. This is achieved by weighting the criteria by their parents (i.e. those elements in the immediate level above) in the hierarchy. It is then possible to determine, in terms of the corporate well-being, the most important:

—segment overall;
—aspects of the marketing mix overall, should mass marketing be adopted. If a multi-segment approach is required, the best mix for each segment can also be evaluated.

This framework enables marketing management to make decisions at any level of the hierarchy, of considerable benefit if future courses of action require changes arising from a turbulent environment.

Facing Complexity with a Plethora of Data

The strategic planning example (Figure 1) shows that marketing management trades off multicriteria to make a number of choice decisions from alternative elements (the components at each criterion). Consider all the elements of the hierarchy at each level from the top goal, through to positioning alternatives (level 4). If it is assumed only one element at each level can be chosen, the number of alternatives facing the marketing manager is (3^4) = 81 outcomes. In practice, the notion of mutual exclusivity is unlikely, since options can be chosen in bundles at most levels, resulting in a plethora of data. With so many options available, if the manager wished to offer a single product positioning to all segments, akin to compromising between the individual needs of each segment (common if financial resources are scarce), it would be necessary to trade off the different needs of each segment to reach the best solution. Since the number of units of information recalled simultaneously in the short term memory is 7±2, according to studies of chess players (Miller 1956), heuristic decision choice, faced with information overload, is evidently prone to error.

Managing Complexity with Pairwise Comparisons. AHP simplifies the above process by making the simultaneity of decision-making more manageable. This is achieved by restricting judgements to pairwise comparisons (Saaty 1977, 1980) for evaluating the relative importance of hierarchical elements. Without AHP, such complexity may lead to seat of the pants decisions (Dyer *et al.* 1988), using our limited human cognitive capabilities (Harker and Vargas 1990).

Dealing with Subjective and Objective Data for Decision Making

In an increasingly competitive business environment resulting from rapidly changing technology, deregulation, shifting demographic and socio-economic forces, marketing has become a key competitive factor in many businesses, which increases the necessity for sound decision-making. But marketing problems are seldom well structured. Typically, marketing management makes complex decisions based on data which is often external to the firm and rapidly changing, so data is often incomplete or out-of-date. Many marketing decisions also rely on both qualitative and quantitative data. Consequently, many decisions are difficult to communicate precisely, and rest upon both objective and subjective judgements.

Integrating Subjective and Objective Data on to a Single Scale. An important feature of

AHP is its ability to integrate both objective and subjective data, and both qualitative and quantitative data on to a single ratio scale. Without this, there is a danger that subjective data may be overlooked, or worse still, decisions rest only on subjectivity and intuition, ignoring hard data because it cannot easily be integrated with soft data (Dyer *et al.* 1988).

Saaty (1990a) discusses in detail why it is possible to misinterpret numerical data taken from *standard* scales. One explanation is that values depend upon reference points. For example, the arithmetic value of a pound is assumed to be the same, whether a person earns a few thousand pounds or a million pounds a year. But the value of an extra thousand pounds may be considered far more significant to the bearer in the former example compared to the latter. The implication is that standard scales force us in to a line of thinking which is not in complete harmony with how we really feel and act. The AHP uses a method of *relative* measurement that is useful for properties for which there is no standard scale of measurement. The number of such intangible properties in marketing is large. For instance, consider difficulties in evaluating the political clout between distributors and manufacturers, the trustworthiness required of advertising agencies, and the empathy of organizations towards customers, to name a few.

A further advantage of relative scales is that they can incorporate information from standard scales, when necessary. The AHP transforms standard ratio scale measurements to relative ratio scale measurements by normalizing them. This determines the priority values of decision elements at each level of the hierarchy. Consequently, AHP allows the decision maker both intuitive insight and flexibility in prioritizing the order of hierarchical elements, based on marketing context.

Dealing with Conflicting Judgements Involving Multidisciplinary Team Decisions

Even when information is complete, there is the likelihood of disagreement amongst key decision-makers, particularly when evaluating the importance of various criteria. For example, one DM might favour financial criteria as a means of choosing between alternative new products, another might consider market share to be more important. AHP can help to resolve conflicting judgements across different DM's.

Managing Multiperson Problems Through AHP. Harker and Vargas (1990) suggest that if DM's (who hold equal power or influence in decision making) cannot agree on their judgements to reach a combined consensus, the decision hierarchy can be simply extended at the first level, by allocating individual hierarchies to each DM. Individual judgements are then made by each DM. These judgements are aggregated to give a combined outcome, which represent the importance of each group outcome. In other circumstances, if the DM's hold divergent judgements and hold *unequal* weight in decision making, then this should be recognized. One method for resolving such a dispute is called 'Combined Group Judgements' (Aczel and Saaty 1983). This is explained under "applications".

Method

The methodology consists of four main stages. These are (1) building the multicriterion decision model (or MCDM), (2) making judgements, (3) computing algorithms and (4) interpreting the data and making decisions. Stage (4) is explained by an application.

Building the MCDM

Since the output is only as good as the decision inputs, building the hierarchical structure representing the problem, comprising of criteria and objectives, is an important stage of the method.

Who Builds the Model? The role of the researcher is to explain how the method operates, and how it might help solve a problem. In order to facilitate this process, there may be occasions when it is necessary for the researcher to build the model, using background literature. But it is generally considered that, where feasible, those DM's who are directly involved or responsible for the outcome of such decision problems should structure the model because they are closest to it, and so should be able to provide the best input (Checkland 1983). Nevertheless, the interpersonal skills of the researcher are often warranted.

It is generally considered that DM's should be interviewed separately to reduce the initial problems of group-think (Jelassi and Beauclair 1987). Semi-structured interviewing is used to identify the problem, if it is not already clear, along the lines of:

> "Why do you believe you have a problem?" "What is the main focus of the problem?" "How will this problem affect you?"

Such questions should help to focus on the root problem, rather than a mere symptom. If there is widespread disagreement amongst a group, it is essential to determine the root consensus of the problem through probing. After confirming the central objective, or focus of the problem, the next stage is to (1) identify the elements contributing to the central objective, and (2) ascertain their relative levels within the hierarchical structure. This involves further questioning:

> "What are the important elements that affect the central objective?" This might be followed by "How are these objectives to be evaluated?" Objectives may be refined, through probing, in to sub-objectives.

The Axiom of Homogeneity. It is necessary to classify and discriminate between elements in order to identify separate criteria that constitute different levels of the hierarchy. Elements can be discriminated on the basis of homogeneity. Homogeneity is a basic axiom of AHP, which requires that elements must be mutually exclusive and ideally exhaustive in order to qualify on the same level of a hierarchy. Each DM is interviewed to identify the elements considered relevant to the problem, and the results transcribed and content analysed.

Once the elements at each level have been identified, it is usually easier to decide on the criteria that represent them, and what they should be called. Any remaining differences of opinion regarding the structure can often be decided by holding group meetings, through probing and semantical exploration.

Making Judgements

The approach described here is using a single DM. The approach for a multiperson problem is explained later. The DM makes pairwise comparisons of elements for each level of the hierarchy in relation to how each contributes towards achieving each goal in the immediate level of the hierarchy above. For example, if the second level of the hierarchy in Figure 1 is examined, the researcher would ask:

> "To what extent is profit level more or less important than sales growth with respect to each scenario?" OR
> "How important is profit relative to sales as a factor under each scenario?"

For each scenario, pairwise judgements would then be made between profit levels and sales growth, then between profit levels and market share, and also between sales growth and market share. The pairwise judgements are based on a ratio scale ranging from 1 to 9, graduating from equal importance to extreme importance, respectively. This scale for measuring the intensity of preferences is represented in Figure 2, which has proven to be reliable (Saaty 1977).

Intensity of importance	*Definition*	*Definition, based on experience and judgement*
1	Equal importance	Two activities considered equally important
3	Moderate importance of one over another	One activity is marginally favoured over another
5	Essential or strong importance	One activity is strongly favoured over another
7	Very strong importance	One activity is very strongly favoured and its dominance is demonstrated in practice
9	Extreme importance	The evidence favouring one activity over another is of the highest possible order
2, 4, 6, 8		Intermediate values between two adjacent judgements

Figure 2. The meaning of the 9-point ratio scale devised by Saaty.

Comparison Matrices. Preference judgements are completed in the form of comparison matrices. The number of elements, *n*, at a given hierarchical level determines the matrix structure (of *n* columns and *n* rows). The number of comparison matrices required at a particular level is equivalent to the number of elements at the preceding level, from which pairwise judgements are based. This is continued throughout the hierarchy. For example, for a hierarchy of five levels represented in Figure 1, the number of comparison matrices required would be three 4×4 matrices at level 5, three 3×3 matrices at each of the levels 2–4 inclusive, and one 3×3 matrix at level 1.

The Axiom of Reciprocal Comparison. An important aspect of AHP is that the intensity of these preferences must satisfy the reciprocal condition (Saaty 1980), e.g. if profits are x times more preferred than sales, then sales are 1/x times more preferred than profits. Therefore, if the hierarchy includes n factors or elements at each level, then only $n.(n-1)/2$ pairwise comparisons are required for each $n \times n$ matrix. In other words, only 1/2 of the potential cells of each matrix require completing because the other half will be the reciprocals. Using Figure 1, level 4, if a decision maker considered economy value position moderately more important than a cheap, "no frills" version in achieving the goal of safety, then a scale of 3 might be assigned to the appropriate cell of the comparison matrix. A "no frills" position relative to an economy value position is then allocated the reciprocal or 1/3. Similarly, if a high performance position was judged to compromise on safety in its preoccupation for speed and acceleration, this might be considered to be marginally less safe than an economy value version, and so ranked as 1/2. The cells are completed and the process is repeated for each matrix. Figure 3 shows a completed comparison matrix with these entries.

Safety	No Frills	Economy Value	Premium
No Frills	-1-	$^1/_3$	$^1/_2$
Economy Value	3	-1-	2
Premium	2	$^1/_2$	-1-

Geometric		Normalisation		Local Priorities
$\sqrt[3]{1 \times {}^1/_3 \times {}^1/_2}$	$= 0.55$	$\frac{0.55}{3.367}$	=	0.163
+				
$\sqrt[3]{3 \times 1 \times 2}$	$= 1.817$	$\frac{1.817}{3.367}$	=	0.540
+				
$\sqrt[3]{2 \times {}^1/_2 \times 1}$	$= 1.00$	$\frac{1.00}{3.367}$	=	0.297
	3.367			1.000

Figure 3. A comparison matrix of ratio judgements with calculated priorities measuring alternative benefits segments with respect to safety.

Manual Calculations

Calculating Algorithms

Local Priorities. Several methods have been used for estimating the relative weights derived from the preferences above. Indeed, there is no consensus as to the best method to adopt. See Zahedi (1986) for a summary of methods, beyond the realm of this paper. The procedure adopted here uses the *geometric mean,* which is simple to understand (Saaty and Kearns 1985), and which is considered to provide a better estimate of underlying ratio scales than other popular methods (Crawford and Williams 1985).

Firstly, the geometric mean of each row of scores for each comparison matrix is calculated. The resulting column vector of scores for each matrix is then normalized to unity to represent the *local priorities,* illustrated by the ratio scores in Figure 3. These resultant local priorities assigned to each element represent their relative value with respect to each particular objective in the immediate hierarchical level above. For example, the local priority value of "no frills" with respect to the "safety" segment is considered far less important, at 0·163, compared to economy value, at 0·540. Calculations are continued for each level of the hierarchy.

Global Priorities. The decision maker also needs to know the impact of each element with respect to the main focus or top goal of the hierarchy. These are referred to as *global priorities.* By definition, the top hierarchical goal or objective is allocated a global priority of 1·0, which is also its local priority (Saaty 1980). Global priorities for any hierarchical elements are calculated by weighting their local priorities by the global priorities allocated to the elements they emanate from (i.e. at the preceding hierarchical level), called their parents. Therefore, for a vector of local priority values $x_1 - x_3$, representing the *first* level of the hierarchy, their global priorities remain unaltered, as follows:

Elements at first level

$$\begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} \rightarrow \Sigma(X_n \cdot 1{\cdot}00) = \begin{pmatrix} x_1 \cdot (1{\cdot}00) \\ x_2 \cdot (1{\cdot}00) \\ x_3 \cdot (1{\cdot}00) \end{pmatrix} = \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix}$$

Local priorities of first level — Global priorities of first level

However, for *subsequent* levels, the priorities will be weighted by the global priorities of their parents, in which the local and global priorities will *not* be equal.

Alternative Computer Calculations

Whilst it is useful to understand how to calculate local and global priorities manually, it can be tedious. Computer software called Expert Choice (Forman and Saaty 1983) has been designed to calculate these priority values quickly and accurately. The hierarchy describing the model is drawn on the computer screen, using the package, not unlike a decision tree, using labels at each node. The next stage is to input the ratio scores describing the pairwise preferences. These may already be available from prior interviews with the decision-makers. With subsequent practice, it is possible to procure judgements directly from the computer screen, which saves valuable time. By moving to each element using the drawing of the hierarchical problem, and moving to the numerical mode, comparison matrices are automatically presented. By inputting the appropriate pairwise judgements for each comparison matrix, the package can calculate local and global priorities for any chosen level of the hierarchy within seconds, by switching to their respective modes.

Application

Using the decision model of Figure 1, pairwise comparisons were developed by the author. These judgements aim to demonstrate the process rather than to necessarily reflect the authenticity to a real problem. The comprison matrices a and b-d of Figure 4 represent the ratio judgements for levels 1 and 2, respectively. The remaining matrices are not shown to avoid unnecessary detail.

(a) Scenarios

Well being of firm	Optimistic environment	Status Quo	Pessimistic environment	Local priorities
Optimistic environment	–	2	5	0.582
Status Quo	1/2	–	3	0.309
Pessimistic environment	1/5	1/3	–	0.109
			I.R.	0.003

(b)

Optimistic environment	Profit	Sales	Market Share	Local priorities
Profit	–	3	1	0.443
Sales	1/3	–	1/2	0.169
Market Share	1	2	–	0.387
			I.R.	0.016

(c)

Status Quo	Profit	Sales	Market Share	Local priorities
Profit	–	2	1	0.400
Sales	1/2	–	1/2	0.200
Market Share	1	2	–	0.400
			I.R.	0.000

(d)

Pessimistic environment	Profit	Sales	Market Share	Local priorities
Profit	–	2	1/2	0.297
Sales	1/2	–	1/3	0.163
Market Share	2	3	–	0.540
			I.R.	0.008

Figure 4. ***Ratio judgements comparing scenarios with respect to well-being of the firm (Matrix a) and objectives with respect to scenarios (Matrices b–d).***

Managerial Benefits in Presentation and Interpretation of Information

Expert Choice can calculate local priorities for each element, as each comparison matrix is completed. Figure 4 shows the computed vectors of local priorities for each comparison matrix. Also, Expert Choice can produce an elborate breakdown of global priorities at each hierarchical level, once all the data from the matrices has been inputted. Table 1 shows part of such a spreadsheet of results. Frequently, marketing managers need to be able to justify their ideas, objectives and recommendations clearly and succinctly. These spreadsheets serve as an effective vehicle for providing evidence to support a decision, in order to gain approval for scarce resources from senior management (Dyer *et al.* 1988). Indeed, frequently analysis is required as a persuading device to legitimatize policy decisions (Eden 1982).

To aid interpretation for executive action, the vectors of local priorities derived from each comparison matrix, along with the global priorities from the spreadsheet analysis, can be reconstructed for each particular level of the hierarchy (see Tables 2–5). From the spreadsheet, the composite global priorities can be calculated. For example, to construct Table 3, the global priorities of objectives (level 2), taken from

Table 1. Spread Sheet analysis showing global priorities under an optimistic scenario

Level 1		*Level 2*		*Level 3*		*Level 4*	
Optimistic	0·582	Profit levels	0·258	Safety	0·028	Cheap	0·005
						Economy	0·015
						Premium	0·008
				Performance	0·080	Cheap	0·006
						Economy	0·018
						Premium	0·055
				Looks	0·150	Cheap	0·015
						Economy	0·038
						Premium	0·096
		Sales growth	0·098	Safety	0·053	Cheap	0·009
						Economy	0·029
						Premium	0·016
				Performance	0·029	Cheap	0·002
						Economy	0·007
						Premium	0·020
				Looks	0·016	Cheap	0·002
						Economy	0·004
						Premium	0·010
		Market share	0·226	Safety	0·122	Cheap	0·020
						Economy	0·066
						Premium	0·036
				Perfomance	0·067	Cheap	0·005
						Economy	0·015
						Premium	0·046
				Looks	0·037	Cheap	0·004
						Economy	0·009
						Premium	0·024
Status quo	0·309	Profit levels	0·124	Safety	0·014	Cheap	0·002
						Economy	0·007
						Premium	0·004
Data used for Tables:	2		3		4		5

Table 2. Local and global priorities at level 1 (representing the likelihood) of each scenario with respect to the overall objective of the firm

Environmental scenarios	*Local priorities*	*Global priorities*
Optimistic	0·582	0·582
Status quo	0·309	0·309
Pessimistic	0·109	0·109
Inconsistency ratio	0·003	

Table 3. Local priorities at level 2 for each objective according to each scenario (and global priorities with respect to well-being of the firm in parentheses)

	Scenarios			
Objectives	*Optimistic (0·582)**	*Status quo (0·309)**	*Pessimistic (0·109)**	*Total composite global priorities*
Profit levels	0·443 (0·258)	0·400 (0·124)	0·297 (0·032)	(0·414)
Sales growth	0·169 (0·098)	0·200 (0·062)	0·163 (0·018)	(0·178)
Market share	0·387 (0·225)	0·400 (0·124)	0·540 (0·059)	(0·408)
Inconsistency ratio	0·016	0·000	0·008	

* Global priorities for prior level.

***Table 4.* Local priorities at level 3 for each benefits segment with respect to each objective (and global priorities with respect to the well-being of the firm in parentheses)**

	Objectives			
	*Profit levels (0·414)**	*Sales growth (0·178)**	*Market share (0·408)**	*Total composite global priorities*
Safety	0·109 (0·045)	0·540 (0·096)	0·540 (0·220)	(0·361)
Performance	0·309 (0·128)	0·297 (0·053)	0·297 (0·121)	(0·302)
Looks	0·582 (0·241)	0·163 (0·029)	0·163 (0·067)	(0·337)
Inconsistency ratio	0·003	0·008	0·008	

* Global priorities from prior synthesis.

***Table 5.* Local priorities at level 4 for each positioning alternative with respect to each benefits segment (and global priorities with respect to the well-being of the firm in parentheses)**

	Segments			
Price/quality positioning	*Safety (0·361)**	*Performance (0·302)**	*Looks (0·337)**	*Total composite global priorities*
No frills	0·163† (0·059)	0·077 (0·023)	0·101 (0·034)	(0·116)
Economy value	0·540† (0·195)	0·231 (0·070)	0·255 (0·086)	(0·351)
Premium	0·297† (0·107)	0·692 (0·209)	0·643 (0·217)	(0·533)
Inconsistency ratio	0·008	0·000	0·046	

* Global priorities from prior synthesis.
† Also illustrated in Figure 3.

the spreadsheet, are added under each scenario to derive their composite global priorities with respect to the top goal, or well-being of the firm. The figures for profit, sales and market share respectively are 0·258 + 0·124 + 0·032 = 0·414, 0·098 + 0·062 + 0·018 = 0·178, and 0·225 + 0·124 + 0·059 = 0·408. Alternatively, the global priorities can be derived manually by weighting the local priorities at each level (derived from the comparison matrices) by the global priorities of their parents. The total composite global priorities are then aggregated. For instance, the global priority of profit (Table 3) = (0·443 × 0·582) + (0·400 × 0·309) + (0·297 × 0·109) = 0·258 + 0·124 + 0·032 = 0·414. This procedure is continued throughout the hierarchy.

The final column of composite global priorities (Tables 2–5) indicate the most important elements at each level with respect to the well-being of the firm, which are:

(1) an optimistic scenario (at 0·582, Table 2), because this is considered the most likely;
(2) profits and market share (at 0·414 and 0·408 respectively, Table 3);
(3) any benefits segments, since there is little to choose between them (at around 0·300 each, Table 4); and
(4) the premium version of product positioning (at 0·533, followed by economy value, at 0·351, Table 5).

Therefore, the best courses of action to be taken at each level for the firm appear to be to choose profits and/or market share as the main objectives, consider seriously all the benefits segments, and focus more effort in developing a premium positioning.

The remaining figures in each table help to explain how the composite global priorities are derived, useful for selling the idea to senior management. For example, the overall importance of profits and market share as objectives can be explained by their local priorities under both an optimistic and status quo scenario (at around 0·400 each, Table 3). Also, the high rating of a premium version is probably accounted for by its significant importance with respect to both performance and looks benefits (at 0·692 and 0·643, respectively, Table 5).

Finally, the inconsistency ratio, produced by Expert Choice, measures the likelihood of the scores relative to a set of random responses and provides a measure of their concentration in making judgements, reflecting transitivity. An inconsistency ratio (I.R.), of $<0{\cdot}1$ is acceptable, otherwise DM's are encouraged to revise their judgements. Many multiattribute techniques such as conjoint analysis do not provide such checks.

Further Benefits in Using AHP: Dealing with Group Decision-making

Marketing decision-making frequently involves multidisciplinary teams (e.g. finance, marketing) whose members are drawn from different levels of the organizational hierarchy (e.g. directors in discourse with middle management). Consequently, their varied backgrounds are likely to release divergent viewpoints. Govoni *et al.* (1986) argues there is a necessity to integrate individual objectives to work towards the good of the company as a whole. But consensus may be difficult if some perceive others to hold too much influence in overall decision-making. To overcome this problem, the method of "combined group judgements" (CGJ), can be used to provide a group outcome, providing that the participants agree to the outcome arising from the process. This is conducted by simply averaging the groups' judgements using the geometric mean. If $a_{ij}^1, a_{ij}^2, \ldots, a_{ij}^M$ represent different pairwise judgements of M members of the group, the composite judgement is given by:

$$\mathrm{CGJ} = [a_{ij}^1 \times a_{ij}^2 \times, \ldots, \times a_{ij}^M]^{(1/M)}.$$

Davies (1991) has used the "combined group judgements" method to develop weights representing the relative influence or power expected of multiple decision makers holding divergent judgements confronted with an advertising agency selection problem. Each DM makes pairwise judgements about each other's relative importance as decision-makers, whose scores are averaged. The resulting comparison matrix of CGJ scores is then treated in the usual way to derive priority values for each DM. Each DM then makes separate judgements at subsequent levels of a common hierarchy. By using the spreadsheet analysis derived from Expert Choice, it is possible to identify how well an individual's set of judgements about criteria compare to the group judgements. This can be used to emphasize voting power, or can help individuals revise their judgements for the good of the group. Whatever the outcome, the process must be acceptable to the participants.

Other Benefits in Using Expert Choice

Sensitivity analysis can be used with Expert Choice to show the impact of a change in judgements upon the subsequent outcome. For example, market dynamics may dictate that the judgements given to environmental scenarios should change, and this will have an impact upon the importance given to subsequent objectives and alternatives of the decision hierarchy. In particular, Expert Choice provides graphics which enable the decision-maker to identify whether, and to what extent, a change in values of an element will affect subsequent priority values on another hierarchical level and, by implication, ultimate decision choices. For decisions ivolving big budgets, such as in strategic planning, identifying the impact of changes can be significant.

Criticisms of AHP

Difficulties in Making Judgements. It has been suggested that DM's may have difficulty in using the ratio scale for estimating the relative importance of different factors. If this is due to unfamiliarity of the scale, a series of pilot runs can be used to fine tune judgements. The I.R., developed by Saaty, also keeps a check on the concentration of judgements made. But the I.R. alone does not necessitate that the preferences made reflect the true preferences of the DM, and is therefore not a sufficient condition for determining how good a set of judgements are (Saaty 1977). For some marketing decisions involving creative input, the DM may not have formed a strong enough opinion on a particular issue. In these circumstances, the skill of the researcher may be required to identify any hesitation which might lead to tentative judgements. Where uncertainty is identified, the underlying preference structure can still be evaluated by using a range of scale values, rather than forcing precise values (Arbel 1989). This involves expressing a range of preferences as a set of double-sided inequalities (characterizing upper- and lower-bounds), and solving as a linear programming problem.

The Controversy Over Rank Reversal. Under changing conditions, rankings are sometimes reversed, which has produced criticisms about the arbitrary way the judgements are ranked (Dyer 1990). Saaty, in defence, suggests that normalization is used to apportion the priority of a criterion to each alternative, according to the relative dominance of that alternative. Normalization can be used to differentiate alternatives according to scarcity or abundance of criteria. Saaty (1990b) uses this argument to explain why rank reversal can be a healthy phenomena, an apparent paradox of utility theory. The presence of copies of alternatives reduces the relative dominance of every alternative, including the original of the copies. The changes in relative dominance explain any reversal in rankings and can reflect real consumer behaviour, e.g. Saaty uses an example of a woman buying a hat. At one store, A is preferred to B slightly, but B is eventually purchased upon subsequent abundance of A at another store.

An alternative viewpoint, offered by Belton and Gear (1983) is that preference order can only be preserved by renormalizing the priority vector weights. This is achieved by allocating unity to the highest ranked option, rather than to the sum of the options.

Thresholds Must be Monitored. Both conjoint analysis and AHP need to ascertain if decision choice is ruled by threshold requirements. If all alternative combinations of elements need to satisfy a minimal requirement of a particular objective, then such a threshold needs to be reached before any trade-off can take place.

Future Avenues for Research

Content Issues

Although published marketing applications have been diverse since 1980, international marketing appears to have been neglected. Accordingly, a rudimentary structure for screening markets and making entry decisions is demonstrated in Figure 5. This represents making decision preferences upon market entry objectives, environmental factors and markets (countries). The choice of entry, in turn, will be determined by the markets considered. There are many other applications which might be considered or refined.

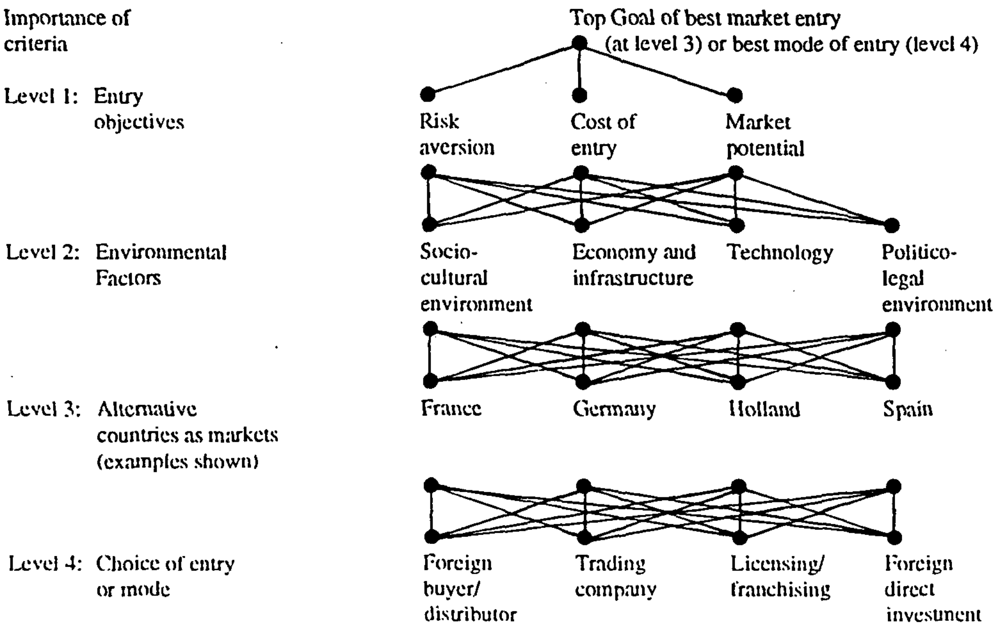

Figure 5. Simplified, exploratory model of international marketing plan.

Process Issues

Another potential area for development is to explore alternative processes for reducing conflict amongst group decision-makers. For instance, Expert Choice could be applied to decision conferencing (Phillips 1986). In this case, outcomes from Expert Choice, based on individual judgements, would be projected on to a large screen, visible to everyone, to encourage feedback and revision of judgements until a satisfactory group outcome is reached.

Finally, more sophisticated methods must be developed for assessing the overall effectiveness of marketing decision-making arising from AHP, compared to conventional methods. In the absence of control experiments, DM satisfaction and questionnaires could be two approaches to adopt.

Summary

Many marketing planning and evaluation tasks involve making multicriterion decisions, sometimes within a group context. The AHP technique, by systematically structuring the problem as a customized hierarchy, can lead to the likely identification of all key components affecting decision-making, which is less likely if making "seat of the pants" decisions. The most important objectives or alternatives at each decision level are derived from a trade-off analysis, which can also help reconcile group conflict. Data collection uses relative intensities of preferences, in which both qualitative and quantitative data are uniquely combined on a single ratio scale of measurement, very useful for marketing management. Although the technique can appear tedious, Expert Choice allows data to be transferred directly on to the screen, from which results can be obtained speedily. Furthermore, the ability to calculate and present results at each decision level can be used to support, persuade and justify proposed outcomes to top management. This is important for marketing managers fighting for scarce resources.

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