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EVALUATING A SYSTEM OF FURNITURE RETAIL OUTLETS USING AN INTERACTIVE ORDINAL REGRESSION METHOD (*)

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1

EVALUATION D'UN RESEAU DE DISTRIBUTION DE PRODUITS D'AMEUBLEMENT
AU MOYEN D'UNE METHODE INTERACTIVE DE REGRESSION ORDINALE

RESUME

Le but de ce cahier est d'illustrer quelques propriétés importantes de la modélisation des situations décisionnelles multicritères dans les organisations. Le problème présenté concerne le cas d'un fabricant de meubles qui veut évaluer ses points de vente afin de lancer une nouvelle série de meubles. Cette évaluation doit aboutir au choix des meilleurs magasins qui auront l'exclusivité de vente du nouveau produit en France.

Afin d'analyser et de résoudre ce problème, nous avons conçu un modèle d'évaluation multicritère dans lequel nous avons retenu 12 critères reflétant la politique commerciale de la société et les préférences des décideurs. Ces critères sont relatifs à la présentation des magasins, au dynamisme des directeurs des magasins et à la qualité des activités de vente des produits du fabricant.

La méthode d'évaluation appliquée tient compte de préférences a priori sur un petit nombre de magasins, les plus connus aux décideurs, et des évaluations multicritères de ces points de vente dans le but d'estimer un système de fonctions d'utilité additives. La méthode utilisée est celle d'analyse de régression ordinale (UTA I) de Jacquet-Lagrèze et Siskos, appliquée dans sa version interactive afin de tenir compte de l'évolution des préférences des décideurs dans le processus de décision. Ainsi, les réactions de ces derniers face aux résultats obtenus à chaque itération du processus ont influencé la définition des critères, les préférences a priori et la formulation du problème.

(ANALYSE MULTICRITERE ORGANISATIONNELLE - PROCESSUS INTERACTIF ; REGRESSION ORDINALE - MODELE D'UTILITE ADDITIVE ; PROGRAMMATION LINEAIRE ; POINT DE VENTE DE MEUBLES)

EVALUATING A SYSTEM OF FURNITURE RETAIL OUTLETS
USING AN INTERACTIVE ORDINAL REGRESSION METHOD

ABSTRACT

The aim of this paper is to illustrate some important properties of the modelling of multicriteria decision-making situations within organizations. The problem presented deals with the case of a furniture manufacturer who wishes to evaluate his retail outlets in order to launch a new furniture line. This evaluation must lead to the choice of the best stores which will have the exclusive right to sell the new product in France.

In order to analyse and solve this problem we have conceived a multicriteria evaluation model in which we have selected twelve criteria while considering the commercial policy of the company and the preferences of the decision-makers. The criteria taken into account relate to the presentation of the store, to the dynamism of the store directors and to the quality of the sales activities of company products.

The method we applied takes into account some a priori preferences to a small number of stores, among the most familiar to the decision-makers, and the multicriteria evaluations of these stores to estimate a system of additive utility functions. The method used is the UTA I ordinal regression method of Jacquet-Lagrèze and Siskos applied in its interactive version in order to take into account the evolution of the decision-maker's preferences in the decision-making process. Thus, the reactions of the decision-makers to the results obtained regarding any one stage of this process influenced the criteria definition, the a priori preferences and the problem formulation.

(ORGANIZATIONAL MULTICRITERIA ANALYSIS - INTERACTIVE PROCESS ; ORDINAL REGRESSION - ADDITIVE UTILITY MODEL ; LINEAR PROGRAMMING ; FURNITURE RETAIL OUTLET)

I - INTRODUCTION

The modelling of multicriteria decision-making situations within organizations comes up against particular difficulties inherent in the structural reality of organizations and stemming from the complex nature of the problems modelled. It follows therefore that the analyst responsible for the model(s) must propose a methodological framework which will take account of : human behaviour during the decision-making process, conflicts between the different actors taking part in the process, the evolution of the information system and finally, any modification in the problem formulation in course of time. Here are some noteworthy aspects of modelling that we shall try to illustrate hereafter in concrete terms in this paper.

The paper deals with the retail-trade network management of two furniture product lines (Product line I and Product line C) of a French furniture firm, which we shall call Firm Ω . The initial event in this study is the programmed launching of a new line in furniture (Product line R) and the problem faced by the manufacturer is where to launch the new product. In other words, what retail outlets of the old network should be used to sell this product ?

The characteristics of the decision-making process as caused by this problem together with the difficulties involved in modelling mentioned above, can be summarized under four headings :

Multiplicity of problems : The launching of a new line in furniture gives rise to a series of problems which in turn are rooted in the problem posed by the marketing of the product. For instance : systematically evaluating and managing the present network of 666 retail outlets in the whole of France ; creating a new distribution network limited to 150 concessionary outlets while at the same time taking into account the constraints of geography and of competition within a given locality ; analy-

sing the furniture market, since no studies are conducted in France in this field, and taking this analysis into account when choosing stores ; launching a powerful advertising campaign and trying to choose stores which will agree to help finance it. An initial difficulty thus crops up in the ability of decision-makers to diversify these problems and arrange them on a scale of priorities (see [12]).

Organizational complexity : Given the great number of stores within the present retail trade system, Firm Ω has divided the whole of France into seven sectors and appointed an agent to take charge of commercial activities in each sector. From the start, these seven representatives were expected to inform the firm about the system of retail outlets. Decisions concerning the management of the network are taken by two individuals, the Sales Manager, since this decision is the exclusive concern of his department and above all, the General Manager of Ω . Because of this organizational complexity, the analyst must, when modelling, solve the problem of co-ordinating responsibilities, perceptions and multiple points of view.

Using multicriteria analysis : The evaluation of the stores must not be made on the single criterion of the turnover (with the manufacturer) of stores during the preceding year. *"Large stores are not the most profitable for us"* declared the General Manager of Ω . It is therefore necessary to define precise criteria which would assess the image of the retail outlet, the relationship the manufacturer has with it, and finally, the type of sale performed. Here, modelling would involve the systematic organization of this task of multicriteria evaluation of the network which, as we stated above, must be carried out by the manufacturer's seven agents.

Toward an interactive approach : In general, it is very difficult to set up a preference model in cases of non-repetitive and competitive strategic decisions, especially when we are talking about a study in which the decision-maker is trying to learn how to decide rather than aiming to discover the best decision. In concrete terms, this means that in trying to solve the problem of evaluating a retail outlet, Ω 's managers want to be

acquainted with evaluation factors and their relative importance rather than the result of this evaluation. This problem formulation inevitably brings us to the interactive model in which the experience and a priori preferences of the decision-makers on the one hand, and the system of information concerning the objective of the decision, on the other, must interact. This means that the role of the model will be to identify and explain the inconsistencies between the two perceptions (that of the decision-maker and that of the expert/informer) in a learning process.

The method we are putting forward falls within the conceptual framework of the trial and error learning process which becomes operational here through an ordinal regression analysis method. Indeed, the ordinal regression must be performed upon a very limited number of stores : for instance, 30 to 50. This analysis allows to work out interactively the overall preference model and then to extrapolate this preference on the 666 retail outlets (see section 3).

2. DESIGNING A MULTICRITERIA EVALUATION SYSTEM

The marketing bearings of the study are presented in [12] ; we will just emphasize here the problem of multicriteria evaluation of the retail outlets.

To exhaustively compare retail outlets means that all the comparative aspects of each retail outlet are identified and analysed. The majority of them are subjective, qualitative, and above all incommensurable. Thus, the construction of criteria requires, first of all, the designing of a limited system of dimensions so as to make the task of evaluation operational, and then to define for each of these dimensions a scale of levels going from the worst to the best (see section 3 for a formal definition of the criterion). In our view, this process of constructing criteria constitutes the "hard core" of multicriteria analysis.

Another important point to note is that all the information on the retail outlets system, apart from the turnover, which is the only objective criterion, must emanate from the firm's seven agents. Multicriteria modelling must be a means of communication between the analyst and the expert in so far as, first, the criteria are designed to represent for the expert independent evaluation points of view and secondly, the levels of each criterion ensure that all the stores can be clearly located.

Having given deep thought to the furniture store, to the quality of sales and to the characteristics of products sold, we have identified, in interaction with the Sales Manager, three store appraisal policies, i.e. (see table 1) :

- a store policy containing criteria relating to the image of the retail outlet ;
- a trading policy designed to characterize the store manager and namely his dynamism ;
- a sales policy whose purpose is to estimate the quality of the stores sales activities.

Each of these three policies are made explicit through four criteria aiming, on the one hand, to take into account the quality of the store in terms of one or several specific aspects (see table 1), and, on the other hand, to make expert evaluation possible.

Table 1 : Evaluation criteria for retail outlets

	Criteria	Characteristics
store policy	1. Store's accessibility	
	2. Quality of siting	: Area - street
	3. Style of presentation	: Arrangement - assortment of products I and C with other brands
	4. Existence of sales stand for products Ω	
trading policy	5. Dynamism	: Four aggregated aspects (see table 2 - Appendix)
	6. Adequacy as regards innovation in the furniture market	
	7. High-pressure advertising and selling	: Two underlying aspects
	8. Mode of payment	
sales policy	9. Store turnover in 1979 (expressed in Francs)	
	10. Quality of sales activity	
	11. Quality of after-sales service	
	12. Type of products sold	: i.e. only I, only C or both

Communication was established with the agents through a simple and precise questionnaire (the section of this questionnaire that deals with multicriteria evaluation is to be found in table 2) which was drawn up successively in conjunction with the Sales Manager of Firm Ω , and the General Manager. This interaction analyst/manufacturer has led to the definition of criteria's evaluation scales from the questionnaire. In the case of criteria defined by two "sub-criteria", the decision-maker indicated the preferential order (and only the order) in all pairs of crossed questions. This is evidenced by means of the small diagrams in table 2 (cf. appendix) under the column heading ; ordinal scales.

To illustrate this point, let us take criterion 7, i.e. high-pressure advertising and selling, as an example. The five levels of the ordinal scale are set in the following way :

Level 1 : The trader sells at a discount price and does so with or without advertising his prices ; the trader launches no commercial drive and advertises his prices.

Level 2 : The trader launches no commercial drive nor does he advertise ; the trader launches occasional commercial drives in his store and advertises his prices.

Level 3 : The trader advertises his products or services and has discount sales or launches no commercial drive.

Level 4 : The trader launches occasional commercial drives in his store without making any advertisements.

Level 5 : The trader launches occasional commercial drives in his store, and advertises his products or services.

The crossing of two sub-criteria in the definition of certain composite or complex criteria was an exercise with which the actors in this process very easily familiarized themselves. Besides, this will become evident later on in the application of our interactive method.

The turnover criterion which is the only objective one in this analysis ranges approximately from 13 000 to 2 200 000 Francs.

The modelling of criterion 5, relating to the dynamism of the store manager confronted with the manufacturer's brand, presented us with some problems as we had to make an aggregate of four sub-criteria coded a, b, c, d. To overcome this drawback, we put forward a very simple aggregation formula of the type $\alpha(a + b) + \beta(c + d)$ with questions a, b, c, d valued from 0 to 1 or 2 in the direction of increasing preferences (see table 2) and α, β weighting factors to which the decision-maker attributed

values $\alpha = 2$ and $\beta = 1$. Given the fuzziness of this mode of evaluation, we considered the scale of this criterion (from 0 to 8) as being completely ordinal.

We had to devote a whole day to the evaluation process of the 666 retail outlets. Each expert has assessed about 95 ($\approx 666/7$) stores by filling up questionnaires for the stores in his own relevant area. This first multicriteria evaluation system raises two serious problems : first, the reliability of the data collected is not the same for all stores as it depends on the agents responsible for evaluation and varies from one perception to the other ; secondly, as we have already underlined it, the structure of the multicriteria system proposed is not considered as definitive and, leading directly to an evaluation or preference model. In this problem, the multicriteria model always postulates the objective of the analysis rather than a static data.

3. PROPOSAL OF AN INTERACTIVE METHOD

The necessity to apply an ordinal regression method (1)

In this section we analyse the problem of making an overall evaluation of retail outlets and put forward the reasons which led to our choice of a preference model. First and foremost, we must remember that our objective is to bring about the ranking of 666 retail outlets. We must therefore aim at multicriteria weighting methods which seem to be the right tools for ranking.

The desire to elaborate a weighting preference model usually leads one to ask the decision-maker a series of appropriate questions with the aim of specifying the analytic form of the model and estimating its parameters, for example the weights of criteria. Sometimes however, analysts design mind-boggling questionnaire methods which are beyond the cognitive ability of the decision-maker ; and this, all the more so as some types of approaches work outside the context in which they have to fit. For instance, in the context of the problem we are trying to solve, it would be unrealistic to propose to the decision-maker a questionnaire involving lotteries on specified criteria, values or substitution rates between criteria, as the usual practice within the organization does not allow for this type of dialogue.

What an organization expects from the analyst is a form of dialogue consistent with the preoccupations of the people who take part in the decision-making process. Questions asked should therefore directly concern the retail outlets which in the eyes of the actor in the decision-making represent a concrete reality. On the other hand, the criteria (or some of them, at least) are nothing but models that the decision-maker tries to apprehend during the course of the process.

(1) The term "ordinal regression" is borrowed from Srinivasan and Shoker [9] who use it to emphasize the fact that the variable to be explained in regression analysis is a binary preference relation or in other words, an ordinal variable.

The main goal of our approach stems from these ideas. What we do, is ask the decision-maker to indicate a small group of stores with which he is very well acquainted and which he can rank-order a priori. These "stimuli" are stores restricted to the B.H.V., Galeries Lafayette, Galeries Barbès type, about which the preferences of the decision-maker are already well-structured in the light of his objectives and his personal experience with his clients. The a priori evaluation of stimuli is carried out in this way : the decision-maker chooses the best stimuli equivalents according to his preferences, then he takes out the index cards of these stimuli, chooses again from among the remaining cards, and so on until all the stimuli are ranked. Finally, he re-examines his subjective ranking to see if he needs to refine still more his classes of equivalents. The drawback with this method is that, when the number of stimuli is too high, the decision-maker cannot take anymore into account the multicriteria evaluations in his subjective ranking. The idea in this approach is to consider the weak-order of the stimuli as an ordinal variable and to adjust a preference model on the criteria. In effect, this implies the carrying out of an ordinal regression and the use of the adjusted model to extrapolate the preferences of the decision-maker on all the stores. In table 3, we have drawn up the subjective weak-order of the Sales Manager on 35 reference retail outlets in ten indifference classes and the multicriteria evaluations of these retail outlets.

In his excellent review of multicriteria models, Mac Crimmon [7] devotes large space to regression analysis models. The models put forward in this analysis cover namely linear cases. It is nonetheless certain that in a problem like ours, it is very difficult to attribute numerical values to criteria in order to develop linear regressions. Our objective is not to try to quantify the qualitative criteria before making a regression analysis, but to put forward a regression analysis which will have this quantification as its output.

Jacquet-Lagrèze and Siskos [3] recently proposed a methodology based on linear programming techniques to deal with these problems. As will be seen

Table 3 : The preference system of the Sales Manager :
The subjective ranking contains ten indifference classes

Retail outlet n°	Subjective ranking	C R I T E R I A											
		1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	2	5	1	6	1	3	3	205 000	4	3	3
2	1	4	4	5	3	6	2	3	3	816 230	4	1	3
3	1	3	4	3	1	8	2	3	3	328 595	4	3	3
4	2	2	4	5	1	8	2	3	3	79 113	4	3	2
5	2	3	2	4	3	7	1	3	2	269 026	3	2	3
6	2	4	4	3	1	8	3	3	2	199 905	4	2	3
7	2	3	1	5	3	8	3	5	3	342 141	3	3	3
8	3	3	1	4	3	2	1	1	3	131 855	1	1	3
9	3	3	2	4	3	4	2	5	3	195 471	3	3	3
10	3	3	2	4	3	6	2	3	3	326 825	3	3	2
11	3	2	2	4	3	6	1	1	3	175 000	3	2	3
12	4	4	4	5	1	8	2	2	3	156 657	4	3	3
13	4	4	4	4	3	7	3	2	3	813 516	2	3	3
14	5	3	2	2	1	6	1	3	3	187 641	3	3	3
15	5	2	2	4	1	4	1	2	2	195 005	2	2	3
16	5	3	2	1	1	6	1	2	3	200 000	2	3	3
17	6	2	2	4	1	3	2	3	3	47 030	3	2	3
18	6	3	1	4	1	6	1	1	3	200 000	3	2	3
19	6	2	3	4	1	6	1	2	3	43 395	3	2	2
20	6	3	2	5	1	3	2	3	3	170 390	3	2	3
21	7	2	2	2	1	3	2	3	2	71 520	3	3	2
22	7	3	2	3	3	4	2	1	3	65 000	3	1	1
23	7	2	2	4	1	3	1	3	3	14 000	3	2	3
24	8	3	2	4	1	5	2	3	3	40 060	4	2	3
25	8	2	2	4	1	5	1	1	3	65 620	3	3	3
26	8	3	1	1	1	4	2	1	2	127 661	2	3	3
27	9	1	1	3	1	1	1	1	2	324 300	2	2	3
28	9	3	2	1	3	4	2	1	3	245 867	1	2	3
29	9	3	1	4	3	4	1	1	3	72 000	3	1	2
30	9	3	1	4	1	6	1	1	3	210 000	1	2	2
31	10	3	2	1	1	4	1	1	3	27 115	1	1	1
32	10	3	2	3	1	5	1	2	3	10 050	3	3	2
33	10	1	2	3	1	2	1	1	3	78 810	2	2	1
34	10	1	1	2	1	2	1	2	3	35 000	2	1	1
35	10	3	2	3	1	5	3	1	3	25 820	3	2	1

later, the regression model proposed is not a weighted sum of the criteria, i.e. a linear model, but an additive utility model. The preference variable to be explained is a weak-order on a group of stimuli and can result from known decision-making situations, such as past choices, local or revealed preferences, etc. The other methods belonging to the same category of ordinal regression use either the technique of alternating least squares [18], or algorithms of non-linear programming [7]. Macquin [7] proposes also a comparative study of these methods based on numerical experiences.

Some theoretical considerations on methodology

Let us put the multicriteria problem in this way : a set of actions ⁽²⁾, noted A , is evaluated on the basis of n criteria $g_1, g_2, \dots, g_n$, which are defined in the form of real-valued functions of the type $g_i : A \rightarrow [g_{i*}, g_i^*]$ so that for action $a \in A$, $g_i(a)$ determines the performance of this action on this criterion ; the bounds of the evaluation scale g_{i*}, g_i^* respectively represent the least and the most preferred value of the i -th criterion. According to these specifications, the multicriteria evaluation of action $a \in A$ is represented by the vector $\underline{g}(a) = [g_1(a), g_2(a), \dots, g_n(a)]$. However, we are using simple vectors $\underline{g} = (g_1, g_2, \dots, g_n)$ to indicate in a general way the elements of criteria space, i.e. the elements of product space $[g_{1*}, g_1^*] \times [g_{2*}, g_2^*] \times \dots \times [g_{n*}, g_n^*]$.

With these notations, an additive utility model is given by the following formula

$$u(\underline{g}) = u_1(g_1) + u_2(g_2) + \dots + u_n(g_n) \quad (1)$$

with $u_i, i = 1, n$ the partial utilities of the criteria, defined respectively on the corresponding evaluation scales $[g_{i*}, g_i^*], i = 1, n$. Another "more convenient" representation of the additive form, which is nonetheless equivalent to (1) (in appropriate scaling, see [4]) is

(2) The term "action" is to be distinguished from the term "alternative" which is very frequently used in the literature. This is explained by the simple fact that the choice of one action does not exclude the choice of another, as can be understood from the term "alternative". In the context of our problem, an action equates with a potential retail outlet and, quite obviously, the problem of choice concerns the selection not of one, but of 150 retail outlets.

$$u(\underline{g}) = p_1 u_1(g_1) + p_2 u_2(g_2) + \dots + p_n u_n(g_n) \quad (2)$$

where

$$u(g_{1*}, g_{2*}, \dots, g_{n*}) = 0, u(g_1^*, g_2^*, \dots, g_n^*) = 1 \quad (3)$$

$$u_i(g_{i*}) = 0, u_i(g_i^*) = 1 \quad \forall i = 1, n \quad (4)$$

$$p_1 + p_2 + \dots + p_n = 1 \quad \text{with } p_i \geq 0 \quad \forall i = 1, n \quad (5)$$

where $p_1, p_2, \dots, p_n$ are the weighting factors of the normalized partial utilities.

The ordinal regression method (known as the UTA method) proposed by Jacquet-Lagrèze and Siskos assesses utility functions respecting specifications (2), (3), (4), and (5). This method uses special linear programming techniques. This type of techniques has already been successfully applied in the case of regression analysis with the linear model $u(\underline{g}) = p_1 g_1 + p_2 g_2 + \dots + p_n g_n$ (see [5], [13], or [17]). The results obtained are very satisfying and sometimes better than those obtained with the traditional method of least squares (see [5] and [18]).

The method is conducted in two phases.

Phase 1 : In its first phase, it assesses an optimal utility function by minimizing a sum (weighted or not) of potential errors $\sigma(a)$, $a \in A'$, where $A' \subset A$ represents the limited set of actions on which bears the problem of the ordinal regression. Partial utilities u_i are assessed on a finite number of levels g_i^j , $j = 1, 2, \dots$ of the scale $[g_{i*}, g_i^*]$, as shown on figure 2.

Without going into details, we shall now lay out the UTA I version of the method which leads to the following linear programme

$$\text{minimize } F = \sum_{a \in A'} \sigma(a) \quad (6)$$

under the constraints

for a and $b \in A'$:

$$\sum_{i=1}^n \{u_i[g_i(a)] - u_i[g_i(b)]\} + \sigma(a) - \sigma(b) \geq \delta \quad \text{if } a \text{ is preferred to } b \quad (7)$$

$$\sum_{i=1}^n \{u_i[g_i(a)] - u_i[g_i(b)]\} + \sigma(a) - \sigma(b) = 0 \quad \text{if } a \text{ is}$$

$$u_i(g_i^{j+1}) - u_i(g_i^j) \geq 0 \quad \forall i \text{ and } j \quad (9)$$

$$\sum_{i=1}^n u_i(g_i^*) = 1 \quad (10)$$

$$u_i(g_{i*}) = 0, u_i(g_i^j) \geq 0 \quad \forall i \text{ and } j, \sigma(a) \geq 0 \quad \forall a \in A' \quad (11)$$

All the technical details of this mathematical formulation are given in [3]. Still, two important remarks have to be made. First, actions a and b in constraints (7) and (8) are not put haphazardly in the decision-maker's ranking, but are consecutive to each other in a chain going from the first to the last action of the subjective ranking, and a large number of constraints economized (see [3], p. 155). Evaluations $g_i(a)$ and $g_i(b)$ in formulae (7)-(8) are expressed in terms of levels $g_i^j \in [g_{i*}, g_i^*]$; when scales are continuous, this assessment is made by linear interpolation. The data in table 3 makes it necessary to solve a linear programme, in which the dual has only 64 constraints (of sign $\leq$) and 90 variables.

Secondly, the transition from the outputs of the linear programme (6)-(11) to the utility given by formulae (2)-(5), is made by expressing $p_i = u_i(g_i^*)$ and by replacing $u_i(g_i^j)$ by $u_i(g_i^j)p_i$ (only if $p_i > 0$).

Finally, we must specify that the parameter δ of inequality (7) plays the role of class discriminator in the weak-order and must take small positive values ; we put it at 0.01 in the information in table 3.

This regression model is evidently more general than the linear model $\sum_i p_i g_i$ (i.e. the weighted sum of the criteria). It follows that it systematically offers better ajustement performances than the linear model.

Phase 2 : The second phase of the method deals with a multiparametric post-optimality analysis, in the sense that it is defined by Van de Panne (in [16], pp. 202-231), with the aim of handling the "fuzziness" of the regression analyses. The goal of this analysis is the relaxation of the mathematical objective (6) in order to account for the Kendall's criterion

τ . We note that the ideal would be to review a posteriori the values of other objectives such as the correlation coefficient R^2 (used in [8] and [19]) or the Kruskal's stress [6]. The choice of Kendall's distance stems from the fact that this distance shows certain physical characteristics ; indeed, it measures the number of violated pairs in the ranking. With the aid of a small example of classical linear regression, Wagner [17] showed, as far back as 1959, that if one changes the optimizing objective (i.e. least square's criterion, criterion of least absolute deviations, Chebyshev's criterion, Kendall's τ , etc.) of the analysis, the result changes considerably from one objective to the other. Our experience in these models has proved that the same phenomenon is more serious in the case of ordinal regression and that it is very tricky to try to make a unique predictive function out of it. In this connection, we propose a "fuzzy" preference model based not on a single "optimal" utility but on a system of utilities consistent with the data analysed (for details and some applications, see [11]). The stability of the solution given by ordinal regression is tested here with the variation's intervals of the parameters and we didn't deem necessary to explicit specific measures of singleness or stability of the solutions.

Very briefly, this analysis is done by transforming the objective of errors (i.e. the objective F) into a new constraint of the type

$$\sum_{a \in A'} \sigma(a) \leq F^* + k(F^*), \quad k(F^*) \geq 0 \quad (12)$$

(after having optimized F and let be F^* the minimum) and by exploring systematically the so formed polyhedron, known as the post-optimality polyhedron. The additive utilities we obtain in this way are the outputs of linear programmes in which we optimize linear functions of the criteria weights, as $[\min] p_i$, $[\max] p_i$, $[\max] p_1 + p_2 + p_3 + p_4$, etc. over the post-optimality polyhedron ⁽³⁾ (see [3] or [10] for more details).

The idea of the interactive approach

The idea of interactiveness comes alive in the effects which the decision-maker thinks a regression analysis can have. This is the reason

(3) A FORTRAN IV computer program was written according to this methodology and was implemented in an interactive version on an IBM 370/168 computer system. Indeed, this paper presents certain outputs of this program.

why the analyst has systematically to establish a dialogue between himself and the decision-maker which will be based on the in-depth interpretation of the results of the model. In this way, the decision-maker will get to know the model of his preferences and can, if he so desires, make the changes he thinks necessary. We should then witness a learning process in which the individual involved learns and also guides the modelling process in course of time. The idea therefore is to progress by means of a series of ordinal regressions in the assessment of the preference model of the decision-maker, and this in a way similar to a trial and error process. Also, and following Zeleny's ideas ([20], pp. 130-183) on the conception and rationality of the *"displaced ideal"*, we would qualify the learning theory proposed here as a *"theory of the displaced preference model"*.

But what is the type of information which serves as a base for interaction between the analyst and the decision-maker ? What does the latter learn during the dialogue process ? The phenomena to be interpreted and discussed are in fact very simple in the context of the development of a regression analysis. We distinguish three types of man-model interactions bearing 1) on the quality of the analysis of ordinal information by ordinal regression, 2) on the acceptation or refusal of the adjusted utilities, and 3) on the problem of extrapolating preferences on the total set of actions. It seems to us that the most logical order in which these interactions must take place is 1) $\rightarrow$ 2) $\rightarrow$ 3) but this may vary, especially with the individuals, the problems and the environment in which the problems arise. In any case, it is important to point out that the outputs of these interactions lead either to a re-initialization of the ordinal regression problem or to a reformulation of the overall decision-making problem.

1) Consistency of the assessed preference model with the a priori preferences of the decision-maker

As regards this aspect of the problem, Mac Crimmon [7, p. 25] states : *"In fact, it has been found that because of inconsistencies in the decision-maker's behavior, the model often does better than the decision-maker"*

(as measured by the performance of the alternatives selected by each on the external criterion). This suggests that the model may be used by the decision-maker to bootstrap his way up to even better performance". The analysis of these inconsistencies must guide the decision-maker to "correct" his ranking by modifying the rank of actions whose multicriteria performances do not justify his judgments made before. These actions can be very easily picked out from the graph presented in figure 1 in which the predicted ranking (computed on the basis of estimated utilities) is presented in abscissa and the subjective ranking of the decision-maker is arranged in ordinate.

In this figure we have marked with asterisks the actions which give rise to the greatest inconsistencies in the analysis of the data in table 3 and which are the farthest from the graph's diagonal. The total number of violations in the subjective ranking is measured in this method by Kendall's τ coefficient. This ranges from - 1 to 1 and we can express it by means of a linear formula between 0 and 1 so as to calculate the percentage of the information which is well returned by the predictive model (ex. : 84 % for figure 1's adjustment).

After corrections by re-ranking, we obtain new inputs by which we can start again regression analysis in a new iteration. Another important aspect of the decision process is the modelling of criteria, that is the assessment of partial utility values and of criteria weights. This discussion point, which we will go on to examine, helps the analyst and the decision-maker to have a clear idea of the importance of any one criterion in comparison to others.

2) Discussion of estimated values and, in particular, of criteria weights

It is worth pointing out that the method of adjusting the preference model must illustrate what is important for the decision-maker through his a priori explicit preferences, and what is not. Using an estimated additive utility model, it is possible to set up a dialogue between the analyst and the decision-maker based on partial utilities and the criteria weights. Figure 2 illustrates the estimated optimal utility for the Sales Manager's preference system.

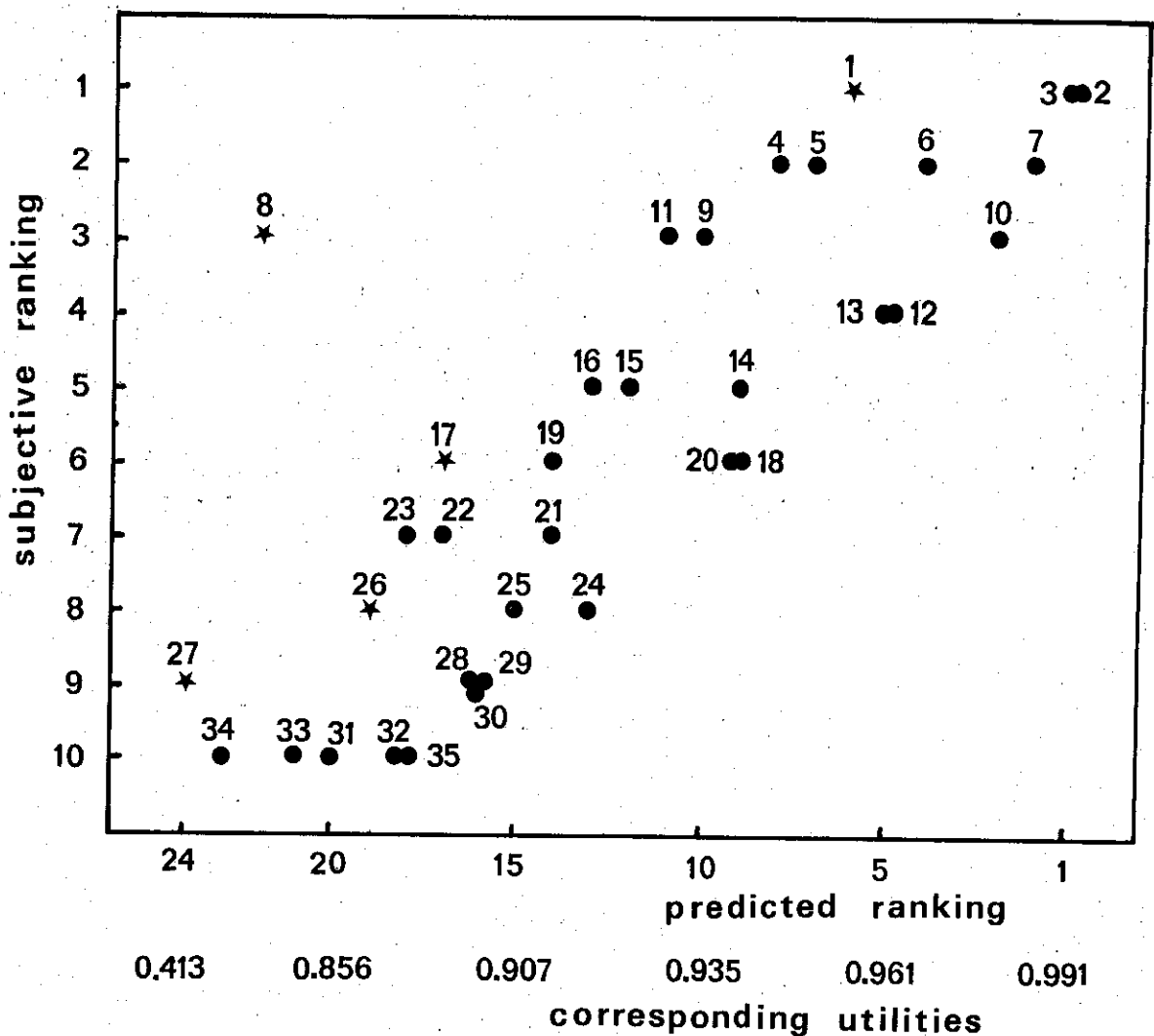


Figure 1 : Ordinal regression analysis on the Sales Manager's preference system : 84 % of the information is returned.

The idea of weights has been traditionally used to indicate the relative importance of a criterion in a given decision situation. According to Zeleny [20, p. 188], there are two components entering into the formation of the weights : "(1) a relatively stable concept of a priori attribute (cf. criterion) importance, reflecting an individual's cultural, genetic, psychological, societal, and environmental background ; (2) a relatively unstable, context-dependent concept of the "informational importance" based on a particular set of feasible alternatives, a given decision situation".

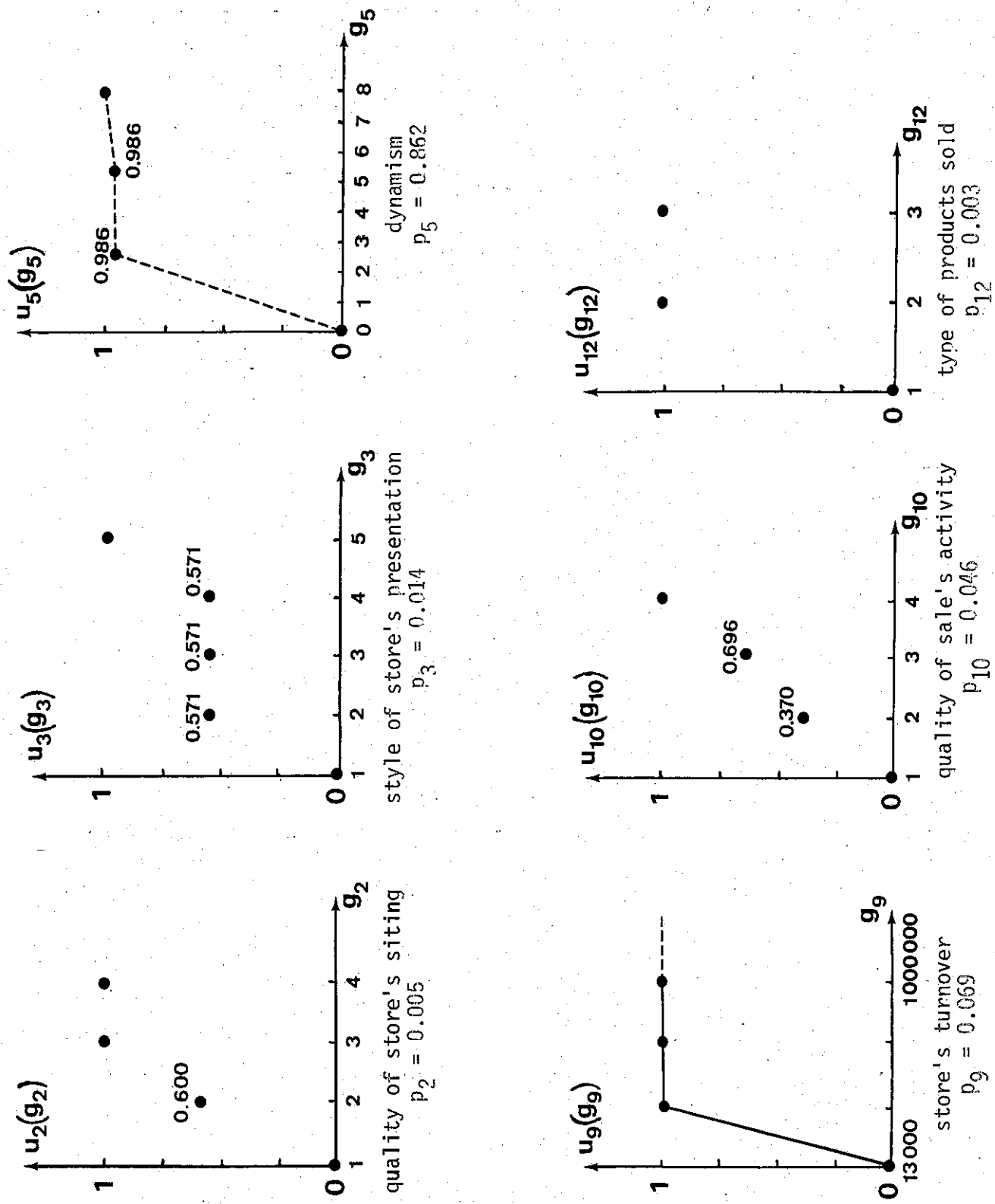


Figure 2 : The assessed utility function for the Sales Manager's preference system

$$u^*(\underline{g}) = 0.005 u_2(g_2) + 0.014 u_3(g_3) + 0.862 u_5(g_5) + 0.069 u_9(g_9) + 0.046 u_{10}(g_{10}) + 0.003 u_{12}(g_{12})$$

It has been shown that in reality the individual cannot weigh the criteria in any single and reliable way. A promising way, therefore, of rationalizing this weighting is to consider predetermined decision situations and to carry out appropriate regression analyses in order to estimate the weighting(s) which are consistent with the decisions that have been taken. We have found this modelling idea to be a satisfying way of coordinating Zeleny's two aspects (subjective and objective) in the assessment of a weighting model.

However, certain decision processes, such as our own, require the analyst to make it clear as to how he constructs his preference multi-criteria model. We suggest, as have Starr and Zeleny [14, p. 22] that *"quite often the decision-maker is interested in finding out what his weights are or what they should be under different decision circumstances. In this sense, the weights of importance could be considered as desirable outputs rather than independent inputs of an analysis. Weights must be revealed or learned through a careful interactive process"*.

Bearing these points in mind the decision-maker is ready to learn, but also to discuss, and eventually to decide whether he accepts or rejects the model of his own preferences. This leads him at a given moment either to change the structure of the criteria (rejection, substitution or redefinition of criteria) or (as we have seen above) to correct inconsistencies according to his learning of criteria values, and thus to propose a new system of subjective preference.

3) Extrapolating the adjusted model on the whole set of actions

A third interaction between analyst and decision-maker, which can in fact be seen in any interactive operations research method, consists in a discussion on the solutions advanced by the analyst. These solutions are precisely here the result of the extrapolation of the preference model such as it has been adjusted by ordinal regression. To this effect, it is necessary to calculate the partial utilities of all the actions (from the shapes of figure 2, for instance) and to rank them afterwards

according to the decreasing order of the global utilities. This means that previous experience and decisions are grafted into unknown situations, in a concrete way, so as to evaluate the retail outlets which the decision-maker is not equipped to evaluate himself. This must be done in a way consistent with the previous behaviour of the decision-maker. A lot of papers on consistency in managerial decision-making (e.g. [1], [2]) have shown that decision performance can be improved when these same decisions are based on the background of previous ones.

However in the context of strategy decisions (in this case the launching of a new product R) which oblige managers to restructure the relations between the organization and its environment, two sorts of inconsistencies can crop up : first, past experience and decisions can refer to situations which differ from the present situation and therefore often lead to unsatisfactory results, and secondly, there may be insufficient knowledge of the problems to be studied which are thus poorly formulated. This means that with the development of information and of the learning process of the actors in the decision, the problems undergo considerable restructuration. It is therefore possible for the decision-maker, during an interaction between himself and the solutions proposed, after extrapolation of the results of regression, to modify not only the predictive model of his preferences, but also the formulation itself of the problem in question. These ideas will of course be illustrated in the next section which demonstrates how the method is applied.

To conclude these remarks on the interactiveness of the method, it is worth pointing out that it is not a well-structured algorithmic procedure with carefully ordered stages, but rather, a free dialogue based on the logic of the proposed ordinal regression, where success in the learning process of the decision-maker is conditioned by thorough knowledge on the part of the analyst of this method. The method therefore proceeds with a series of ordinal regressions on a trial and error basis. Here the output to be improved is not necessarily the quality of the adjustment of this regression, but rather emphasizing the extent of the decision-maker's knowledge of his problem.

4. APPLICATION

After having experimented with this method on the Sales Manager's preference data we discussed the evaluation system obtained with the General Manager. It is not our intention here to give all the details of the discussion or the arguments involved, but rather to highlight the results of the man-model interaction.

The reactions of the decision-maker to the results of the regression (see figures 1 and 2) were as follows :

- The information provided by the Sales Manager is faithfully returned (cf. figure 1).
- The "store accessibility" criterion is, in fact, not important and can be eliminated from the anticipated system of evaluation.
- Figure 2 shows that the "dynamism" criterion dominated over a number of other criteria ($p_5 = 0.862$) in the sense that it completely penalizes the traders who show little dynamism (for which $g_5 \leq 2$), but does not come to any conclusions about the stores for which $g_5 \geq 3$. What is more, this criterion is highly synthetic and it is difficult to locate the source of its importance. Consequently, it has to be split into two criteria, one combining aspects (a) and (b) of the questionnaire (cf. table 2) and the other the remaining two aspects (c) and (d), with the following ordinal scales :

criterion g_5 : dynamism 1

The trader expects from the manufacturer :

		only a product	a product and services	as much co-operation as possible
The trader :	rejects manufacturer's brand	1	2	3
	tries to obtain manufacturer's brand	2	4	5

criterion g_5^1 : dynamism 2

		The trader :	
		buys other brands	programmes or has programmed purchases
The trader discusses prices and discounts :	yes	1	3
	no	2	4

Discussion on the ranking of 666 stores distributed according to geographical sectors led to major disagreements on the part of the decision-maker. The latter found that there were certain comparison results which were "true" for the commercialization of product R and a number of others which contradicted his revealed preferences, but which on the other hand could be "true" where it concerned the setting up of distribution networks for the two other products. What is therefore clear is that the information used is inappropriate since the evaluation system it entails is not solely for product R, but refers to all the products together. The problem formulation therefore had to be changed and a system of evaluation per single product had to be worked out.

The ordinal regression analysis must be resumed again with the preference data provided by the General Manager. The latter therefore suggested 50 reference stores (among those with which he was most familiar) which be ranked in four different ways, that is to say, once globally and the three other times according to the commercialization policy for each of products I, C and R (see table 4). Of the stores indicated however, only 10 figure among the 35 previously suggested by the Sales Manager. This illustrates the variety of points of view which exist in the present sales network. Furthermore, as the problem formulation grows, so the study process becomes far more important.

Figures 3 and 4 respectively show optimal utility and the ordinal regression diagram obtained for product R during this new iteration.

Table 4 : The four preference systems of the General Manager

Retail outlet n°	FOUR RANKINGS				C R I T E R I A												
	R	I	C	Glo-bal	2	3	4	5	5'	6	7	8	9	10	11	12	
1	1	4	1	1	2	4	1	5	4	3	2	3	1 041 526	4	3	3	
2	1	8	2	1	4	5	3	5	1	2	3	3	816 230	4	1	3	
3	2	7	7	7	4	5	1	5	2	2	3	3	65 470	3	2	2	
4	2	7	7	7	1	3	1	5	4	3	3	3	63 145	4	3	3	
5	2	3	5	2	4	3	1	5	4	2	3	3	328 595	4	3	3	
6	3	3	6	2	2	2	1	3	4	3	3	3	372 420	4	3	3	
7	3	1	6	7	4	5	1	5	4	3	3	2	164 387	3	3	3	
8	3	16	6	7	2	3	1	2	2	1	2	3	89 105	4	3	2	
9	3	4	5	4	2	4	1	4	4	2	3	3	761 874	4	2	3	
10	4	16	10	12	4	5	1	5	4	2	3	3	79 113	4	3	2	
11	4	2	6	-	2	4	3	5	4	3	3	3	182 270	3	2	3	
12	4	12	11	11	1	2	1	3	4	2	3	3	163 780	3	3	2	
13	5	7	8	6	4	4	2	4	4	3	1	3	157 281	1	2	3	
14	5	3	4	3	1	5	3	5	3	3	5	3	342 141	3	3	3	
15	6	12	9	6	2	4	3	2	4	2	5	3	195 471	3	3	3	
16	6	11	9	12	1	4	1	5	4	1	2	3	150 000	4	3	2	
17	7	6	8	8	2	4	3	3	4	2	3	3	326 825	3	3	2	
18	7	6	8	3	2	4	1	3	4	1	2	3	306 631	4	3	2	
19	8	3	4	3	4	4	3	5	4	3	1	3	625 500	3	2	3	
20	8	11	11	11	2	2	1	3	4	1	3	3	187 641	3	3	3	
21	8	5	10	13	2	4	1	4	4	1	3	3	70 000	3	3	2	
22	9	16	10	13	3	4	1	4	4	1	2	3	43 395	3	2	2	
23	9	10	8	12	4	4	1	4	4	1	1	3	300 000	3	3	2	
24	9	17	11	13	2	4	1	5	2	2	2	3	60 000	4	3	2	
25	9	7	9	14	2	5	1	5	3	2	5	3	122 476	4	3	3	
26	10	16	11	13	2	4	1	2	3	3	1	3	150 000	1	2	2	
27	10	11	9	14	4	3	1	5	4	3	3	3	115 475	4	3	3	
28	11	17	11	-	2	4	2	4	4	1	3	3	392 000	2	3	3	
29	11	10	8	10	1	4	3	5	3	3	3	3	222 457	3	2	3	
30	11	10	8	10	2	4	3	5	3	3	1	2	401 545	2	2	3	
31	11	14	13	14	2	4	3	4	3	2	5	3	124 843	3	3	3	
32	12	16	10	13	2	4	1	1	4	1	2	3	250 000	1	3	2	
33	13	18	3	5	1	4	3	1	3	1	2	3	2 179 165	1	3	3	
34	13	15	4	8	2	4	3	2	3	1	2	2	729 000	1	2	3	
35	13	9	3	9	2	4	3	4	3	1	2	3	300 000	1	3	2	
36	13	15	3	4	1	4	1	2	4	1	3	3	821 739	4	2	3	
37	14	18	8	15	1	4	1	5	1	1	2	3	13 600	1	2	1	
38	15	17	12	16	1	1	1	2	4	2	1	2	127 661	2	3	3	
39	16	13	12	15	1	4	1	4	3	1	1	3	210 000	1	2	2	
40	16	14	12	14	2	4	3	5	3	3	2	3	250 865	3	2	3	
41	16	18	9	15	1	3	1	2	4	2	1	3	172 440	1	1	3	
42	17	14	13	15	1	2	3	4	4	2	3	3	114 207	3	3	3	
43	17	19	12	15	2	2	1	4	4	2	2	3	101 740	1	2	3	
44	17	14	12	15	2	1	3	4	3	2	2	3	145 251	1	2	3	
45	18	19	15	17	4	5	1	4	2	3	3	3	30 570	4	2	3	
46	18	19	15	17	2	3	1	4	2	1	2	3	13 161	3	3	2	
47	18	17	13	17	2	4	1	4	4	3	3	3	57 440	3	2	3	
48	18	19	15	16	1	3	1	2	4	2	2	3	54 330	3	3	3	
49	18	19	13	15	2	4	1	5	4	3	3	3	139 974	3	3	2	
50	19	18	14	15	1	4	1	4	4	1	1	3	155 000	1	2	1	

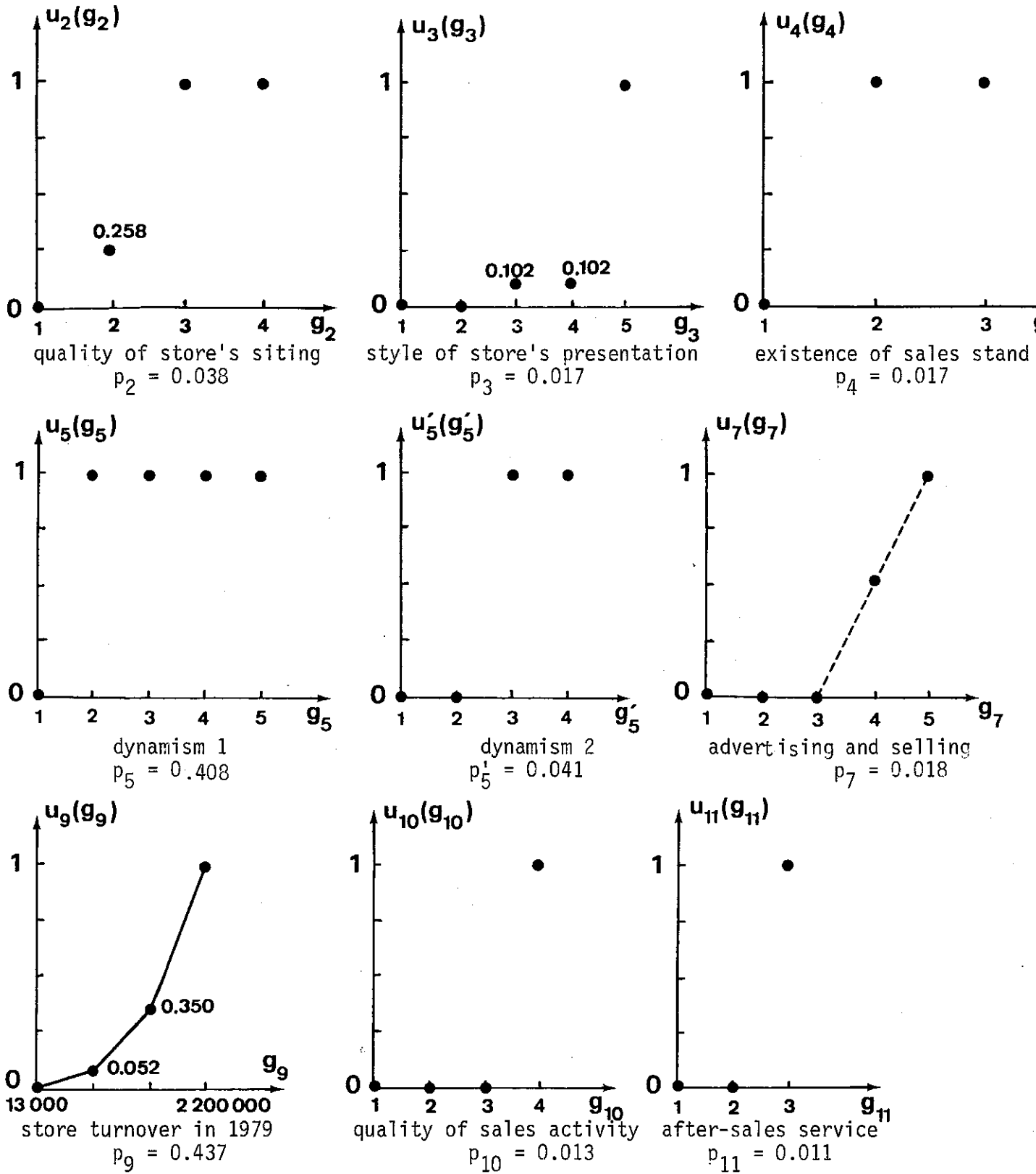


Figure 3 : The assessed optimal utility for product R :

$$u^*(\underline{g}) = 0.038 u_2(g_2) + 0.017 u_3(g_3) + 0.017 u_4(g_4) + 0.408 u_5(g_5) + 0.041 u'_5(g'_5) + 0.018 u_7(g_7) + 0.437 u_9(g_9) + 0.013 u_{10}(g_{10}) + 0.011 u_{11}(g_{11})$$

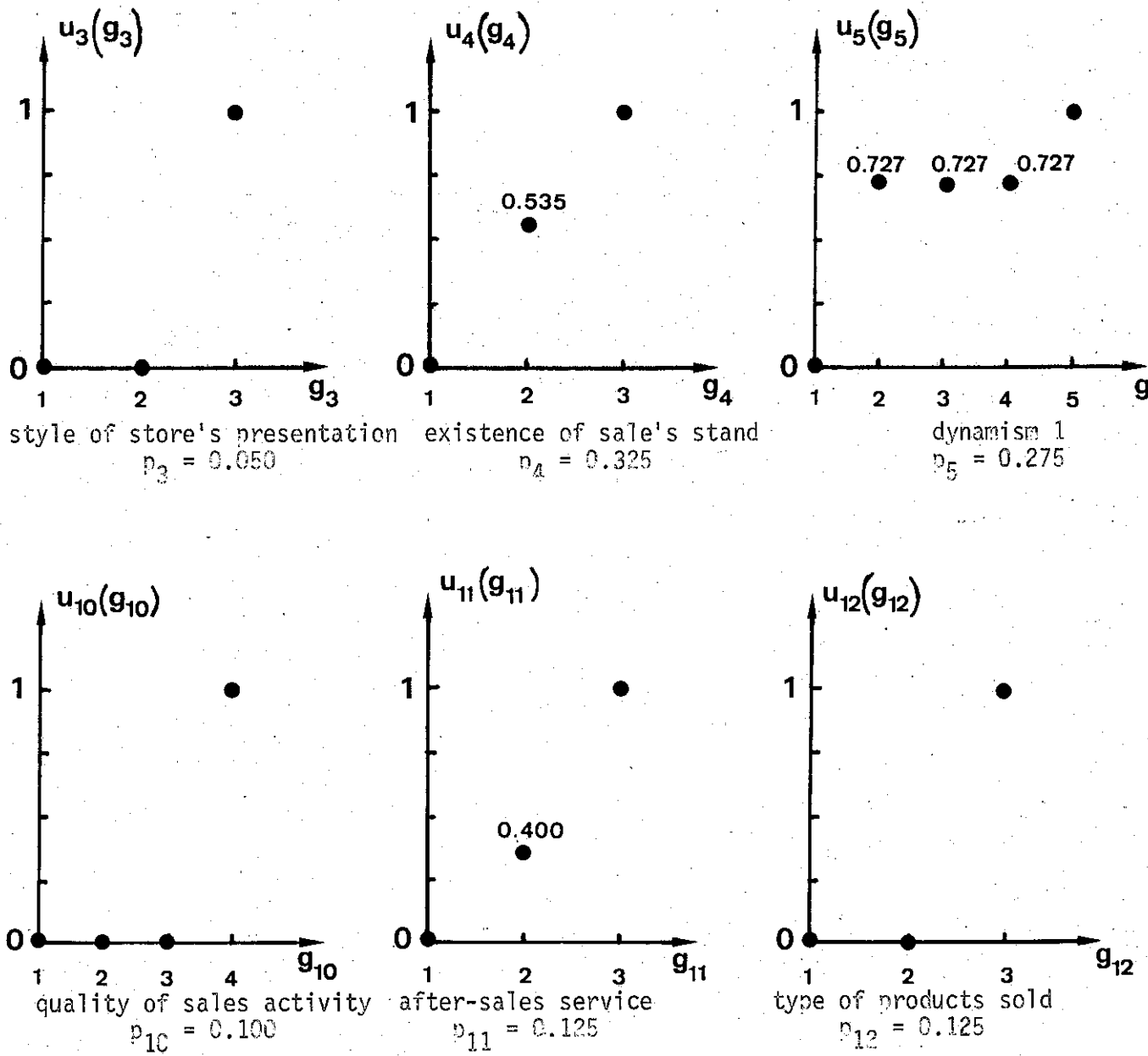


Figure 5 : The optimal utility for product I :

$$u^*(\underline{g}) = 0.050 u_3(g_3) + 0.325 u_4(g_4) + 0.275 u_5(g_5) + 0.100 u_{10}(g_{10}) + 0.125 u_{11}(g_{11}) + 0.125 u_{12}(g_{12})$$

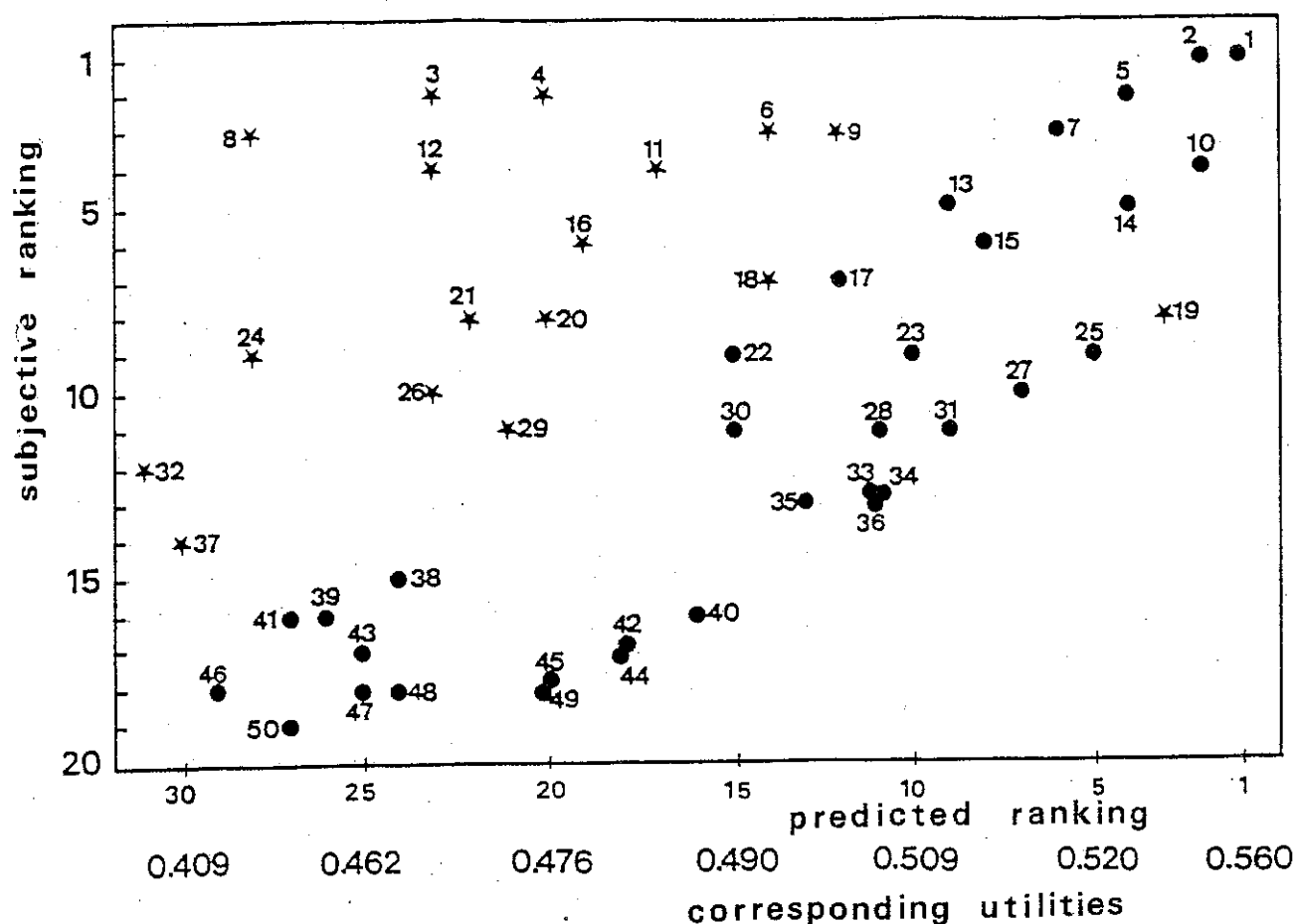


Figure 4 : Ordinal regression result for product R

The quality of this adjustment (with $\delta = 0.005$) is lower than that of the previous iteration. 68 % of the information was returned this time for the optimal utility. Stability tests for this utility function were carried out using the post-optimality analysis mentioned in section 3. A system of three utility functions was then sought after where each function consisted in maximizing the total weight of one of three selection policies. Having obtained $F^* = 1.872$, we determined as the objectives in post-optimality analysis $[\max] p_2 + p_3 + p_4$, $[\max] p_5 + p_5' + p_6 + p_7 + p_8$ and $[\max] p_9 + p_{10} + p_{11} + p_{12}$ selecting respectively as $F^* + k(F^*)$ within (12) the values 2.0, 2.2 and 2.0. Table 5 only shows the weights and the quality of the adjustments effected ; the weights of the optimal utility are charted here for reference purposes. Each estimate of any one utility needed about a minute's calculation on an IBM 370/168 computer system.

Table 5 : Sensitivity analysis of the evaluation model for product R : weightings (in %).

C R I T E R I A	"Optimal" utility	Utilities corresponding to the policies		
		Store	Trading	Sales
Quality of siting	3.8	3.2	3.2	2.7
Style of presentation	1.7	10.8	0.7	0
Existence of sales stand	1.7	2.1	0.6	1.6
TOTAL WEIGHT	7.2	16.1	4.5	4.3
Dynamism (a), (b)	40.8	37.1	52.3	31.3
Dynamism (c), (d)	4.1	4.7	4.4	2.3
Innovation	0	0	0	0
Advertising and selling	1.8	1.4	3.0	2.0
Mode of payment	0	0	0	0
TOTAL WEIGHT	46.7	43.2	59.7	35.6
Store turnover	43.7	38.4	34.4	34.7
Quality of sales activity	1.3	0.9	0.9	2.4
After-sales service	1.1	1.4	0	1.2
Type of products sold	0	0	0.5	21.8
TOTAL WEIGHT	46.1	40.7	35.8	60.1
Returned information	68 %	67 %	67 %	69 %

Post-optimality analysis shows relatively good stability for the optimal utility. The only source for concern is a considerable transfer of weight between the "turnover" and "type of product sold" criteria in the first and the last column of table 5. It is therefore clear that by maximizing the total weight of the criteria of the "sales" policy, we obtain first , a weight of 21.8 % for the "type of products" criterion, while

in the other solutions the weight for this criterion is almost zero, and secondly, the "turnover" weight has fallen from 43.7 % to 34.7 %. Nonetheless, close scrutiny of the partial utility of the "type of products" criterion corresponding to the weight of 21.8 % is necessary :

	$g_{12} \rightarrow u_{12}(g_{12})$
the store only commercializes product I	$\rightarrow 0.0$
the store only commercializes product C	$\rightarrow 1.0$
the store commercializes products I and C	$\rightarrow 1.0$

This utility therefore favors large stores and so, once again, the "turnover" criterion. This argument encourages selecting optimal utility instead of the system of the three other utilities of table 5 as the evaluation system for the 666 stores. Another consequence of post-optimality analysis is that the "trading" and "sales" policies dominate (maximum weights of 59.7 % and 60.1 %) in the overall evaluation system.

Discussion of the results (product by product) led to further comments from the General Manager of Ω :

- The solutions suggested for products C and R are satisfactory. However, the evaluation system proposed for product I must be changed.

- Product I responds to a different market given the length of time it has been available on the market and its features ("natural" series). The group of criteria must be revised to make it more consistent with the sales policy for this product. The necessary changes are as follows :

- (1) criteria 5' (dynamism 2) and 9 (turnover) must be eliminated ;

- (2) the ordinal scale of criterion 2 (quality of siting) must be modified by selecting three levels rather than four, according to the following transformations :

1	$\rightarrow$	1
2	$\rightarrow$	1
3	$\rightarrow$	2
4	$\rightarrow$	3

(3) criterion 3 (style of presentation) must be redefined taking into account only its first aspect in the questionnaire (cf. table 2) :

the arrangement is very ordinary → 1

the arrangement is agreeable → 2

the arrangement is luxurious → 4

(4) criterion 12 (type of product sold) must be redefined so as to give preferential status to the stores which only commercialize product I

the store only commercializes product C → 1

the store commercializes products I and C → 2

the store only commercializes product I → 3

What emerges is that setting up our interactive method reveals the preferences of the decision-maker on the basis of multicriteria information which changes with time. It is worth remembering in this context that for product I, the General Manager eliminated the "turnover" criterion which, prior to this study, was the basis on which all the mini-decisions dealing with network management were taken. This means that the sale of this product will be authorized for small local stores in the same way as for "Mamouth"-style hypermarkets.

The above modifications were thus integrated into the information system of table 4 ; the new regression analysis was carried out with the overall preference of corresponding to the column for product I and the ten selected criteria. Only one result of this analysis is being presented : optimal utility (figure 5) ; this returns (with $\delta = 0.05$) 66 % of the information analysed.

The complete set of results was discussed with the decision-maker who considered them satisfactory.

The solutions proposed in this study have been considered for application in Ω company, and in particular, in the preliminary stages, those relating to the new product.

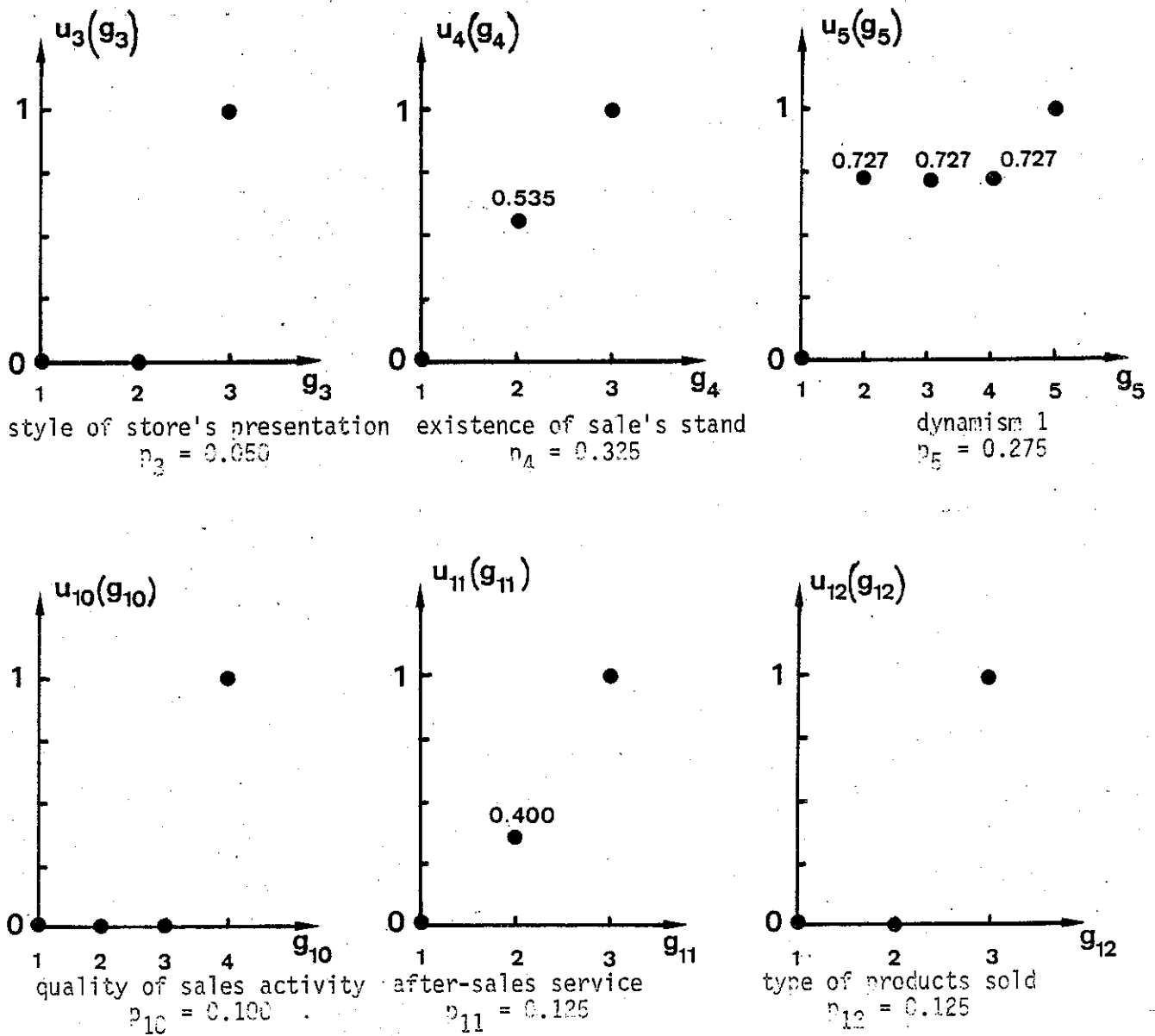


Figure 5 : The optimal utility for product I :

$$u^*(g) = 0.050 u_3(g_3) + 0.325 u_4(g_4) + 0.275 u_5(g_5) + 0.100 u_{10}(g_{10}) + 0.125 u_{11}(g_{11}) + 0.125 u_{12}(g_{12})$$

5. SOME CONCLUSIONS

This paper demonstrates the contribution made by a multicriteria ordinal regression method to solve a complicated organizational problem. The fact that the method is so well suited to getting to the heart of the decision system presented is due partly to the simplicity of its technique and also to the possibilities it offers for dialogue via the man-model interactions.

Implementation of the method as it was carried out on the problem of evaluating the retail outlets highlighted some of the features of multicriteria approaches which are often neglected by analysts. In fact the method outstripped the normal role of a multicriteria technique which is to rationalize (and even dictate) the right solution ; here the method makes it possible for the actors in the decision-making process to identify the various problems, and thus to give each one of them closer consideration and greater collaboration in order to find a solution.

In order to control the impact (and even the efficiency) of this study on the organization in question, we carried out a second a posteriori study of the same problem (see [9]). This involved contacting and interviewing the Sales Manager, one of the actors in the process, a year after the study had been carried out. It was thus possible to discover how a multicriteria involvement in a process of organizational decision-making is seen by the organization itself. It also made it possible to draw some conclusions on the study process as well as possibilities for improving this sort of approach.

The comments of the Sales Manager shed light on two fundamental results (according to [9]) of using this method in the decision-making problem :

- Gradual change of the problem formulation from "assess an evaluation system" to "create a data storage system". The company saw the study as the occasion for discovering an information system which might clarify different sorts of management activities within the distribution network. The experience was seen as a first step towards constructing permanent information systems which would enable integration of the qualitative evaluations.

- A tendency to present the problems as being independent from each other and individually solved. The Sales Manager considers problems such as "where to launch the new product", "whether or not to finance advertising for the selected stores", etc. as being separate, contrary to the analyst who seems in favor of consistency between organizational activities. This idea was in fact argued by Steinbruner [15] who opposes an account fitting with the analytic paradigm, that of the analyst seeking a superior level of rationality, to that of the actor, who, according to the cybernetic paradigm, emphasizes the separation of the problems.

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APPENDIX

Table 2 : Questionnaire on multicriteria evaluation
of a potential retail outlet (Criteria 1-3)

Criteria definition	Ordinal scales																				
1. <u>STORE'S ACCESSIBILITY</u>																					
- The store is not very accessible (street unknown, suburb, congested) <input style="float: right;" type="checkbox"/>	1																				
- The store is accessible but without parking space <input style="float: right;" type="checkbox"/>	2																				
- The store is accessible with parking space <input style="float: right;" type="checkbox"/>	3																				
- The store is in a main street with parking space <input style="float: right;" type="checkbox"/>	4																				
2. <u>QUALITY OF STORE'S SITING</u>																					
- Characterize the type of area and street in which the store in question is found :																					
<u>area</u> - working-class (W) ☐ - fashionable (F) ☐	<u>street</u> - non shopping (NS) ☐ - shopping but working-class, or shopping centre of the Mamouth type (WS) ☐ - shopping and fashionable or shopping centre of the Parly 2 type (S) ☐																				
	<table border="1" style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="width: 25%;"></td><td style="width: 25%;">S</td><td style="width: 25%;">NS</td><td style="width: 25%;">WS</td><td style="width: 25%;">S</td></tr> <tr> <td>A</td><td></td><td></td><td></td><td></td></tr> <tr> <td>W</td><td>1</td><td>2</td><td>3</td><td></td></tr> <tr> <td>F</td><td>2</td><td>2</td><td>4</td><td></td></tr> </table>		S	NS	WS	S	A					W	1	2	3		F	2	2	4	
	S	NS	WS	S																	
A																					
W	1	2	3																		
F	2	2	4																		
3. <u>STYLE OF STORE'S PRESENTATION</u>																					
- Evaluate store's arrangement (carpet , heating, cleanliness, shop-front), type of assortment :																					
Arrangement : very ordinary (O) agreeable (A) luxurious (L)	☐ ☐ ☐																				
- Compared to level I and C the assortment is :																					
. very superior or very inferior in quality (+-) . of the same or slightly superior in quality (=)	☐ ☐																				
	<table border="1" style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="width: 25%;"></td><td style="width: 25%;">+-</td><td style="width: 25%;">=</td><td style="width: 25%;"></td></tr> <tr> <td>O</td><td>1</td><td>3</td><td></td></tr> <tr> <td>A</td><td>2</td><td>4</td><td></td></tr> <tr> <td>L</td><td>3</td><td>5</td><td></td></tr> </table>		+-	=		O	1	3		A	2	4		L	3	5					
	+-	=																			
O	1	3																			
A	2	4																			
L	3	5																			

Table 2 : Questionnaire on multicriteria evaluation
of a potential retail outlet (Criteria 4-6)

Criteria definition		Ordinal scales
4. <u>STAND</u>		
- The trader has not provided for a stand	☐	1
- The trader has provided for a stand	☐	2
- The trader has built or plans to built a stand	☐	3
5. <u>DYNAMISM</u>		
a) The trader - rejects manufacturer's brand	☐	0
- tries to obtain manufacturer's brand	☐	1
b) What the trader expects from the manufacturer :		
- a product	☐	0
- a product and service	☐	1
- as much co-operation as possible	☐	2
c) The trader discusses prices and discounts :		
- yes	☐	0
- no	☐	1
d) The trader - buys other brands	☐	0
- programmes or has programmed purchases	☐	1
$2a + 2b + c + d$		
6. <u>ADEQUACY AS REGARDS INNOVATION</u>		
Specify attitude of trader towards any product innovation :		
- the trader is cautious	☐	1
- the trader accepts novelty	☐	2
- the trader tries to obtain new products	☐	3

Table 2 : Questionnaire on multicriteria evaluation
of a potential retail outlet (Criteria 7-12)

Criteria definition			Ordinal scales
7. <u>HIGH-PRESSURE ADVERTISING AND SELLING</u>			
- What is the trader's type of advertisement :			
. no advertisement (NA)	☐		
. price advertisement (PA)	☐		
. advertisement for products or services (PS)	☐		
- What is the trader's attitude :			
. sells at a discount (D)	☐		
. launches no commercial drive (O)	☐		
. launches occasional commercial drives in his store (C)	☐		
8. <u>MODE OF PAYMENT</u>			
The trader is :			
- a bad payer	☐		1
- a fairly good payer	☐		2
- a good payer	☐		3
9. <u>STORE'S TURNOVER IN 1979</u>			F
10. <u>QUALITY OF SALES ACTIVITY</u>			(quantitative)
What is the store's welcoming service like :			
- high-pressure salesman	☐		1
- no welcome	☐		2
- discreet and effective welcome	☐		3
- efficient welcome and services	☐		4
11. <u>AFTER-SALES SERVICE</u>			
- non-existent	☐		1
- average	☐		2
- good	☐		3
12. <u>TYPE OF PRODUCTS SOLD</u>			
Product(s) I	☐		1
C	☐		2
I. & C	☐		3