

# FRAMEWORK FOR THE ANALYSIS OF CONSUMER CHOICE BEHAVIOUR REGARDING CUT FLOWERS AND POT PLANTS

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## Abstract

Both in economic and in marketing literature it is sometimes assumed that consumers are implicitly or explicitly engaged in some multistage choice process before the actual purchase takes place. Stages that may be distinguished are: determination of the budget share that will be spent on each product class, the choice of a product category within a product class and the choice of a specific brand or variety within a product category. In each of these stages many factors may influence consumer choice behaviour.

This paper discusses in which part of the flower and plant buying households a multistage choice process can be assumed. Subsequently, a mathematical model will be proposed and discussed for each phase in the choice process.

The data were obtained from a consumer panel and only those households belonging to a panel for a period of two years were selected. These households were then used to form a sample of 1000 households. In this way it was possible to base the analysis in each particular phase of the choice process on cross-section data, time-series data and on a pooling of cross-section and time-series data.

The analysis can also be performed on the whole market as well as on particular market segments, which means that potential advantages of market segmentation can be evaluated.

## 1. Problem definition

Consumers face many alternatives in order to fulfil their needs and it may be very difficult to solve this choice problem at one time. It is often assumed, therefore, that a consumer has a strategy to reduce the complexity of his choice problem. One such a strategy is that he subdivides his choice problem into minor ones, each of which is attended to separately. In the economic theory of consumer behaviour and in consumer behaviour theory a multistage choice process is sometimes assumed.

The subject of this paper regards consumer behaviour with respect to cut flowers and pot plants in the Netherlands. Because of the great diversity within this product class, a three stage choice process is assumed. The first stage regards the question of how much will be spent on cut flowers and pot plants. In the second stage the question considered is how the budget for cut flowers and pot plants can be divided over rather homogeneous subgroups and the final stage regards the choice of a particular bunch of flowers or a particular plant within a specified subgroup.

It cannot be assumed, however, that all households are engaged in such a multistage choice process for cut flowers and pot plants. Therefore, a criterion must be developed to eliminate some of the households.

When important segments can be distinguished in the flower and plant market, the choice of these products can also be analysed for separate segments. For that purpose data from individual households are required. To this end we obtained consumer panel data regarding cut flowers and pot plants from NIAM (Dutch Institute of Agricultural Marketing Research) which is related to the Dutch Attwood organization, which collects these panel data on behalf of the Dutch Commodity Board for Ornamentals. The data cover the period of December 1972 to November 1974.

The paper is organized as follows. First, the concept of a multi-stage choice process is discussed and applied to consumer behaviour regarding cut flowers and pot plants and a model proposed for each stage of the choice process. Second, the framework of the study is shown and discussed. Third, a criterion must be developed to eliminate households for which a multistage choice process regarding flowers and plants can not be assumed. Finally, the proposed model for each stage in the choice process is discussed and some examples given.

## 2. A multistage choice process for cut flowers and pot plants

In the economic theory of consumer behaviour a two-stage maximization procedure is sometimes assumed. The first stage involves the optimal allocation of income among broad product classes. The second stage implies the optimal spending of a product class budget to all products within that class. This notion is based on the work of Strotz (1959) who introduced the concept of a utility tree. If there is weak separability of the utility function, utility maximization over the total budget can be acquired by utility maximization over separate product classes.

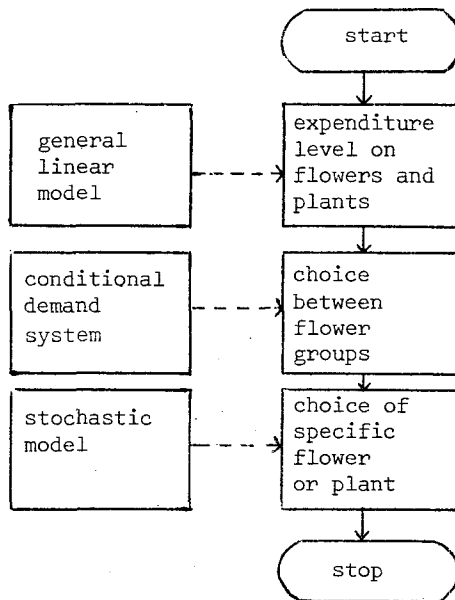
In consumer behaviour theory, Pratt (1965) and Gredal (1966); amongst others, assumed some multistage decision process. Pratt assumed the following stages: competition for income allocation among major categories, general shopping (= information search), income allocation to major categories, product decision (= intention to buy a product), specific shopping (brand, store), purchase and finally post-purchase behaviour.

Gredal assumed the following steps: the general purchasing decision or budgetary considerations, the concrete purchasing decision (specific brand or make within a product class), the selection decision (price, quality, brand, type of outlet, etc.) and the technical purchasing action.

For the consumer the costs of information processing are lower when a multistage approach is assumed, because it is not necessary to evaluate and to compare all products at one time. In the analysis the fact that product buying is not analysed as a separate event, but in its relation with other products can be considered as an advantage. These arguments hold particularly true for the product class of cut flowers and pot plants, which contains many items.



Figure 2 - Review of the proposed model per phase in the multistage choice process



The models as mentioned in Figure 2 will be discussed further in section 5.

### 3. Framework for the analysis of choice behaviour regarding flowers and plants

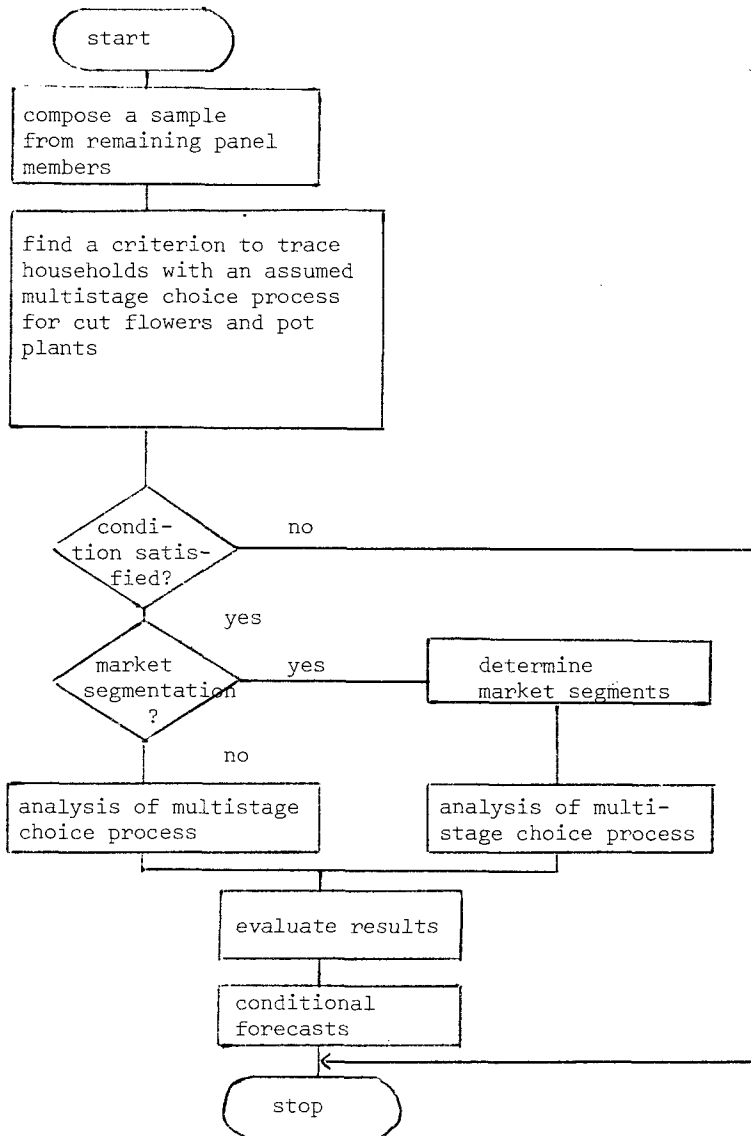
The proposed framework for the analysis of consumer choice behaviour with respect to flowers and plants is given in Figure 3.

The first box relates to the way in which the available data are organized. Data of individual households taken over a period of two years are available. Of course, not all households were panel members for the whole period. In order to be able to make analyses based on individual household data for the whole period only those households who had been panel members during this period were selected. A sample of 1000 households was then formed based on the same sampling criteria on which the original panel was composed.

The next step involves the already mentioned criterion to remove some of the households. The derivation of this criterion will be discussed in section 4. Each household was examined to see whether or not the accepted condition was satisfied. If not, the household was no longer evaluated. If it was satisfied, then the remaining households were investigated to see whether or not market segmentation could be fruitfully applied. In both cases the analyses as given in Figure 2 regarding the multistage choice process will be applied. Next, the outcomes of the parameter estimation in each phase of the choice process can be evaluated. If important market segments can be traced, the outcomes for these market segments will be evaluated against the results for the whole market.

Finally, when parameter estimation in the proposed models has been successful, the models can be used for conditional forecasts.

Figure 3 - Flow chart of the proposed framework



4. Criterion to trace households with an assumed multistage choice process for flowers and plants

As we dispose of panel data in which each household's purchases are on record, we want to base the criterion to trace households with an assumed multistage choice process for cut flowers and pot plants on these purchase histories. As the choice of this criterion will be more or less arbitrary, we will investigate whether some support for a particular choice can be found.

We have found a useful theory in a paper presented by Sheth and Raju (1973). They distinguish four major types of repetitive choice behaviour: reflected purchases, impulse purchases, habitual purchases and curiosity-based purchases.

Reflected purchases involve an evaluation process among alternatives, For flowers and plants these purchases can be expected when a product is bought for the first time or when it regards important gifts.

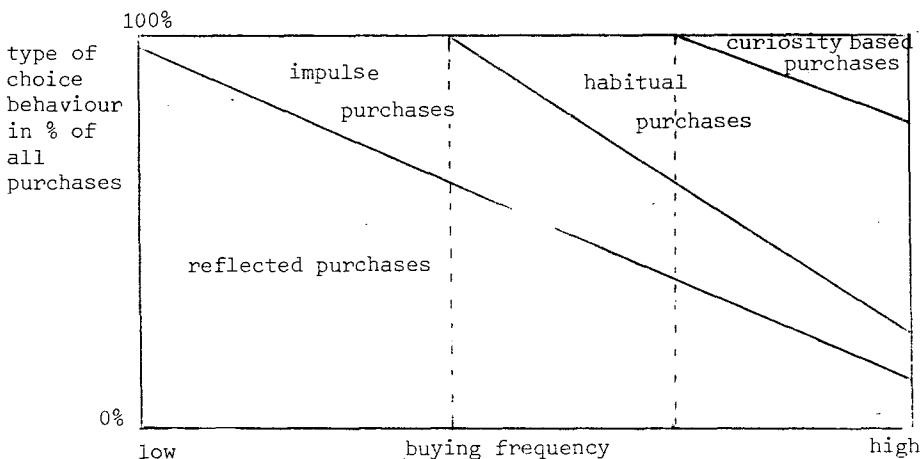
Impulse purchases are choices solely due to the motivational impact of the situational stimuli. These purchases can be stimulated by an attractive display of flowers and plants in for example a street stall.

Habitual purchases are based on past rewarded experiences with the product. For flowers they can be stimulated when for example their keeping has been improved.

Curiosity based purchases can be labelled as novelty, curiosity or exploratory behaviour of a consumer who is bored with the normally used product.

When the four types of choice behaviour are applied to cut flowers and pot plants and are combined with a household's buying frequency as described in Figure 4, a criterion can be derived to judge whether households can be assumed to be engaged in a multistage process for flowers and plants or not.

Figure 4 - Assumed association between buying frequency and type of choice behaviour for cut flowers and pot plants.



In Figure 4 it is assumed that light buyers mainly make reflected purchases, for example in the case of special occasions like Mother's Day, anniversaries etc., when some deliberation before buying can be expected. Occasionally, an impulse purchase is made. It is assumed that heavy buyers usually make habitual purchases. It is possible that some impulse purchases are made on days of the week when they normally do not buy. Heavy buyers would be expected to be among the first to buy flowers or plants that are considered as new varieties as soon as it is offered.

The dotted lines in Figure 4 can be interpreted in the following way. As long as households do not show habitual buying behaviour for at least part of the year when, for example, flowers are cheap, they are assumed to be light buyers who do not have a multistage choice process for cut flowers and pot plants. All other households are assumed to be engaged in such a process. For these households, however, a distinction can be made between heavy buyers, who are assumed to show curiosity-based behaviour from time to time and the intermediate class of buyers, who do not show this kind of behaviour.

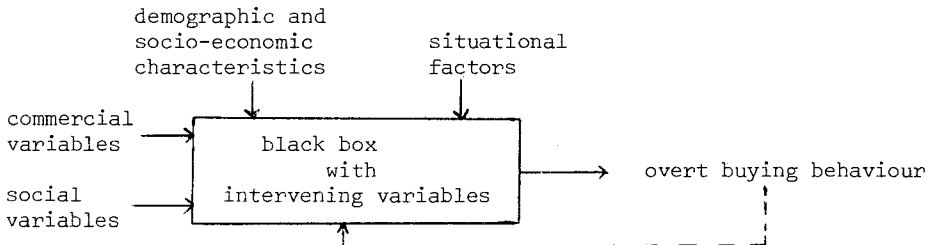
Now the question of how to make this criterion operational can be raised. First of all households that have a rather low average buying frequency, say less than once per 3 weeks, will be removed. The remaining households are divided into two groups: the heavy buyers with an average buying frequency of at least one per fortnight and the households with an average buying frequency of one per 2 to 3 weeks. For the latter category the fact of whether or not they mainly buy gift flowers and/or plants is investigated. If they do, then they are removed from the analysis because it is then assumed that external forces play a greater role in flower or plant buying than a household's own need for flowers. The remaining households are assumed to be implicitly or explicitly engaged in a multistage choice process for cut flowers or pot plants.

## 5. Modelling the phases in a multistage choice process regarding flowers and plants

### 5.1. Introduction

In this section models are described and discussed for each phase in the multistage choice process as depicted in Figure 2. For the explanation of consumer choice in each of these phases essentials of consumer behaviour models will be used as a frame of reference. These essentials are presented in Figure 5.

Figure 5 - Essentials of consumer behaviour models



A short elucidation of Figure 5 will be given. Commercial variables represent the elements of the marketing mix. Social variables are influences from relatives, reference groups or the social class to which one wishes to belong. Examples of situational factors are importance of purchase, time pressure when buying and a household's short-term financial situation.

In Figure 5 a so-called black box has been depicted. It is assumed that incoming information is processed in some way by intervening variables such as way of perception, motives, choice-criteria and attitudes before an actual purchase is made. For example, an enterprise decreases the price of its products in order to stimulate demand. Consumers, however, might experience this price reduction as the first in a series of price reductions and subsequently delay buying.

Finally, experiences with the purchased product(s) may influence the intervening variables and therefore future buying behaviour.

### 5.2. Modelling the expenditure level on cut flowers and pot plants

As we cannot use a demand system as proposed by the economic theory of consumer behaviour to explain the expenditure level on product classes like clothing, food, travelling and flowers and plants, because of a lack of necessary data, we have tried to explain the expenditure level on cut flowers and pot plants from the variables that are disposable in our data set.

Ideally we should relate a household's expenditure level regarding flowers and plants to the variable "income" and other explanatory variables. However, we only dispose of the proxy variable "social class", which variable did not give satisfactory results. Ofcourse, this result does not necessarily imply that the variable "income" do not influence buying behaviour regarding flowers and plants.

To get an idea which factors might influence the buying level regarding flowers and plants, the variables "number of purchases" or "quantity purchased" were used, which gave better results than the variable "expenditure level".

The two examples that follow are in principle based on the data of all households. In the first example, however, data of 738 of the 1000 households for which an additional explanatory variable, viz: "walking distance to nearest supermarket" could be obtained, has been used.

So far, no households are removed on the basis of the criterion as discussed above. The way of analysis, however, remains the same.

In Table 1 the results of a cross-section analysis are given. All explanatory variables are redefined in dummy variables with value 1 when the description holds and value 0 otherwise.

The second example regards a time-series analysis in which the weekly purchases of all 1000 households together are explained from prices, the occurrence of celebration days and summer holidays. The results are given in Table 2 for both an additive and a multiplicative regression model.



Table 1 Results of a regression analysis with the number of flower purchases in two years as variable to be explained and demographic, socio-economic and store-choice variables as explanatory variables.

| explanatory variable  | regression coefficient | t-value          |
|---|------------------------|------------------|
| district 1 <sup>1)</sup>                                    | 26.92                  | 6.92 a)          |
| district 2 <sup>2)</sup>                                    | 19.60                  | 5.69 a)          |
| degree of urbanisation outside district 1 + 2 <sup>3)</sup> | 10.62                  | 2.69 a)          |
| white collar job  | 8.00                   | 2.66 a)          |
| garden  | -6.57                  | -2.06 c)         |
| wife's age between 40 and 65                                | 5.28                   | 2.02 c)          |
| supermarket within a walking distance of 10 minutes         | 10.04                  | 3.81 a)          |
| negative attitude towards housekeeping                      | 3.09                   | 1.14 d)          |
| weekly market as favourite buying place                     | 18.37                  | 5.21 a)          |
| hawker as favourite buying place                            | 17.18                  | 3.15 a)          |
| constant  | 12.87                  |                  |
| $R^2 = 0.205$   | a) $p < 0.005$         | c) $p < 0.025$   |
| $n = 738$   | b) $p < 0.01$          | d) $p \geq 0.10$ |

1) agglomerates of Amsterdam, The Hague and Rotterdam.

2) Provinces of North-Holland, South-Holland and Utrecht, without the three agglomerates.

3) at least 50.000 inhabitants in municipality of residence.

Table 2 Results of a regression analysis with the number of flower stems purchased or the number of pot plants purchased per week as variable to be explained and average price per week, occurrence of celebration days and summer holidays as explanatory variables

| explanatory variable    | cut flowers               |                      | pot plants     |                      |
|-------------------------|---------------------------|----------------------|----------------|----------------------|
|                         | additive model            | multiplicative model | additive model | multiplicative model |
| average price           | -8733(6.20) <sup>1)</sup> | -0.887(7.98)         | -20.93(2.31)   | -0.440(2.23)         |
| Mother's Day            | 2702(7.73)                | 0.679(7.20)          | 235.31(10.71)  | 0.908(5.99)          |
| All Souls' Day          | 299(0.94)                 | 0.103(1.21)          | 38.92(2.18)    | 0.307(2.48)          |
| Christmas               | 642(1.89)                 | 0.246(2.69)          | 114.04(5.95)   | 0.647(4.87)          |
| Summer holidays         | -581(2.19)                | -0.174(2.49)         | -32.85(2.22)   | -0.271(2.60)         |
| constant                | 5877                      | 6.952                | 207.74         | 5.413                |
| $R^2$                   | 0.45                      | 0.50                 | 0.64           | 0.42                 |
| $n$ <sup>2)</sup>       | 103                       | 103                  | 103            | 103                  |
| Durbin-Watson statistic | 2.13                      | 1.96                 | 1.78           | 1.84                 |

1) The values in brackets are absolute t-values

2) 104 weeks minus one because of the correction for autocorrelation

For comments on the results as given in Tables 1 and 2 the reader is referred to Van Tilburg (1979).

5.3. Modelling the choice between homogeneous flower groups within the product class cut flowers and pot plants

As the product class of cut flowers and pot plants contains many items it is assumed that first a choice is made between homogeneous flower groups. Given this assumption, the question can be raised of how many flower groups can be distinguished, Flower groups can be derived in an indirect way by computing a purchase-relationship matrix K with typical elements

$$k_{ij} = \frac{a_{ij}}{a_i + a_j - a_{ij}} \quad \text{with } i, j = 1, 2, \dots, n$$

where

$n$  = the number of distinguished flowers and plants

$a_{ij}$  = the number of households that has bought both products  $i$  and  $j$

$a_i$  = the number of households that has purchased product  $i$

Multidimensional scaling has been applied to the coefficients  $k_{ij}$  in order to trace flower groups (like Wierenga (1976) for milk and milk products). In this way five subgroups could be distinguished. These are current cut flowers, the remaining cut flowers, current flowering pot plants, the remaining flowering pot plants and green pot plants.

As already mentioned, we wish to apply a conditional demand system (e.g. Philips 1974) to model the choice between flower groups. Well-known models that may be suitable for this purpose are the Rotterdam model (e.g. Barten 1966, Theil 1975, 1976), the Linear Expenditure System (e.g. Philips 1974, Theil 1975) and the Indirect Addilog Model (e.g. Somermeijer and Langhout 1972, Theil 1975).

For the choice between these demand systems two criteria will be used. First, the demand system must be able to handle zeroes for quantities demanded and total budget, because the data of individual households are used in the analysis. Second, it must be easy to incorporate explanatory variables other than total budget and prices in the model.

An evaluation of the three models based on these two criteria is given in Table 3.

Table 3 Evaluation of three demand systems

| Model                           | zeroes allowed for quantities? | ease to incorporate budget? | other explanatory variables |    |
|---------------------------------|--------------------------------|-----------------------------|-----------------------------|----|
| Rotterdam Model                 | yes                            | yes                         | not easy                    | 1) |
| Linear Expenditure System (LES) | yes                            | yes                         | easy                        | 2) |
| Indirect Addilog Model (IAM)    | yes                            | no                          | easy                        | 3) |

1) see Barten (1964)

2) see Pollak and Wales (1969)

3) see Blokland (1976)

In the Rotterdam model it is not easy to incorporate variables other than price and income.

The IAM can only be used for households that have bought flowers and/or plants in each period. For the rather small number of households that fulfilled these requirements the results were quite unsatisfactory.

As the LES is based on an additive direct utility function, inferior or complementary products are ruled out. In our opinion flowers cannot be considered to be inferior products which is confirmed by Ostendorf (1975). The same argument holds for pot plants.

Regarding the aspect of complementarity we will first define this concept together with substitutability according to Henderson and Quandt (1958): "Two commodities are substitutes if both can satisfy the same need of the consumer; they are complements if they are consumed jointly in order to satisfy some particular need. These are loose definitions, but everyday experience may suggest some plausible examples. Coffee and tea are most likely substitutes, whereas coffee and sugar are complements"

We conclude that flowers and plants are rather substitutes than complements, which means that there are no objections from that point of view for using the LES for our purpose.

Application of the LES to our data gave quite satisfactory results. This will be illustrated with the following example.

The LES can be specified as follows:

$$q_{hkt} = c_{kt} + \frac{\beta_k}{P_{kt}} (m_{ht} - \sum_{j=1}^K c_{jt} P_{jt}) \quad (1)$$

with  $k = 1, 2, \dots, K$  flower groups  
 $h = 1, 2, \dots, H$  households  
 $t = 1, 2, \dots, T$  periods (in our case quarters)

where

$q_{hkt}$  = the purchased quantity of flower group  $k$  in quarter  $t$  by household  $h$ ,

$m_{ht}$  = household  $h$ 's expenditure on cut flowers and pot plants in quarter  $t$ ,

$P_{kt}$  = the average price for flower group  $k$  in quarter  $t$ .

$c_{kt}$  when redefined as  $c_{hkt}$  can be used to specify explanatory variables other than prices and total budget in the model:

$$c_{hkt} = \alpha_{1k} m_{hk,t-4} + \alpha_{2k} x_{h1} + \alpha_{3k} x_{h2} \quad (2)$$

where for example

$x_{h1} = 1$  if walking distance to the nearest supermarket is less than 10 minutes for household  $h$   
 $= 0$  otherwise

and

$x_{h2} = 1$  if household  $h$ 's dwelling was built before 1945  
 $= 0$  otherwise

Apart from assumptions about the error structure, 20 parameters have to be estimated in the given example. The estimation of the parameters takes place in two cycles. In the first cycle only the  $\beta_k$  and



because many small factors influence the final choice (see Figure 5). For example, the carnations asked for are not available and the consumer has no time to visit other outlets. Other examples of influencing variables are the retailer's advice and the way in which flowers are displayed. Therefore, it is assumed that the choice in the third phase of the multistage choice process can be described and partly explained by a stochastic model of consumer behaviour. (For an extensive treatment of stochastic models of consumer behaviour the reader is referred to Wierenga (1974)).

Several writers (Colard 1975, Kalwani and Morrison 1977) have stressed that the choice of a particular stochastic model to describe consumer behaviour is not a matter of trial, but should be based both on theoretical considerations and empirical testing.

Colard (1975, p.30/31) for example relates the choice of a stochastic model to Howard and Sheth's (1969, p.27) distinction between extensive problem solving, limited problem solving and routinized response behaviour as summarized in Table 5.

Table 5 - Relation between stages of problem solving according to Howard and Sheth and the most suitable stochastic model according to Colard.

| <u>Stages of problem solving</u> | <u>Stochastic model</u>               |
|----------------------------------|---------------------------------------|
| - extensive problem solving      | none                                  |
| - limited problem solving        | Linear Learning Model or Markov Model |
| - routinized response behaviour  | Multinomial Model                     |

Extensive problem solving refers to a situation in which a buyer has not yet developed well-defined and structured choice criteria. Limited problem solving is the stage in which the choice criteria are known, but the buyer is undecided which of a set of alternatives is best for him. Routinized response behaviour is the last stage in which the buyer has strong predispositions toward the alternatives considered.

Colard reserves the first situation for completely new products, the second situation for a new alternative (brand) in a known product class and the third situation for when no new alternatives are considered.

It can be assumed that for habitual buyers the final choice of a flower or plant is a matter of routinized response behaviour. In that case the multinomial model should be applied. Such a theoretical foundation for the choice of a stochastic model greatly simplifies testing. What remains to be done is, when possible, to test data of individual households to see whether they obey a multinomial model or not.

Stochastic models only describe the choice process of one person. This implies that for parameter estimation, persons or households can only be taken together when they have the same probability distribution regarding the faced alternatives.

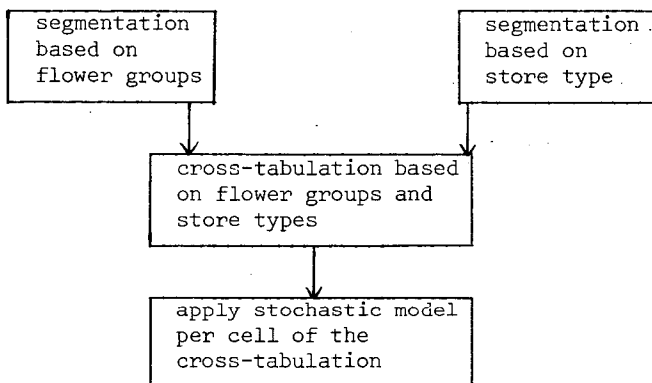
As homogeneity cannot usually be assumed, two solutions have been proposed in the literature. The first is to specify a probability distribution over the parameter(s) of the stochastic model, which means

that heterogeneity is built into the model. A second solution is to divide the sample into homogeneous segments.

A third possibility is to combine both solutions by specifying a probability distribution over the parameter(s) of the stochastic model which describes outcomes of choice processes within a rather homogeneous segment.

An approach to find more homogeneous segments is depicted in Figure 6.

Figure 6 Procedure to find homogeneous market segments regarding the modelling of the final phase in the multistage choice process



First, segments are composed of households with about the same choice regarding the second phase of the multistage choice process. For example, households that buy mainly current cut flowers. Second, because of the great diversity in the marketing approach of distinct types of retail outlets the households are also segmented on the basis of favourite store type. By cross-tabulating these two groups homogeneous subgroups are obtained. Next, household's choice in a particular flower group can be represented by a stochastic model per cell of the cross-tabulation.

A final remark regards the inclusion of factors that may influence the choice of a specific flower or plant in the stochastic model. For how this can be done the reader is referred to Leeflang (1974) and Colard (1975).

## 6. Discussion

In the preceding sections a framework was proposed for the analysis of flower and plant buying behaviour as recorded in a consumer panel.

The central part of the framework considers the assumption of a multistage choice process. The type of households for which this assumption seems acceptable is discussed. A model has been proposed for each phase of the choice process.

A subject for further research is an evaluation of the approach as discussed in this paper. This can be done by comparing the results based on the hypothesis of a multistage choice process with the outcomes of a simple model in which the demand for an individual flower or plant is related to its own price, the price of competing products, etc.

Although the approach as discussed before is particularly directed to cut flowers and pot plants, the question of whether a similar approach can also be applied to other frequently bought agricultural product classes such as vegetables and fruit and milk and milk products must be raised.

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