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TYPICAL FOOD PRODUCTS IN EUROPE: CONSUMER PREFERENCE AND OBJECTIVE ASSESSMENT

TYPIC

PROJECT N° QLK1-CT-2002-02225

TECHNOLOGICAL IMPLEMENTATION PLAN

ANNEX

Method Assessment Forms

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Key Action 1.	Food Nutrition and Health
Area 1.3	Role of Food in Promotion and Sustaining Health with respect to [...] consumer choice [...]
Thematic Action 1.3.1	Consumer needs, attitudes and responses with regard to food products, food processing and labelling

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Method Assessment Form 1. WP1 Typicality assessment with questionnaire

Form filled by: P. Roncales

Method: Typicality assessment with questionnaire (45 participants)
Partner responsible: SC6-a Veterinary Faculty, Univ. Zaragoza) SC1-a, (CTCPA, France)
Type of measurement: Typicality assessment of food chain actors
Application field: Typicality assessment of any kind of food, drink and other items

DESCRIPTION

Food chain actors: Experts which dedicate part of their activities to the definition ans assessment of typicality participated including manufacturers, distributors, managers, public administration and members of academia.
Attributes generation: the attributes can be generated by sending a questionnaire to food chain actors with a broad range of visual, odour, taste and texture attributes. The participants are asked to rate the importance of each attribute for typical product categories. Based on the frequency of mentioned attributes, the most relevant list of attributes is generated.
Typicality assessment: A score card including the most important attributes were sent to food chain actors and for the intensity of each attribute has to be chosen, which describes the highest typicality for a typical product or product category.
Data analysis: The collected data are analysed with statistical models. The objectives are to characterise the underlying data structure, to explain differences in overall typicality by the list of attributes, to select those attributes, which are most important for typicality perception (drivers of typicality).

RANGE

Typicality assessment with food chain experts in a QDA approach allows to measure not only overall typicality, but to explain this complex perception by a list of more precisely defined attributes related to typicality.

LIMITS

Food chain experts were not evaluating real samples. Thus their assessment is based of an typical profile for each product category in their mind.
Food chain actors, especially experts in their particular field, tend to overestimate their own experience and are not willing to accept attributes, which they are not used to. Using the alternative form, no interaction and discussion takes place between food chain actors, which makes it more difficult to generate a comprehensible list.
Food chain actors produce and distribute foods and drinks for consumers, however their view regarding typicality may not reflect to 100% the preference and buying behaviour of consumers.

COST

Time of preparation: one week for writing and sending out questionnaires
Time of measurement: 2 weeks allowing the food chain experts to send back the questionnaires
Time of data processing: 2 weeks
Required skills: MSc familiar with sensory evaluation and professionals survey
Required experience: good experience in sensory analysis
Required p-m: 1 month
Budget of equipment: Marginal cost (cost of one sample measurement): € 50

BENEFITS

Adequacy: high for food and drink items perceived as very typical, weak for commodities and standardised products
Accuracy: depends on the expertise and relevant selection of food chain actors
Reliability: low
Optimal target: Food and drink items which are perceived as very typical

Method Assessment Form 2. WP1 Typicality assessment (QDA with experts)

Form filled by: **U. Fischer**

Method: **Typicality assessment (QDA with experts) (15 to 40 participants)**
Partner responsible: P3 (DLR Rheinpfalz, Germany), SC3 (LWK Rheinland-Pfalz, Germany) SC5 (Sicarex Beaujolais, France), SC6-a Veterinary faculty, Univ. Zaragoza)
Type of measurement: Typicality assessment of food chain actors
Application field: Typicality assessment of any kind of food, drink and other items

DESCRIPTION

Prerequisites: For the protocol a sensory facility is needed to suit at least 10 food chain actors.
Samples: According to a scientific protocol or based on other marketing considerations a range of typical and non typical food or drink items are selected for assessment purpose.
Panel: The panel consists of 20, better 40 relevant food chain actors from the fields of production, marketing, sales, buying agents of super markets, discounters and specialised wine shops, wine and food journalists, members of the regional wine quality certification board and policy makers.
Typicality assessment: An assessment form displays for each attribute generated during the focus group meetings (method assessment form 2) a bi-directional scale is presented, with a mark typical in the middle of this just-about-right scale. Typicality refers to the stereotype of a food or drink item, which is purchased by a normal consumer. It does not reflect the individual archetype of the food chain actor. Sensory perception which is stronger or weaker than the typical intensity, receives marks to the right or left of the typicality mark. Overall typicality was scored on a one directional intensity scale with the highest typicality on the right end of the scale.
Data analysis: The collected data are analysed with statistical models. The objectives are to characterise the underlying data structure, to explain differences in overall typicality by the list of attributes, to select those attributes, which are most important for typicality perception (drivers of typicality).

RANGE

Typicality assessment with food chain experts in a QDA approach allows to measure not only overall typicality, but to explain this complex perception by a list of more precisely defined attributes related to typicality.
Using the bi-directional just-about-right scale enables the assessors to interpret the perceived intensity regarding its positive or negative contribution of overall typicality. A single attribute can be just about right, too strong or too weak.

LIMITS

Food chain actors, especially experts in their particular field, tend to overestimate their own opinion and are not willing to accept attributes, which they are not familiar with. Thus they may not accept the list of attributes generated by others or the unusual just-about-right scale.
Attributes are only explained in a cognitive way. No physical standards are presented. Thus food chain actors may vary in the interpretation of a given attribute.
Food chain actors produce and distribute foods and drinks for consumers, however their view regarding typicality may not reflect to 100% the preference and buying behaviour of consumers.

COST

Time of preparation: 1 week, depends on number and availability of the samples and food chain actors
Time of measurement: 3 hours for 20 wines.
Time of data processing: 1 month
Required skills: lab technicians familiar with sensory evaluation
Required experience: good experience in sensory analysis
Required p-m: 1 ½ month
Budget of equipment: renting of a sensory room (€ 500)
Marginal cost (cost of one sample measurement): € 100

Benefits

Adequacy: high for food and drink items perceived as very typical, weak for commodities
Accuracy: depends on the expertise and relevant selection of food chain actors
Reliability: has to be validated by a control group
Optimal target: Food and drink items which are perceived as very typical

Method Assessment Form 3. WP1 Focus Group with food chain actors

Form filled by: U. Fischer, : P. Roncales

Method: Focus Group with food chain actors (15 participants)
Partner responsible: P3 (DLR Rheinpfalz, Germany) SC3 (LWK Rheinland-Pfalz, Germany) SC5 (Sicarex Beaujolais, France), SC6-a Veterinary Faculty, Univ. Zaragoza), SC-1, CTCPA Rodez
Type of measurement: development of sensory attributes describing typical food and drinks
Application field: Typicality assessment of any kind of food, drink and other items

DESCRIPTION

Focus group participation: Relevant food chain actors are selected from the fields of production, marketing, sales, buying agents of super markets, discounters and specialised wine shops, wine and food journalists, members of the regional wine quality certification board and policy makers.
Generation of attribute list: Based on the sensory evaluation of a representative selection of relevant food and drink items, as well as own expertise, a list of visual, odour, taste and textural sensory attributes are selected which are able to describe in a comprehensible manner the typical sensory characteristics.
Typicality assessment: For typicality assessment, a suitable scale has to be developed, using a one dimensional intensity scale or a bi-directional just-about-right scale with the most typical intensity in the middle of the scale. Suitability of the scale has to be tested prior to its application with other food chain actors.

RANGE

Rapid method used to explore typicality assessment and to validate and quantify the descriptors elicited by means of food chain actors questionnaires. Focus group discussion with relevant food chain actors allows to develop the most relevant sensory attributes to describe typicality of a food or drink item. Incorporating a wide range of actors at different levels of the food chain will lead to a comprehensible list of attributes.

LIMITS

Consensus between food chain actors is not easy to reach, as each one has business objectives. When products are close to standardisation, good elicitation of typicality profiles is hard to obtain. Food chain actors, especially experts in their particular field, tend to overestimate their own experience and are not willing to accept attributes, which they are not used to. Using the alternative form, no interaction and discussion takes place between food chain actors, which makes it more difficult to generate a comprehensible list. Food chain actors produce and distribute foods and drinks for consumers, however their view regarding typicality may not reflect to 100% the preference and buying behaviour of consumers.

COST

Time of preparation: one week for preparation, 3 meetings with food chain actors of 2 hours each. Alternatively: distribution of questionnaires and collection of filled out forms.
Time of measurement: 1 month
Time of data processing: 40h
Required skills: ability to lead a discussion with strong personalities.
Required experience: Good expertise in the particular food or drink item.
Required p-m: 2 p.m.
Budget of equipment: none
Budget of consumables: € 100 – 500 for representative samples of food or drink item
Marginal cost (cost of one sample measurement): 1200€

BENEFITS

Adequacy: good for exploratory stage
Accuracy: low
Reliability: low, depends on the choice of participants of focus group
Optimal target: homogeneous and small segments products with clear delimited category

Method Assessment Form 4. WP1 Sensory profile analysis

Form filled by: **U. Fischer, P. Roncales**

Method: **Sensory profile analysis by trained panel (20 to 25 judges)**
Partner responsible: P3 (DLR Rheinpfalz), P5 (INRA Montpellier), SC6-a Veterinary Faculty, Univ. Zaragoza), SC1-a (CTCPA, France)
Type of measurement: recording the intensity of sensory attributes with a trained panel
Application field: sensory characterisation of an kind of food, drink or item

DESCRIPTION

Prerequisites: For the protocol a sensory facility is needed to suit at least 5 trained judges. A minimum of 13 judges are required, 18 to 25 are optimal.
Samples: According to a scientific protocol or based on other marketing considerations a range of typical and non typical food or drink items are selected.
Attributes generation: In focus group discussion with the judges a representative choice of products are presented and judges are requested to mention those sensory attributes, which describe the best existing differences between the sample. For each attribute, a physical standard is developed and judges have to validate them.
Panel: The panel consists of a minimum of 13, better 18 to 25 trained judges. During training, judges are familiarised with the scale, attributes and the food type. Recognition of physical standards, repeatability and ability to discriminate are monitored. Standard conditions (ISO norms) are used for protocol implementation.
Sensory descriptive analysis: Judges are requested to rate the intensity of each attribute in each sample on a 10 cm unstructured line scale, anchored by the expression weak and strong on the left and right side, respectively. Samples are presented in randomised order following a predefined statistical design. Samples should be evaluated in duplicates, better in triplicates.
Data analysis: The collected data are analysed with statistical models. The objectives are to characterise the underlying data structure, to explain differences in sensory properties, to obtain relationships between sensory attributes, to explore the performance of the whole panel and individual judges and to test the significance between subgroups in the data set.

RANGE

Descriptive data allows to quantify in an objective manner the sensory properties of the samples evaluated and test for statistical significant differences among them. Descriptive data characterise the food and drink items at the same perception level like consumers, the sensory level.
Descriptive data serve as the base to explain the sensory base for preference patterns among consumer and typicality perception of food chain actors. Descriptive data may be explained by physio-chemical methods which are responsible for the chemical or physical stimuli leading to the observed sensory perception.

LIMITS

Trained judges may more sensitive to sensory differences than consumers. Thus differences described as significantly different in descriptive analysis, may not lead to a perceived difference among consumers. The organisation and training of a sensory panel needs a lot of expertise and a well equipped sensory facility. However, sensory analysis can be performed by external agencies or academic research institutions. Sensory perception follows non linear relationships between stimuli concentration and perceived intensity. However, most physical-chemical analysis obey a linear relationship. Thus explaining sensory patterns by physical-chemical analysis is not trivial.

COST

Time of preparation:	4 weeks of panel selection and training
Time of measurement:	6 weeks, depending on number of samples per session (4 to 6 samples/ session)
Time of data processing:	2 weeks
Required skills:	MSc in food science/nutrition with one year experience in sensory analysis
Required p-m:	3 pm
Budget of equipment:	€ 6000 (computer, software, scanner (paper version)), € 12000 for computerised version. Less costly when externalised

Marginal cost (cost of one sample measurement): € 600

BENEFITS

Adequacy: high if the panel is well trained and motivated
Accuracy: high, if the panel is well trained and sample handling is professional
Reliability: high, if the panel is well trained and sample handling is professional
Optimal target: Any food or drink or other item, which displays perceivable sensory differences.

Method Assessment Form 5. WP2 Consumer scanned data panel

Form filled by: **G. Giraud**

Method: **Consumer scanned data panel**
Partner responsible: ENITA Clermont France, CITA Zaragoza Spain
Type of measurement: recording of consumers' actual purchasing behaviour
Application field: any kind of good with code bar sold in supermarkets with a scanner at the cash-desk

DESCRIPTION

The protocol needs close relationships with a distributor chain and consists with:
Selection of the panel: The panel is built with the frequent purchasers of the selected products. They are volunteers and chosen among the holders of the distributor's loyalty card in the selected region(s). The panel should counts more than 800 consumers in order to ensure sufficient number of observations over one year.
Screening of the selected products on shelves: The shelves of retailers are often changing according to seasons and promotion campaigns. Recording purchasing data needs a monitoring of what is changing on the shelves.
Observation of the purchases: The data of panellists' purchases are collected during 12 months. They relate to the whole family of selected products, sometimes with competitor products.
Data analysis: The data collected are analysed with stochastic models in order to obtain explanation not limited by linear loyalty of purchases.

RANGE

Scanned data panel allows to track actual purchasing behaviour of identified consumers over one year, while face to face interview and self reporting don't.
Scanned data panel is able to monitor loyalty behaviour combined with variety seeking, as it covers long time with recorded data. Scanned data panel is very convenient for clustering and consumer segmentation on the basis of long lasting recording
In addition scanned data panel could be enriched by consumer tests such as hedonist test and/or trade-off measurements and face to face interview with the same panellists. This enrichment allows comparing verbal, hedonist and actual responses with the same panellists.

LIMITS

Supermarkets do not fit very well with the measurement of purchases of small-scale productions like most of PDO-PGI labelled food products. Panels from marketing agencies are focusing on strong brands but are porous regarding regional and local products with low frequency of purchase.
Panel agencies are not allowed to transfer the name and address of their own panellists to third party, but distributors use their own databases. Thus the use of identified and volunteer panellists for hedonist test and trade-off measurement is not possible with data from panel agencies. In this case, the present protocol needs to recruit an *ad hoc* panel.
When focussing on consumer behaviour, not on market share of products, it is worthy to pay attention to suitability between observed products and their consumers. *Ad hoc* panel has not to be representative of usual market, but needs to be significantly correlated to the relevant niche market.

COST

Time of preparation: several meetings with the retailer partner, two months for recruitment
Time of measurement: four separate weeks for shelves monitoring, one day for data collection
Time of data processing: two months
Required skills: MBA in marketing studies
Required experience: good knowledge of mass-marketing techniques and database management
Required p-m: 6 months engineer, 2 months technician
Budget of equipment: 2000 € for laptop and 1000 € for software licence (if not bought before)
Budget of consumables: 1000 €
Marginal cost (cost of one sample measurement): 1300 € (basis 20 selected products)

BENEFITS

Adequacy: high for strong brands, medium for regional products
Accuracy: high for purchases recording, medium for market share measurement
Reliability: high
Optimal target: strong branded goods

Method Assessment Form 6. WP2 Consumer hedonist test

Form filled by: A.Lebecque

Method: Consumer hedonist test
Partner responsible: ENITA Clermont France, CITA Zaragoza Spain
Type of measurement: descriptive and quantitative test in order to analyse consumer preferences or satisfaction
Application field:

RANGE

LIMITS

Need a panel higher than 100.

COST

Time of preparation: long (several days)
Time of measurement: 2 X 20 minutes per test (10 products tested)
Time of data processing: 2 weeks
Required skills: high
Required experience: high
Required p-m: 14 p.m
Budget of equipment: medium
Budget of consumables: High
Marginal cost (cost of one sample measurement)

BENEFITS

Adequacy: high
Accuracy: medium to high (depends on the number of consumers)
Reliability: high
Optimal target: consumer preferences

Method Assessment Form 7. WP2 Consumer focus group

Form filled by: G. Giraud, C. Amblard

Method: Consumer focus group (8 participants)
Partner responsible: FfM (P7)
Type of measurement: Qualitative method – Discussion of groups of consumers on a specific purpose
Application field: Category of products (dry-cured ham and red wine)

DESCRIPTION

A focus group is generally a group of 8 to 12 individuals who discuss about a defined topic under the direction of a moderator who promotes interaction and assures that the discussion remains on the focused topic

RANGE

Facilitation of elicitation of consumer expectations, knowledge and concerns about a specific topic
Generation of wording from consumer vocabulary
Generation of items in order to realise questionnaire for quantitative survey

LIMITS

Interaction between participants is specific and doesn't allow any generalization
Limited representativeness

COST

Time of preparation: 7 working days on two weeks (elaboration of the guide for moderator, of the protocol, recruitment of participants, organisation of the meeting)
Time of measurement: Two hours
Time of data processing: One week per group (transcription, analysis and interpretation of data)
Required skills: MBA consumer survey and marketing techniques. moderator: attentive listening and has respect for participants, communicates clearly in writing and orally, adequate background knowledge on the topic of discussion – analysis: qualitative data analysis
Required experience: Medium - Having conducted at least one focus group
Required p-m: 1 p-m
Budget of equipment: One computer, one camera and one dictaphone
Budget of consumables: 240 € (30 € / consumer, including a gift of 20 €)
Marginal cost (cost of one sample measurement): 210 € / consumer, including structural and personnel costs (total: 1675 €)

BENEFITS

Adequacy: High
Accuracy: Medium (depends on discussion)
Reliability: Medium (depends on knowledge of participants), high for elicitation, low for generalization
Optimal target: Identification of consumer expectations, knowledge and concerns about any specific topic (e.g.: PDO labelled food products, GMOs or any societal issue as ethics and enterprises, gender issue, perception of food traceability)

Method Assessment Form 8. WP2 Conjoint Analysis

Form filled by: G. Giraud, C. Amblard

Method: Conjoint Analysis (100 consumers)
Partner responsible: FfM (P7)
Type of measurement: Quantitative method – Trade-off measurement
Application field: Any kind of good with different possible combination of attributes

DESCRIPTION

Conjoint analysis is a market research tool for developing effective product design. Consumers rank cards defined by particular levels of attributes. It consists of a trade-off measurement to determine the main attributes expected by the consumers, and to measure the weight and attractiveness of typicality elements in consumer perception by means of statistical software.
Software calculation requires orthogonal plan of combined attributes and modalities in order to find out each individual part worth of each proposed combination of attributes.

RANGE

Identification of the main typicality attributes expected by consumers
Experimental measurement of preferences of combined attributes
Avoidance of pure declarative responses

LIMITS

Difficulty for the consumer to rank more than 10 cards
Risk of cognitive overloading
The obtaining of an orthogonal plan may required too much cards which may be different from the reality of market (some attributes are not fully independent, eg. Price level and brand, breed and region of origin, …).

COST

Time of preparation: one month (realisation of the orthogonal plan, elaboration of the cards, recruitment and training of interviewers, organisation of surveys)
Time of measurement: 17 hours (10 minutes / consumer)
Time of data processing: Two weeks (data capture, analysis and writing)
Required skills: Social science knowledge, software SPSS (or equivalent) knowledge, ability to create a sub-program of conjoint analysis, quantitative data analysis
Required experience: High
Required p-m: 1,5 p-m
Budget of equipment: A computer – Software SPSS (or equivalent)
Budget of consumables: 1000 € (10 € / consumer, including mailing, phone calls and different consumables…)
Marginal cost (cost of one sample measurement): 50 € / consumer, including structural and personnel costs (total: 5000 €)

BENEFITS

Adequacy: High
Accuracy: High
Reliability: High (if Ordinary Last Square statistical method used for analysis)
Optimal target: Measurement of consumer preference for an attribute behind the trade-off of different levels of different combinations of attributes

Method Assessment Form 9. WP2 Price / Preference Trade-off

Form filled by: G. Giraud, C. Amblard

Method: Price / Preference Trade-off (100 consumers)
Partner responsible: FfM (P7)
Type of measurement: Quantitative method
Application field: Choice of a limited number of sets of products among samples

DESCRIPTION

Consumers are asked to rank several sets of products in accordance to their preferences. All samples are presented with the same ratio value for money

RANGE

Identification of a trade-off between price and quantity according to brand and origin
Measurement of actual choice
Avoidance of pure declarative responses

LIMITS

Limited number of choice (3-4 maximum)

COST

Time of preparation: One week (Choice of sets, labelling, recruitment of participants and interviewers, organisation of survey)
Time of measurement: 9 hours (5 minutes / consumer)
Time of data processing: Three days (data capture, analysis and writing)

Required skills: in Social science and data analysis
Required experience: Medium
Required p-m: 0,5 p-m
Budget of equipment: A computer – Software SPSS (or equivalent)
Budget of consumables: 1000 € (10 € / consumer)
Marginal cost (cost of one sample measurement): 30 € / consumer, including structural and personnel costs (total: 3000 €)

BENEFITS

Adequacy: High
Accuracy: Low (due to limited choice tested)
Reliability: High
Optimal target: Measurement of price preference trade-off towards different brands or domestic and foreign goods

Method Assessment Form 10. WP2 Attitude questionnaire

Form filled by: M. Petzoldt

Method: Attitude questionnaire (100 consumers)
Partner responsible: FfM (P7)
Type of measurement: Quantitative method, Measurement of attitudes towards a specific topic
Application field: Attitudes can be measured for any topic of interest

DESCRIPTION

In market research a questionnaire is used in order to investigate consumers` attitudes, knowledge and concerns towards a specific topic of interest.
Consumers have to answer several questions. For the purpose of investigation of attitudes normally statements/items (dealing with the topic) are formulated, on which the consumers have to quote their level of agreement or disagreement. Several kind of scales are already developed depending on the purpose of measurement (satisfaction or opinion, practices, …) and population targeted (children, adolescents, adults, elderly, …). On the basis of the attitude questionnaire the sample can be described.
In a further step the results of attitude questionnaires can be used for segmentation of consumers and for explaining the results of other social science methods (e.g. conjoint analysis, hedonist tests, panel survey).

RANGE

Investigation of consumers´ attitudes, knowledge and concerns about any specific topic
Avoidance of cognitive overloading

LIMITS

Pure declarative responses
Risk of responses in accordance to “social desirablility”
Risk of interviewer´s influence
Questionnaires on practices are more reliable than those on opinion

COST

Time of preparation: one month (realisation of questionnaire (often based on focus group discussions analysis), pre-test, recruitment and training of interviewers, organisation of surveys)
Time of measurement: one week for 40 to 70 filled-in questionnaires (7-15 minutes /consumer) (15 minutes = maximum)
Time of data processing: 3 weeks (data capture, data analysis, reporting)
Required skills: knowledge of social sciences and quantitative data analysis, experience with software (SPSS or equivalent), deep knowledge about the topic to be investigated
Required experience: Medium
Required p-m: 2 p-m for 40-70 questionnaires
Budget of equipment: computer-software (e.g. SPSS)
Marginal cost (cost of one sample measurement): 40 €

BENEFITS

Adequacy: Medium
Accuracy: Medium
Reliability: Medium
Optimal target: Measurement of consumers´ attitudes, concerns, expectations and knowledge towards any specific abstract topic like opinion

Method Assessment Form 11. WP3 Front-face fluorescence spectroscopy

Form filled by: E. Dufour

Method: Front-face fluorescence spectroscopy
Partner responsible: ENITA-
Type of measurement: Fluorescence spectroscopy
Application field: All the products (ham, wine, cheese, milk, honey, meat, cereals, flour, ….) with intrinsic fluorescent probes

RANGE

Not determined

LIMITS

Not determined

COST

Time of preparation : no preparation
Time of measurement : between few seconds to 2 min., depending on the experimental conditions
Time of data processing : few seconds
Required skills : no specific skills; can be performed by a technician in the plant
Required experience
Required p-m
Budget of equipment : between 8 000 € and 20 000 €; depending on the characteristics of the fluorimeter
Budget of consumables : quartz cuvette (80 €)
Marginal cost (cost of one sample measurement) : 40 €

BENEFITS

Adequacy
Accuracy
Reliability
Optimal target

Method Assessment Form 12. WP3 Mechanical Property Measurement

Form filled by: I. Colquhoun

Method: Mechanical Property Measurement
Partner responsible: IFR
Type of measurement: Physical method
Application field: Ham or other solid food materials

DESCRIPTION

A tensile test was performed stretching the ham until failure with recording of the force – distance curve. Samples were taken from the hams cut into rectangular strips 60 x 4mm, slice thickness as received. Test strips were cut parallel to the fibres for the two muscle types *BF* and *SM*. 30 strips (15 x 2 muscle types) were cut and measured for each sample. Clamps at the two ends of the test strip were adjusted to be exactly 40mm apart at the start of the test. Three parameters (failure stress, failure strain and stiffness) were derived from the force distance curve and values of each parameter compared for different samples by ANOVA. Principal component analysis of the full force distance curves was also carried out.

RANGE

Simple test intended to approximate measurement of forces involved in chewing ham

LIMITS

Lack of repeatability in values measured for replicate samples was a major problem. Significant differences established between muscle types and to a lesser extent between countries.

COST

Time of preparation: 15 min per sample
Time of measurement: 30 min (2min x 15 replicates)
Time of data processing: 2 weeks (parameter derivation). 1 month (further analysis)
Required skills: dexterity in cutting test pieces
Required experience: limited (to do measurement), high (to develop data analysis methods)
Required p-m: 2
Budget of equipment: 20000€
Marginal cost (cost of one sample measurement): 50€

BENEFITS

Adequacy: not adequate fro the level of discrimination required
Accuracy:
Reliability: less reliable with hams than with other food types
Optimal target:

Method Assessment Form 13. WP3 HPLC-mass spectrometry of hams

Form filled by: I. Colquhoun

Method: HPLC-mass spectrometry of hams
Partner responsible: IFR
Type of measurement: HPLC/MS (electrospray positive mode)
Application field: metabolomics, metabolite profiling

DESCRIPTION

Analysis of the hams was carried out by reversed phase HPLC/MS. The class of compounds analysed (moderately polar non-volatiles) was comparable to that in NMR because the extraction method was similar. LC/MS, however, is a more sensitive method so a wider range of compounds is measured and the individual compounds are explicitly quantified although their identities are not necessarily known.

RANGE

10-1000 $ug.ul^{-1}$

LIMITS

1 $ug.ul^{-1}$
Not all the measurable compounds have yet been identified. The compounds measured (here the polar fraction) depend on the extraction solvent. Although not done here it would be possible to modify the extraction procedure so that both polar and lipid components were measured.

COST

Time of preparation: 10 samples per day
Time of measurement: 60 min
Time of data processing: data transfer: 1 day; statistics: 2 weeks
Required skills: chromatography, spectrometry, statistical techniques
Required experience: in all above
Required p-m: 1.5 for 42 hams
Budget of equipment: 200,000€
Marginal cost (cost of one sample measurement): 20€

BENEFITS

Adequacy: metabolite profile is thought to depend on maturation time (this parameter tightly correlated with others in the samples examined)
Accuracy: good
Reliability: good if appropriate quality controls applied
Optimal target: metabolites in many foods

Method Assessment Form 14. WP3 Protein extraction, electrophoresis

Form filled by: I. Colquhoun

Method: Protein extraction, electrophoresis
Partner responsible: IFR
Type of measurement: 1D gel electrophoresis (50-150 kDA)
Application field: protein separation

DESCRIPTION

42 ham samples of known origin were used in the study but 19 Spanish, 18 French were used for data anlaysis. From each sample, four protein fractions were extracted (from fraction 1 – most soluble to fraction 4 – least soluble). Constituent proteins were separated and semi-quantified by 1D gel electrophoresis (details in DL-9). Sufficient material was prepared to allow each fraction to be analyzed in triplicate lanes. The complete extraction process was carried out twice. An experimental design was generated which randomly allocated the 24 specimens (4 fractions × duplicate extractions × triplicate lanes) originating from each sample to different gels and lane positions. Also allocated to random positions on each gel were at least two reference lanes, for containing the reference proteins, and at least one empty lane. In total, 134 gels were prepared and 118 data processed, each including up to 9 lanes of sample data.

RANGE

Loading of 1 ug of protein per lane

LIMITS

1 ug of protein (target) was easily detected

Lengthy sample preparation. Further mass spec analysis of those bands found most useful for discrimination would be interesting but limited resolution of 1D gel technique could be a problem.

COST

Time of preparation: development: 8 months; 42 hams X 6 replicates X 4 fractions: 3 months
Time of measurement: 3 months (simultaneously with preparation)
Time of data processing: 2 months
Required skills: High in protein analysis and in data pre-processing and multivariate analysis
Required experience: strong experience in electrophoresis
Required p-m: 12 months
Budget of equipment: 9000€
Marginal cost (cost of one sample measurement): 90€ (6 replicates X 4 fractions per sample)

BENEFITS

Adequacy: country discrimination achieved but variability in replicate samples prevented deeper exploration
Accuracy:
Reliability: first attempt to get quantitative information by this technique for such a large number of samples. Fractionation requirement was complication (spill over of proteins from one fraction to another)
Optimal target: Commonly used qualitative technique: any application where additional quantitative data is required

Method Assessment Form 15. WP3 ^{1}H and ^{13}C NMR of wines

Form filled by: I. Colquhoun

Method: ^{1}H and ^{13}C NMR of wines
Partner responsible: IFR
Type of measurement: wine, liquid foods in general
Application field: food profiling

DESCRIPTION

Two methods were used: ^{13}C NMR on a 400MHz NMR instrument and ^{1}H NMR on a 600MHz. For ^{13}C NMR the wines had to be freeze dried and redissolved in D_2O and the pH of each wine adjusted to the same value. This was necessary in order to concentrate the wines to get the spectrum in an acceptable length of time (2 hrs per sample but each sample was run 3 times and the 3 spectra eventually co-added so 6 hrs run time per sample).
The 600MHz NMR machine only became available late in the project but it allowed measurement of all 120 wines in a much shorter time: no concentration was required, only pH adjustment and addition of 10% D_2O. Two experiments were performed, one in which only the water signal was suppressed (massively strong ethanol and glycerol signals left relative to everything else) and one in which the water and ethanol peaks were all suppressed. Both experiments took about 15 mins

RANGE

Measures the most abundant compounds. ^{13}C NMR gives better resolution but poor signal to noise. ^{1}H NMR gives more complex spectra but better signal to noise (more compounds detected in shorter time). Applicable to all liquid foods or food extracts

LIMITS

Concentration needed for ^{13}C NMR risks losing components and altering chemical composition. ^{1}H NMR preferable as no concentration is done. If no NMR suppression of ethanol signals is carried out it affects signal to noise of other signals. Suppression of ethanol 'bleaches' spectral regions around the two ethanol signals (potentially losing information about other compounds). However signal to noise of remaining regions is much better.

COST

Time of preparation: 24 hrs for 20 samples (^{13}C), 10 mins per sample (^{1}H)
Time of measurement: 6 hrs (^{13}C), 30 mins (^{1}H, two methods)
Time of data processing: 5 mins per sample (pre-processing), 2 weeks (whole set, data analysis)
Required skills: organisation, pipetting
Required experience: NMR (high to set up experiment, medium to run routinely) data analysis (high)
Required p-m: 6 (^{13}C), 1 (^{1}H)
Budget of equipment: 150,000€ (400MHz NMR); 450,000€ (600 MHz NMR)
Marginal cost (cost of one sample measurement): 60€ (^{13}C); 15€ (^{1}H)

BENEFITS

Adequacy: ^{13}C only effective for Beauj vs Dorn distinction. 1H seems better eg some separation of Dorn according to producer/distribution type (estate or co-op vs winery or discount)
Accuracy:
Reliability: ^{1}H shows good repeatability, ^{13}C affected by lengthy preparation requirement
Optimal target: Other beverages – wine is one of the most difficult for NMR because of the ethanol content but ^{1}H NMR is promising provided spectrometer allows sophisticated signal suppression experiments

Method Assessment Form 16. WP3 ^{1}H NMR of hams

Form filled by: I. Colquhoun

Method: ^{1}H NMR of hams
Partner responsible: IFR
Type of measurement: profiling of polar metabolites in aqueous ham extract
Application field: food profiling

DESCRIPTION

Fat is removed from the ham, muscle tissue is frozen and powdered. Weighed amount of tissue is extracted into dilute acid solution, filtered, solution is pH adjusted and transferred to NMR tube. ^{1}H NMR spectra are run with suppression of the residual water signal (extraction was directly into deuterated solvent). About 30-40 (identified) major metabolites are measured simultaneously. Principal component analysis is carried out on the processed whole spectral traces.

RANGE

Applicable to many solid foods. Metabolites measured depend on extraction procedure. Similar to HPLC/MS method for hams but in principle all compounds with hydrogen atoms are detectable (the compound does not have to be ionisable or retained on a chromatography column). Because all compounds are measured simultaneously explicit quantification of a large number of compounds is difficult but the quantitative information is present in the spectral traces.

LIMITS

Lower sensitivity than HPLC/MS means that fewer compounds are detected. The data processing however is simpler.

COST

Time of preparation: 60 mins per sample
Time of measurement: 20 mins per sample
Time of data processing: 5 mins per sample (pre-processing), 2 weeks (data analysis, whole data set)
Required skills: organisation, standard laboratory skills
Required experience: NMR and data processing (medium-good)
Required p-m: 3
Budget of equipment: 150,000€ (400MHz NMR)
Marginal cost (cost of one sample measurement): 15€

BENEFITS

Adequacy: good discrimination between Iberian and French, Teruel intermediate
Accuracy:
Reliability: good level of repeatability
Optimal target: major metabolites (amino acids, organic acids, small peptides, choline compounds etc) in muscle tissue.

Method Assessment Form 17. WP3 Liquid-liquid extraction / fractionation - HRGC

Form filled by: J. Schroeden

Method: Liquid-liquid extraction / fractionation - HRGC
Partner responsible: DLR (P3)
Type of measurement: gas chromatography
Application field: liquid samples

DESCRIPTION

The liquid-liquid extraction is the sample preparation for the gas chromatography-olfactometry. The wine samples are extracted with a solvent mixture and concentrated with a vigreux distillation column. The extracts are used to separate, identify and quantify the sensory relevant compounds by performing an aroma extract-dilution analysis.

RANGE

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LIMITS

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COST

Time of preparation ½ hour + 24 hours extraction time + 8 hours fractionation + 4 hours concentration
Time of measurement -- sample preparation for GC/Olfactometry
Time of data processing --
Required skills can be performed by a trained technician
Required experience --
Required p-m
Budget of equipment ~ 1000 € (rotation perforator; cooler; columns;..)
Budget of consumables ~25 € (solvents;silica gel;...)
Marginal cost (cost of one sample measurement) 150 €

BENEFITS

Adequacy	optimum for extraction of liquid food samples
Accuracy	--
Reliability	High
Optimal target	extraction of liquid food samples

Method Assessment Form 18. WP3 SPME (Solid Phase Micro Extraction)-HRGC

Form filled by: J. Schroeden

Method: SPME (Solid Phase Micro Extraction)-HRGC
Partner responsible: DLR (P3)
Type of measurement: Headspace - gas chromatography
Application field: liquid samples – volatile analysis

DESCRIPTION

Volatile compounds of wine samples in the gaseous head space are adsorbed on the surface of a solid-phase-micro-extraction fibre. The adsorbed compounds are released by thermo desorption in the injector of a gas chromatograph. The compounds are detected by a flame ionisation detector.

RANGE

all red wines

LIMITS

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COST

Time of preparation ½ hour
Time of measurement 1 hour
Time of data processing 1 hour
Required skills no specific skills, can be performed by a technician
Required experience
Required p-m
Budget of equipment ~ 50000 € (depends on gc-system; auto sampler etc.)
Budget of consumables 2 €
Marginal cost (cost of one sample measurement) 30 €

BENEFITS

Adequacy	Optimum for the wine aroma analysis
Accuracy	--
Reliability	High
Optimal target	Individual contribution of volatiles to wine aroma.

Method Assessment Form 19. WP3 Gas Chromatography Olfactometry, HRGC

Form filled by: J. Schroeden

Method: Gas Chromatography Olfactometry, HRGC
Partner responsible: DLR (P3)
Type of measurement: gas chromatography
Application field: all extractable samples /food samples

DESCRIPTION

Volatile compounds are responsible for the aroma of wine. The method to determine the sensory relevant compounds is aromaextract-dilutuion analysis.
The wine samples are extracted and analysed by gas chromatography .The extracts are diluted stepwise by a factor of 10 and sniffed by two persons in parallel. The compounds are identified and quantified with reference substances, GC/MS and Kovats retention indices determined by GC/FID.

RANGE

all red wines

LIMITS

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COST

Time of preparation no preparation (preparation is liquid-liquid extraction/fractionation)
Time of measurement 20 hours (2 judges)
Time of data processing 5 hours
Required skills olfactometry performed by trained judges
Required experience judges have to be trained on method
Required p-m
Budget of equipment 30000 € depends on GC-system (GC + Sniff system)
Budget of consumables --
Marginal cost (cost of one sample measurement) 300 €

BENEFITS

Adequacy	
Accuracy	--
Reliability	High
Optimal target	Detection of the sensory relevant flavour compounds in red wines and all other food

Method Assessment Form 20. WP3 Solid Phase Micro-extraction (SPME)-HRGC

Form filled by: D. Garcia Gonzales

Method: Solid Phase Micro-extraction (SPME)-HRGC
Partner responsible: CSIC (P4)
Type of measurement: Physicochemical
Application field: Ham aroma

DESCRIPTION

Ham volatiles are concentrated by static-headspace and adsorbed on a solid phase microextraction fibre. Then, they are released by thermo-desorption into a gas chromatograph. Volatile compounds are detected by means of a flame ionisation detector (FID).

RANGE

ppb to ppm

LIMITATIONS

None

COST

Time of preparation: 180 min
Time of measurement: 86 min
Time of data processing: 180 min
Required skills: Chemist
Required experience: High
Required p-m:
Budget of equipment: 52000 €
Budget of consumables:150 €
Marginal cost (cost of one sample measurement): Not determined

BENEFITS

Adequacy: Optimum for the ham aroma analysis
Accuracy: <10% (RSD_r)
Reliability: High
Optimal target: Individual contribution of volatiles to ham aroma. Ham characterization & authentication.

Method Assessment Form 21. WP3 Electronic nose based on MOS sensors

Form filled by: D. Garcia Gonzales

Method: Electronic nose based on MOS sensors
Partner responsible: CSIC (P4)
Type of measurement: Physicochemical
Application field: Ham aroma

DESCRIPTION

The temporary and reversible adsorption of the volatile reducing compounds at the sensor surface changes its electrical resistance. Thus, the sensor response depends on the concentration of some volatile compounds in the sample. An array of metal oxide sensors (MOS) has been used in this study.

RANGE

µVolts to Volts

LIMITATIONS

None

COST

Time of preparation: 40 min
Time of measurement: 10 min
Time of data processing: 120 min
Required skills: Physics/Chemist
Required experience: Medium
Required p-m:
Budget of equipment: 72000 €
Budget of consumables: 100 €
Marginal cost (cost of one sample measurement): Not determined

BENEFITS

Adequacy: High for the global aroma information
Accuracy: <10% (RSD_r)
Reliability: High
Optimal target: The whole ham aroma. Ham characterization & authentication

Method Assessment Form 22. WP3 TOF-MS

Form filled by:

Method: TOF-MS
(cf. analytical protocol “Flow injection electrospray / APCI ionisation mass spectrometry of wines for characterisation of their polyphenolic fraction”)
Partner responsible: INRA-SPO (P5b)
Type of measurement: Mass spectrometric rapid method
Application field: To characterise polyphenols in red wines

RANGE

All red wines

LIMITS

groundless (rather qualitative information)

COST

Time of preparation 1 min
Time of measurement 3 min
Time of data processing 1 min
Required skills: practice of mass spectrometry analysis and thorough knowledge on wine phenolic composition
Required experience: six month training (technician or above)
Required p-m: 48 samples/ day (cleaning necessary)
Budget of equipment: 250 000 euro
Budget of consumables: 15 000 euro/year (2 euro / sample)
Marginal cost (cost of one sample measurement)
5 euro/sample
25 euro/sample, including structural and personnal costs

BENEFITS

Adequacy
Accuracy
Reliability
Optimal target

Method Assessment Form 23. WP3 Thiolysis

Form filled by: V. Cheynier, S. Preys

Method: Thiolysis
(cf. analytical protocol “Tannin analysis in wines by thiolysis without fractionation”)
Partner responsible: INRA-SPO (P5b)
Type of measurement: Chromatographic reference method
Application field: To quantify tannins in red wines

RANGE

All red wines

LIMITS

LOD = 0.67 mg/l, and LOQ = 2.23 mg/l (total quantity of tannins)

COST

Time of preparation 45 min
Time of measurement 1h15
Time of data processing 15 min
Required skills: practice of HPLC analysis and thorough knowledge on wine phenolic composition; handling of toxic and unpleasant reagents
Required experience: six month training (technician or above)
Required p-m: 8 samples/ day
Budget of equipment:
45 000 euro (HPLC-DAD - 180 000 euro including MS detector), plus 5000 euro (rotary evaporator), 250 euro (bain-marie), 4500 euro (laminar flow hood)
Budget of consumables: 24 000 euro/year (20 euro / sample)
Marginal cost (cost of one sample measurement)
150 euro/sample
600 euro/sample, including structural and personal costs

BENEFITS

Adequacy
Accuracy
Reliability
Optimal target

Method Assessment Form 24. WP3 HPLC-DAD

Form filled by: V. Cheynier, S. Preys

Method: HPLC-DAD
(cf. analytical protocol “Phenolic compositional analysis by HPLC-DAD”)
Partner responsible: INRA-SPO (P5b)
Type of measurement: Chromatographic reference method
Application field: To quantify phenolic acids, flavonols, and red pigments in red wines

RANGE

All red wines

LIMITS

LOD from 1.3E-3 to 1.1E-2 mg/l, and LOQ from 4.3E-3 to 3.5E-2 mg/l depending on the molecules

COST

Time of preparation 5 min
Time of measurement 1h30
Time of data processing 30 min
Required skills: practice of HPLC-DAD (and MS analysis for method development and monitoring) and thorough knowledge on wine phenolic composition
Required experience: six month training (technician or above)
Required p-m: 8 samples/ day (16 in HPLC-DAD if automatic injection is available 24h/day)
Budget of equipment : 45 000 euro (HPLC-DAD - 200 000 euro including MS detector)
Budget of consumables: 18 000 euro/year (15 euro / sample)
Marginal cost (cost of one sample measurement)
30 euro/sample (50 euro/sample with MS analysis)
150 euro/sample (240 euro/sample with MS analysis), including structural and personnal costs

BENEFITS

Adequacy
Accuracy
Reliability
Optimal target

Method Assessment Form 25. WP3 HPLC-DAD

Form filled by: V. Cheynier, S. Preys

Method: HPLC-DAD
(cf. analytical protocol "Phenolic compositional analysis by HPLC-DAD")
Partner responsible: INRA-SPO (P5b)
Type of measurement: Chromatographic reference method
Application field: To quantify phenolic acids, flavonols, and red pigments in red wines

RANGE

All red wines

LIMITS

LOD from 1.3E-3 to 1.1E-2 mg/l, and LOQ from 4.3E-3 to 3.5E-2 mg/l depending on the molecules

COST

Time of preparation 5 min
Time of measurement 1h30
Time of data processing 30 min
Required skills: practice of HPLC-DAD (and MS analysis for method development and monitoring) and thorough knowledge on wine phenolic composition
Required experience: six month training (technician or above)
Required p-m: 8 samples/ day (16 in HPLC-DAD if automatic injection is available 24h/day)
Budget of equipment : 45 000 euro (HPLC-DAD - 200 000 euro including MS detector)
Budget of consumables: 18 000 euro/year (15 euro / sample)
Marginal cost (cost of one sample measurement)
30 euro/sample (50 euro/sample with MS analysis)
150 euro/sample (240 euro/sample with MS analysis), including structural and personnal costs

BENEFITS

Adequacy
Accuracy
Reliability
Optimal target

Method Assessment Form 26. WP3 FT-MIR spectroscopy

Form filled by: F. Rwagasore

Method:	FT-MIR spectroscopy
Partner responsible:	CRA W (P8)
Type of measurement:	Physical
Application field:	Wine analysis

RANGE

LIMITS

900 - 3000 cm^{-1}

COST

Time of preparation: depends on the type of sample. For wine analysis there is no preparation the sample is directly injected in the sample holder.
Time of measurement: 6 minutes by measurement
Time of data processing: 1 minute
Required skills: in routine there is no skills required
Required experience: in routine there is no experience required
Required p-m : 50 samples / day / p-m
Budget of equipment: 30000 €
Budget of consumables: 1€
Marginal cost (cost of one sample measurement): € 10/sample

BENEFITS

Adequacy: Good
Accuracy: which parameters for spectroscopy method
Reliability:
Optimal target:

Method Assessment Form 27. WP3 FT-NIR spectroscopy

Form filled by: F. Rwagasore

Method:	FT-NIR spectroscopy
Partner responsible:	CRA W (P8)
Type of measurement:	Physical
Application field:	Ham analysis

RANGE

LIMITS

1100 - 2498 nm

COST

Time of preparation: depends on the type of sample. For ham analysis 10 minutes are necessary to prepare 1 sample.
Time of measurement: 6 minutes by measurement
Time of data processing: 1 minute
Required skills: in routine there is no skills required
Required experience: in routine there is no experience required
Required p-m: - NIR analysis: 50 samples / day/p-m
- Samples preparation + NIR analysis: 20 samples / day / p-m
Budget of equipment: 60000 €
Budget of consumables: 1€
Marginal cost (cost of one sample measurement):
- 10 €/sample (NIR analysis)
- 25 €/sample (NIR analysis + sample preparation)

BENEFITS

Adequacy: Good
Accuracy:
Reliability:
Optimal target:

Method Assessment Form 28. WP3 Texture profile analysis

Form filled by: P. Roncales

Method: Texture profile analysis
Partner responsible: Universidad de Zaragoza (SC6a)
Type of measurement: Instrumental measurement of force-deformation curves
Application field: Determination of ham texture parameters

DESCRIPTION

A Texture Analyser TA.TX2 (Stable Micro Systems Ltd.), with a 25 kg load cell, was used. The sample (*Biceps femoris* and *Semimembranosus)* suffers a compression until it is reduced to a certain percentage of its initial height. This compression is made in two bites. The following parameters were calculated: hardness, adhesiveness, springiness, cohesiveness, chewiness and fracturability.

RANGE

LIMITS

All hams having deformation forces under 25 kg.

COST

Time of preparation: 15 min
Time of measurement: 15 min
Time of data processing: 30 min
Required skills: experience in texture measurements
Required experience: 2-3 sessions
Required p-m:
Budget of equipment: 15000 €
Marginal cost (cost of one sample measurement): 50 €

BENEFITS

Adequacy:
Accuracy:
Reliability:
Optimal target:

Method Assessment Form 29. WP3 Colour measurement

Form filled by: P. Roncales

Method: Colour measurement
Partner responsible: Universidad de Zaragoza (SC6a)
Type of measurement: Reflectance spectrophotometry
Application field: determination of colour CIE L* a* b* parameters

DESCRIPTION

A reflectance spectrophotometer (Minolta CM-2002; Osaka, Japan) was used to measure the surface of dry cured ham (*Biceps femoris* and *Semimembranosus*). This reflectance spectrophotometer uses a Xenon light source, calibrated against a white plate supplied by the manufacturer. The illuminant used were D65 (colour temperature of 6504 ºK) and the standard observer position was 10º. This illuminant was based on actual measurements of the spectral distribution of daylight. The parameters registered were CIE L* (ligthness), a* (redness), and b*(yellowness).

RANGE

LIMITS

No limits

COST

Time of preparation: 10 min
Time of measurement: 15 min
Time of data processing: 30 min
Required skills: experience in reflectance spectrophotometry
Required experience: 2-3 sessions
Required p-m:
Budget of equipment: 10000 €
Marginal cost (cost of one sample measurement): 40 €

BENEFITS

Adequacy:
Accuracy:
Reliability:
Optimal target:

Method Assessment Form 30. WP4 Decision Trees Modelling

Form filled by: C. Amblard

Method: Decision Tree
Partner responsible: ENITAC (P1)
Type of measurement: Exploratory statistical method – Model of consumer behaviour
Application field: Data base analysis

DESCRIPTION

Decision Tree method is an exploratory statistical method to investigate multivariate data with a low number of observations. It is based on conditional likelihood and computerised learning approaches.
Decision Tree is used to predict membership of cases or objects in the classes of a categorical dependent variable from their measurements on one or more predictor variables. It is also a good tool for helping to choose between several courses of action. They provide a highly effective structure within which you can lay out options and investigate the possible outcomes of choosing those options.

RANGE

Decision Tree results are independent of data form and magnitude.
Decision Tree and rules are more easily interpreted than equations.
Decision Tree allows to analyse data with a low number of observations.
Decision Tree can be considered as complementary of factor analysis because it explores data set before using more traditional statistical approaches.

LIMITS

Predicted variables must be qualitative.
Results are based on probabilities.
Decision Tree doesn't give the relative weight of each factor in the explanation of the model.

COST

Time of preparation: One week (preparation of the data base)
Time of measurement: 5 minutes to create one decision tree
Time of data processing: Two weeks (data capture, analysis and writing)
Required skills: Social science knowledge, software AnswerTree (or equivalent) knowledge, and quantitative data analysis
Required experience: High
Required p-m: 1 p-m
Budget of equipment: A computer – Software AnswerTree (or equivalent)
Budget of consumables: 0 €
Marginal cost (cost of one model): non-identified

BENEFITS

Adequacy: High
Accuracy: High (based on probabilities)
Reliability: Medium
Optimal target: Create a model of consumer behaviour