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Structuring consumer preferences with the SEM method

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Abstract

Structuring preferences has been developed with econometric models using functional flexible parametric form and the exploring the perceptions about expressed and latent needs using different multivariate approaches. Purpose of this research is to explore the demand for a new drink using the mean-end chain (MEC) theory and multivariate SEM procedure. The first part is dedicated to description of specialty foods for their capacity to create new niche markets. The MEC theory is introduced to explain the relations between attributes and consumers' perceptions of secondary needs revealed as benefit and values. The second part is dedicated to the empirical investigation of demand of a drink obtained from the "Olivello spinoso" a spontaneous plant. Empirical data were collected with "face to face sensorial test", and used to test the consumer perceptions for the product's attributes and preferences using the SEM approach. Conclusive remarks are in terms of suggestions about the modification of the product's attributes to increase the demand.

Key words: Demand, Mean-End Chain, multivariate analysis, Specialty products, Niche market, customer satisfaction, SEM.

1 - Introduction

Many factors contribute to stimulate the consumer's perceptions for food products: integrated innovations (technology, information, services and marketing strategies) are incorporated into the product to challenge a large spectrum of consumer needs that are caused by physiology, socio-demographic structure, psycho-graphic profiles, household composition, gender and lifestyle. Products are a bundle of intrinsic/extrinsic attributes able to challenge the consumer's needs by stimulation of affective and cognitive mechanisms able to elaborate perceptions of benefits and values. These innovations are integrated into the total food quality approach defined as the most problematic areas (Grunnert et al, 1996). There is a growing interest for foods able to stimulate curiosity and satisfy higher order consumer needs: increasing demand for nutraceutical and functional foods challenging the nutrition-healthy foods in an ageing society; the importance of effects of nutrients and calories in relation to the human well-being (physical) and acceptance (self-fulfilment). The increasing share of older households and uncommitted disposable income of many of these households makes this a sizeable market segment of food. Other emphasize the market potential of niche segments with the identification of specialty products (Kuperis). Due to changes in lifestyle and higher incomes, a growing number of people are practicing sport and physical activities; the search for new drinks is stimulated both by the curiosity and expected higher utility due to satisfaction of functional as well as secondary needs that originate from the practice of these activities. In fact the perceptions of physical benefits are linked to values like security and acceptance in social contest: the last ones are perceived by a larger number of consumers. An higher number of consumers are now moving away from the trade-off of quality versus price toward that of shopping versus enjoyment (AGB/Europanel). The 1992 CAP reform has enforced the policy to enhance the quality perceptions for specialty products (reg. 2078/92 for the environment protection; reg. 2092/91 regarding the biological production; reg. 2081/92 (DOP) and 2082/92 (IGP) dedicated to the specialty products). The growth of segmentation and niche markets is a viable alternatives to saturated conventional food market outlets. While widespread national stereotypes are evolving under the pressure of homologation food cultures by making a convergence in demand, the persistence of national and regional habits seems to manifest persisting consumer habits for local and regional products, method of elaboration and historical heritage that contribute to the diffusion of niche markets (Askegaard & Madsen, 1995). For typical products, these strategies are supported

by UE policies dedicated to the product/process innovation, and to explore in a greater detail the inherent consumer perceptions for food attributes. The purpose of this paper is a two-fold: first to propose the MEC to model the consumers' preferences and second, use the hedonic approach to model the consumer preferences and give suggestions to modify the product to improve the market performance.

2 – Olivello a specialty product

Specialty products are able to transmit perceptions of benefit and values with different cues; they are shared in three main groups: protected denomination, organic and typical non protected products. The legal enforcement of protected "typical products" (regulation 2081/92 (DOP group) and 2082/92 (IGP group) and AS/Stg products, contributed to generate quality perception due to institutional cues. A second emerging group that are now consolidating their market position is represented by the biological products, they are attracting new consumers for their capacity to stimulate positive cues for higher quality due to natural method of cultivation, product safety, respect of the nature, use of ethical cultivation methods. A third group are typical products not officially protected; they have intrinsic market potentials for their geographic specificity, potential socio-economic impact, contribution to biodiversity, landscape preservation. Our research will be dedicated to explore the niche market potential of the non protected specialty Olivello spinoso (Hyppophae rhamnoides, Family Eleagnacee). It is bushy plant growing spontaneously in isolated colonies in river bank, sandy soil, sunny areas, with separated male and female plants reaching the maximum height of two or three meters, its presence is signalled in different parts of Europe and in some regions of Italy, notably in Friuli V.G and is classified a minor fruit like blackberry, raspberry, bilberry. The products: leaves, roots and especially fruits are small drupae disposed around thorny branches with spines. The interest for this kind of plant is due to many reasons: it contributes to the biodiversity in wild areas, it is potentially appreciated by consumer for the presence of glucides, proteins, lipids, a large amount of Vitamin C and other anti-oxidant products, alkaloids, essential oils and tannins all having positive effects on the human metabolism. The role of the vitamins is of primary importance for the physical activity: acting as a biocatalyst, they improve the physical performance and resistance to stress in case of intense and prolonged physical efforts, sickness and aging. Beside most of the vitamins could be chemically elaborated, it is recommended to take them in natural food or drink because of the synergetic effects in combination with sugar, fat and other organic components. Laboratory analyses indicate the composition of Olivello pulp contain appreciable quantities of: provitamin A, and vitamins of the group B, (B_1, B_2, B_6, B_{12}), vitamins E, K, P, a great deal of vitamin C, some organic acids, flavonic, glucosides, phospholipids, and other active elements of the human methabolism. The C vitamin is in the range between 100 and 1200 mg/100 gr, much higher compared with citrus fruits: i.e the orange contains between 80 mg/100 gr; citron: 130 mg/100 gr; apple: 15 mg/100 gr. For these nutrients Olivello is considered a natural integrator drinks (isotonic and energetic drinks), to be used to improve the physical well being.

4 – Quality perception and preferences

The product is a complex representation of the consumer's mind built on concrete dimension (physical attributes) and abstract symbolism to satisfy a large spectrum of functional as well as psychological needs. In the recent consumer theories the food product are a bundle of attributes that generate utility in terms of benefits and consequent values. (Audenauert and Steenkamp, 1997). The satisfaction is measured indirectly by the perception of quality, defined a one dimension overall evaluative judgement about the product fitness with the intended use. (Aaker, 1995). The economic literature presents different approaches to quality: the objective quality was defined "the total measurable or documentary attributes of a product measured by physical or chemical instruments"; with the ISO the definition is " the characteristics of a product which are important to satisfy stated

or implicit needs". The general concept of subjective food quality is a bit complex: it integrates a number of more restrictive approaches to quality perceptions, notably the mean-end chain theory (Gutman, 1982), the multiattribute theory (Fishbein & Aizen, 1975), the economics of information (Darby e Karni, 1973). These approaches demonstrate that consumer judgement about an expected quality is not univocally stated, because of the interaction of different quality cues. Intrinsic quality cues are sensorial perceptions of intrinsic quality attributes and specifications, intended as information stimuli of quality; combined with cost cues and extrinsic cues caused by extrinsic quality attributes, induce the consumer to formulate a quality judgement (Bredhal, Grunnert & Fertin, 1998). The quality perceptions represent the relations between attributes and needs explained with psycho-functional models (Maslow hierarchy, Mean-end chain theory), these explain the higher order motivation constructs for purchase motive fulfilment. A quality function deployment approach is based on the distinction between expected and experience quality and a quality guidance approach (Steenkamp, 1996) relates the intrinsic product's attributes to ex-ante and ex-post quality based on perceptions of quality classified in: 1) ex-ante perceptions, before the product use of one or more quality cues, that help the consumer to predict the expected product's fitness to use (usually compared to other alternatives); ex-post perceptions, based on testing the product fitness to use. Perceptions are stimulated by observable attributes classified in three groups: a) intrinsic attributes related to satisfaction in terms of physical benefits: biological, physical or chemical components, calories, flavour, colour, taste, transparency, density, others; b) extrinsic attributes not part of it; they stimulate extrinsic cues of quality, price brand, packaging, image, style, communication, origin, typicality, history, service, dealer, and increase the consumer's curiosity; c) abstract attributes are values derived from benefits, and their perception depends on personality, selfish, social of the subject. The specialty foods can fulfil higher order consumers' needs in different ways using: i) intrinsic cues of original attribute composition: texture, colour, tenderness, flavour, production methods; ii) extrinsic cues with appropriate extrinsic attributes like packaging, form, material, design, style and services able to improve the intrinsic cues; iii) symbolic cues related to typical food quality eventually protected with "ad hoc" regulations; iv) amplifying the consumer perceptions of intrinsic/extrinsic cues with marketing strategies. The elaboration of cues in the quality judgement is framed as follows:

i) product levels: base, actual, implemented to integrate the intrinsic and extrinsic attributes in a global perception to stimulate the preference and choice;
ii) purchasing style: convenience, specialty and shopping goods that generate the demands for different categories of products;
iii) expected and experience quality associated to search and experience goods.

5 – Stated preferences, discrete choice and measure

The conventional demand approach is build up on the choice axioms and behavioural assumptions of consumer rationality within a given preferences choice set framed in different econometric versions. This construction is not always suitable for taking into account changes in preferences for diet, food safety, lifestyle and other factors affecting the quality perceptions. To stylise these factors are proposed alternative approaches based on dynamic translating and scaling (Pollack and Wales, 1992). The empirical approach focussing on relevant product characteristics as determinants of the utility function directly or as inputs into the household production processes, was firstly proposed by Lancaster and experimented in hedonic models. For the difficulty to integrate the individual motivations affecting the consumer's behaviour, and market incompleteness to specify all the transactions about relevant product's attributes, it is required to define an indirect utility function based on discrete choices and stated (revealed) preference for product's attributes, by observing the individual response facing a defined choice set. In the more general situation it is possible to predict the consumer reactions to some hypothetical, non revealed or potential characteristics of a given good. This allows to fit into the utility function, the hedonic values of quality perceptions (hygienic, safety, healthy, credence, and others). An extension of the approach of assessing consumer's

preferences in terms of product features is proposed by Mc Fadden (1973) with the consumer's discrete choice from specified choice set. The stated preference approach is based on a given set of similar substitutable products, which attribute composition and changes are explicitly signalled in level to the consumer. The consumers are assumed to reveal their preferences by indicating the set of preferred choice attributes or ranking them according with changes in the perceived utility depending on their subjective profile based on personal traits like income, education, gender, lifestyle, and social contest. The most important conditions for the success of this experimental design addressed to assess the consumer's preferences are: i) selection and specification of the product profile by relevant attributes; ii) consequences' separability; iii) consumer awareness of attribute and levels. These factors allow to rank preferences for attributes, including the emotional ones affecting the consumer decisions, by structuring psycho-functional relations between attributes and consumer perceptions of benefits and values.
The MEC approach defines the links between product attributes considered instruments (means) to procure values (ends) through consequences expressed by functional and psychosocial benefits. Drawn from psychological theory of consumer motivation, consumer cognitive structure and categorization processes, values are centrally held beliefs, relatively stable in time and suitable for cross-cultural comparison, affecting consumer's perceptions of product's features, to stimulate motivations for behavioural responses. (Valli, Loader and Traill, 1999). Stated consumer preferences are explored in ordering: i) the four main groups of nutritional attributes: glucides, lipids, vitamins and other minor ingredients; ii) the cues for extrinsic attributes. Assuming the consumer cognitive approach, the stated preference for attributes generating benefits and values can be ordered hierarchically, supporting experimental hypotheses to be tested to evaluate respondents' stated responses to attributes considered relevant in preliminary laddering test. Perceptions of intangible constructs as benefits and values related to attributes and generating consumer's response are measured using the latent variables (LV or equivalently constructs). The LV, not directly observed can be represented by measurable items that are indicators of the latent construct; this allows to postulate a causal nexus from LV to the caused items. It is important to notice that a construct can be represented by an index made by different item score; for instance the well being after training can be attributed to the different measurable items of the drink in question: quantity of water (causal relation with satisfaction of the primary need, the thirsty), quantity of vitamin, sugar or salt (causal relation with recuperation of energy representing a primary need and satisfaction that is a secondary need) and others. The inference seems to be more complicate, nevertheless it gives more accurate vision of the role of attributes in the consumer's mental image. The experimental approach will be developed in the following six steps: i)definition of construct; ii) definition of the pool of items generated by construct that will be the sensorial descriptors of the product's identity; measured in direct interview; iii) revision of scale with elimination of some non relevant items; iv) testing the reliability and uni-dimensional condition by examining the correlation between items which should be positively related with construct causing them. Uni-dimensional means that all of the item in scale are determined by a single OV; a condition to be verified with factor analysis.; v) validation to ensure that the scale is able to represent the underlined effect; vi) testing and ordering the preferences. This will be the hedonic measure of consumer's preferences.

6 - Material and method

A preliminary step consisted in searching for relevant information about representative attributes to generate sensorial perceptions of Olivello drink related welfare against a number of other surrogate products like tea, isotonic beverage, orange soda, lemonade, syrups, powdered drinks and others, more or less artificially enriched with the vitamins C. The explored literature was also an informative source to orient toward the major attributes to be tested. Following, the laddering techniques (Reynold and Gutman, 1988, Aaker, Kumar, Day) generated other qualitative information about attributes benefit and values. They represented the major headings according

with consumer's preferences and the pool of items for each construct that in the first step are large enough and reduced in the next revision step.
Using individual in depth interview on a sample of respondents randomly selected, the key product benefits were identified and trigger creative insights. With laddering, the sequential questioning contributed to indicate the quality function deployment passing through from product attributes to user desire. Firstly there were proposed three alternative similar drinks taster were asked to indicate the preference for a list of attributes like sweetness, aroma, flavour, vitamin content, antioxidant properties and others were probed to observe if they were important to the respondent, then that reason was probed and so on. This is the procedure followed by the stated preference and discrete choice approach, to test the associations between attributes and benefits and then between benefits and values. A representative sample group of subjects males and females randomly drawn from areas and demographic conditions performing physical activities were selected. Here following there is a list of questions/answers.

List of questions and answer

1) Q - When do you drink?
   A – When I am thirsty or tired after physical training and sport.
2) Q – What do you drink?
   A – I alternate the fresh water with orange soda, cola, and seldom I drink beer or wine.
3) Q – After you have trained, what do you prefer to drink?
   A – I drink fresh water or an integrator if available in frig.
4) Q – Do you drink alone or in company?
   A – I drink alone and frequently in company of my friends.
5) Q – Is it different your choice of drink if you drink alone or in company ?
   A - Yes of course.
6) Q - What do you drink alone?
   A - Usually mineral water, during and immediately after training I will drink integrator and water.
7) Q – Where do you buy the drinks?
   A – At the market in stock of bottle seldom single or can for orange and integrators.
8) Q – Drinking in company where do you drink?
   A - In bar, sometimes at the club or with the training friends, sometimes at home;
9) Q – Why do you drink in company?
   A – The pleasure socializing, relaxing and doing gossip.
10) Q – Why this gives you more pleasure?
   A – It satisfies my curiosity, pleasure to be in company.
11) Q – Do you have a preferred brand of drink?
   A – Yes I prefer …
12) Q – Why?
   A – I am accustomed to this brand, is palatable and gives me satisfaction.
13) Q – Do you read the label on the bottle?
   A - I choose it
14) Q – What does it means for you?
   A – It makes me in a good mood.
15) Q – Do you change your drink?
   A - Yes, it depends on my mood.
16) Q – Are you interested in the composition?
   A – When I drink something new I lock at the composition especially calories, sugar and vitamins

Proceeding into deeper product's insight, there were explored the connections between concrete functional benefits related to physical attributes versus abstract psychosocial benefits that contributed to personal self-esteem considerations and values of the personal life style and culture. Other two experimented and complementary techniques were the hidden issue and the symbolic analysis that attempted to deepen the consumer's preference by analysing with the first, the personal "sore spots" and with the second one, the symbolic meaning of the objects. The laddering technique was completed with the association pattern technique (APT, see Gutman, 1982) that made possible to explicit the different group of associations:

a) direct associations: attribute-attribute; benefit-benefit; value-value.
b) Cross associations:
   b1 - attribute-functional benefits; attribute-psychosocial benefits;
   b2 - functional benefits-terminal values; Functional benefits psychosocial benefits –
   b3 – psychosocial benefits -terminal values; psychosocial benefits – instrumental values

The APT matrix was the second preliminary step in structuring the survey, then in the following table the three steps, potential generators of associations are reported for the drink.
These approaches were used to identify the associations and make the list of "a priori" attributes.
In the tablet are reported the associations between attributes and benefits and between benefit to value to correlate in the experiment the consumer perceptions to products attributes.

Table 3 – List of attributes, benefits and values obtained with laddering about the drink

Attributes *	Benefits perceptions	Values perceptions
1st group: Intrinsic attributes (quantitative measure)		
Colour	Attractive	Fun and enjoyment
Sugar content	Palatable	Self-respect
Water content	Thirst-quencher	Security
Acidity	Flavour, Freshness	Excitement
Density	Need add water, last longer	Self-fulfilment
Clean	Not polluted	Sense of belonging, love
Vitamin C content	Good for health, recovery from stress	Self esteem, recognition, status
Vitamin B content	Good for health	Well respected
Mineral content	Integrate the mineral losses for stress	Sense of accomplishment
		Good relationship
2.nd group: Extrinsic attributes		Self actualisation needs
Bottle form	Easy to handle	
Bottle material	Good for longer conservation	Respect for the nature
Bottle capacity (cc)	Good for moderate use	Respect for his own body
Name of producer	Guarantee the product	Credence in the loyalty of the producer
Brand/ quality Label	Evocate feelings	
Knowledge about the Origin	Stimulate perceptions of Environment quality	Memories exciting edonic values of territory
Vitamin role for the health	Important for health	Pleasure of living
Natural features	Genuine in contrast with industrial beverages	
Biologically produced	Good for health, genuine, safe	
Price	Convenience	
3.rd group: habits	Quality and courtesy	
Place of purchasing	Spontaneous, friendly	
Relation with seller	Facility of access	
Service of selling point	Not essential in some seasons	

* the first group generates perceptions about quality attributes, the second and third generate perceptions about cues of attributes. The relation between attributes and benefits are indicated side by side in the table

7 – Hedonic approach and perceptions of benefits/values.

The empirical sensory analysis was an hedonic approach to rank consumer preferences by testing the sensorial perceptions of the product's attributes. This consisted in measuring the association between a set of items indicators associated to specific latent construct. (Henson and Traill, 2000). The empirical analysis was performed in a two steps procedure: abstraction and integration phase; the first one directed to build up the psychophysical relations between physical product's attributes and perceptions of cues and attributes, the second one dedicated to classify the perceptions. The main difficulty was to capture reliable information about the importance of attributes, and limit to

information processing by consumer in organizing these information for quality evaluation. For this purpose it was opportune to reduce the number of intrinsic cues and attributes. A second complication was represented by the existence of multiple correlations between intrinsic cue/attribute, so that a specific cue/attribute could simultaneously generate different perceptions The integration step was the elaboration of quality preference by integrating the perceptions of intrinsic/extrinsic cue that represented the consumer ability to predict the performance of the product . This was an expression of expected quality important in stimulating the consumer curiosity and induce him to test the product

8 – Sensory evaluation

Sensory analysis was the method uses to provide insight about perceptions of quality by scaling the sensorial reactions (sight, smell, taste and touch) to product intrinsic attributes. Different methods were attempted to emulate the way the individuals organize the wide variety of sensorial stimuli and ranking preferences. Sensory analysis was the method uses to provide insight about perceptions of quality by scaling the sensorial reactions (sight, smell, taste and touch) to product intrinsic attributes. Different methods were attempted to emulate the way the individuals organize the wide variety of sensorial stimuli and ranking preferences. Perceptions were indirectly detected with sensorial scale reporting the individual reactive stimuli. The following table summarise the sensory methods used for different problems. The affective test was carried out as an integrated part of the lab instrumental measure using a sample of randomly selected consumers from a target groups and they were requested to evaluate the product according to a scale preference. According to Stone and Sidel, for reliable results it is needed: i) an exhaustive and ordered list of sensory attributes; ii) repeated measures of the intensity of each quality and statistical methods to signal significant correlations. Consumer's preference for attributes are measured by asking to each one to indicate the overall preferences using a bipolar semantic scale

Table 5 - Construct (LV) and items hypothesized to represent the perceived sensory quality of Olivello

Ingredients: lab measure	**Construct 3 = Taste/Flavour = 7 items**	**Construct 6 = marketing 1 = 5 items**
sugar	sweet	price convenience
water	acid	brand appreciation
vitamin C	bitter	packaging
	sour	label information
	astringent	image
	palatable	
	taste of citron	
	persistency	
Construct 1 = Colour = 4 items	**Construct 4 = Functional = 5 items**	**Construct 7 = marketing 2 = 7 items**
intense	thirsty-quencer	quality of selling point
dense	healthy	relation with seller
clean	anti-stress effect	product typical
transparent	anti-oxidant effect	easy to find in the shell
	integrator of mineral elements	well exposed
		attractive product
		excite curiosity
Construct 2 = Smelling = 4 items	**Construct 5 = Practicity = 5 items**	
good	bottle shape	
intense	material	
aromatic	functional design	
natural	capacity	
	preservability	

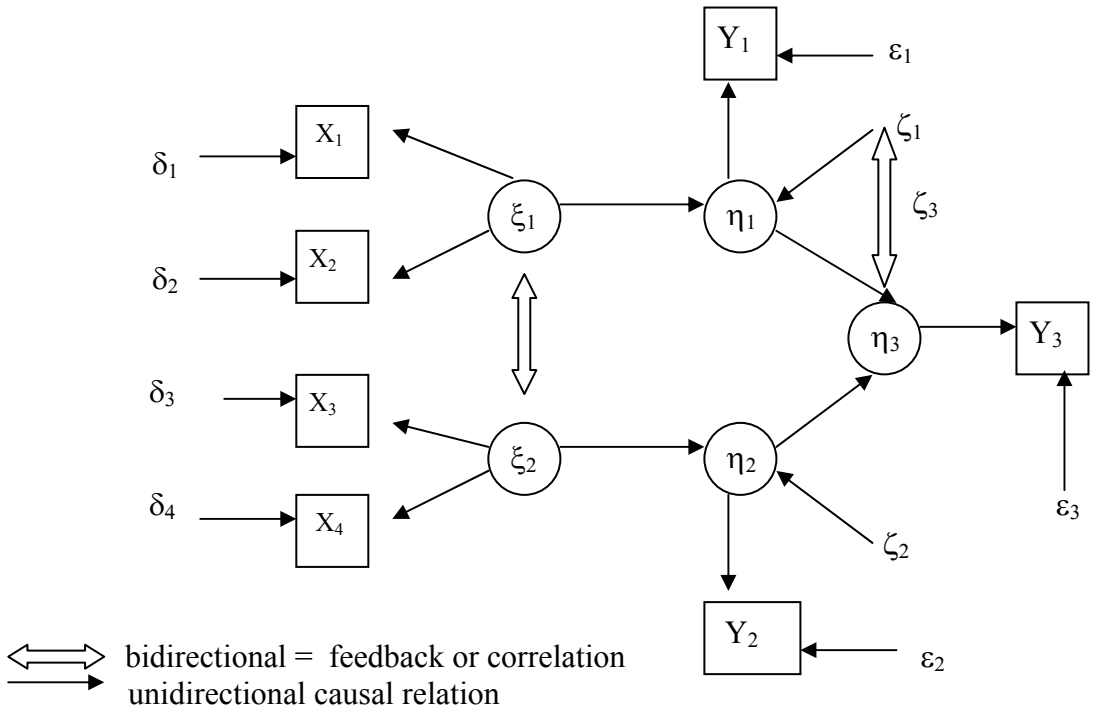
Survey.

In the questionnaire used for survey were listed different types of questions: quantitative scaling, questions, qualitative questions, stated preferences to explore the perceptions of the interviewed by compiling the questionnaire, reporting four main groups of questions, three of them related to sensory perceived dimensions of intrinsic attributes: visual impact, smelling, taste and the fourth one related to extrinsic attributes: market environment, packaging, geographic origin, label, functionality, originality of the bottle. The score for items were assigned using a Likert seven point level bipolar semantic differential scale bounded at each end by polar extreme adjectives. The respondents were asked to rate a given attribute object (allowing to detect perceptions of attributes and cues about the product). In designing the semantic differential scale task, the selection of an appropriate sample of adjectives pair was assumed to be central to the ability to generate a score for the attribute and product to be examined (Churchill, 1991). The objects were selected after some preliminary exploratory studies about product/service attributes described in words familiar to respondents. The pole rotation, to avoid the halo effect or correlation between judgements was also introduced. The respondents were asked to point out the value reflecting their perceptions. Likert statements like "do you prefer more the colour clear or dark" or "do you prefer more stronger or softer smelling were examples of the questions submitted to the respondents. Two groups of constructs were explored: the intrinsic attributes had the purpose to explore the perceptions about physical components of original product; the second one focused on extrinsic attributes such as market factors, facility to use, well being and a mix of other factors that implement the product's image. Data about consumer perceptions were collected from 140 face to face interviews made in "at home sensorial testing" using a list of questions related to items the in the precompiled questionnaire; the criteria used for recruitment and identification of the target group were socio-demographic and psycho-graphic variables: age, income, residence, gender, habits, hobbies randomly extracted using a phone book. The drink was offered in glass bottles of 33 cc volume, with label reporting the components, name of producer, geographic origin, deadline. The study consisted in two parts: the first one was dedicated to measure the attitudes and behaviour related to purchase and consumption; the second one was dedicated to analyse the consumer perceptions of sensory attributes. The attitudinal statements were formulated in the questionnaire to detect construct and items. In developing the scale, the purpose was to select the product's items that most accurately reflected variations in latent constructs. It was likely that the item importance could be observed ex-post; this would require a review of the items considered at the beginning of the test. Sign and magnitude of correlation between single items were used: being the scale an effect indicator of the causal correlation between construct and items, positive signs were expected. (Bollen, 1984). Those with weak values would be eliminated as their effect was proved to be statistically insignificant; the negative sign indicated a correlation opposed to the one expected. The second observation was the extent to which individual items were correlated to the sum of the remaining items. In general a low value of items respect the total correlation was the indication of the scarce importance of the item. Third consideration: items must show high variance to improve the discrimination among single respondents. Items related to attitudinal statements were submitted to respondents to score and merge into group under relevant construct headings.

9 – Description of the SEM model

The psychometric approach is largely adopted in social and behavioural science to deals with unobservable or latent variables (constructs) using observed or manifest variables as indicators of attitudes, perceptions, affection and others emotional states related to constructs. This approach allows to evaluate the relationship between preference and sensory characteristics of the food, using covariance measure by means of the structural equation model (SEM) assuming a linear structure of the causal relation (LISREL) between latent and/or manifest variables. (Joreskog and Sorbon). The model combines the properties of the causal econometric models with the factorial analysis

approach focussing on latent variables. Hence the approach can be explorative or confirmative, in both cases three are the steps: i) formulation of hypothesis of causal relations among variables; ii) definition of structural equation (structural model representing the causal relations among latent variables) with measurement equations (measurement model representing the relations between LV and indicators using item-score); iii) estimation of coefficients of the variables. For this experiment are non explicitly evaluated the differential influences caused by sex, personality, experience, mood, social interaction, lifestyle and others that could influence the answers of the interviewed. The sensory focus group interview is the technique used to give dimension to the observed variables being the underlying dimensions (i.e questions or items) of non observable constructs (latent variables). The indirect multi-item Likert scaling procedure is a combination of item scores that demonstrated in a number of tests to be appropriate as reliability and validity, rather than the direct approach with response to the score on a single question aimed directly at the construct (Spencer and Traill). There is a causal nexus that goes from the construct to items so the construct is regressed with a specific set of items, the coefficients are the construct loadings, their values measure the relation of a single item with the construct and the error accounts for the unexplained residual variance. The item scores substitute the original unobservable variables to represent indirectly a significant hypothesized relation with the construct. The relations in the model are structured with reference to the consumer theory that is a consistent predictor of the causal nexus among observed and latent variables based on perceived utility of constructs, that will allow to follow a confirmative approach. The algebraic formulation of the model is based on the eight matrices previously described that allow to estimate the parameters of the covariance matrix between x and y. An example of the model with relations among latent exogenous/endogenous variables, indicators and errors are represented in the figure below. (Corbetta p. 85) The general representation of the Path scheme for Lisrel structural model is indicated in the following figure.



SEM is the algebraic formulation of the path model and the basic assumption is that dependent and independent variables are measured with errors; this implies that the structural model must be integrated by two measurement models the first one using latent endogenous variable η (endogenous construct); the second one using latent exogenous variable ξ. (exogenous construct). The measure of exogenous constructs is a factor analysis in the sense that it assumes

that the latent exogenous variables, representing the unobserved exogenous construct of the product, are indirectly measured with errors, in a multidimensional scaling approach using manifest variables as item-score of the latent ones. The relations between manifest and latent exogenous variable are represented in the following equation expressed in a matrix notation:

$$1)\ x = \Lambda_x \xi + \delta$$

were x is the vector (qx1) of observed exogenous variables, Λ_x is the matrix (qxn) of the structural coefficients between latent and observed variables or factor loading, ξ is the vector (nx1) of latent exogenous variables (common factor) and δ (qx1) is the measurement error. This equation allows to measure the relationship among the observed variables by measuring the relationship among observed and latent exogenous variables. The relations between manifest and latent exogenous variable are represented in the following matrix notation:

$$2)\ y = \Lambda_y \eta + \varepsilon$$

were y is the vector (px1) of observed exogenous variables, Λ_x is the matrix (pxm) of the structural coefficients between latent and observed endogenous variables or factor loading, η is the vector (mx1) of latent endogenous variables and ε (px1) is the measurement error.
Structure of the model: the current notation of an econometric model in LISREL notation is:

$$3)\ \eta = \Gamma \xi + \zeta$$

where: η(mx1) is the vector of latent endogenous variable, ξ (nx1) has the meaning already described, Γ (mxn) is the matrix of coefficients between η and ξ, and ζ is the error vector.
By allowing a condition of reciprocal causation among dependent variables η, that frequently occurs in these interactive models where exogenous condition cannot be strongly assessed, the coefficients among η are in the matrix B, and the following general structural equation can be formulated as follows:

$$4)\ \eta = B\eta + \Gamma\xi + \zeta$$

Of the four equations reported above, the first, second and fourth represent the SEM model and will be used to measure the covariance of LISREL.

Table 6 - Summary of the SEM model

Type of model	Equation	Variables	Parameters and matrices	Errors
Factor analysis	$X = \Lambda_x \xi + \delta$	X, ξ	$\boldsymbol{\Lambda_x}$ $\boldsymbol{\phi}$ $\boldsymbol{\theta^{\delta}}$	δ
Model structure	$Y = BY + \Gamma X + \zeta$	X, Y	**B, Γ ψ**	ζ
Measure	$Y = \Lambda_y \eta + \varepsilon$ $X = \Lambda_x \xi + \delta$	Y, η	$\boldsymbol{\Lambda_y}$**, B ,** $\boldsymbol{\psi}$**,** $\boldsymbol{\theta^{\varepsilon}}$	ε, ζ

10 - The statistical analysis.

To solve the model it is required to have the number of equations equal to the number of variables: in general the number of variables is larger than the number of equations so the model to admit a solution, need to restrict some variables. The starting point is the algebraic relation between the (theoretic or restricted) covariance matrix between x and y and the eight matrices of the theoretical model to estimate the unknown structural parameters. The estimation is based on the computation of both, the unrestricted covariance matrix S calculated with the observed data, and the theoretic covariance matrix $\Sigma\theta$ restricted by the model parameters values. The second step is to minimize the distance between the two matrices: min $F = F(S, \Sigma\theta)$. There are seven different methods of computation; the frequently used one is the maximum likelihood estimation using an iterative procedure that allows a progressive convergence between S and Σ. The Wishart distribution expressed in function of the estimated parameters is a validation procedure that gives

the probabilistic range that the S is derived from Σ. A proposed measure based on: c = N*F; if the sample size is large enough c will approximate to a χ^2 distribution with degree of freedom determined as the difference between the number of independent data points in S and the number of independent estimated parameters. The statistical properties of SEM are:

1) level of measurement of observed variables The complete specification of Lisrel requires the definition of eight matrices: the first four are used for the structural coefficients: B, Γ, Λ_x Λ_y and the other four for the covariances: Φ, Ψ, Θ_ε, Θ_δ; the first four are usually rectangular, the second ones are squared and symmetric ones.

2) restriction on the error terms in the structural and measurement equations. These are:

2.1) independent variables and errors are not correlated in the same equation:

E(ξ, ζ ') = 0; 2) E(η, ε ') = 0; 3) E(ξ, δ') = 0;

2.2) dependent variables errors across equations are uncorrelated:

E(η, δ') = 0; 2) E(ξ, ε ') = 0

2.3) combination of errors in different equations are not correlated:

E(ζ, ε ') = 0; E(ζ, δ ') = 0; E(ε, δ ') = 0

Last condition is that none of the structural equations is redundant, this means that B is non singular, positive and defined, so admits an inverse B^{-1}, in other words the equations must be independent among them and this exclude the possibility of a linear combination among endogenous variables. (Corbetta)

11 - Results and discussion

The parameters of the SEM model are estimated with the maximum likelihood, that is appropriate to the ordinal measurement of items (Joreskog e Sorbom). The perceived quality is operationalized by computing the coefficient of the construct-items relations (first equation) and covariances among constructs. After simulation of different structures starting from the more general one, that are all admissible under the prior state of knowledge and observing the statistical results, the final structure is represented by 46 variables of these, 20 are the observed variables (items) that represent the equations, and 26 are the unobserved variables respectively 20 errors and 6 latent exogenous variables (constructs): the estimation required 210 distinct sample moments to obtain 55 parameter values with 155 degrees of freedom. When the minimum distance is achieved, the goodness of fit of the model is : χ^2 = 179,75 and with 155 d.f. it is calculated the value χ^2 / d.f. = 1,158 with probability level 0,089 (9%). The values of the estimated coefficients in the underlying measurement model and the structural model along with their standard errors and ratio C.R. to evaluate their significance are reported in table 7 and 8.

The meaning of the coefficients refers to the importance of each of the consumer needs derived as a part of the Lisrel formulation. Excluding the variables with C.R below 2 and those with negative sign, 14 over 19 coefficients can be considered statistically significant to explain the consumer preferences. The colour only suggest attractiveness, smelling suggest taste of Raspberry and to be palatable. Higher order sensation of flavour (sensorial related to intrinsic attribute) and packaging (related to extrinsic attribute) are determined by a number of items that simultaneously contribute to generate them. Flavour is positively correlated to sweetness, to a bilberry sensation, to acidity and acrid that is supposed to be a variant of the acid. Packaging facilitate the use, the conservation in frig and the glass material is appreciated. Functionality is the most complex: the consumers revealed their attitude to the healthy properties of the drink by appreciating the natural composition of vitamin C and A the antioxidant properties, the biological cultivation and less the origin so even the local consumer are more pragmatically concerned with the properties related to the health instead of origin. For marketing purposes, price and label reporting the composition and other information about the product are the items mostly appreciated.

Table 7 - Construct-item regression weight

CONSTRUCT	ITEM	ESTIMATE	S.E	C.R
Colour	Attractive	1,354	0,545	2,484
Smelling	Rasberry			
Smelling	Palatale	0,847	0,246	3,443
Flavour	Sweet	0,469	0,197	2,381
Flavour	Astringent	-0,932	0,218	-4,275
Flavour	Intense of lemon	0,317	0,190	1,668
Flavour	Intense of bilberry	0,753	0,228	3,303
Flavour	Acrid	0,526	0,204	2,578
Flavour	Acid	0,385	0,181	2,127
Packaging	Practical	0,785	0,175	4,486
Packaging	Material	1,131	0,163	6,937
Packaging	Fit good with frig	0,903	0,176	5,131
Functional	Vitamin C	0,471	0,082	5,777
Functional	Vitamin A	0,996	0,149	6,684
Funconal	Antioxidant	0,601	0,197	3,051
Functional	Biological	0,321	0,134	2,395
Functional	Regional origin	0,244	0,160	1,525
Marketing	Price	0,944	0,391	2,414
Marketing	Label	0,479	0,284	1,687

Table 7.1 - Construct- construct regression weights

CONSTRUCT	CONSTRUCT	ESTIMATE	S.E	C.R
Color/consistency	Smell	1,365	0,613	2,227
Flavour	Colour/consistency	-0,647	0,303	-2,135
Flavour	Smell	-1,571	0,375	-4,189
Packaging	Colour/consistency	0,621	0,269	2,308
Packaging	Smell	0,782	0,239	3,272
Packaging	Flavour	-0,529	0,164	-3,226
Packaging	Market	0,178	0,221	0,805
Functional	Colour/consistency	0,421	0,215	1,958
Functional	Smell	0,565	0,224	2,522
Functional	Flavour	-0,426	0,168	-2,536
Functional	Packaging	0,541	0,119	4,546
Functional	Marketing	0,178	0,221	0,805
Marketing	Colour/consistency	0,521	0,349	1,493
Marketing	Smell	-0,035	0,326	-0,107
Marketing	Flavour	0,829	0,375	2,211

11 – Conclusive remarks

This exploratory analysis focussing on potential niche market of a new product has revealed the importance of the product profile with relevant attributes related to perceptions signalled by items, suggesting the importance of some factors and items that contribute to improve the consumer perception. The approach can be implemented by improving the effectiveness of items to constructs by using a questionnaire with more direct detailed questions. A change of statistical methodology is also likely to improve the consumer response. The advantage of the structural equation modelling based on or covariance analysis for modelling the causal nexus among attributes improve the information of factor analysis that do not allow the elicitation of items and remodelling.
To improve the perceptions two direction can be experimented: i) to implement the marketing strategies for brand equity that is the solution for a private seller; ii) an institutional strategy based on the regional promotion of local food and possibly to apply for a typical IGP product. The first solution is quite risky considering that most of the crop is produced in the mountain region of Carnia, with unstable climatic conditions. A financial support can limit the risk and offer more incentives to producers. The second alternative seems to be a better opportunity to improve strategies that are crucial for the market development. A typical product already perceived positively by the consumer can be further implemented with collective brand strategies which effects must be considered in the more general frame of the rural development.

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