THE ROLE OF SENSORY EVALUATION IN FOOD QUALITY CONTROL, FOOD RESEARCH AND DEVELOPMENT: A CASE OF COFFEE STUDY

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Abstract

In Vietnam, the applying of sensory evaluation is only limited in some important coffee or tea manufacturers to grade these products according to an international or national norm (ex. TCVN-321579). This kind of sensory practice based on operations of some experts. However, quality of food product is a complex issue and not one to be solely defined by the experts who are often searching either for the default of products or for subtleties that are of little interest to the consumer.

Of all a product's attributes, the most vital are the sensory properties, as they are most apparent to the consumers. Therefore, the majority of consumer complaints relate directly to sensory quality failures. The case study on coffee products showed that properly trained sensory panels can be used to analyze and to detect quality problems early enough to put them right. In addition, by using preference test, we could gain insight into what might be influencing the consumer preferences and therefore what the key attributes of a product may be. Descriptive methods were used to quantify these key attributes and the applying of multivariate data analysis permitted uncovering sensory derived segments. These data are important in demonstrating that sensory evaluation influences business decisions and ensures product success through understanding and linking consumers and products.

Keywords: consumer preference, descriptive analysis, sensory evaluation

I.   INTRODUCTION

Sensory evaluation has been defined as a scientific method used to evoke, measure, analyze and interpret those responses to products as perceived through the senses of sight, smell, touch, taste, and hearing (Stone and Sidel, 1993). This definition has been accepted and endorsed by sensory evaluation committees within various professional organizations such as the Institute of Food Technologists and the American Society for Testing and Materials. The field of sensory evaluation has grown rapidly in the second half of the 20th century, along with the expansion of the processed-end food and consumer products industries. Nowadays, sensory evaluation becomes a tool irreplaceable in food industry while interacting with the key sectors in food production (Fig. 1). When a consumer buys a food product, they can buy nutrition, convenience, and image. Nevertheless, most importantly consumers are buying sensory properties/performance and sensory consistency. Therefore, sensory evaluation should be an integral part in defining and controlling product quality. Every company committed to quality should support, develop and operate QC/sensory program.

Beside it, as Product Development and Marketing functions are requiring new methods and tools to understand both products and consumers, the input of Sensory Science has expanded significantly beyond the "product development phase". From the inception of an idea through in-market maintenance of product quality, the sensory professional can act as a strategic business partner by providing unbiased data to aid in corporate decision-making.

Fig. 1: *Sensory evaluation in relation with different sectors of food production*

We can see the outcome of sensory testing as a way to reduce risk and uncertainly in decision making. When a product development manager asks for a sensory test, it is usually because there is some uncertainly about exactly how people perceive the product. In order to know whether it is preferred or equivalent to some standard product or whether it has certain desirable attributes, data are need to answer the question. With data in hand, the end-user can make informed choices under conditions of lower uncertainty or business risk. In most applications, sensory evaluation functions as risk reduction mechanism for both researchers and marketing managers.

Despite the fact that sensory evaluation has an important impact on food production, this field of science is still not broadly practiced by Vietnamese food factory. The sensory evaluation is limitedly implicated in some important coffee or tea manufacturers to grade these products according to an international or national norm (ex. TCVN 3215-79; TCVN 4193-2001).

In the coffee trade, a high diversity of classification systems is applied and the use of the ''expert cupper'' is the norm. There is not a unique and universal system applied worldwide for the quality control of green coffee. Tailor made procedures are selectively implemented by International, National, local bodies, trading institutions and private companies. Procedures are mostly geared to facilitate the trading of the commodity and sensory quality is in most cases described by ''cuppers'' or ''liquorers'' using personal opinion and tasting experience accumulated over the years. (Feria-Morale, 2002). However, one of the main problem in the use of sensory expert in the sensory evaluation of quality control is the qualification of "expert" is not well defined. In according with ISO 856-2(1994), the experience is not only criteria of an expert but also to be trained and have highly sensory sensitive.

The capability of the ''expert'' is not under scrutiny because these individuals acquire all the required knowledge over time and after conducting these evaluations year after year for a long period. In fact, they become extremely sensitive to the changes that may occur to the specific product they evaluate. However, the most controversial strategy in sensory quality control still remained is to assign a quality level to a product with reference to a mental standard developed by one or a group of experts or panellists. Almost criticisms have been based mainly on two aspects: the lack of concordance between experts as to the mental standard applicable to a certain product and the fallacy of assuming that the opinion of the experts represents that of the consumers (Costel, 2002). Lecturers, interested in the role of sensory evaluation in quality control, are strongly recommended to refer to a special publication of Elsevier (Food Quality and Preference, Number 13, 2002) to have a complete overview. Due to the limit of this paper, the only application of sensory evaluation in the product research and development will be further illustrated through rough an example of coffee study.

II.   MATERIALS AND METHODS

- Subjects:

Two groups of subjects participated in this study. The first group consisted of 13 (six males and seven females ranging in age from 21 to 23 years old) students from Department of Food Technology,

HoChiMinh city University of Technology. These subjects were enrolled in a training program designed to produce coffee trained subjects. They were trained 1h per week to detect and identify added flavours (roast, caramel…) in coffee and to evaluate the intensity of general compounds (bitterness, coffee flavour…) on a non-structural linear scale. During this phase, the panels developed their own vocabulary to describe the coffee samples. The second group consisted of 92 untrained subjects (52 male and 40 female ranging in age from 20 to 50 years old). They were recruited from staff and students at the University of Technology and University of Economic through advertising and by word of mouth. All assessors were interviewed to confirm that they were frequent coffee drinkers. They were coffee consumers but did not have any formal training or experience in the description of coffee flavour. A questionnaire ascertained age, gender, occupation, and frequency of consumption of coffee. The purpose of the test was explained to consumers who were then showed how to note their responses on a nine-point hedonic scale.

- Coffees:

Both groups tasted fifteen coffees (Table 1). The first seven coffees were European coffees (note from 1 to 7). Preliminary work showed that some of these coffees present fairy constant and salient characteristics. Specially, coffee 3 is very "acid"; coffee 1 and 7 is very "bitter" and "burnt". The last eight coffees were Vietnamese coffees. All coffees were prepared in the same way. The procedure for brewing coffee was standardized by ICO and followed by all participants. Brewed sample (30ml) were immediately served for each assessor prior to tasting and presented in white ceramic cup and served at 50-60ºC (Borchgrevinket *et al*, 1999). The sample were held for a maximum 20 minutes and then discarded if not used by the panels.

Table 1. The 15 coffee samples used for the sensory profiling and preference

Coffees	Country	Been	Roast	Coffees	Country	Been	Roast
1	French	Arabica	Medium	8	Vietnamese	Arabica	Medium
2	French	Arabica	Medium	9	Vietnamese	Arabica-Robusta	Medium
3	Germany	Arabica	Medium	10	Vietnamese	Robusta	Medium
4	Austria	Arabica	Medium	11	Vietnamese	Arabica-Robusta	Medium
5	Austria	Arabica	Medium	12	Vietnamese	Arabica-Robusta	Medium
6	Italian	Arabica	Medium	13	Vietnamese	Arabica	Dark
7	Italian	Arabica	Medium	14	Vietnamese	Arabica-Robusta	Dark
				15	Vietnamese	Robusta	Dark

- Test procedures:

Descriptive test: Evaluations were carried out by all panellists in sessions that contented of four samples, although the number of sessions per day and the timing of the session varied from participant to participant. However, participants followed the same experimental design, ensuring that the same samples were grouped in sessions for all panels, and three replicate judgments were made on each sample by each judge. The assessors were asked to evaluate the coffee attributes on a non-structural linear scale and to rinse out their mouth with water between coffee samples.

Consumer test: Consumers assessed fifteen coffees in two sessions. In the first session, they evaluated eight coffees and in the second one was seven coffees. The consumers were asked to rate their preferences (overall degree of liking, and the degree of liking of aroma, taste, appearance, mouthfeel, aftertaste) on a nine-point hedonic scale. Water and cereal crackers were supplied for refreshing palates between samples. Due to the difficulty in preparation of coffee samples, the planning of the sessions was evaluation of four coffee samples, break, and evaluation of the remaining coffee samples. During the

break after the first session, subjects were asked to fill out a questionnaire about their coffee consumption habits. Thus, the total duration of a session was about 45 minutes. The randomised presentation was affected to all consumers.

All the panels performed the tests in a sensory room, with a separate booth for each assessor.

- Statistical analysis:

ANOVA, using SAS 8.1 for Windows, tested whether originality of coffees had significant effects on coffee profile and coffee preference. The cluster analysis (SPAD 4.5) had been used to find out the group of coffee and consumer preference and the stepwise regression to find out the attributes corresponding with coffee preference.

III.   RESULTS AND DISCUSSIONS

-    *Profile of European and Vietnamese coffees*

The originality did not have significant effect on the profiles of European and Vietnamese coffees (Fig.2). However, European and Vietnamese coffees were significantly different ($P<0.05$) for the sour (15) and bitter taste (14) and for the colour (12). Among the fifteen coffees studied, the coffee number 3 is the most acid followed by the coffees 2 and 5. The most acid one of Vietnamese coffee was number 8. The coffees number 14, and 15 were the most bitter and darkest for all products. Average linkage clustering indicated the three coffees 13, 14, and 15 were perceived to be very dissimilar to the fifteen coffees (Fig. 3). The fifteen coffees were principally classified in two categories. One category contained 13, 14 and 15. The other categories contained two clusters.
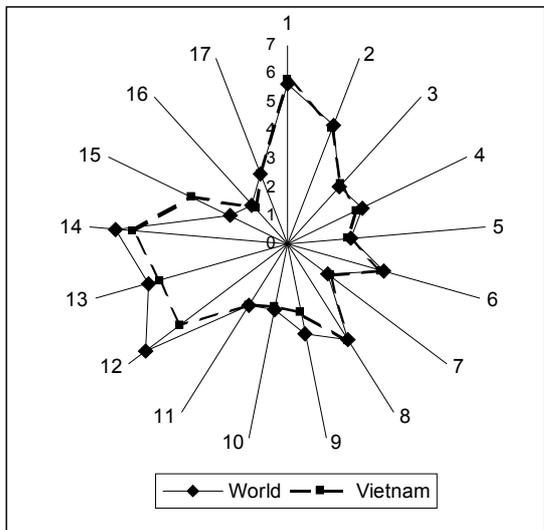
Fig.2: Profiles of European and Vietnamese coffees
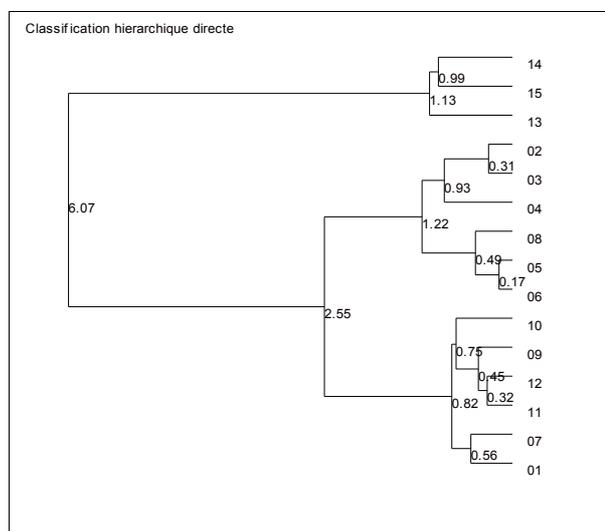
**Fig.3**: Classification of 15 coffees

- Consumer preference

The Pearson correlations among hedonic attributes (Table 2) showed significantly correlations ($P<0.01$) between the overall degree of liking and the other liking. However, the taste degree of liking including taste, mouthfeel, and aftertaste was the highest correlated attributes with overall degree of liking.

Average liking indicated the four coffees 12, 13, 14, and 15 were the most preferred while analysis clustering showed that the fifteen coffees were principally classified in two categories (Fig.4). One category contained 12, 13, 14 and 15. The other categories contained the remained coffees.

Table 2. Pearson correlations among hedonic attributes

	Overall	Aroma	Taste	Appearance	Mouthfeel	Aftertaste
Overall	1					
Aroma	0.87*	1				
Taste	0.98*	0.79*	1			
Appearance	0.87*	0.78*	0.80*	1		
Mouthfeel	0.98*	0.84*	0.96*	0.91*	1	
Aftertaste	0.99*	0.82*	0.99*	0.85*	0.98*	1

* Correlations were significant at 0.01 level
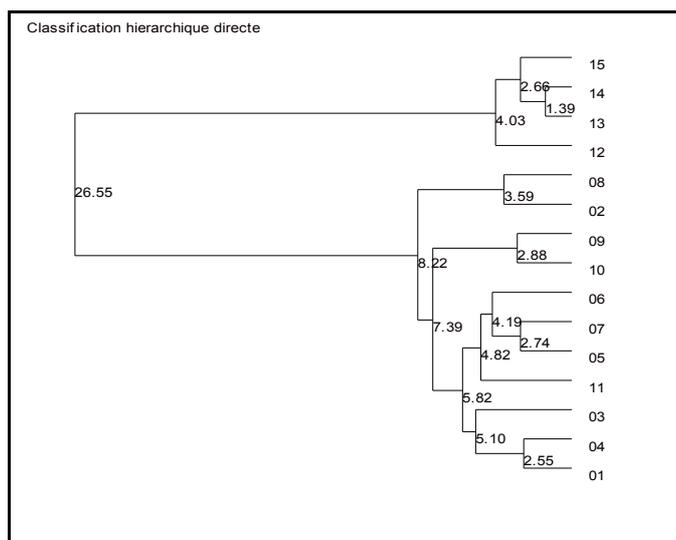
Fig.4: *Coffee preference clusters of 92 consumers*

Stepwise regression by overall degree of liking on (15 coffees x 17 attributes) data matrix showed that a model linear of 13 on 17 attributes could explain the overall degree of liking from the answers of 92 consumers (*P*<0.05). Furthermore, the results indicated that the characteristic contributed positively to the preference of consumers were smell attributes (roast, earth, sweet, butter, moist), colours attribute (dark), and tastes attribute (bitterness). The attributes reduced the consumer preference included smell attributes such as almond, sour, sweet smell and taste attributes like sour, sweet, and salty. The attribute sour taste was "the worst" for all seventeen attributes.

IV.   CONCLUSION

Although there were small differences found between European and Vietnamese coffees, the Vietnamese consumers preferred to Vietnamese coffees than European coffees. However, their preferences were not unconditional. The most liking were the three coffees *13, 14, 15* over the fifteen coffees tasted and the most preferred attributes of coffee were *butter, burnt, and sweet smell, dark colour and bitter taste*. The Vietnamese consumers disliked *sour taste* in coffee for all products. The results of this study will be completed by study in progress with French consumers to find out what attributes of Vietnamese coffee should be improved in accordance with their preference.

In the past, Sensory Evaluation reacted to quality control, and operations. In the future *"Sensory scientists can add insight to their reports on testing results. Providing insights to the larger organization about products and consumers drives the business and assures that the products in the pipeline are delivering customer satisfaction. Courage in the application and interpretation of core sensory methods and statistics is essential for getting the most out of the allocated research time and money. In addition, techniques from anthropology and other behavioural sciences provide depth and insight into the*

unspoken motivation and emotions that trigger different acceptance and purchase responses from various segments of the population." (Civil, 2003)

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