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Food Product Development by Integrating Marketing and Sensory Analysis - a Tool to the EU-Integration Challenge

Voedingsmiddelenontwikkeling door integratie van markt- en sensorische analyse - een instrument om de uitdaging van de EU-integratie aan te gaan

door

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«Experiment!
Make it your motto day and night.

Experiment - And it will lead you to the light.
The apple on the top of the tree - Is never too high to achieve
So take an example from Eve...

Experiment!
Be curious - Though interferring friends may grow.
Get furious - At each attempt to hold you down.

If this advice you only employ - The future can offer you
infinite joy.
And merriment...

Experiment! And you'll see!»

Cole Porter

Gent, June 2001

The promotor,   The author,

Prof. Dr. ir. J.VIAENE   ir. R. JANUSZEWSKA

PREFACE

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Renata Januszewska

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LIST OF ABBREVIATIONS

1E	First level: environment
2E	Second level: entrepreneur
3E	Third level: enterprise
7Ss	Refers to: structure, strategy, systems, skills, shared values, staff, and style
A	Appearance-Bitterness-Oriented segment (Chapter 8)
A	attitudes (Chapter 6)
A	attributes (Chapter 7)
ACE	Action for Cooperation in the field of Economics
ANOVA	analysis of variance
ASTM	American Society for Testing and Materials
B	behaviour
B1	cocoa mass of the first source
B2	cocoa mass of the second source
BI	behavioural intention
b_i	salient beliefs
BTS	Bartlett's Test of Sphericity
C1 - C13	chocolate samples from 1 to 13
CARBI	cognition and affection-related behavioural intention model
cb_k	control beliefs
CCQ	cross-cultural questionnaire
CCSQ	cross-cultural sensory questionnaire
cf.	citation
COMCC	conceptual model of chocolate choice
COW	Conservative Owners
CP	central point sample (C13)
D	discriminant score
e.g.	exempli gratia: for instance, for example
e.i.	id est: that is
EFF	efficacy
e_i	expected outcome of behaviour
ENB	external normative beliefs
et al.	et alii: and other people
etc.	et cetera: continues
EU	European Union
FAC	facilitating conditions
H1 - H4	Hypotheses from 1 to 4
HI	habit index
HIC	high-intensity-context
HIM	high-intensity-mixture context
HIP	high-intensity-pure context
HoQ	House of Quality
Hows	technical and sensory relations
INB	internal normative beliefs
KMO	Kaiser-Meyer-Olkin Measure
LIC	low-intensity-context
LIM	low-intensity-mixture context
LIP	low-intensity-pure context

M	mean
MARCC	model of affection related chocolate choice
mc_j	motivation to comply with the referent's behaviour
MEN	Moderate Entrepreneurs
MIC	medium-intensity-context
MRD	marketing research development
N	number of respondents
nb_j	normative beliefs
P	panels
PACE	product and cycle-time excellent process
PBC	perceived behavioural control
PC	principal components
pf_k	perceived facilitation of control factor
PRA	personal relative advantage
PS	preference score
p-value	probability level associated with F-value
Q1	screening questionnaire
Q2	market survey
QA	Quality Assurance
QC	Quality Control
QDA	Quantitative Descriptive Analysis
QFD	Quality Function Deployment
QL1 - QL3	quality settings from 1 to 3
QN1 - QN4	quantity settings from 1 to 4
R	Rough Judges segment
R&D	Research and Development
REN	Radical Entrepreneurs
S	Sweetness-Oriented segment
SD	standard deviation
SDA	Spectrum Descriptive Analysis
SME(s)	Small Medium Enterprise(s)
SN	subjective norms
SPSS	Statistical Package for Social Sciences
SRA	societal relative advantage
T	Texture-Oriented segment
TI	taste index
TPB	Theory of Planned Behaviour
TPBQ	Theory of Planned Behaviour Questionnaire
TRA	Theory of Reasoned Action
vs.	vice versa: the reverse
Whats	attributes evaluated by consumers
X,Y,Z	solution sets used for screening of trained panels (Chapter 7)
X,Y,W, Z	chocolate couverture samples (Chapter 3)
X1 - X16	indirect questions in TPBQ
Y1 - Y14	direct questions in TPBQ
Y_i	response surface corresponding to consumers' preference for chocolate
a-Cronbach	measure of scales' reliability
ß	regression coefficient

CHAPTER 1

General Introduction

1.1 Introduction

The doctoral research investigates *consumers' behaviour towards chocolate* in two countries Belgium and Poland through new models and applied approaches. Understanding of consumers' attitude and behaviour is seen as foundation on which the tools to develop small and medium-size enterprises (SMEs) in food sector, can be built.

The *choice of countries* is based on their different political and cultural backgrounds. Poland is in the preparatory stage for accession to the EU while Belgium has been a member from the beginning of the Community. Both countries have considerably different cultural environment that is highly relevant for cross-cultural research. Additionally, Poland is an interesting field of research with respect to marketing and international business issues because of the well-advanced process of transition from centrally planned to market-oriented economy, indicating the dynamics of changing values and expectations of the nation.

An increase of importance of *young people* who undertake consumption decisions in a more independent way is one of major characteristics of the Central European countries (Nikodemska-Wolowik, 1999). This observation is confirmed as it was shown that people between twenty and thirty years old state to have the highest interest and consumption of chocolate (Viaene & Januszewska, 1999).

Making cross-cultural research with *the same age group* brings an important advantage. Such group shows comparable understanding of the questionnaire, because the learning time is approximately equal and therefore, environmental influences contributing to formation of attitude may be related.

In this thesis, the systematic approach is applied to *chocolate* - the product being repositioned, diversified and offered in new commercial ways all over the world. Chocolate is an excellent product to find out, on the one hand, the different consumers' attitudes and taste preferences and, on the other hand, to establish tools for competitive advantage and improve business performance. While consumption of chocolate reflects fully conscious or volitional behaviour (rewarding) it also confirms non-volitional nature of people's behaviour (craving). The belief structure reflecting health-related, nutritional, functional, and pleasurable aspects of chocolate consumption was found to be multi-dimensional (Tuorila & Pangborn, 1988b).

The *cross-cultural research* is important for a number of reasons. First, it helps to develop methods and approaches for marketing strategies in business environment. The increasing competitiveness pushes companies to focus on market niches and concentrate on narrow target groups. Growing self-consciousness of Polish customers may contradict with new propositions of global firms, which do not understand ethnocentric values and local habits. Therefore, it is valuable to analyse the perception of extrinsic product cues and values of Polish consumers.

Second, cross-cultural research about consumer's perception of intrinsic cues of food and preferences identifies a limited number of consumer groups, showing various *preference patterns* that exist in a majority of countries but in different proportions (McEwan, 1998; Moskowitz *et al.,* 1985). Many studies established that taste is the most powerful predictor of food choice (e.g. Tuorila-Ollikainen *et al.,* 1986; Tuorila, 1987) therefore, sensory segmentation for preference is believed to bring competitive advantage in product development.

Third, a cross-cultural study adds to understand the concept of *'life course'* (Furst *et al.,* 1996) during which a variety of experiences contribute to formation of a person's preferences and patterns (Clausen, 1986; Elder, 1991). Peoples' attitudes towards foods are influenced by historical background, cultural and social settings as well as individual experiences (e.g. Bordieu, 1986; Devine & Olson, 1991;

Tuorila & Meiselman, 1992). The question is whether different cultures can be compared and if yes, due to which factors (Eagly & Chaiken, 1993). From this point of view, it is interesting to apply the Theory of Planned Behaviour (TPB), which is one of the mostly experimentally tested theories, across two countries.

The ultimate *process of decision-making* may be explained by the attitudes linked with cognitive, affective, conative, and economic considerations of consumers. However, studies that combine these dimensions within a cross-cultural context are rare as being difficult to accomplish (Prescott, 1998). Until recently, there was no research that systematically analysed the above aspects of the same food within the same population and examined interactions between them (Chiva, 1999). The models, in which these factors are jointly analysed, help both marketing and Research and Development (R&D) departments to reach a better product for specific or global consumers.

To find consumers in new, changing or developing markets is a matter of searching for proper and direct *communication tools* with consumers. Modern marketing research creates novel methods based on psychological approach. However, the tradition of the quantitative market research in Central European countries is short. Professional marketing activities have a recent history of about ten years in Poland. Generally, there is lack of comparative studies such as those between members of the European Union.

The following is description of the conceptual framework of research. Next, hypotheses and research aims are set up. Finally, research design, thesis structure, and its outline, are presented.

1.2   Conceptual framework

A conceptual framework of the doctoral thesis is outlined in Figure 1.1. It is based on *two assumptions*. First, development of specific orientation either marketing or R&D is an indirect outcome of the company's strategy and organisational structure (Nyström, 1990). Second, marketing and R&D orientations have explicit impact on the company's innovation style, and implicit on business performance (Trail & Grunert, 1997).

Focus of the doctoral research is on *consumer behaviour* in regard to consumption of chocolate. An attempt is to develop new tools for joined research by marketing and R&D in chocolate industry. These tools can help to link consumer ultimate behaviour, product acceptance and final business performance.

The central part of the Figure 1.1 shows the *wheel of factors* influencing consumer behaviour. Culture and demographics indicate that research is made in cross-cultural design and with a specific target group. Investigation of wheel factors allows development of consumers' *attitudes*, which are indicators of consumer *behaviour* towards chocolate. Five groups of experimental factors are recognised.

First, are factors related to consumers' *cognitions and personality*, which are believed to be the best starting point in consumer research. Cognitive perceptions of food vary according to a certain culture as they emerge from any information available. Information come from perceived core qualities of food, its origin, nutritional consequences, health impact as well as economic considerations (e.g. Wierenga, 1983; Van Trijp & Schifferstein, 1995; Tuorila, 1997). Also analysis of personality traits adds information to consumers characteristics and it has been widely applied in consumer decision-making research (e.g. McCrae & Costa, 1987; Stafleu *et al.,* 1991; Piirto, 1992; Mowen, 2000).

Second, the *affections and preferences* for taste of chocolate are studied. The affective dimension is formed during exposition of taste organ to sensory stimuli, particularly those related to smell and taste. Intensity of preference varies for a certain food between individuals and is explained as the outcome of interactions between person and food from the physiological, psychological and sociological points of view. It is also believed that members of one food culture exhibit a similar food preference (Prescott & Bell, 1995; Tuorila, 1997; Prescott, 1998).

Figure 1.1   Conceptual Framework

```
        COMPANY              COMPANY
        STRATEGY             STRUCTURE

                   COMPANY
                   CULTURE

                   COMPANY
                   CLIMATE

      MARKET                 RESEARCH          Chapter 2
    ORIENTATION            & DEVELOPMENT

           INNOVATION & INNOVATIVENESS                      Chapter 9

                    Chapter 6

                        3rd.
    Chapter 5        Cognitions           Chapter 7
                        Vs.
                     Affections
                                              4th.
        2nd.                               Sensory
     Affections        WHEEL              Sensitivity
         &               of                   &
     Preferences      Acceptance          Perceptions
                        and
        1st.          Behaviour               5th.
     Cognitions       Factors              Preference
         &                                     Vs.           Chapter 3
     Personality                           Perceptions

    Chapter 4                              Chapter 8
                    Culture   Demographics

              BUSINESS PERFORMANCE
```

Based on:
Nyström (1990), Trail & Grunert (1997)

Third, the *interactions between cognitions and affections* are studied in the model of Theory of Planned Behaviour (TPB). In the TPB, the person's behavioural intention is predicted from attitudes, subjective norms, and perceived behavioural control component (Fishbein & Ajzen, 1975; Ajzen, 1991). While attitudes are derived from salient beliefs concerning the consequences of behaviour and their value for a person, the subjective norms are linked to the social consequences of the use of a certain food (Lähteenmäki & Tuorila, 1998). Perceived control is explained as the degree to which a person feels that s/he is in control of behaviour. In this thesis, hedonic ratings and habit are added to the TPB model.

Fourth, is a group of factors related to *sensory sensitivity and perception* of sensory cues in chocolate. This aspect is investigated through the trained panel approach. Physico-chemical responses to basic tastes, detection and discrimination of thresholds, and responses to tastes in chocolate, are studied.

The *experimental design* is developed, in which the combination of ingredients is used to determine what blend of cocoa masses and sugar produces more desirable consumer acceptability (e.g. Box *et al.* 1978; Cornell, 1981; Khuri & Cornell, 1987). As the proportion of the first component increases (decreases), the proportion of at least one other component decreases (increases) to keep the total weight of the product the same. Thus, the experimental design allows estimation of acceptability response, especially when the final product optimisation or investigation of the contextual effects on sensory scores is foreseen (Baxter, 1989).

Fifth, the relation between consumers' *preferences and perception* of sensory characteristics is studied due to preference mapping. This method is chosen to relate product acceptability data from consumers to sensory characterisation of the same product by a trained sensory panel (McEwan, 1995). The changes in perception of sensory characteristics correspond to preference directions.

The *mapping* is used to identify which products compete with each other, as well as to discover whether or not there exist in the category unfilled holes that have promise (cf. Moskowitz, 1994c). This technique locates stimuli in a geometrical space, in which more qualitatively similar stimuli lie closer to each other and vice versa. The mapping is used to develop hypotheses, while *modelling* describes, predicts and identify the salient dimensions along which consumers differentiate products in the category (cf. Moskowitz, 1994c). The linear or polynomial

equations from the specific combinations of ingredients are created. These equations are used to estimate or to optimise the likely consumer response to those combinations. The attribute profile corresponding to the optimum is especially interesting for R&D scientists.

Preference cluster mapping is chosen to study relations between preferences and perceptions, and is interpreted as the extension of preference mapping (Lundahl & Kolsky, 1998). First, cluster analysis is performed on the respondents, segmenting them into a number of clusters based on hedonic response patterns to products. Second, the factor loading scores from the descriptive evaluations of the products are used to build either linear or quadratic regression models. Then, coefficients of each preference cluster are plotted in the geometrical space of sensory attributes' perception as in preference mapping. The result is a set of 'ideal products' for each cluster of respondents with different product preferences.

Additionally, the doctorate research investigates extrinsic and intrinsic cues of chocolate by the integrated approach of *Quality Function Deployment* (Hauser & Clausing, 1988; Bech *et al.,* 1994). Hereby, consumers' attitudes and preferences are jointly studied in the House of Quality. However, this approach is only applied by large food companies because top management commitment and special allocation of resources for interactive teams, are necessary.

G*eneral objective* of the doctoral research is to *develop models* showing the importance and possibilities for integration of both marketing and R&D analyses in food industry. Since this integration is believed to improve innovation strategies and bring competitive advantage, these models are regarded as tools of competition policy in food sector. They allow the entrepreneur learning how to focus on the firms' core competencies, architect innovation strategies, and gain competitive advantage in the overall business performance.

The research is mostly based on a *conclusive* type of research, testing hypotheses and relations between factors proposed in theoretical and empirical models.

1.3 Hypotheses and aims

Four *hypotheses* are developed corresponding to the theoretical concepts. They offer means to integrate marketing and R&D approaches to understand the consumer's cognitive style and affective predisposition.

H1   Integration of marketing and R&D operations improves understanding of consumers 'needs' and 'wants'. The hypothesis is that the importance for the consumer of both intrinsic and extrinsic cues can be evaluated in the House of Quality, and is leading to a better understanding of the forces driving competitive advantage for a food company.

H2a-H2c Segmentation is a strategic tool in competitive marketing. Attitudes towards food products are formed through benefit beliefs, values and personality traits of consumers, and are related to perception of extrinsic cues in food products.

H3a-H3b An experimental design brings the competitive advantage to R&D in understanding consumers' preferences. Taste preferences of the individuals are related to perception of intrinsic cues in food products.

H4   At enterprise level, product innovation is linked to the firm's organisational culture and climate. The environmental, individual and organisational factors contribute to the formation of culture, perception of competitive advantage and the strategies for innovation.

The following four specific *aims* are set up in relation to hypotheses of research.

AIM 1 To apply the approach of the Quality Function Deployment to the development of the House of Quality for chocolate. In this way the integration of marketing and R&D can be realised and the 'voice of consumer' understood. Additionally, the target market can be established for further analysis (*H1*).

AIM 2 To start from the marketing approach to achieve consumers' segmentation. The segmentation has to be made in cross-country perspective applying two theoretical concepts of attitude formation through cognitions-personality (*H2a*) and affections-preferences (*H2b*). Additionally, to confirm findings across established segments through the extended version of the Theory of Planned Behaviour (*H2c*).

AIM 3   To develop the experimental design for chocolate and to test the samples across Belgium and Poland looking for both descriptions of products by trained panel (***H3a***) and sensory preference segments in the consumer panel (***H2b***). The relationship between perceptions and preferences should be established by the comparison of responses from the trained and consumer panels (***H3b***).

AIM 4   To elaborate a model for analysing the potentials to innovate at level of SMEs. This has to be realised due to integration of factors related to the environment, entrepreneur, and enterprise. The model should be applied among Polish manufacturers of confectionery products (***H4***).

1.4   Research design, thesis structure and outline

Figure 1.2 shows the *research design*, i.e. how conceptual framework and date sources are related to each chapter. Generally, there are three types of research undertaken (Malhotra, 1996). First, *descriptive* research is made to learn about characteristics and fundamental differences between marketing and R&D approaches to product development. The literature review is based on secondary data in the domain of food technology, marketing, sensory analysis, new product development and innovation as well as business management.

Second, *conclusive* research is conducted to find the marketing and R&D competitive advantages. Initially, the consumer survey in Poland is realised. A total of five hundred and twenty-four respondents represent all age groups and professions. In this way, the target group is found. Later on, the conclusive research relates to the cross-cultural study with Belgian and Polish consumers. The sample is large and represents three regions of each country.

Third, two *exploratory* studies are accomplished with trained panels and a group of SMEs. Trained panels are set up in Belgium and Poland and work according to the same scheme of sensory research. The second exploratory study is based on face-to-face interviews with forty owners of SMEs in Kraków region in Poland. In this case, the sample size is considered as non-representative but indicating some patterns. Thus, the hypothesis **H4** should be confirmed in future research.

Figure 1.2 Research Design and Data Sources

	Chapter 1	General Introduction

PART I

	Chapter 2	**DESCRIPTIVE RESEARCH**
		Secondary data

	Chapter 3	**CONCLUSIVE RESEARCH**
		Consumer survey, N=524

PART II

PART III

CONCLUSIVE RESEARCH

Chapter 4	
Chapter 5	Consumer survey, N=1200
Chapter 6	

PART IV

EXPLORATORY RESEARCH

Chapter 7	Trained panels, N=14

CONCLUSIVE RESEARCH

Chapter 8	Consumer survey, N=1200

PART V

Chapter 9	**EXPLORATORY RESEARCH**
	Face-to-face interviews, N=40

Chapter 10	General Discussion

Figure 1.3 presents the *thesis structure* that corresponds to its *outline*. The thesis is divided into five parts and includes ten chapters. Each chapter's title is followed by the main focus of the study, which is indicated in bold capital letters.

Part I includes general introduction, conceptual framework, hypotheses and aims, research design, thesis structure and its outline (*Chapter 1*).

The characteristics and fundamental differences between marketing and R&D departments are described in *Chapter 2*. The objective is to present an overview on integration of both orientations to improve the performance of food industry. The integration proposal is based on documented examples from business environment. Since innovation is regarded to be a major source of competitive advantage of a company, focus is on the role of consumer-oriented tests for marketing and technical product development.

Part II presents a comprehensive way to understand how the integration of marketing and R&D may be achieved (*Chapter 3*). The concept of Quality Function Deployment is used to find consumers' needs and expectations. The aim of this study is to build a structured approach to food development through the House of Quality model with application to chocolate couverture.

In *part III* the marketing advantage of consumer segmentation is exploited in three models. First, is the Conceptual Model of Chocolate Choice (COMCC) by means of which personality-based segmentation is achieved (*Chapter 4*). The model is based on theoretical concepts and empirical approaches that stress importance of cognitive factors in the consumer decision-making process.

Second, is the Model of Affection-Related Chocolate Choice (MARCC) that analyses the segments in preference for chocolate (*Chapter 5*). The model is developed due to the vast amount of literature showing the paramount importance of consumers' food taste preferences.

Third, is the model of Cognition and Affection-Related Behavioural Intention (CARBI) and integrates the findings of two previous models into the Theory of Planned Behaviour (*Chapter 6*). This approach is undertaken due to the evidence that incorporation of both cognitive and affective factors into the TPB model, increases its predictive power.

Figure 1.3   Thesis structure

Chapter 1	General introduction

FRAMEWORKS & OBJECTIVES

PART I

Chapter 2	Towards an integration of R&D and marketing in product development

FUNDAMENTALS OF R&D AND MARKETING

PART II

Chapter 3	Quality Function Deployment in the chocolate industry **H1**

FRAMEWORK FOR INTEGRATION OF R&D AND MARKETING

PART III   **PART IV**

Chapter 4 Market segmentation for chocolate in Belgium and Poland **H2a**	*Chapter 5* Sensory segments in preference for plain chocolate across Belgium and Poland **H2b**

Chapter 7 Context effects in evaluation of chocolate quality through the experimental design – cross-cultural study **H3a**

COMPETITIVE MARKETING   **COMPETITIVE R&D**

Chapter 6 Application of the Theory of Planned Behaviour to consumption of chocolate: cultural differences across Belgium and Poland **H2c**

EXTENSION OF TPB MODEL TO AFFECTIVE & CONATIVE FACTORS

Chapter 8 Acceptance of chocolate by preference cluster mapping across Belgium and Poland **H3b**

PREFERENCE CLUSTER MAPPING

PART V

Chapter 9 Innovation potential in small and medium enterprises manufacturing confectionery products in Poland **H4**

INNOVATION POTENTIAL

Chapter 10	General discussion

DISCUSSION & CONCLUSIONS

Part IV consists of two chapters. *Chapter 7* explains the experimental design of chocolate and describes how the samples are analysed by the trained panels in Belgium and Poland. The main aim of this chapter is to find differences in panelists' sensory sensitivity and perception of sensory attributes in chocolate. This approach brings the R&D advantage because trained panels are relatively inexpensive when compared to instrumental evaluations of product quality.

Chapter 8 explores differences between the consumer and trained panels in perception of sensory cues of chocolate. This is achieved due to the preference mapping that allows description of each experimental sample in terms of its core attributes. Products that compete with each other are identified and consumers' perception of generic and augmented cues of chocolate is also mapped across the found segments. Then, modelling procedure is established to find the combination of cocoa masses that is related to the highest acceptability of chocolate.

In *part V,* existence of marketing and R&D strategies for product innovation is analysed in Polish SMEs (*Chapter 9*). The aim is to show the potentials to innovate through analysis of the environment, entrepreneur, and enterprise (3EN-model). The hypothesis that an entrepreneurial firm has the most favourite culture and climate for innovation is tested with manufacturers of confectionery products.

Chapter 10 presents general discussion of results and conclusions from the doctoral research. Limitations and recommendations for further research and improvements in methodology are indicated.

The thesis is a compilation of papers that were published or are submitted for publication in international journals.

CHAPTER 2

Towards an Integration of R&D and Marketing in Product Development

2.1 Abstract

In the second Chapter, two approaches which are characteristic for Research & Development and Marketing departments are compared. First, R&D versus Marketing orientations are explained, then the major differences between them are presented. The integration of both approaches may improve competitive advantage of the food industry. Factors stimulating such integration are presented on the basis of data from real business circumstances. Innovation is regarded as a major source of competitive advantage of a company. Therefore, integration in sensory methodology, that is commonly but differently used by R&D and Marketing departments, may contribute to the improvement of innovation practices and successful business performance. Finally, the role of consumer tests, oriented for marketing and product development, is illustrated.

2.2 Introduction

The aim of the study is to compare two approaches which are characteristic for Research & Development and Marketing departments and to show how the integration of them may improve competitive advantage in the food industry. First, R&D versus Marketing orientations are explained, then major differences between them are presented. Following is the integration proposal on the basis of documented data from real business circumstances. Innovation is regarded as a major source of competitive advantage of a company. Therefore, integration in

sensory methodology that is commonly but differently used by R&D and Marketing departments, may contribute to the improvement of such innovation practices and successful business performance. Finally, the role of consumer tests oriented for marketing and product development in food industry, is illustrated.

2.3   R&D versus Marketing orientation

In the economic literature (Grunert & Harmsen, 1997) neither R&D nor market orientation is expected to have a *direct* effect on business performance. Both of these orientations can however, influence innovation processes, whose outcome can in turn influence business performance. Figure 2.1 presents a general framework for analysing innovation within a food company.

Figure 2.1   A Framework for Analysing Innovation
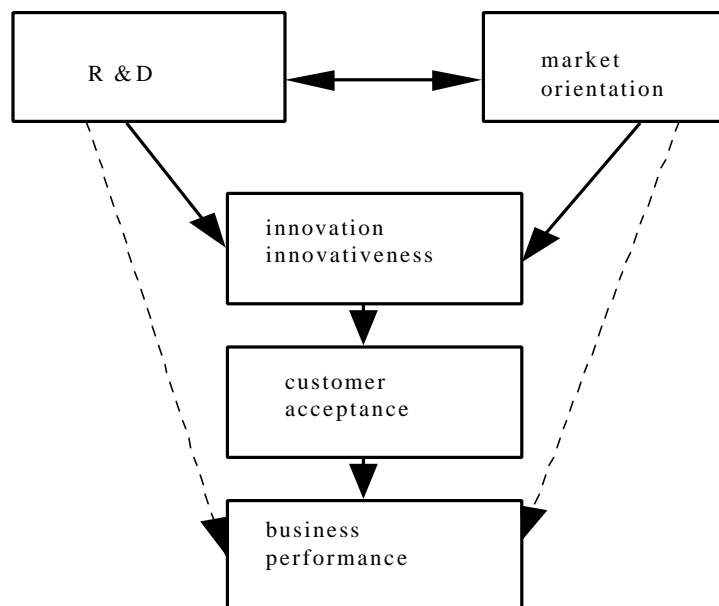
Source: Grunert & Harmsen, 1997

Generally, there are two major views on innovation. In one view presented commonly by the industrial economics literature, innovation and innovation success is closely linked to technological change and to R&D activities. In the other view, taken mainly from the marketing literature, innovation is regarded as

the detection and fulfilment of needs and wants of potential customers, and innovation success is therefore linked with the concept of the degree of market orientation inside the innovative company.

Recent literature presents a view that R&D and market orientation, that represent technology push and market pull respectively, are both needed for successful operation. They are believed to be major determinants of innovation in the form of new products or processes, which if well received by consumers, are contributing to superior business performance. The dotted lines in Figure 2.1 represent the attempts of empirical research that have been done to test relationship between R&D, Marketing and business performance.

Based on the consumer behaviour theory, the specific framework to choose food presents stages in process from primary production to consumption of food products (Figure 2.2).

Figure 2.2   Stages in Process from Primary Production to Consumption of Food Products
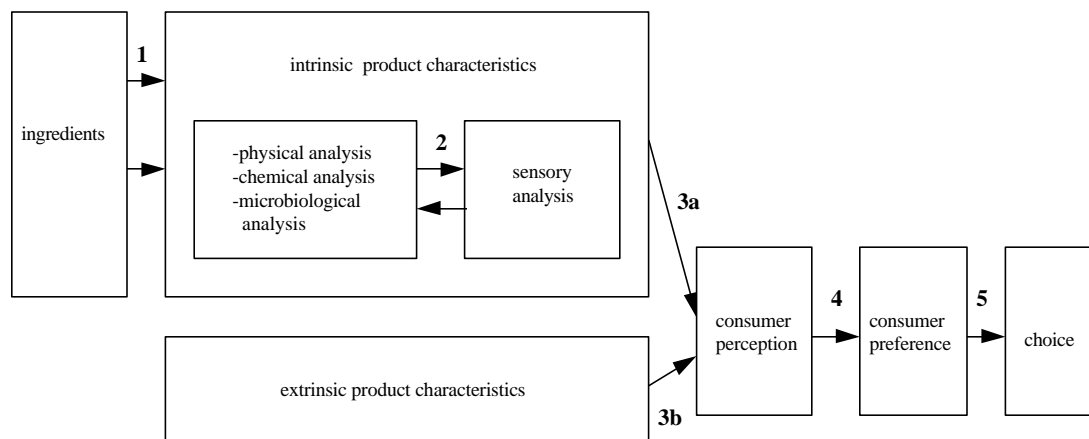
Source: Van Trijp & Schifferstein, 1995

Figure 2.2 gives an overview of five marketing process steps that influence consumer preference and choice. Understanding of consumer choice behaviour is the basis of a successful marketing strategy. The choice behaviour is largely based

on previous consumer preferences, but non-product related factors such as availability and price promotions may interfere with the relation between consumer perception and final choice. A need structure differs among groups of consumers as well as consumer perceptions, which are in fact the ideas about brands or products within a certain product category. These ideas are cognitive in nature and originate from the interpretation of intrinsic (3a) and extrinsic (3b) cues (Steenkamp, 1989). Stage 3a consists of intrinsic product characteristics, which can be evaluated by the means of physical, chemical, microbiological and sensory analyses (step 2). Changes in the physical product may concern changes in ingredients too (step 1). That is a part of R&D department responsibility.

2.3.1   R&D orientation

In the R&D approach product evaluation is typically *product* oriented. Instrumental, physico-chemical and sensory analyses are used to evaluate intrinsic cues of physical product, such as odour, taste, size or appearance. For food products, sensory analyses are the main concept of integration with marketing. They are also widely used in the marketing tests, although in a different way, putting the priority on people's perceptions of sensory quality rather then the real taste evaluations.

In the process of sensory judgement usually 4 stages are recognised (Van Trijp & Schifferstein, 1995). These are: physical concentration, perceived concentration, coded sensation and overt response. In the laboratory situation, products are coded and the environment is far from the market place reality. Such approach contributed to the establishment of quality assurance and quality control processes within industry (Meilgaard *et al.,* 1991), services to product development and product improvement as well as services to marketing research development (Sidel & Stone, 1993).

2.3.2   Marketing orientation

The most basic concept underlying marketing is that of consumer orientation. The market consists of many types of customers, products and needs. The marketer's task is to determine which segments offer the best chance to achieve company objectives. Köster (1996) suggests that 'categorising people in groups according to

their reactions on questions regarding their attitudes, values and beliefs is a simplification of consumer reality'.

The real product extends beyond the physical characteristics. Properties are added to the core product by the composition of the marketing mix. For a marketeer it is more important to know what consumers think they taste, than what they really taste (Lesser, 1983).

In marketing, consumer attitudes and behaviour are measured with the aim to segment the respondents into homogenous groups with a meaningful interpretation. A market segment consists of consumers who respond in a similar way to a given set of marketing stimuli. Differences in methodology between consumer and product oriented approaches are discussed below.

2.4 Differences between R&D and marketing orientations

In this section, the basic differences in approach of R&D and Marketing are explained. Table 2.1 shows the contrast characteristics of both orientations, based on literature.

The primary focus of R&D is the product or production process, while the Marketing approach explores the consumer behaviour on the market. The criterion type of each orientation is also different. R&D department considers the internal validity of tests as the primary importance over the external validity, which is the aim of the marketing orientation. In Table 2.1, the five key characteristics differing both approaches are outlined. First, the type of respondent is contrasted. Then a short presentation of methodology by the tests and techniques used is considered. After discussing the type of stimuli, which refer to the product characteristics, scaling procedure and test circumstances are compared.

2.5   Type of respondent

2.5.1   R&D respondent

In R&D, trained panel of limited size is used. Such panel has to be previously well selected and the methodology is designed according to the type of product evaluated. Internal validity of sensory tests is achieved when subjects are able to seclude themselves from disturbing influences that do not relate to the integration between the sensory system and the product.

As the type of respondent varies from street to street it is important for the sensory leader to decide who and how many people should take part in the analysis. The parameters such as age or gender may influence the taste and flavour detection. However, the literature is rather contradictory in those aspects.

Table 2.1   Differences between R&D and Marketing Orientations

ORIENTATIONS	R&D	MARKETING
Primary focus	product or production process	consumer behaviour
Criterion	internal validity	external validity
Type of respondent		
Number	6-12	>50
Characteristics	trained or expert	naive
Methodology		
Characteristic tests	perceptible	perceived
	A/ instrumental	C/ qualitative, - exploratory
	B/ sensory	D/ quantitative - conclusive
	b1/ discriminative,	d1/ descriptive
	b2/ descriptive,	d2/ causal
	b3/ affective	
Type of stimuli (product)		
cues measured	core	augmented & generic
Scaling procedure		
scaling	ordinal, nominal, ratio	multidimensional, conjoint
terminology	specialised	less detailed, consumer
Test circumstances		
place	laboratory	in-home, streets, test-centres
degree of control	strict	moderate
protocols	detailed instructions	questionnaires

Based on: Van Trijp & Schifferstein, 1995

2.5.2 Marketing respondent

Sensory test in marketing are performed by an independent panel of more then 50 people depending on the tested product, circumstances for carrying the test and type of respondents to be evaluated. For example, the sensory test performed at the local station with four age groups of respondents should involve at least 200 people.

In consumer tests the following factors are usually taken into account: age, gender, income, education, profession, consumption/purchase amount, frequency of usage etc. Additionally, attitudes, values, beliefs and lifestyle are checked before the respondent is classified to the group of similar characteristics and allowed to evaluate the product (Solheim, 1996).

2.6   Methodology

2.6.1 R&D methodology

The R&D department uses instrumental and sensory tests to examine the quality of products.

Instrumental tests are perceived as the most objective methods of product evaluation. They are performed according to the standards or detailed procedures that are sometimes the confidential methods developed by companies or scientific institutions. Sensory methods of product evaluation consist of the following three types of tests: discriminative, descriptive and affective tests.

The first, *discriminative* tests are performed to find out differences between products. Technically, there are many tests of such magnitude, for example: duo-trio, triangle or paired comparison tests.

Descriptive tests are more elaborative and have another aim. They are employed when a detailed description of the product's attributes is essential. Such analysis provides an information about a significant difference between two or more products and shows in what way this difference consists in. Here the Quantitative Descriptive Analysis (QDA) is the most applied method.

The last type of sensory tests, namely *affective*, are the preference tests and in reality need different circumstances to perform. These tests verify which product the consumer prefers and how it is evaluated compared with the consumer's ideal. Here the affective analysis can either be carried out separately or as a part of market analysis.

2.6.2 Marketing methodology

Basically, marketing research is divided into two approaches: exploratory and conclusive research.

Exploratory research is unstructured, based on small samples of respondents and may utilise popular qualitative techniques such as focus groups, depth or pilot studies. The main objective of exploratory research is to discover ideas, understanding and insights. Information needed is defined only loosely and research process is flexible and unstructured. The respondents' sample is small and not representative. Analysis of primary data is qualitative and findings are tentative, never conclusive.

Conclusive research tests specific hypotheses and examines their relations. Information needed is clearly defined. Research process is formal and structured. The sample of respondents is large and representative. The data analysis is quantitative in nature; therefore findings can be conclusive and may be used as input into decision making. Conclusive analysis can focus on descriptive or causal research.

Descriptive research looks for market characteristics or functions. It is a pre-planned and structured process marked by the prior formulation of specific hypotheses. The following techniques may be used: secondary data, surveys, panels, observations, etc.

Causal research is used to obtain evidence of cause-and-effect (causal) relationships. Marketing managers continually make decisions based on assumed causal relationships. These assumptions may not be justifiable, and the validity of the causal relationships should be examined via formal research (Malhotra, 1996).

2.7   Type of stimuli

The overall process of the perceptions and preferences' formation is presented in Figure 2.3. That process is influenced by various kinds of stimuli.

Figure 2.3   Formation of Perceptions and Preferences Depending on the Type of Stimuli
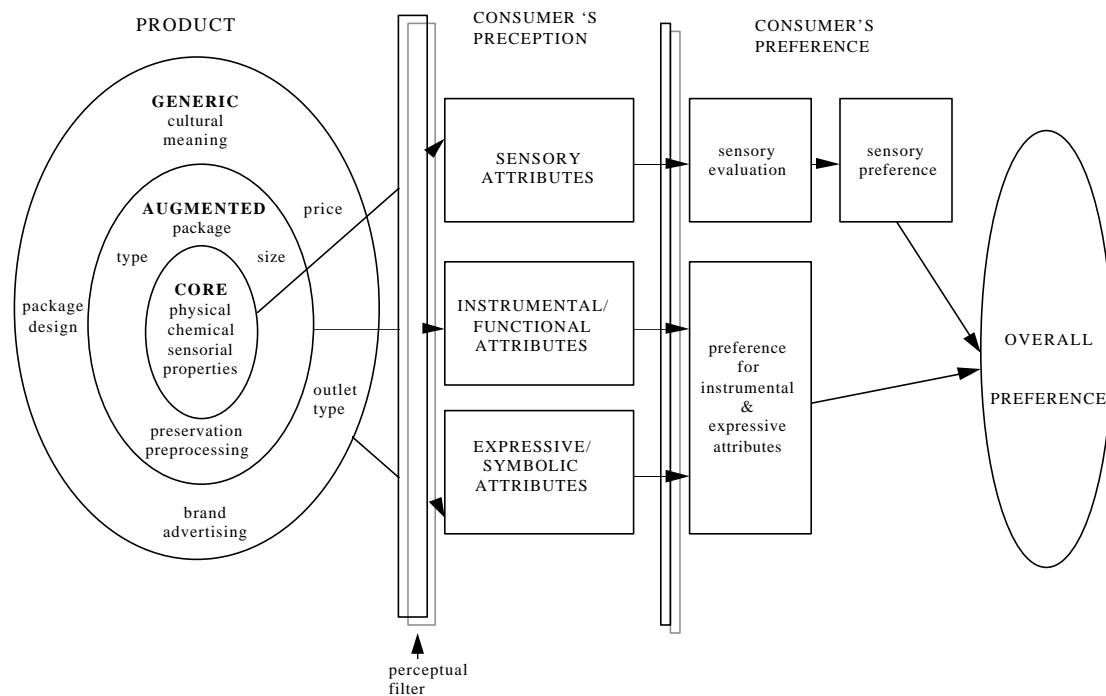
Source: Wierenga, 1983

2.7.1   R&D stimuli

In the R&D approach, the product has to meet defined standards. Physical and sensory aspects of the so-called *core product* are measured (Leeflang & Beukenkamp, 1987). These aspects consist of hedonic (taste, smell, colour, texture etc.) and instrumental (ingredients, nutritional components, additives etc.) attributes. These are also known as the *intrinsic cues* of food product (Steenkamp, 1989) and are defined as the part of physical product, which cannot be changed without also changing the product in its physical formulation.

Type of stimuli is related to macroscopic and individual factors of each respondent that influence his/her believes and attitudes and overall acceptability of food product (Köster, 1996).

Macroscopic factors consist of cultural (e.g. importance of food, religion, food traditions and cuisines, attitudes and beliefs) and economical (availability, price etc.) influences. They are contributing to the situation, i.e. event in which eating is involved.

On the other hand individual factors such as: sensory sensitivity, preferences and aversions, sensory memory and imagination are characteristic for each respondent. The last two individual characteristics of consumers are of great importance in marketing approach. That is a situation rather and a global image of the product we have eaten that we remember, instead of the real product.

2.7.2   Marketing stimuli

In a marketing approach, product has to be adjusted to the consumer needs and changing preferences. Therefore, not the product himself, but the consumer is the subject of investigation through the augmented and generic product attributes (Leeflang & Beukenkamp, 1987).

The *augmented product's* attributes are related to the core attributes of physical product plus its functional attributes perceived by consumers. These can be as follows: package, brand name, price, advertising, distribution or others.

The *generic product* attributes are those of augmented ones plus benefits that the consumer can derive from the product. Here some symbolic or expressive attributes are suggested such as: exclusiveness, distinction, progressiveness, sobriety or modesty in consuming specific products, utility, convenience, durability, acceptance by other people, feelings of safety, status and prestige. Symbolic or expressive attributes may convey something about the consumer to another person in his social environment, as so-called 'conspicious consumption' (Wierenga, 1983).

These are known also as *extrinsic cues*, which are related to the product but are not a physical part of it (Steenkamp, 1989). They influence consumer perception but

can be adjusted without changing the physical product (e.g. brand name, price, and other marketing cues).

2.8 Scaling procedure

2.8.1 R&D scaling

R & D approach requires small size samples or specific market segments to be tested. A panel of respondents evaluates the product using detailed terminology that is strictly defined. In some methods, such as free choice profiling (Williams & Langron, 1984) subjects are asked to develop their specialised terminology, which is then however, discussed and standardised for all judges.

The general category rating scales (e.g. 8-point hedonic scale) or "relative-to-ideal" scales are the graphic representations used in consumer product testing.

General category rating scales are often used in the overall preference measurements and in distinguishing between food samples, while the "*relative-to-ideal*" scales are implemented in the identification of the "ideal" level of sensory attribute and the concentration of the physical characteristic in the food product (Solheim, 1996).

2.8.2 Marketing scaling

In the marketing approach, the consumers' terminology differs from the experts' one in both quantitative and qualitative aspects. Marketeers construct more abstract and less detailed terminology.

As we consider type of scaling procedures, the following suggestion may be of usage. Perception with respect to instrumental (core product) and expressive (augmented and generic products) attributes is usually done through the 'compositional' approach.

In the *'compositional'* approach, a large number of attribute scales is developed and the representative consumer population is selected to rate various product

alternatives on these scales. Next, correlation coefficients between scales are computed and the correlation matrix can serve as the input to multivariate analysis. Having then a small number of dimensions that summarise most of the original ratings, one can realistically interpret them.

Various studies on vegetables (Wierenga, 1983), meat or meat products (Horsfield & Taylor, 1976) or chicken breast (Frijters, 1976) show that consumers choose few attributes of specific product as the most important ones. For example, three most important attributes, i.e.: toughness, succulence and flavour (96 % of the variance in an original set of 11 attributes), have been found for meat and meat products, while cohesiveness, dryness and fattiness appeared to be at the highest frequency for cooked chicken breast.

The example of scales used in the evaluation of cocoa products is showed in Annex 2.1.

2.9   Test circumstances

2.9.1   R&D test circumstances

Sensory tests are done in the controlled environment of laboratory rooms, where coded boots are installed. Here the detailed protocols and instructions about tasting procedure are submitted to panellists and the neutralisation of the taste senses between samples such as rinsing, crackers, etc., are required. That is far from the real market situation, which does not undermine the importance of such analysis. For the integration of two discussed approaches it is however, more important to see the sensory analyses through the marketing approach.

2.9.2   Marketing test circumstances

Consumer oriented, marketing approach is always carried in an uncontrolled environment and external validity is needed. External validity requires test circumstances that are as 'natural' as possible. It is reasonable here to limit human contact as each consumer should respond unbiased. We also should look for the proper behaviour of respondents, they have to be motivated to take part in the

survey and quite opinionated about the product tested. Normal usage conditions are suggested and the stimulus context should be adjusted to them. As the test circumstances, at the second approach, are less controlled and so far more realistic, there are a few possibilities for marketeers to conduct them.

Test circumstances play also a great role in the correct design of affective tests that have to follow product-for-consumer, integrated approach. The environment in which test is carried out should, as much as possible, resemble a real market situation. Test circumstances have to be checked for their best utility for the problem itself, as one place may be much better or worse then other to perform such analysis.

2.10 Integration of R&D and Marketing

Integration of R&D and Marketing within food companies is stimulated, since market conditions are changing by the increased competition, faster technological developments and more demanding consumers (Maljers, 1991).

This section consists of the factors/suggestions that may stimulate integration inside a firm and the management responsibilities in bringing a new approach into the problem. Quality Function Deployment, as one of the formal management processes, is presented because of its documented usefulness in business performance.

2.11 Factors stimulating integration

Factors that may stimulate integration between these two - product and consumer oriented - approaches to business development, consist of the following four suggestions (Van Trijp & Shifferstein, 1995). First, all employees should be aware of the fact that integration yields a competitive advantage to the firm. It is believed that R&D employees are usually less aware of that.

Second, mutual understanding and the ability to recognise each other's skills and limitations are important. The marketing people should be more aware of limitations to production and that not all marketing concepts may be fulfilled.

Third, R&D employees should be aware that consumer behaviour is the ultimate criterion for the firm's success.

The fourth is the requirement of integration in the personal, financial and organisational levels.

Figure 2.2 shows the stages in process from primary production to final choice and consumption of food products. One can realise that the factors contributing to the integration in laboratory and marketing research origin in the human factor. Starting from the point of raw materials reception, the marketeers, and not only R&D people, should be highly involved. Ingredients play an important role in the intrinsic quality cues of food product, the best they are, the higher the quality achieved. But the highest quality may not be the strategy of the firm.

For the marketeer the consumers' behaviour is the interests to evaluate, through the analysis of their knowledge about product, beliefs and attitudes. They examine a product's perception, taking into account both intrinsic and extrinsic cues. However, for consumers, it is believed that they are more interested in the benefits they derive from the product then in the technical features of this product per se. There are obviously consumers who are aware of the mineral or vitamin level in special products.

For the R&D people it is commented that they are less aware of the fact that the possible integration with marketing outcomes usually yields a competitive advantage to the whole business performance. While designing and developing a new food product, they should always take into consideration the extrinsic product cues such as the possible price, image, convenience, special feelings that may influence people's attitudes and contribute to the acceptance or rejection of the product.

2.12   Management responsibilities

The ways that management can contribute to the stimulating climate for integration consist of six approaches (Anon, 1996).

First, is the relocation of *physical facilities* design inside the firm. The relocation and physical facilities design means co-locating cross-functional development groups as a way of improving integration.

Second, is the *personnel movement* across the functions. By doing such, it is believed that information flow across functional boundaries increases. This may be achieved by the recruitment of people with multiple skills or training them extensively in the areas of the interest.

Third, is the *informal social system* that reduces the language, cultural and physical barriers to integration, to provide joint recreational activities.

Fourth approach is the change in the *organisational structure* that may be designed through the following groups: permanent co-ordinating groups, matrix organisations or project teams.

As a fifth approach of integration, the *incentives and rewards system* is recommended. Marketing personnel usually gains the bonuses based on increase in market share (regardless of how much the share of the market was increased), while R&D personnel achieves the bonuses based on technology improvements (whether or not this has led to better performing products or improvements in market share). Two kinds of incentives create barrier to effective organisation by differentiation of responsibilities across functions.

If the performance evaluation of a new product exists in the firm, through the monitoring of ultimate product development profits, the possible conflicts between departments are easier to locate and avoid in the future. The joint system of incentives leads to higher profits on a new product introduction what is proved by certain studies.

Sixth is the *formal management process*. The formal management processes can be defined as phase-review process, stage gate process, product and cycle-time excellence process (PACE) or the quality function deployment.

Quality function deployment (QFD) is the worthwhile one to look closely at in the context of that paper. This is a planning process to design new products, the management technique developed in the 1970's in the Mitsubishi's Kobe shipyards that is believed to improve strongly communication and understanding between the R&D and Marketing departments. The QFD focuses on integrating the flow of communication in the firm, and of which, the House of Quality (HoQ) is the main component (Bech *et al.,* 1994).

The idea behind the House of Quality is to replace consumers' desire for products together with the technological possibilities. The technical and sensory relations in the House represent mutual connections between the internal product specifications. Here three types of relations are recognised:

- mutual relations between technical specifications,
- mutual relations between sensory specifications, and
- relations between technical and sensory specifications.

The relationship matrix translates the subjective quality into measurable or documentable objective quality attributes. Target for product development is expressed in objective attributes and based on consumers' demands. Consumers' needs (demands) are the starting point of each investigation. Such approach of 'listening to the voice of customer' is achieved by the determination of level of consumer acceptance on a blind-labelled sensory basis. And these relations, as a part of sensory consumer tests, are the field of integration between R&D and Marketing approaches.

Summarising, the formal recognition of support to integration is especially needed within the firm. Additionally, the process of balancing the short term (development) and long term (research) objectives of the firm is essential. The management should encourage entrepreneurial behaviour by supporting new ideas and risk taking and the formalisation of integration of marketing and R&D in the organisational structure (Van Trijp & Shifferstein, 1995).

It is also believed that integration would require very specific and detailed formulation of the research objectives, particularly with respect to the trade-off between internal and external validity. Also mutual understanding of prime

responsibility, specific skills and limitations of the two departments is necessary to be taken into consideration.

2.13   Role in Food Industry

Integration in R&D and Marketing approaches may be undertaken by the focus on the new and challenging role of sensory evaluation in the food industry. Growth of the sensory evaluation can be attributed to the increased interest and support of the consumer products industry.

For the food industry, sensory evaluation is the natural extension of each firm's desire to achieve the highest product quality and therefore, to improve competitiveness on the market. Sensory evaluations present a cost-effective resource with a wide range of applications and can provide a unique product information not readily available from other sources (Sidel & Stone, 1993).

The role of sensory evaluations in the food industry is outlined in the next topic. First, the current role of such evaluations in the integrated approach of R&D is presented. Then the future role is proposed.

2.13.1 Sensory science in food industry

Sensory science is both an investigative and informative discipline. However, today the sensory information must be actionable in the business environment as the management has usually little patience for impractical approaches and vague data. That is why the sensory analysis used to rely on the expert judges in the past. Today data are obtained from reliable expert panels with the rigorous control of the measurement process and statistical applications to behavioural data.

Independent departments are organised within companies and the basic tasks of sensory management can be summarised as follows (Sidel & Stone, 1993).

First, the sensory staff should *educate users* of sensory methods (in both R&D and Marketing departments) through seminars and presentations, describing available

services (and their value) to new managers and potential users, and also through the circulation of summaries of relevant research from sensory literature.

Second, they should act in the *pro-active and comprehensive research.* As for many new product development projects, it is much better and more useful to include a broad range of experimental and competitive products. Information gained from such research can be used in many ways. It may be useful for Marketing as a category review and/or for identification of sensory-based preference segments among consumers. Also it may be used for product development teams.

Third, the *sensory experiments* should be *designed*, meaning that they have to include factorial or fractional designs, all of which require systematic variation of the experimental variables, including internal and external product cues.

Fourth is the *identification* and *description* of consumer *preference clusters* that increase popularity of optimisation research, design studies and use of multivariate statistics. It should be realised that there are many benefits to develop new products based on sensory preference groups. Products are targeted for the best product for one or more clusters or developed for the best compromise product across the clusters.

2.13.2 Current role of sensory evaluations

Current, *service* role of sensory evaluations may be discussed in three levels: services to product development, services to marketing research development (MRD) and services to quality assurance and quality control.

Services to product development are realised through the following alternative processes: new product development, pilot-plant scale-up, production benchmark, cost-reduction, product/processing change, industrial/sensory correlations, product stability and shelf life or product optimisation (Schutz, 1983; Sidel & Stone, 1983).

Services to MRD can be achieved in the processes of competition monitoring, advertising claim support (Sidel & Stone, 1992), identification of consumer preference groups or test design and supervision process.

As the last one, *services to quality assurance and quality control*, the sensory evaluations can participate in the processes of product distribution, training and monitoring of Quality Assurance/Quality Control (QA/QC) panels and programmes as well as in the development of sensory specifications.

2.13.3 Future role of sensory evaluations

In the future, the sensory evaluations will continue their service role to the food industry, however it is strongly believed that they will also contribute to the *research role* binding the interests of both R&D and Marketing departments and thus *servicing the business strategy.*

The research role is foreseen through the affective tests, which are a direct link between the consumer and other sensory respondents, such as the development processes. Here, it is important to improve subject screening criteria and test procedures, as the results should be a valid source of consumer preference. It is believed that the information from sensory affective tests provides greater opportunities for interaction with marketing research and integrates the two informal sources (Carter & Riskey, 1990).

Affective tests focus on products and the products' acceptance is measured as a function of product differences and similarities. Physical products are presented and evaluated, but product alternatives are reduced to one or two, which is studied by marketing research. Context for the test is limited to the minimal amount of information necessary to describe the product (e.g. barbecue-flavoured ketchup) and its usage (e.g. a snack, a breakfast drink etc.).

In such affective tests, the dependent variable is passive in comparison to typical marketing tests where the dependent variable is rather active and more cognitive then sensory action oriented. Affective tests are used with consumers qualified according to product attitude and usage behaviours.

2.14 Discussion and conclusions

Traditional sensory techniques cannot be 'simply applied' for marketing practice. Rather, marketing requires sensory techniques that are fundamentally different from what has been developed and used in traditional sensory analysis (McBride, 1990).

The discriminative sensory test conjoined with a questionnaire about instrumental and expressive attributes can be successfully applied to find out consumers' acceptance. In the integrated test for marketing and R&D, two approaches have to be joined. First, as the marketing approach to sensory analysis focuses on what is perceived in the product irrespective of whether these perceptions originate from the intrinsic or extrinsic cues, the consumer test should include questions for both cues.

Second, the R&D approach to sensory focuses on these characteristics that are perceived irrespective if they have significance for consumers in the market. In another words, the integrated test should put much more importance on the questions developing the relationship of major sensory cues to consumer behaviour.

General opinion is that 'there is more to do then bringing independent consumers into the sensory lab or relating expert profiling data to preferences collected from a consumer panel'. Integration may be achieved by a complimentary use of consumer and product oriented sensory methods.

Focus on external validity requires sensory tests that are fundamentally different from what is used in product-oriented approach. Closer co-operation of marketing and R&D may result in new methods that more explicitly relate sensory analysis to consumer behaviour, called by McBride (1990), 'the third generation of sensory analysis'.

Approaching a test of the 'third generation' it is important to understand how to design a *product-for-consumer* oriented test, taking into account five basic aspects related to the differences in sensory practice: type of respondent, methodology, type of stimuli, scaling procedure and test circumstances (Schutz, 1988).

Many factors of economical, physiological and sociological nature can provoke consumers' perceptions, i.e., ideas about brands and/or products, which are cognitive in nature and originate from the interpretation of intrinsic and extrinsic cues.

Human expectations for certain food product are linked to sensory ability and personality traits; both are key determinants of individual difference in interaction patterns of extrinsic and intrinsic cues. The expectations may be divided for typical hedonic and typical sensory-based expectations.

Deliza & MacFie (1996) review the broad literature on this subject and indicate three basic extrinsic characteristics widely examined for their influence on expectations. These are: types of advertisement, package/labelling and information. As far as advertisement is considered, the soft- and hard-sell approaches are presented. Depending on the Private Body Consciousness (PBC), people are segmented to those of high- and low-PBC (Miller *et al.,* 1981). The first group consists of those who are used to magnify any disparity found between the product recorded and expected (contrast effect), while the second group consists of people who are used to minimise any differences in tested products or assimilate these new tastes (assimilation effect).

It seems to be important to know the personality traits of individuals to whom the ad is exposed. The high PBC people are more influenced by hard-sell approach then others, and low PBC are more susceptible to soft-approach. Explanation of both terms may be necessary here as it has a direct connection with R&D or Marketing approaches to problem recognition. First, hard-sell ad focuses on claims about the intrinsic characteristics of the product, i.e., inherent quality or functional value of it. Second, the soft-sell ad, called the 'image-oriented' ad, does not contain any explicit information about intrinsic cues but consists of some illusions associated with the product (Deliza & MacFie, 1996).

On the other hand, expectations arose through the brand perception rather then perceived sensory product differences (Chernatony, 1991). Turoila *et al.* (1994) and Aaron *et al.* (1994) concentrate on the various information provided to consumers that lead to shifts in hedonic judgement. Their conclusions are however, not so one-dimensional that one might expect.

Therefore, the so-called "matched expectations" (Deliza & MacFie, 1996) that come from the sensory evaluations on the one hand and marketing analysis on the other, are the factors leading consumers to the repetition of use or rejection of certain products.

Integrated models of food product selection are elaborated on here. To achieve this, we need to understand the way that expectations interact with messages coming from intrinsic cues of each product. Only the structured and organised approach is able to combine research at different levels contributing to the better validation of an objective strategy. Integration of R&D and Marketing approaches is a major key to success.

When product innovations are based on unfilled needs of the market (Hauser, 1984) such a pull strategy demands for market-directed R&D (Urban & Hauser, 1993).

Therefore, on the one hand marketeers should realise the importance of R&D, as the expert panel is an auxiliary tool at the early stages of product development. It is not expensive, gives direct feedback and reduces risk that competitors become informed. On the other hand, R&D employees should know that sensory aspects may serve as a 'criterion' or limiting condition to product development and that it is only a part of the quality strategy to improve business, which aims at non-sensory aspects generally.

Also the study of non-sensory aspects and consumer behaviour related to product attributes is important because of the increasing competition on the national and international markets.

2.15   Acknowledgements

Annex 2.1   Example of Scales Used in the Integrated Approach for Chocolate Products

INTRINSIC CUES (coded samples without packaging)

COCOA BODY
Definition: The sensation of cocoa feeling associated with cocoa powders and/or compound coatings

Slightly cocoa-like			Very cocoa-like	
Sample 125		Sample 843		

PARTICLES ON SNAP
Definition: The amount of irregularity, protrusions, grains, or bumps that can be seen on the surface of snap of the product

Smooth			Grainy
	Sample 843		Sample 125	

EXTRINSIC CUES (real products)

PACKAGE COLOUR (assuming it is dark violet)
Definition: The primary colour (hue) of package that affects overall perception of the product on a shelf

Slightly violet			Very dark violet	
	Sample 125			Sample 843

PERCEPTION OF LUXURY
Definition: Mental association with expensive product, which is not necessary, but which gives you pleasure

No luxury perception		High luxury perception	
Sample 125		Sample 843	

CHAPTER 3

Quality Function Deployment in the Chocolate Industry

3.1 Abstract

The aim of the third Chapter is to build a structured approach to food development through the House of Quality model with application to chocolate couverture. The final concept relates to filled (composite) chocolate that, according to definition, is a chocolate with filling of (praliné) covered by chocolate couverture of not less than 15%. The research procedure that consists of the five steps was developed in association with the House of Quality model. First, the marketing research was conducted to determine the segment of filled-chocolate consumers. As a result, a target group of people between 20 and 29 years old was found. Second, the behavioural motives of the consumers in the target segment were analysed. Then product objective specifications were established through physico-chemical and instrumental methods. Finally, sensory analyses were performed involving both consumer and trained panels. A few significant correlations between instrumental and sensory scores were established. The last step of research relates to analysis of the mutual relations between technical and sensory measurements and integration of results in the House of Quality matrix. Methodology introduced in this experiment corresponds to the Quality Function Deployment approach; data evaluation - by ANOVA and factor analysis - is implemented.

3.2 Introduction

Traditionally, marketing analysis and R&D activities that include both instrumental and sensory analysis, are each carried out in their respective

departments in the firm, often in a quite uncoordinated way (McBride, 1990). The obvious way to improve a company's performance would be to integrate three types of analysis into a method that can be well understood and implemented by all parties. Quality Function Deployment (QFD) is a structured approach for product development that can be theoretically applied for creation of food products. However, this is a complicated task, as the co-operative management of many departments is necessary. Development of QFD usually involves communication of information about skills and resources, future strategies, costs and current production approaches (Globerman, 1980) and, therefore, the company may not be willing or even be able to afford the whole QFD process (Grunert *et al.,* 1997).

The aim of the current study is to apply the QFD to chocolate, integrating different research methods within the House of Quality model (Hauser & Clausing, 1988; Bech, *et al.,* 1994). Chocolate serves as an example of a very complex product, whose final quality depends on various intrinsic and extrinsic interactions (such as liking of taste through brand perception etc.).

First, the research model is developed and the different parts of the House are defined. Second, the different types of analyses are explained focusing on quantitative results. Third, the structural relationships between the different parts are discussed and the House of Quality is constructed. Finally, the mutual relations in the roof of the House lead to the optimal product development in the chocolate industry.

3.3   The House of Quality model

The QFD approach emphasises the voice of the consumer as the starting point of product development. It is believed that associated credence values and consumers' expectations that emerge from previous experience may help in explaining quality judgement functions. On the other hand, ingredients that affect the product's quality as well as production steps have a significant influence on flavour and texture development. The QFD approach is based on the assumption, that if we know the correlations between sensory aspects of the product, the mutual technical relations and the combination of the sensory and technical relations, and if we can relate them to the voice of the consumer, then we have a high probability of

success during new product development process. All these relations can be presented in the House of Quality that consists of a few matrices (Figure 3.1.).

Figure 3.1 House of Quality for Chocolate
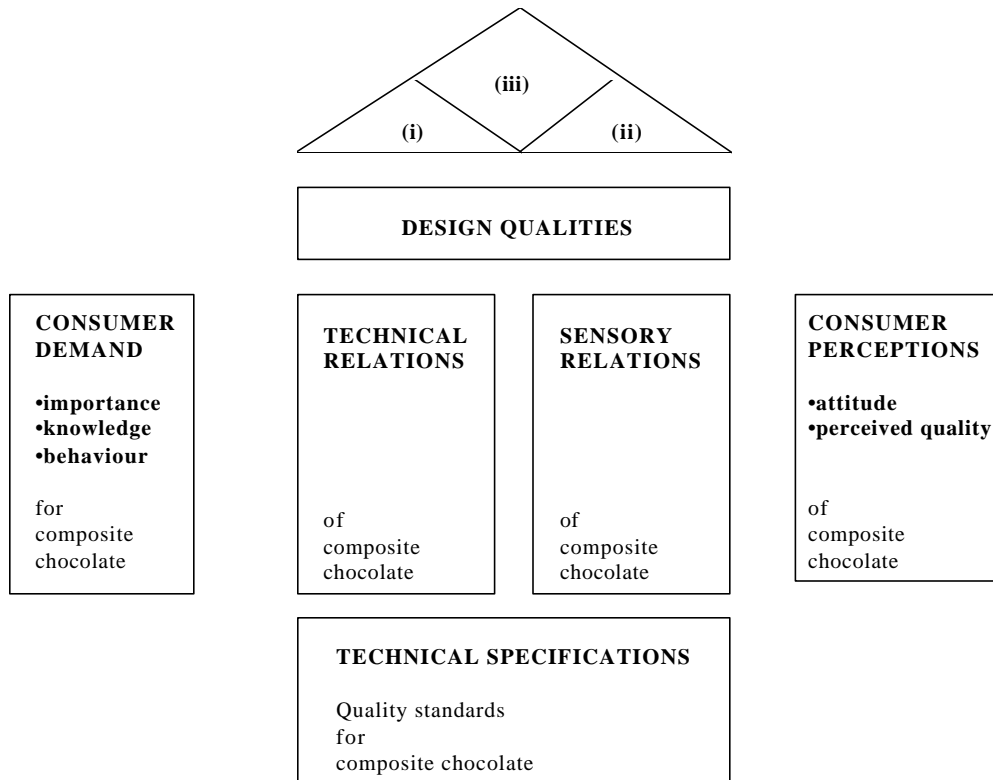
Mutual relations between:

(i)   technical specifications,
(ii)   sensory specifications,
(iii) technical and sensory specifications

Source: Hauser & Clausing, 1988;

Bech et al., 1994

The main elements of this research model include as follows:

Consumer demand - identification of "Whats", i.e. attributes that consumers evaluate (qualitative aspect) and the relative importance of them (quantitative aspect).

Design qualities - through "Hows", i.e. technical and sensory relations – based on technical and sensory specifications included in quality standards.

Technical and sensory specifications - technical measures and sensory mean scores. The absolute and relative scores of each "How" are calculated and direction of improvement is indicated (Guinta & Praizler, 1993). Before looking to target goals, the objective statement, like a hypothesis, is the starting point. It is based on a clearly defined customer component (through segmentation) and a product component (new concept). Finally, it simply says what we are trying to accomplish.

Consumer perceptions - of how far existing products fulfil the established criteria (Bech *et al.*, 1994). This matrix of the House of Quality is also called 'Consumer Competitive Assessment'. Here previously determined "Whats" are judged in relation to the products of a few competitors. Also 'Engineering Competitive Assessment' of established control factors "Hows" can be evaluated by the marketing and R&D staff in the company, who monitor competing products.

3.4 Research design

The research design consists of 5 steps and is illustrated in Figure 3.2.

3.4.1 Consumer segmentation

Consumer segmentation criteria were age categories and gender. Equal percentages of male and female participants within each of the four age groups were addressed in the 'screening questionnaire' (Q1). A total of 524 respondents were either citizens of Kraków or people who commute from the suburbs. The survey took place in a few institutions, universities, schools and public places. The potential segment of filled chocolate consumers was established in the age category 20-29 years old. Figures from chocolate companies indicate that this is a group, which consumes the most.

3.4.2 Analyses of consumer needs

The aim of this step was to identify consumers' demand for the product in the segment established in the previous step. Consumer needs were identified by a market survey (Q2), which was based on a random sampling procedure and took place in various locations around Kraków. An equal number of male and female

participants answered the questions. Q2 analysed the behavioural motives of purchase and consumption as well as attitudes towards the tested product.

Figure 3.2 Steps in Research Design
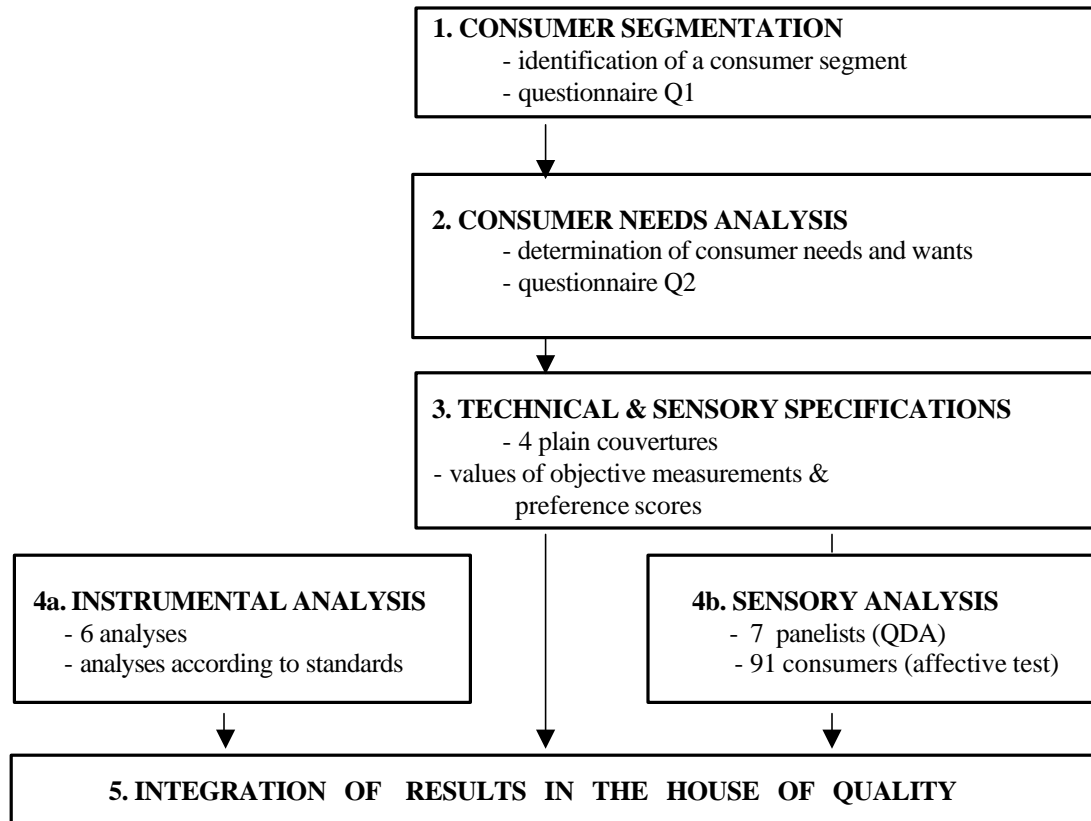
3.4.3 Technical and sensory specifications

Experimental products that varied in flavour and texture characteristics were selected. These represented four couvertures with discernibly different levels of cocoa butter, sugar content and particle size. Another criterion was cocoa bean origin, as two companies produced these couvertures.

3.4.4 Instrumental (a) and sensory (b) analyses

The aim of instrumental measurements was to establish objective limits of the specific components, which play an important role in sensory perception. A total of six physico-chemical and instrumental analyses were conducted as follows:

acidity, sugar and fat content (influence on flavour), hardness, adhesiveness and particle size (impact on texture). All couvertures were analysed sensorially using Quantitative Descriptive Analysis (QDA) by a trained panel of seven people. As the sensory test is assumed to be less valid from the perspective of quantitative evaluation by a consumer panel, an affective (hedonic) test was performed on 91 consumers from the target segment.

3.4.5   *Integration of results in the House of Quality*

Data from the instrumental analysis, the sensory and consumer studies are integrated into the model of the House of Quality according to the 'ideal' product, as perceived by consumers.

3.5   Consumer segmentation and needs

Consumer segmentation was achieved by means of a screening questionnaire (Q1) that consisted of questions related to purchase and consumption behaviour of filled chocolate and the attitude towards this product. Using the total of 524 respondents, four age groups were addressed with equal percentages of males and females in each of them.

Cross tabulation done by SPSS (Statistical Package for Social Sciences) shows that both males (92%) and females (97%) consume filled chocolate. As the aim of Q1 was to discover the most likely segment of consumers, differences in general attitude toward filled chocolate were analysed. This attitude by means of attention to filling type was found to differ between gender and age categories. With respect to gender, it appears that women (91%) state more interest for filled chocolate than men (73%). Considering age categories, the group between 20 and 29 years stated the highest attention to the tested product (93% of positive answers). Therefore, this group was chosen for a target segment.

In the next step, potential consumers' wants and needs, according to the perception of filled chocolate products, were searched in a market survey (Q2). The target segment of 197 respondents consisted of young women (58%) and men (42%). Consumer needs were established through a set of questions related to three key

categories: product, situation (of purchase or consumption), and package.

In the first category, aspects related to the product were investigated. This part consists of 10 statements revealing importance of cues mentioned in Table 3.1. Since the present study focuses on intrinsic quality of chocolate, therefore, only three sensory aspects (flavour: taste plus odour, appearance, and texture) from the first category will be discussed. Also, the possible extrinsic and credence quality attributes (through second and third categories) are presented in Table 3.1. Each of these three categories of possible "Whats" was analysed separately. Pearson correlations and mean ranks by the Friedman Test (non-parametric distribution to answers) are calculated.

Table 3.1   Experimental "Whats"

PRODUCT*		SITUATION**		PACKAGE***	
Taste	8.01	To try something tasty	8.56	Expiry date	8.45
Freshness	7.76	Impulse buy-shopping in supermarket	8.13	Design	6.94
Appearance	6.23	To buy a gift	7.94	Colour	5.81
Texture	6.20	To go for something new	7.28	Info on ingredients	5.73
Odour	6.13	For guests	6.49	Producer name	5.30
Price	5.95	To release stress	6.39	Info on calories	5.00
Ingredients	5.41	To get some energy	6.16	Shape	4.88
Pack appearance	5.07	To have a snack	4.83	Funny-like	4.59
Brand	4.45	To have something luxurious	3.94	Box name	4.24
Box size	3.03	To buy something inexpensive	3.11	Size	4.05
Shop decoration	2.96	To eat something healthy	2.24		
		My family's hobby	1.70		
		My hobby	1.68		

*Note: *   Pearson χ^2 = 707.4, df = 10, p<0.01*
*** Pearson χ^2 = 1042.5, df = 12, p<0.01*
****Pearson χ^2 = 399.9, df = 9, p<0.01*

3.6   Product selection and instrumental analysis

Two chocolate producers contributed to this study. One plain couverture - referred to henceforth as *X* - is manufactured by a medium-size firm, while three other dark couvertures (*W*, *Z* and *Y*) are produced by a multinational company. It was decided to conduct independent physico-chemical and instrumental analyses assuming

differences in production processes and quality control methods used by both companies.

According to literature, the most important parameters influencing sensory perception of chocolate are acidity, sweetness, smoothness and hardness, as well as colour intensity and gloss (Beckett, 1994). The following analyses of the fundamental importance on sensory perception were done: acidity level, sugar content, particle size and hardness. As chocolate hardness strongly depends on amount and crystalline structure of cocoa butter, the fat content was analysed. Additionally, adhesiveness is reported as a measure of chocolate texture.

Ingredient levels and physical characteristics established in the four couvertures, together with methodology applied, are presented in Table 3.2. Each datum is a mean from 3 (fat, sugar), 5 (acidity, hardness, adhesiveness) or 10 (particle size) repetitions due to the reliability of the method involved. The uniformity of tested samples (cut cone shape) and stable temperature (~20°C) during analysis, were controlled.

The most preferred couverture (i.e. *Y*) is characterised by a high sugar content and a medium cocoa fat level in comparison to other investigated couvertures. *Y* is also the least hard couverture with a very small particle size of its solid components.

Table 3.2   Objective Characteristics of Four Couvertures

LEVELS	METHOD	W	Z	Y Preferred	X
ACIDITY °N	Titration	8.2	5.4	5.9	6.3
ADHESIVENESS g mm (negative)	Texturometry	34	13	19	24
FAT % in dry matter	Soxhlet Extraction	43	36	35	33
HARDNESS Newton units	Texturometry	77	150	61	181
PARTICLE SIZE μm	Micrometry	13	12	12	28
SUGAR % in dry matter	Lane-Eynon Titration	30	48	54	56

3.7   Sensory analysis

3.7.1   The consumer panel

The consumer panel is necessary to validate the initial positive reactions to a new product established by a trained panel. Its importance cannot be exaggerated during the final stages of product acceptance by the target segment. Therefore, a consumer panel of 91 young people from the target segment evaluated the palatability of couvertures *X*, *Y*, *Z* and *W*. Samples were uniform, in the shape of a cut cone, and coded with three-digit random numbers. The same panel was asked to write appropriate descriptors reflecting taste, mouthfeel, odour or texture of the tested samples. The panelists' judgement was based on their enjoyment and the overall impression of the product, for which no specific training is needed. Consumers' scores were rated on a 9-point scale, ranging from "extremely dislike" (1) through "neither like nor dislike" (5) to "extremely like" (9).

The Friedman Test (N=91, Pearson $?^2$=18.9, df=3, p<0.001) used for data analysis derived from evaluation of plain couvertures by consumer panel shows that *Y* is the most preferred. It seems that a balance between the perceived bitterness and sweetness was found for the couverture with relatively high sugar content and a medium level of cocoa butter. While evaluating a list of descriptors provided by consumers, it became evident that men were more critical (negative hedonic adjectives) but women indicated more textural characteristics (evenness, melting in mouth). The correlation matrix, computed by one-way ANOVA, indicates that consumers gave significantly different preference scores for only two pairs of couvertures *X-Y* and *Z-W*.

3.7.2   The trained panel

The aim of this research step was to find out which sensory attributes drive consumer preferences. Therefore, the same couvertures were analysed by a trained panel. Analysis took place in separate booths in the sensory laboratory. From 45 volunteers, a panel of 7 people was screened by discriminative analyses including Basic Flavour Test, Triangular Test, Rank-Order Test and Basic Solutions Test (Barylko-Pikielna, 1975). Panelists were subjected to intensive training sessions with, first, water and milk solutions of sweet and cocoa-like tastes and, second, reference samples. The second step of training was done during 10 sessions, twice

a week. As European food law on chocolate is very strict (Council Directive, 1973) information on the percentage of cocoa solids is available on the package. Therefore, popular commercial brands with a known percentage of cocoa butter were selected as reference samples. Prior to the three main sessions, three training sessions with the couvertures (*X*, *Y*, *Z* and *W*) were performed. No significant differences (p<0.05) between answers in the three main sessions were found for each panelist, which may indicate effectiveness of training sessions.

Quantitative Descriptive Analysis (Meilgaard *et al.,* 1991) was used for the evaluation of sensory quality of chocolate couvertures. Instead of using some suggestions related to desirable qualities for rapid evaluation of eating chocolate (Hoskin, 1994), it was decided to compose the initial list of 92 terms (Full *et al.,* 1996; Urbanski, 1992; McEwan & Colwill, 1989) and to present it to the sensory panel with the aim of discovering proper and efficient terminology. During the training sessions, it appeared that some descriptors were still not recognised, and the list was finally reduced to 18 terms and then, definitions of each descriptor were developed (Appendix 3.1).

The samples were solid couvertures in the shape of a cut cone of 1.5 cm in diameter and height, and were served at room temperature (~20°C) in covered plastic cups. All samples were coded with three-digit random numbers. Mineral, uncarbonated water with a neutral taste was provided in every session for rinsing between samples. The first part of the evaluation, related to appearance descriptors, was performed in normal lighting conditions, then flavour and texture descriptors using red light. Panelists followed the established order and manner of analysis showed in Appendix 3.1. All answers were recorded on intensity-structured scales of 10 boxes, where the ones on the edges indicated the absence or maximum value of a certain descriptor. The middle box of each scale reflected mean intensity of the descriptor.

As before, mean ranks (Friedman Test) were calculated for each couverture's sensory descriptor and are shown in Figure 3.3 as 'Targets'. In the next step, the associations in the perception of those 18 descriptors were investigated. Pearson correlations were calculated for *Y* (Appendix 3.2). Then, the one-way ANOVA between pairs of couvertures was computed (Table 3.3).

Analysis of variance shows that a significant difference in perceived intensity levels emerged within the group of five descriptors: colour intensity, texture on surface, bitterness, sweetness and smoothness. In relation to *Y*, three observations may be indicated. First, *Y* and *W* are significantly different in bitterness and sweetness as well as in colour intensity perception. Second, *Y* and *Z* are not different in the trained panel evaluations. Third, *Y* and *X* are significantly different in relation to smoothness and colour intensity. It was observed that a significant difference in perception of colour intensity was recorded for all relations to *X*, which may suggest an influence of particle size on surface colour.

Table 3.3   Differences in Perception of Couverture Pairs by Trained Panel

SENSORY DESCRIPTORS	COUVERTURES					
	W-Z	*W-Y*	*W-X*	*Z-Y*	*Z-X*	*Y-X*
APPEARANCE						
colour intensity	Ns	1.66*	3.04**	Ns	2.41*	1.39*
texture on surface	Ns	Ns	1.20*	Ns	Ns	Ns
FLAVOUR						
bitterness	2.49**	3.29**	3.67**	Ns	Ns	Ns
sweetness	2.14*	2.96**	3.26**	Ns	Ns	Ns
TEXTURE						
smoothness	Ns	Ns	3.29**	Ns	3.20**	3.03**

*Note: * p<0.05; ** p<0.01 (1-tailed)*

Corresponding with instrumental analyses, the list of descriptors was reduced to flavour (8) and texture (6) associations. Beta-weights of each descriptor, related to the importance of each cue, are shown in Table 3.4.

Table 3.4   Flavour and Texture Correlations Perceived by Trained Panel

FLAVOUR DESCRIPTORS	B-WEIGHTS TO AROMA	TEXTURE DESCRIPTORS	B-WEIGHTS TO FIRST BITE
acidity	+0.014	adhesiveness	+0.185
aftertaste	+0.000	melting-in-the-hand	+0.234
bitterness	+0.313	melting-in-the-mouth	-.0.251
cocoa body	+0.579**	oily mouthcoating	- 0.309
fruitiness	+0.253	Smoothness	+0.192
smokiness	+0.486**		
sweetness	- 0.002		

*Note: ** p<0.01 (1-tailed)*

Factor analysis (KMO<0.5 and Bartlett's Test of Sphericity p<0.01) were computed for flavour and texture descriptors. In case of the flavour group, three main components (with factor loadings) were calculated as follows: 1/ bitterness (0.84) and acidity (0.53); 2/ aroma (0.90), cocoa body (0.78) and smokiness (0.64); 3/ fruitiness (0.93), aftertaste (0.66) and sweetness (0.12). Three dimensions of flavour would therefore be bitterness, aroma-chocolateness and fruitiness.

For the second group (texture), there were only two main components: 1/ melting-in-the-mouth (0.81), melting-in-the-hand (0.77) and oily mouthcoating (0.70); 2/ first bite (0.93) and adhesiveness (0.54). Particle size had a value of 0.07 within the second principal component. This suggests two dimensions: meltiness and structure.

3.8 Integration of results in the House of Quality for chocolate couverture

The House of Quality is constructed for the most preferred couverture (Y) on the basis of correlations established in this study (Figure 3.3). It is also possible to create four Houses that would analyse each couverture separately. The House of Quality focuses on intrinsic cues of chocolate in relation to the voice of the consumer.

Three sensory cues appear on the side of the consumer "Wants" for chocolate couverture. These are flavour of couverture, chocolate appearance and texture. The importance values of these "Whats" were calculated from the market survey by random sampling in the target segment. These values were measured on a 5-point category scale ranging from "not important" (1) to "very important" (5).

The central part of the House of Quality is composed on the basis of calculated relations between design qualities. These relations come from correlation matrices set up by the sensory panel for this couverture. In the optimisation study, a critical step is setting the ingredient levels in test products. Providing the tested products are chosen with care, and that there are two or more levels of each ingredient for the design of test products (Fishken, 1983), the correlations show high probability. However, the acceptability peak point may be non-linearly related to the ingredient level and that is especially true for complex foods with ingredients such as fat.

On the other hand, some chocolate ingredients may interact strongly with other components or texture characteristics (Appendix 3.2) and not be linearly correlated with acceptance. This is also the reason why sensory intensities are usually compared by means of trained and consumer panels. This central part of the matrix of technical relations (between design qualities i.e. six instrumental analysis and three intrinsic "Whats") is established through intensive literature study.

Figure 3.3   The House of Quality for Chocolate Couverture

Then, the matrix of sensory relations (between 18 sensory descriptors and three "Whats") is composed through Pearson correlation for couverture *Y*. If the correlation falls into flavour-flavour category, only one sign indicates this relationship. If there is a correlation between flavour-appearance descriptors, two signs are introduced. These signs are presented as follows: ⊙ - strong positive correlation (p<0.01), ○ - medium positive correlation (p<0.05), and Δ - weak negative correlation (p<0.05). Weights of these signs are: 9, 3 and 1, respectively.

In the matrix of technical and sensory specifications (i.e. Targets), either the objective (instrumental) or the mean (sensory) scores for each attribute appear. Finally, the absolute and relative importance values are indicated. For calculation of the absolute value of each "How" it is necessary to undertake two steps. The first is to multiply importance values of each "What" by the correlation weights in the column of "How". The second is to sum up these values and introduce into the matrix as the absolute importance score for a specific "How". After that, ranking of all absolute scores allow the estimation of relative importance values of each "How".

The last matrix is the roof of the House of Quality. It consists of three types of mutual relations: technical, sensory and technical versus sensory relations. Mutual technical relations are estimated from the technical relation matrix, while mutual sensory relations are the calculated correlation coefficients for couverture *Y* (Appendix 3.2). In the top roof of the House, the indicator of positive and negative relations between technical and sensory levels are shown.

Finally, the right-hand side of the House presents consumer ratings on competitive products. The same group of 91 people of age 20-29 years was questioned about the perception of three intrinsic "Whats" in relation to filled chocolate produced by three potential competitors. The scale from 1 to 5 indicates the quality image of each "What" for a Polish company, then the biggest competitor in the country, and finally for a well-known European firm producing a filled-chocolate assortment. All respondents were acquainted with the real names of the companies. It is interesting that for couverture flavour (taste aspect) as well as texture cues, all three firms were given almost the same scores. However, in assessment of appearance the European company was given 20% more positive answers. The consumer competitive assessment is necessary to obtain an initial estimate of the

relative importance of test products and to provide preliminary indication of how well an optimal product will perform in the target segment.

3.9   Discussion

Discussion starts from the marketing point of view on the House of Quality. Three types of needs are discussed: primary, secondary, and tertiary. Then some crucial parameters that have impact on flavour, texture and appearance of chocolate are analysed.

Through market research, the voice of the consumer has been established. It consists of primary and secondary needs. The primary, called *strategic* needs, were the most frequently mentioned values related to filled chocolate such as: taste, appearance, value for money or compatibility of filling and couverture. The secondary, are *tactical* needs that are usually suggested by R&D staff as they recognise the best means, by which potential wants can be achieved. Here the following needs may be mentioned: flavour of fillings (taste and odour), flavour of couverture, colour of chocolate, low price or freshness. The third level of needs, called *operational*, is tightly connected with the instrumental and sensory evaluations of products.

In regard to the Theory of Means and Chains, which is usually applied in the QFD approach for gathering the voice of consumer, products' attributes (e.g.: attractiveness, pleasantness, luxury image, living style or social acceptance) may serve as benefits or consequences of human behaviour. From these consequences, it is possible to build up some values and preferences. How to get to the core of perceived attributes is a matter of recognition of product values themselves, situational aspects of product consumption and the best ways of product marketing.

In a more or less conscious way, the consumers' judgement is based on intrinsic quality attributes of products. Nowadays, chocolate is not a rare or privileged product. Recognition of its values surely involves previous experience and future expectations carried by promotion or package. However, what makes it so desirable is sensory quality.

Chocolate *flavour* is the most important in the overall sensory evaluation. Many researchers try to discover the phenomenon of chocolate taste but up to now there is no definitive molecular description of this. From the sensory context, it is possible to indicate which flavours are recognised as positive or negative. Basically, the positive notes are those of aromatic character, acid, fruit, bitter and burnt (to some extent of course). Then the auxiliary flavours, that are described as somewhat desirable, are honey, malt, fudge, toffee, caramel and raisins. Undesirable off-flavours are beany, pungent, tobacco, herbal, spicy, phenolic, green, bready, earthy, mouldy, medicinal and hammy/smokey notes (Urbanski, 1992).

Three *textural* sensory properties are of great importance in chocolate perception. These are smoothness, meltiness and hardness. With regard to smoothness, some researchers report that it is pointless to refine chocolate below 10µm as the human buds and sensory nerve endings cannot distinguish differences below that particle size. If this happens, then peanut butter-like undesirable flavour emerges. Urbanski (1992) states that the optimum lies between 10µm and 50µm, above which products are felt to be gritty. This research shows that chocolate of 28µm particle size is already perceived as coarse and it has a paramount influence on overall sensory quality. It is also interesting that coarser chocolate usually appears to be much sweeter.

Texture is also connected with meltiness of cocoa butter. It gives an exceptionally different melt-in-the-mouth characteristic that is unique only to this product. Crystalline structure of cocoa butter not only influences gloss and stability of chocolate, but is also responsible for the perception of transition from a hard material to liquid oil at mouth temperature. Investigations of Markov & Tscheuschner (1989) show that brands of plain chocolate (special dark, dark and semi-sweet chocolate) melt more slowly than milk chocolates where the type of extender fat used is very important. In this research, high values of standard deviations for melting-in-the-hand and melting-in-the-mouth descriptors were reported, which indicates no stable perception of these attributes among panelists.

Hardness plays an important role in the sensory assessment of chocolate. Plain chocolate brands show greater bite firmness than milk chocolates and with respect to 'fineness' they are judged to be of a superior quality (Markov & Tscheuschner,

1989). In our experiment, bite firmness, as the measure of force needed for a first bite, was not correlated with hardness measurement.

Factors that determine why and which foods are consumed are numerous, but for chocolate, unique sensory properties are perhaps paramount. Sensory perception of chocolate depends on four factors: wonderful and clear chocolate aroma, sweet taste, smooth texture and luxurious melt-in-the-mouth quality. All of them may be investigated in the House of Quality in relation to consumer needs and development of new products.

3.10   Conclusions

The Quality Function Deployment approach indicates many possibilities, which emerge from the integration of both sciences - marketing and food science and technology. There are at least two important benefits from the introduction of the QFD. First, a high degree of conceptual research on the product under consideration reduces the final production cost. Second, the consumer segmentation and consumer analyses increase the potential market share at the moment the new product is launched into the market.

In this study, four products were analysed and compared. There was one target segment, which certainly limited possible observations and the obtained strategies. Of course, the House of Quality model can be developed for more products in a certain experiment. Each of these Houses will show significant differences between the designed variables, i.e. the particular preferences and real sensorial perceptions. The most practical is, however, to build the House, which reflects the optimal preferences and perceptions.

The QFD is the process of developing new products and, therefore, a creative approach for many segments, including more products in the experimental design, is rather preferred. This study shows how one may start to develop an appropriate model.

3.11 Acknowledgements

Annex 3.1   Final List of 19 Sensory Descriptors with Definitions

TERM	DEFINITION
APPEARANCE	
COLOR INTENSITY	*Intensity (tint) of typical colour of product, from light brownish to dark brown*
COLOR BRIGHTNESS	*Luminescence of colour, from mat to shiny*
TEXTURE ON SURFACE	*Amount of regular cavities or holes on surface of bottom side of chocolate sample that are seen, from even to gritty*
TEXTURE ON SNAP	*Amount of irregular cavities or holes on the snap surface that are seen, from even to gritty*
MELTING-IN-THE-HAND	*Level of chocolate melting after 30 sec from taking into hand, from melted little to melted very much*
FLAVOUR	
AROMA	*Aromatic taste sensation typical for chocolate, from lightly aromatic to highly aromatic*
ACIDITY	*Organoleptic characteristic of pure substance or mixture giving acidic taste, from lightly acidic to very acidic*
BITTERNESS	*Organoleptic characteristic of pure substance or mixture giving bitter taste, from mildly bitter to very bitter*
COCOA BODY	*Impression of cacao taste associated with chocolate products, from light cacao to very cacao-like*
FRUITNESS	*Impression of fruity taste, from light fruity notes to distinct fruity notes*
SWEETNESS	*Organoleptic characteristic of pure substance or mixture giving sweet taste, from lightly sweet to very sweet*
SMOKINESS	*Impression of smoke/hammy taste, from light smoky notes to distinct smoky notes*
TEXTURE	
FIRST BITE	*Hardness felt during the first bite of chocolate sample in half by incisors, from very soft to very hard*
OILY MOUTHCOATING	*Oily aftertaste, from light to distinct*
AFTERTASTE	*Odour and taste impression that is still felt after sample is swallowed (here 10 sec), from low to high impression*
ADHESIVENESS	*Impression of force needed for removal of sample from gums after 5 chews, from no force to high force*
SMOOTHNESS	*Perception of evenness of chocolate during rubbing a tongue and palate, from very even to very granular*
MELTING-IN-THE-MOUTH	*Amount of melted chocolate sample after 30 sec, from little to very much melted*

Annex 3.2   Correlations in Perception of Couverture by Trained Panel

SENSORY DESCRIPTORS	Y
FLAVOUR	
cocoa body-sweetness	+0.73*
TEXTURE	
melting-in-hand - texture on surface	+0.69*
oily mouthcoating - melting-in-hand	+0.81*
oily mouthcoating-texture on surface	+0.85**
FLAVOUR-TEXTURE	
acidity-texture on snap	+0.89**
aroma-texture on snap	-0.70*
smokiness-texture on surface	-0.75*
sweetness - melting-in-mouth	-0.79*
FLAVOUR-APPEARANCE	
acidity-colour intensity	-0.89**
TEXTURE-APPEARANCE	
first bite-colour intensity	-0.81*
melting-in-hand - colour brightness	+0.84**
texture on snap-colour intensity	-0.80*

*Note: * $p<0.05$; ** $p<0.01$ (1-tailed)*

CHAPTER 4

Market Segmentation for Chocolate in Belgium and Poland

4.1 Abstract

The aim of Chapter 4 is twofold. First, to investigate the perception of chocolate based on attribute importance and benefit beliefs among Belgian and Polish consumers. Second, to examine the impact of the individual characteristics of consumers on their perception of chocolate. Making cultural comparisons provides important understanding as well as practical applications to marketing. Sub-cultural design (six cities in total) was chosen as the most appropriate in complex societies where indigenous groups share influences on patterns of cuisine, food preferences and choices. Belgium serves as an example of the country with two dominant cultures (Dutch and French). In Poland, the sub-cultural differences in consumption patterns are less visible. In this study we have an opportunity to test this assumption. The comparative research is synchronic, i.e., makes comparison at one point in time. The market survey is based on exploratory research and literature. Data evaluation by factor, cluster, and discriminant analysis is implemented. Results show a clear difference between Belgian and Polish respondents in their behaviour and attitude towards chocolate. The greatest disagreements occur in importance attached to augmented (package, price, novelty) characteristics of chocolate products and perception of health consequences by consumption of chocolate. Other major discrepancies lay in anticipation of affective reactions from chocolate (e.g. addiction) and preferences for chocolate varieties. Segmentation to five major clusters leads to more detailed comparison and may allow positioning of fondant chocolate in the target market.

4.2   Introduction

The importance of cross-cultural research lays in developing potential for marketing strategies in business environment. The current study presents a survey performed in Belgium and Poland undertaken to reveal the cultural differences in consumers' attribute assessment and beliefs associated with chocolate.

Globalisation of world economy contributes to the wide perception of many differences between various cultures. On the one hand, the process of globalisation is seen as uniformisation in science and real life. On the other hand, it is obvious that the cultural differences between nations are nowadays even more visible. The importance of culture in business environment is paramount. Four barriers are considered uncontrollable by business: culture and social conditions; political situation and legislation; economic and technological state; and rules of competition (Murdoch, 1999). The increasing competitiveness pushes business to find market niches and to concentrate on the narrow target groups.

To find consumers in new, changing or developing markets is a matter of searching for a proper and direct communication process with consumers. Modern marketing research has to be ambitious in creating new methods based on psychological market segmentation. The lack of extensive research may lead to the formulation of inappropriate marketing strategies. Many examples show wrong application of products' names, symbols or colours on packages that activate negative associations and influence business performance. Quantitative market research becomes increasingly important in Central European countries. Growing self-consciousness of customers may contradict with new propositions of global firms, which do not understand ethnocentric values and habits. One of the new characteristics of Central European countries is the increase of importance of young people who undertake consumption decisions in more independent ways (Nikodemska-Wolowik, 1999).

The study focuses on consumers in Belgium and Poland. Recent focus on these two countries has been presented by De Pelsmacker and Geuens (1998), Verbeke and Viaene (1998), Roozen and De Pelsmacker (2000). The rationale for this choice of countries is twofold and based on the differences in the political and cultural background of both countries. First, Poland is in the final preparatory stage for accession to the EU while Belgium has been a member from the very start.

Second, both countries have a considerably different cultural environment, which is highly relevant for the underlying cross-cultural research based on perception of Eastern and Western European consumers. Professional marketing activities have a recent history of no more than ten years in Poland. Additionally, the well advanced process of transition from the centrally planned to the market-oriented economy makes Poland an interesting field of research, especially with respect to marketing and international trade issues.

The *objectives* of the research are twofold. First, to investigate differences in *the attitude structures* of Belgian and Polish youth, by means of attribute importance assessment and beliefs in chocolate. Second, to examine *the impact of individual characteristics* of consumers on their attitude structure by psychological criteria. Additional questions analyse *behaviour* of respondents in the consumption of chocolate.

4.3   Models of food perception

The consumer and his needs are the centre of interest for successful business performance. The plethora of factors that influence food choice has been presented in many food choice models. At first, the motivational model by Lewin (1943) focused on the symbolic meaning of food in the context of human values and relationships. Dickens (1965) identified several factors as determinants of food preferences and classified them into four groups: cultural, social, personal and situational. Other models, such as the environmental model of Lund and Burk (1969), the ecological model of Wenkam (1969) or the motivational model of Maslow (1970) are the pioneering models in research on the forces shaping food habits.

Howard (1963) proposed the first integrative Model of Buyer Behaviour. The model utilises the learning theory in a systematic way. It discriminates between true problem solving behaviour, limited problem solving and automatic response behaviour.

In the late 60's the first version of the Engel, Kollat and Blackwell Model was created, which describes decision-making process. The amended EKB Model of

1982 is organised in five layers: input, information processing, decision processing, decision process variables, and external influences. It is said (Engel & Blackwell, 1982) that the EKB Model is unique in highlighting the decision process and including the proven relationships of the behavioural intentions found in the Model of Fishbein.

The Fishbein and Ajzen (1975) and Ajzen and Fishbein (1980) structured attitude model is called The Theory of Reasoned Action. This model became the operational one influencing a significant amount of research in the field of investigation of consumers' attitude. This "analytic" model gives possibility of systematic identification of influential benefits and attributes in choice behaviour. Other applied frameworks investigating factors of food choice are those of Khan (1981), Randall and Sanjur (1981) and Shepherd (1985). In all of them there is a clear distinction between the three most important groups of influences: the individual, the food, and the environment.

For instance, the modified Shepherd's Model of Food Choice (1989) describes three determinants of food choice: the food, the person and the socio-cultural or economical context. Depending on the food product, an individual may report physiological effects (e.g. satiety, hunger or appetite) or may perceive the sensory attributes (e.g. aroma, texture or taste). The individual's attitude towards the product is developed on the basis of three elements: the affective (liking) component, psychological factors (e.g. personality, experience or mood) and economic considerations. As the attitude is finally formed and the physiological effects appear upon consumption of the product, the choice of food is established.

In 1993, Loudon & Della Bitta proposed a simplified Decision Process Framework that shows a circular presentation of factors of the external environment and individual (person) nature, which influence the decision process. The external environmental factors consist of the cultural influences, sub-cultural influences, social class influences, family influences, personal influences, etc. The individual determinants include learning and memory, personality and self-concept, attitudes, motivation and involvement and information processing. All of these factors drive problem recognition and the formation of final decision process.

Finally, it is worth to mention Furst's *et al.* (1996) the Conceptual Model of Food Choice, which consists of three elements. First, there is a life course that relates to

the past, current and future personal roles. The life course generates the second element, which is divided into five choice influences: ideas, personal factors, resources, social framework, and food context. The third element reflects the personal system that is influenced by value negotiations and undertaken strategies.

Cross-cultural research on the valuation of chocolate includes three elements: individuals, the food and the special context in which the chocolate is perceived. The following are the recent studies that stress the importance of psychological and contextual factors in the consumption of the chocolate.

4.4   Conceptual model of chocolate choice (COMCC)

The aforementioned models of food choice point toward three key elements for cross-cultural segmentation research on the valuation of chocolate. These three elements pertain, first, to characteristics or attributes of the food concerned, second, to characteristics of the individual, and third, to the specific context in which the food is consumed.

Several recent studies stress the importance of the psychological and contextual factors in decision-making towards and consumption of chocolate. *Social appropriateness* and *rewarding* with chocolate is especially important in case of sweet foods (Lähteenmäki & Tuorila, 1994). Such foods are popular in many situations, however, they are cross-culturally recognised as the very appropriate ones in some social situations such as a wedding, a birthday or a common party. The aspect of rewarding with chocolate was studied in both stressful ("feeling blue") or comforting ("watching TV") situations. Schutz (1994) indicated the appropriateness as the measure of the cognitive-contextual aspects of food acceptance.

Disinhibition and *cognitive restrain* are studied by Lähteenmäki and Tuorila (1995). Three factors are used to measure eating behaviour of sweets: disinhibition (craving), hunger, and cognitive restrain (associated with practical attempts to control eating). It was established that the liking for sweet foods is more clearly related to disinhibition and hunger, i.e., hedonic dimension of human perceptions, than to cognitive restraint.

Gender differences in the attitude and behaviour towards sweet snacks are shown in the study of Grogan *et al.* (1997). The research is based on the analysis of behavioural intention, consumption, and dietary restrain components. While women rate significantly higher on pleasantness, there is no significant gender difference in the reported consumption frequency of chocolate. Women rate significantly lower on healthiness of sweet snacks and show negative belief about weight-gain. They are also more influenced by the experts in the dietary domain. On the other hand, men show negative belief about tooth decay caused by sweet snacks and more positive utility of convenience of such foods. The study further indicates that the pleasantness is a better predictor of behavioural intention than healthiness in both genders. It seems that taste is a more powerful incentive than healthiness when determining intentions to eat sweet snacks.

Based on the general food choice models, on the one hand, and on the specific previous empirical insights related to attitude and behaviour towards chocolate and sweets, on the other hand, the Conceptual Model of Chocolate Choice (COMCC) is proposed (Figure 4.1).

Figure 4.1   Conceptual Model of Chocolate Choice (COMCC)
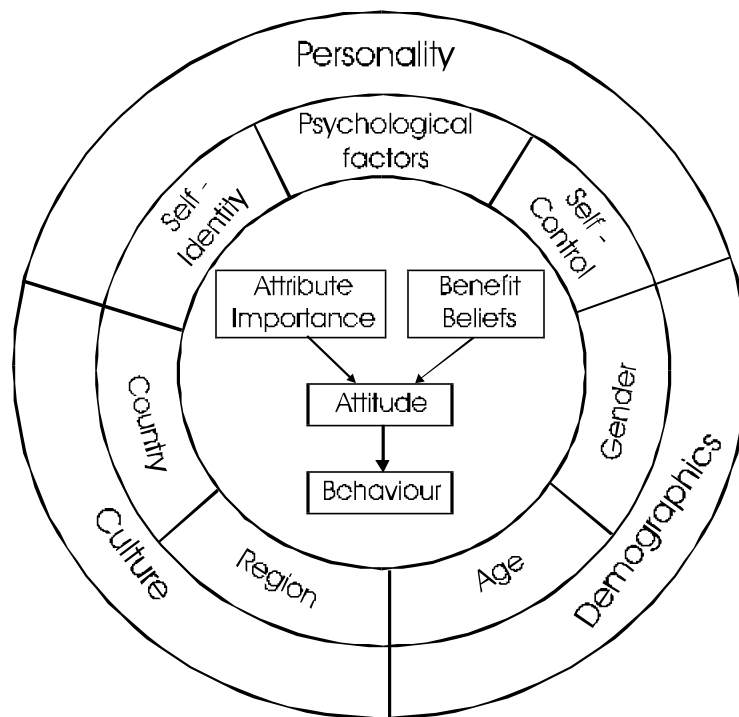
The core of the model refers to basic elements in consumer decision-making processes. It integrates the assessment of the importance of product attributes and the formation of beliefs about product benefits. Both processes result in the creation of an attitude and ultimately in behaviour, i.e., amount, frequency and varieties consumed.

Thirteen *attributes* and twenty-one *benefit belief* statements of nutritional, functional, sensory or abstract character are developed from the literature. For instance, there is the belief in addiction from chocolate (Hetherington & MacDiarmid, 1993) or craving for chocolate and associated guilt (Benton, 1999; Rozin *et al.,* 1991; Rozin, 1998). It appeared relevant to test the consumers' knowledge related to one of the most recent reports on moderate consumption of chocolate contributing to decrease of heart disease incidence (Kris-Etherton & Etherton, 1999). The aspect of dental health (Curzon, 1999), contribution to obesity (Bolton-Smith & Hetherington, 1999) or gastro-intestinal problems associated with consumption of chocolate (Knight, 1999a) are of vital importance to a majority of consumers, therefore, these questions are included in the research design. Additionally, beliefs about chocolate as a source of energy (Burke, 1999) or magnesium and caffeine (Knight, 1999b) are investigated.

The processes in the core of the COMCC model are influenced by three sets of factors that refer to the individual and to the specific chocolate consumption context. The three sets of influencing factors are: personality, culture and demographics. Cultural influences are captured through the incorporation of inter-country or inter-regional differences. Demographic influences are restricted to age and gender.

Personality factors are asumed to be a set of factors, which has the largest influence on decision-making towards chocolate. The personality factors influencing chocolate consumption are split between psychological factors, self-identity and self-control.

A range of questions analysing *psychological* traits and social values of respondents comes from the eminent studies from the social psychology, which are helpful to choose proper segmentation criteria. To find whether the respondent is susceptible to opinions of other people, it is important to check his/her personal or public consciousness. Specific questions measuring both these factors, are taken

from the study of Realo and Allik (1998) who modelled the self-consciousness scale in its relation to the Five-Factor Model of Personality (McCrae & Costa, 1987). Additionally, the research of Axelson and Penfield (1983), who found four salient food- and nutrition-related attitude factors of elderly, is used. The following attitudes are investigated: sociality and adventure, utilitarianism, qualitative-pleasurable, and nutritious-healthful attitude. A set of statements, which Axelson and Penfield used in their study, is selected. They reflect each of the four factors and are compiled from many statements with the highest factor loading scores. Moreover, three questions related to the self-rewarding attitude, stated craving and perceived satisfaction after consumption of chocolate are added. Additionally, the eight bipolar scales of self-assessment based on the Five-Factor Model (McCrae & Costa, 1987) are added. Finally, there are two questions related to *self-identity* with the product (Could you enjoy life without this product?) and perception of *self-control* (Can you stop eating chocolate any moment you like?). The complete list of research variables is shown in the Annex 4.1.

At the end, direct questions on demographics (*gender)* and behaviour (*amount* and *frequency* of recently consumed chocolate) as well as preferred *varieties* of chocolate are mentioned.

4.5   Research design

The research design comprised three steps. The *first* step consisted of *exploratory research* and *initial segmentation.* Exploratory research relates to the extensive literature review in the domain of food science, human psychology and sociology (e.g. Axelson & Penfield, 1883; McCrae & Costa, 1987; Realo & Allik, 1998; Nuttall, 1994; Kris-Etherton *et al.,* 1994; Knight, 1999a; Knight, 1999b, etc.). Initial segmentation is achieved by the qualitative and quantitative analyses (Viaene & Januszewska, 1999a) and confirms a target market, which consists of a group of people between 20 and 30 years old. This group shows the greatest emotional involvement in the consumption of chocolate as well as states the highest intake of the product. As the target market is represented by a group of students in a profile of applied biological sciences, the education factor is considerably uniform and contributes to the comparability of data.

The *second* step consisted of *a cross-cultural market survey* through the set of research questions on consumers' attribute assessment, benefit beliefs and psychological characteristics. By means of this cross-cultural questionnaire (CCQ), the sub-cultural segmentation is completed. The CCQ consists of the introductory page and the consumer profile (segmentation) part.

The *introductory page* contains three selection questions about consumption of chocolate in general (if the answer is negative, the respondent is thanked and asked to return the questionnaire), liking of fondant chocolate, and nationality. *Consumer profiles* are investigated in the main part of the CCQ. All questions are evaluated on 7-point Likert scales with edges marked: "strongly disagree" (1) and "strongly agree" (7).

The cross-cultural market survey *covers* Belgium and Poland, and within each country a distinction was made between the north (Gent in Belgium and Olsztyn in Poland), central (the capitals Brussels and Warsaw) and the south (Gembloux in Belgium and Kraków in Poland). The research questionnaire (CCQ) was *translated* due to the parallel translation (Malhotra, 1996) from English to Dutch (Gent and Brussels), French (Gembloux) and Polish (Olsztyn, Warsaw and Kraków) versions. In each city 200 respondents took part in the survey, making the total of 1200 respondents. *Gender* of respondents was distributed in equal percentages, as questionnaires were pre-coded according to the quota sampling procedure (Malhotra, 1996).

The survey was *conducted* in March (Belgium) and May (Poland) of 1999. It took place at Ghent University, the Meurice Institute and Flemish High School (both in Brussels), Gembloux University, University of Varmia & Mazuria in Olsztyn, Warsaw Agricultural University, and Agricultural University of Kraków. The execution of the CCQ was similar to in-hall testing methodology. The procedure consisted of two steps. First, the meetings with students were arranged in advance with help of academic staff. Second, at the beginning of survey, the respondents were shortly briefed with the aim of the study and instructed how to self-administer the questionnaire.

4.6   Data analysis and results

The *third* step of the research design is *data analysis*. The total of 1200 respondents has been reduced because of two selective questions on different nationality (N=49) and dislike of fondant chocolate (N=115). The missing answers and extremities contributed to the removal of another 143 cases, which resulted in a total number of 893 valid cases. After data inspection, they are analysed by factor, cluster and discriminant analyses.

First, the *factor analysis* is computed for Z-scores of each set of experimental variables (Annex 4.2). The internal reliability (Cronbach's alpha) of the scales related to attribute importance (α=0.70), beliefs (α=0.70), and personal criteria (α=0.76) is high and acceptable (Malhotra, 1996). Through the principal component analysis with Varimax rotation twenty-one factors are extracted. Determination of the number of factors is based on Eigenvalues greater than 1. Annex 4.2 presents the result of the factor analyses together with the cumulative percentage of variance explained by a number of chosen factors. Kaiser-Meyer-Olkin Measure (KMO) of sampling adequacy is satisfactory and Bartlett's Test of Sphericity (BTS) is significant (p<0.000) for all three sets of variables.

There are *three factors extracted from attribute importance*. The factors relate to respondents' perception of core, augmented or qualitative attributes of chocolate. This finding confirms research of Wierenga (1983). Similarly, the factor analysis led to a grouping of attributes, which largely corroborates Nelson's (1970) trilogy of credence, search and experience attributes.

Next, there are *seven factors elicited from beliefs*, which include: anticipated affective reactions (feeling of addiction), functional impact (release of stress), positive (prevention of sclerosis) or negative (cause of obesity) health-related impacts, and beliefs on fondant chocolate (more pleasure fondant chocolate).

In the end, *eleven factors from psychological criteria* are calculated. The result confirms the research of Axelson and Penfield (1983), as well as Realo and Allik (1998) as some of the similar factors are formed. For example, personal consciousness (I like analysing myself), public consciousness (I often compare my appearance with that of other people), social-adventuresome (I like to eat chocolate with friends) or qualitative-pleasurable (I buy only best quality chocolate).

All research factors help to find latent (underlying) dimensions of consumers' perception of the product. They also explain categories of consumers' psychological traits, which are much more stable and insusceptible to changes than any attitude or purchase motive (Mazurek-Lopacinska, 1997).

Second, the *cluster analysis* is computed to identify persons with similar characteristics. Ward's hierarchical procedure that applies calculation of squared Euclidean distance is used. The distances at which clusters are combined, as obtained from inspection of the agglomeration schedule and distance matrix, are used to determine the final number of clusters to continue with. This procedure finally led to a five-cluster solution with each cluster having a substantial size. The respondents are fairly uniform distributed among the clusters, further referred to as "groups". The profile of the groups in terms of country, city and gender is presented in Table 4.1.

Table 4.1   Characteristics of Respondents after Cluster Analysis

In %	GROUPS					Pearson X²	df	p
	1	2	3	4	5			
Frequency	23.3	19.6	18.8	20.7	17.6			
Countries						241.03	4	.000
Belgium	87	51	9	48	35			
Poland	13	49	91	52	65			
Cities						23.01	8	.003
North	38	33	44	35	45			
Center	29	36	36	43	25			
South	33	31	20	22	30			
Gender						68.70	4	.000
Male	58	59	49	58	21			
Female	42	41	51	42	79			

For the simplicity of explanation it is possible to assume that Group One is represented by Belgians (87%), and group Three by Polish respondents (91%). Groups Two and Four are largely equal in terms of country representation. The Group Five is peculiar in that it has one third of Belgians (35%) and two thirds of Polish people (65%). It is worth to notice that this group consists of women in majority (79%). Distribution of gender in the other four groups is very even.

Third, the *discriminant analysis* with cross-validation procedure (leave-one-out classification) is applied. The analysis is calculated for determination of the five

segments and description of the two countries. In case of segments, where the aim is to discriminate between the previously established five groups of respondents, the classification result is optimistic (71.4%), Wilk's Lambda (0.13), p<0.000. As the observed significance level is very low, the null hypothesis that the groups have the same means is rejected and it is assumed that classification of cases into groups, based on their discriminant scores, is correct. Percentage of variance, in each of four functions, is distributed respectively as follows: 30.5%, 26.5%, 24.3%, and 18.7%. In case of counties, the number of cross-validated respondents, who are correctly classified into groups, is very high (89.6%), Wilk's Lambda (0.38), p<0.000. The results of the discriminant analysis are presented in Table 4.2.

Table 4.2 Classification Function Coefficients from Discriminant Analysis

FACTOR LABEL	GROUPS 71.4% correctly predicted					COUNTRIES 89.6% correctly predicted	
	1	**2**	**3**	**4**	**5**	**BELGIUM**	**POLAND**
V1-QUGU	-.416	**.288**	**.298**				
V2-AUGM	-.701		**.561**		**.293**	-.854	**.789**
V3-CORE	**.299**	-.323		-.476	**.406**		
B1-AARE		**.577**	-.993		**.549**	**.461**	-.422
B2-FUNC			**.362**	-.682	**.239**	-.535	**.491**
B3-PHEA		**.520**			-.534		
B4-NUTR	-.470		**.571**	-.456	**.750**	-.782	**.724**
B5-FOND	**.431**	**.665**	-.300	-.334	-.634	**.448**	-.411
B6-NHEA	**.538**	-.652					
B7-SISO	-.690	**.338**		**.250**	**.486**	-.639	**.592**
P1-PRSC				**.313**			
P2-PUSC	-.463			**.275**	**.220**		
P3-CRAV	**.367**			-.925	**.906**		
P4-HERE	-.357	**1.058**		-.562	**.411**		
P5-SOAD			**.609**	-.548	**.338**		
P6-OPEX		-.316	**.512**				
P7-BOCO			-.502		**.495**		
P8-QUPL			-.231		-.251		
P9-FRUT		**.670**	-.383				
P10-PRCE			**.602**		-.506	-.511	**.475**
P11-SECO	**.292**			-.336	-.471	**.472**	-.438
Disciminant Score (D)	**-1.17**	**2.83**	**1.11**	**-3.48**	**2.70**	**-1.94**	**1.80**

Note: Fisher's linear discriminant functions

The total discriminant score (D) indicates the direction of consumers' attitude towards consumption of chocolate products.

Group One (D=-1.17) is characterised by moderate and negative attitude towards consumption of chocolate, Groups Two (D=2.83) and Five (D=2.70) by a strong and positive attitude, while Group Three (D=1.11) shows a moderate and positive attitude. Group Four (D=-3.48) expresses the strongest negative attitude. Analysing the group of Belgian vs. Polish respondents in total, it is surprising to notice that young Belgian (D=-1.94) consumers of chocolate are rather negative towards consumption of chocolate when they are compared with Polish (D=1.80) consumers.

Finally, *cross-tabulation* is used to determine significant differences between the five groups in the amount and frequency of currently consumed chocolate, preferred varieties, self-identity, and self-control (Table 4.3).

Respondents of the Groups One, Two and Five consume the greatest amount of chocolate. The same groups state the highest frequency of snacking with chocolate. Milk and milk with nuts chocolate are the most preferred varieties in Groups Four and Five. Groups One and Two like the fondant chocolate. A choice of Group Three, which likes the fondant chocolate with nuts, indicates the interest of this group in "specialities". The self-identity with chocolate appears to be a good predictor variable of the potential involvement with this product. Groups Three and Five, which are represented in majority by Polish respondents, say that it is "impossible to enjoy life without chocolate". Finally, the self-control of respondents in relation to the consumption of chocolate does not differ a lot between all groups, however, it can be concluded that for Groups One, Two and Five the decision to quit chocolate consumption would come with some difficulty.

4.7   Profiling of segments and discussion

A few crucial differences between the target market of youth people in Belgium and Poland are found. The data are analysed from two directions. First, an individual portrait of each of the five groups is developed. Second, a comparison between the total number of respondents from both countries is presented. In regard to the characterisation of groups, the following labels are given: Independent (One), Health-Conscious (Two), Innovative (Three), Restrained (Four), and Hedonist (Five) (see Table 4.4).

Table 4.3   Cross-Tabulation Analysis in the Groups

In %	GROUPS				
	1	**2**	**3**	**4**	**5**
Amount					
X²=153.3, df=16, p<0.000					
1 bar or less	8.2	10.3	**25.0**	**46.2**	16.8
2 bars	13.5	20.6	23.8	23.9	20.6
3 bars	16.3	20.0	20.2	8.7	20.0
4 bars	23.1	15.4	10.1	12.0	12.3
more then 4 bars	**38.9**	**33.7**	20.8	9.2	**30.3**
Frequency					
X²=138.2, df=16, p<0.000					
< then 1/ month	1.7	3.2	5.5	16.0	0.7
1-2 times/ month	7.6	15.3	18.9	22.9	11.0
3-4 times/ month	21.1	**33.1**	**37.8**	**34.0**	33.1
few times/ week	**49.8**	29.9	32.9	21.8	**42.1**
everyday	19.8	18.5	4.9	5.3	13.1
Varieties					
X²=89.8, df=20, p<0.000					
fondant	**32.0**	**38.5**	12.5	16.4	12.0
fondant & nuts	12.7	8.5	**32.8**	9.4	14.5
milk	22.7	18.8	17.2	28.1	27.7
milk & nuts	22.1	19.7	17.2	**31.3**	**30.1**
white	8.3	5.1	1.6	11.7	4.8
all of them	2.2	9.4	18.8	3.1	10.8
Self-identity					
X²=103.8, df=16, p<0.000					
definitely cannot	20.2	**23.8**	**33.9**	13.0	**35.9**
cannot	5.8	9.8	12.5	3.2	12.2
neither/ nor	12.0	23.7	17.3	12.4	13.5
can	21.2	22.5	15.5	17.8	16.0
definitely can	**40.9**	20.2	20.8	**53.5**	22.4
Self-control					
X²=131.7, df=16, p<0.000					
definitely cannot	18.3	12.0	7.2	3.8	28.7
cannot	11.5	16.6	6.0	4.3	16.6
neither/ nor	9.1	8.6	7.8	3.8	10.8
can	15.9	**34.3**	24.0	24.3	13.4
definitely can	**45.2**	28.6	**55.1**	**63.8**	**30.6**

4.7.1   *Independent*

The group referred to as "Independent" gives high scores on the two following factors. First, it is the factor related to belief in negative consequences (NHEA=0.538) resulting from eating chocolate, such as being obese or getting bad teeth. The second is the factor referring to stated self-control (SECO=0.292). According to Phares (1978) and Szmigielska (1980), people with high inner-

control are less conformist, less submissive to external influences, self-confident, ambitious, tolerant and independent in their activities, responsible, entrepreneurial, suggestive and willing to co-operate, as well as less susceptible to fears and psychical breakdown. Respondents belonging to this group admit high involvement with the product through the positive scores on questions about deep desire (CRAV=0.367) for chocolate, frequent snacking and immediate consumption. Additionally, the group shows strong preference towards fondant chocolate (FOND=0.431). Finally, a very low score on the importance of augmented characteristics (AUGM=-0.701) or search attributes, is noticed. The group called "Independent" consists of 87% of Belgian respondents.

4.7.2 Health-Conscious

The only element common to Groups One and Two is the strong liking of fondant chocolate. However, Group Two gives a higher score (FOND=0.665) than Group One, admitting an extraordinary interest in taste, price and brands of the fondant chocolate. Another unique characteristic is the highest score on the factor called "frugal-utilitarian" (FRUT=0.670). It means that the group is in favour of convenient and average quality chocolate products. On the other hand, the group is moderately interested in quality-guarantee or credence cues of products (QUGU=0.288), such as country of origin. This group is the only one which is convinced about the positive health impact (PHEA=0.520) resulting from the consumption of chocolate, and do not see any negative influences of chocolate on health (NHEA=-0.652). On the other hand, it expresses the anticipation of affective reactions (AARE=0.577), such as addiction to chocolate, hyperactivity or guilt. Consequently, it connects chocolate with the feeling of sickness (AARF=0.338). In spite of this, the respondents state extremely strong belief in feeling better from consumption of chocolate (HERE=1.058). All of these health-related aspects suggest a label "Health-Conscious". The group is represented equally by Belgium (51%) and Poland (49%).

4.7.3 Innovators

This group consists of respondents who are the most social and active. They give the highest scores in a range of questions examining social and adventuresome attitude (SOAD=0.609) as well as on questions reflecting openness to experience

(OPEX=0.512). Another unique characteristic is their attention to augmented characteristics or search attributes (AUGM=0.561). The economic aspect (PRCE=0.602) is very important to this group. They also show interest in quality-guarantee (QUGU=0.298) cues of chocolate, which are connected with country of origin, trademark, and quality label. Beliefs in positive nutritional (NUTR=0.571) and functional (FUNC=0.362) impact of chocolate consumption are reported. All of this allows construction of the psychological portrait of this group. According to Garbarski (1998), people who are active in participation with other social groups and are very mobile as well as show traits of opinion leaders, are typical innovators. The innovators are courageous, entrepreneurial, perceive the lower risk during purchase decision, possess the positive attitude towards new products and usually perceive themselves as innovators, hence the label of this group. It is peculiar, that there is a strong lack of belief in addiction from chocolate or guilty feelings (AARE=-0.993). This together with low scores on the "body-consciousness" (BOCO=-0.502) may indicate that this group has no problems with weight control. Polish respondents (91%) represent the "Innovators".

4.7.4 Restrained

Respondents of this group show a moderate personal (PRSC=0.313) and public consciousness (PUSC=0.275). It means that they are aware of self-emotions and mood swings as well as concerned about how other people see them. They believe that eating chocolate causes feelings of sickness and is more appropriate for older people (SISO=0.250). This group emerges as the least social one among all five groups (SOAD=-0.548). Respondents belonging to this group do not often snack with chocolate or experience any deep desire towards this product (CRAV=-0.925). They do not reward themselves with chocolate (HERE=-0.562) and do not believe in a social utility of this product (FUNC=-0.682). All of this suggests the label of the group, i.e., "Restrained". It seems that in this case, the creation of any loyalty towards chocolate products would be almost impossible as the attitudes of these respondents express a typical "defence of self-esteem (ego)", through all negative beliefs about chocolate. Such defensive attitudes are insusceptible for any changes, as they are a part of a psychical construct, which allows the individual adaptation to the environment (Mazurek-Lopacinska, 1997). The majority of respondents of this group come from the two capitals, i.e., Warsaw (23%) and Brussels (20%).

4.7.5   Hedonists

The label of this group comes from the great number of positive answers to many factors. The respondents express typical craving behaviour (CRAV=0.906), positive belief in nutritional benefits of chocolate (NUTR=0.750), rewarding attitude (HERE=0.411) as well as importance of core characteristics or experience attributes of chocolate (CORE=0.406). The group believes in addiction (AARE=0.549) or sickness (SISO=0.489) from chocolate, and it may be speculated that such an attitude comes from the personal experience. The group is highly body-conscious (BOCO=0.495) and worry about appearance in the public (PUSC=0.220). However, it shows a rather active type of personality (SOAD=0.338). This group is the most negative towards fondant chocolate (FOND=-0.634). These respondents are so much in favour of chocolate (milk) that money does not play any important role in purchasing decisions (PRCE=-0.506). "Hedonists" are represented by 65% of Polish people.

4.7.6   Belgian vs. Polish respondents

Comparison of total Belgian and Polish respondents is more straightforward and conclusive. On the one hand, the *Belgian respondents* taking part in the study are self-controlled (SECO=0.472), anticipate affective reactions related to chocolate (i.e. addiction or hyperactivity) (AARE=0.461), like fondant chocolate, and pay attention to its brand and price (FOND=0.448). They neither pay a lot of attention to the package of chocolate (AUGM=-0.854), nor believe in nutritional value of chocolate in relation to its high content of magnesium and caffeine (NUTR=-0.782). They also do not think that chocolate is appropriate for older people or those who exhibit "more sophisticated taste preferences" (SISO=-0.639). It seems that the young Belgian consumers of chocolate are more suspicious towards common beliefs that chocolate satisfies craving, releases stress or is socially appropriate (FUNC=-0.535). Finally, Belgians do not think that chocolate is too expensive (PRCE=-0.511).

On the other hand, the *Polish respondents* express quite contradictory beliefs about chocolate. They pay a lot of attention to the package of chocolate (AUGM=0.789), strongly believe in positive nutritional value of chocolate (NUTR=0.724), as well as believe that chocolate causes sickness in general and that fondant chocolate is more appropriate for older or "sophisticated" people (SCSO=0.592). Polish

consumers hold belief in the positive functional impact of chocolate (FUNC=0.491) and are price-oriented (PRCE=0.475). They do not perceive themselves as self-controlled (SECO=-0.438) but also do not anticipate to be addicted to chocolate (AARE=-0.422). Generally, they believe that fondant chocolate does not bring pleasure and is expensive (FOND=-0.411).

The profiling analysis shows that the psychological criteria help to explain consumers' behavioural intention and formulate recommendations for marketing strategies for each group. Table 4.4 summarises the characteristics of the segments and sets recommendations for future advertisement. Except for the " Restrained" chocolate consumers, key elements that are in line with the profile of the segments are proposed.

Table 4.4   Strategic Groups

GROUP'S	1	2	3	4	5
LABEL	Independent	Health-conscious	Innovative	Restrained	Hedonists
Successfully predicted (%)*	66	77	74	71	73
Characteristics	-Most self-confident -Fondant chocolate is most preferred	-Rewarding themselves -Positive beliefs about chocolate -Conservative	-Active -Open for experience -Value-for-money -Non-conformist	-Restrained -Negative beliefs about chocolate -Lowest consumption	-Highly involved -Liable to pay more -Weight-careful
Advertisement focus	SAFETY GUARAN-TEE	LIFE-STYLES REFERENCE GROUPS PRESTIGE	TECHNI-CAL PARAME-TERS NOVELTY ORIGINA-LITY SPECIFI-CITY PROMO-TIONAL PRICE	*NO* *EFFECTIVE ADVERTISE-MENT*	RATIONAL ARGU-MENTS POSITIVE HEALTH INFLUENCE PRICE RISES

Note: Canonical discriminant analysis

4.8   Conclusions

The overall *attitude structure* based on attribute importance and beliefs in chocolate varies between Belgium and Poland as well as between segments (groups) found in these countries. *The impact of psychological characteristics* of respondents on this attitude structure is evident. Idiosyncracies of respondents help to explain types of motives that influence behaviour. Rational (economic considerations) vs. emotional (e.g. anticipation of guilt, addiction, sickness or hyperactivity) motives are strongly related to psychological characteristics of people.

It is observed that active people are more convinced about social appropriateness of chocolate products (innovative & hedonist), which corroborates with previous studies by Schutz (1994). Consumers who associate chocolate with higher values (sophistication) are rewarding themselves with this product (health-conscious & hedonist). It is further noticed that if people pay attention to core characteristics or experience attributes (taste, smell, texture) of food, they also tend to exhibit a kind of desire for a pleasure associated with the consumption of this product (independent & hedonist). A group of people strongly avoiding chocolate is found. Their behaviour may be explained by two factors: disinterest in taste (particularly dislike of fondant chocolate) and unsociability. Finally, it is observed that there are significant differences between men and women in self-identity with chocolate (p=0.022) and self-control (p=0.009). In regard to self-identity, men say that they can live without chocolate while women say that they cannot. The question on self-control reveals the same tendency, i.e., men pretend to be able to stop eating chocolate any moment they want, but women are more sceptical. On the other hand, there is no significant difference in answers of men and women in relation to the amount (p=0.065) and frequency (p=0.506) of the chocolate consumed, as well as related to preferred chocolate varieties (p=0.487).

In conclusion, former analysis proved valuable in a cross-cultural setting and revealed relevant segments of chocolate consumers. A future challenge specifically deals with the question whether these segments can be validated through sensory evaluation studies. The integration of both the marketing research and sensory approach should lead to in-depth recommendations to marketing and product development.

4.9   Acknowledgement

Annex 4.1   Variables in Research Design

VARIABLES	LABEL	EXPLANATION
Attribute		**Importance of chocolate's…**
importance	V1	- appearance
	V2	- smell
	V3	- taste
	V4	- texture
	V5	- filling (in case of composite chocolate)
	V6	- price
	V7	- package appearance
	V8	- pack size
	V9	- country of origin
	V10	- trademark
	V11	- quality label
	V12	- novelty
	V13	- other persons' opinion
Benefit		**Consumption of chocolate …**
beliefs	B1	-..reduces stress
	B2	-..is very appropriate in during social meetings
	B3	-..satisfies my deep desire for something sweet
	B4	-..makes me easier fall in love
	B5	-..is a quick energy intake
	B6	-..prevents sclerosis and heart diseases
	B7	-..helps to prevent bacteria growth in the mouth
	B8	-..provides body in magnesium
	B9	-..provides body in caffeine
	B10	-..is bad for my teeth
	B11	-..makes people fat or obese
	B12	-..causes sickness afterwards
	B13	-..brings a feeling of guilty afterwards
	B14	-..causes addiction to it
	B15	-..makes people hyper-active
	B16	-..causes ulcers
	B17	-..fondant is better for old people than young
	B18	-..fondant provides more pleasure then milk chocolate
	B19	-..only people with sophisticated taste enjoy fondant chocolate
	B20	-..fondant is more expensive than milk chocolate
	B21	-..brand of fondant chocolate is of big importance
Personal	P1	I watch my figure while eating
characteristics	P2	When I have something delicious, like chocolate, I eat it immediately
	P3	I often snack with chocolate between meals
	P4	Watching people eating chocolate makes me eager to do the same
	P5	I am very sensitive to changes in my mood
	P6	I like analysing myself
	P7	I am constantly examining my motives
	P8	I am generally attentive to my inner feelings
	P9	It is important for me to know what people think of me
	P10	I usually worry about making a good impression
	P11	I often compare my appearance with that of other people
	P12	I am afraid to seem stupid
	P13	I like to serve special chocolate desserts when I have guests
	P14	I like to eat chocolate with friends
	P15	I like trying new chocolate products
	P16	Chocolate products are too expensive to eat everyday

P17	I think new convenience chocolate desserts are great
P18	I eat any chocolate to stop hunger
P19	I buy only the best quality chocolate products to eat everyday
P20	I prepare special and expensive chocolate desserts for myself
P21	The chocolate I eat must have a very good flavour and appearance
P22	Nutritional labelling gives me more confidence in the chocolate I buy
P23	I stay well because I eat chocolate
P24	I eat a certain chocolate because it makes me feel healthier
P25	I eat chocolate to reward myself for something I achieved
P26	I often have a deep desire for chocolate
P27	After eating chocolate I feel immediately satisfied
P28	Generous vs Economical
P29	Timid vs Confident
P30	Suspicious vs Trusting
P31	Concerned vs Unconcerned
P32	Conservative vs Experimenting
P33	Undisciplined vs Controlled
P34	Weight Careless vs Weight Carefull
P35	Socially Pasive vs Socially Active

Source: Axelson & Penfield (1983), Knight (1999a,b), Kris-Etherton et al. (1994), Mc Crae & Costa (1987), Nuttal (1994), Realo & Allik (1998), Viaene & Januszewska (1999a)

Annex 4.2   Factor Analysis from Research Variables

FACTOR LABEL (% variance explained)	LOADING SCORES	VARIABLES INCLUDED
45,9%		
(V1-QUGU)	.799	V10 – TRADE MARK
QUALITY-GUARANTEE	.740	V 9 – COUNTY ORIGIN
	.632	V11 – QUALITY LABEL
(V2-AUGM)	.710	V 7 – PACK APEARANCE
AUGMENTED	.701	V 8 – PACK SIZE
CHARACTERISTICS	.580	V 6 – PRICE
	.565	V13 –OPINION OF OTHERS
	.466	V12 – NOVELTY
(V3-CORE)	.649	V 2 – SMELL
CORE	.610	V 4 – TEXTURE
CHARACTERISTICS	.590	V 3 – TASTE
	.576	V 1 – APPEARANCE
	.398	V 5 – FILLING
57,7%		
(B1-AARE)	.771	B14 – CAUSES ADDICTION
ANTICIPATED	.713	B15 – BRINGS HYPERACTIVITY
AFFECTIVE REACTIONS	.561	B13 – FEELING OF GUILT
	.507	B16 – CAUSES ULCERS
(B2-FUNC)	.730	B 1 – RELEASE IN STRESS
FUNCTIONAL	.711	B 2 – SOCIALLY APPROPRIATE
IMPACT	.559	B 3 – SATISFIES CRAVING
	.552	B 4 – HELPS TO LOVE
(B3-PHEA)	.748	B 7 – PREVENT OF BACTERIA
POSITIVE HEALTH	.709	IN MOUTH
IMPACT		B 6 – PREVENT SCLEROSIS
(B4-NUTR)	.715	B 8 – MAGNESIUM INTAKE
NUTRITIONAL	.707	B 5 – ENERGY INTAKE
IMPACT	.611	B 9 – CAFFEINE INTAKE
(B5-FOND)	.733	B18 – FONDANT PLEASURE
BELIEFS IN	.629	B20 – FONDANT EXPENSIVE
FONDANT CHOCOLATE	.622	B21 – FONDANT BRAND IMPO
(B6-NHEA)	.845	B10 – TEET DECAY
NEGATIVE HEALTH	.754	B11 – OBESE INCREASE
IMPACT		
(B7-SISO)	.639	B12 – CAUSES SICKNESS
SICKENESS -	.610	B19 – FONDANT FOR
SOPHISTICATION	.427	SOPHISTICATED
		B17 – FONDANT FOR ELDERY
59,7%		
(P1-PRSC)	.874	P 6 – AUTO-ANALYSIS
PERSONAL	.852	P 7 – EXAMINING MOTIVES
CONSCIOUSNESS	.788	P 8 – INNER FEELINGS
	.420	P 5 – MOOD SENSITIVE
(P2-PUSC)	.781	P11 – COMPARE APPEARANCE
PUBLIC	.759	P 9 – OTHERS IMPORTANT
CONSCIOUSNESS	.712	P12 – AFRAID SEEM STUPID
	.686	P10 – WORRY IMPRESSION

(P3-CRAV)	.703	P 3 – OFTEN SNACK
CRAVING	.676	P26 – DEEP DESIRE
	.614	P 4 – BEHAVIOR IMITATION
	.603	P 2 – EAT IMMEDIATELY
(P4-HERE)	.792	P24 – FEEL HEALTHIER
HEALTHFUL –	.760	P23 – STAY WELL
REWARDING	.639	P25 – ACHIEVEMENT REWARD
	.538	P27 – IMMEDIATELY SATISFIED
(P5-SOAD)	.745	P14 – WITH FRIENDS
SOCIAL –	.671	P15 – TRYING NEW
ADVENTURESOME	.681	P13 – FOR GUESTS
(P6-OPEX)	.711	P35 – SOCIALY ACTIVE
OPEN - EXPERIMENTING	.707	P29 – CONFIDENT
	.569	P32 – EXPERIMENTING
	.460	P30 – TRUSTING
(P7-BOCO)	.729	P34 – WEIGHT CAREFUL
BODY IMAGE	.712	P 1 – WATCH FIGURE
CONSCIOUSNESS	.621	P22 – NUTR LABEL CONFIDENCE
(P8-QUPL)	.724	P19 – BEST QUALITY
QUALITATIVE –	.614	P21 – PERFECT FLAVOR/LOOK
PLEASURABLE	.484	P20 – SPECIAL FOR ME
(P9-FRUT)	.761	P18 – ANY TO STOP HUNGER
FRUGAL – UTILITARIAN	.580	P17 – NEW GREAT CONVENIENT
(P10-PRCE)	.801	P31 – UNCONCERNED
MONEY – ORIENTED	.477	P28 – ECONOMICAL
	.333	P16 – TOO EXPENSIVE
(P11-SECO)	.804	P33 – CONTROLLED
SELF - CONTROLLED		

Note: Factor Analysis, Varimax rotation

V1-V3: KMO = .729, BTS p<0.000
B1-B7: KMO = .741, BTS p<0.000
P1 -P11: KMO = .793, BTS p<0.000

CHAPTER 5

Sensory Segments in Preference for Plain Chocolate
Across Belgium and Poland

5.1 Abstract

The aim of Chapter 5 is to compare consumers' preference for plain chocolate in Belgium and Poland. The proposed Model of Affection-Related Chocolate Choice (MARCC) takes into account three factors: affective dimension, culture and demographics. The affective dimension is a core of the current research and demographics are restricted to the target group. The influence of culture was investigated (Januszewska et al., 2000) and five personality segments were found. The relationship to these segments is shown throughout this study. The research is based on an experimental design according to which a set of 13 plain chocolates was manufactured. The market survey was conducted in the north, the south and in the capitals of both countries. Respondents evaluated their preference towards plain chocolate, the perception of an ideal level of sensory attributes, the expected and the actual liking of the chocolate. The current, self-declared hunger and mood states were recorded. Behavioural measures included the frequency, the consumption amount, and the preferred chocolate varieties. Each respondent judged four chocolates among which there was a central point sample (CP). This sample represented the medium level of sugar and two cocoa masses among all experimental samples in four contexts. The chocolates were presented within four completely balanced blocks that were designed to keep the order of presentation under strict control. Data evaluation by descriptive (means, standard deviations, cross-tabulation), factor, cluster and discriminant analysis was implemented. Results are presented in five steps. First, the CP sample is most liked in all contexts independent of consumers' country of origin, gender or personal

characteristics. Second, a clear separation of the overall liking from the sensory directionals is observed. Third, consumers are classified in four sensory segments. Fourth and fifth, these segments are analysed to reveal groups of respondents who emphasise different sensory attributes of plain chocolate. It may be concluded that the MARCC model helps to gain information about the sensory segments in relation to the personality of respondents.

5.2   Introduction

The importance of cross-cultural research on consumers' perception of food quality or preferences is paramount for several reasons. On one hand, there is often less country to country variation in basic sensory preference than is expected (Moskowitz & Krieger, 1998a). Sensory segmentation identifies a limited number of consumer subgroups, showing various preference patterns that may exist in all countries but in different proportions. A study on preference of coffee (McEwan, 1998) between five European countries discovered three sensory segments that were found to be independent of the country of the respondents. On the other hand, some studies (McEwan, 1998; Moskowitz *et al.,* 1985) indicated clusters of individuals that showed extremely different preference patterns for many sensory liking relations.

Knowledge about sensory segments established in many countries brings competitive advantage because it can enable a marketing strategy to be targeted at a specific group of people. It is clear that research on sensory preference segmentation may contribute to the innovation of confectionery, as it helps both R & D and Marketing departments to develop appropriate strategies.

People aged between 20 and 30 years old are an interesting target group for several reasons. First, this group is seen as especially important in countries of Central Europe due to more independent methods of purchase than expressed by other demographic groups (Nikodemska-Wolowik, 1999).

Second, the modification of preference occurs more quickly in younger people who have less-established preferences (Birch, 1981). Therefore, to expose the target group of youth to foods that have different tastes may change both

preferences and consumption patterns as well as contribute to the shifts in attribute importance and benefit beliefs about the product.

The aim of this study is to compare the liking of plain chocolate in Belgium and Poland. It is analysed through statements on preference of chocolate and judgement of sensory attributes in relation to an internal "ideal" standard. The objective is to find whether differences exist and if they do, between which groups of people.

5.3   Theoretical concepts

The sensory preference model is based on theoretical concepts and empirical studies in relation to food choice (Van Trijp & Steenkamp, 1998) (Figure 5.1).

Final food choice is formed due to sensory preference that is in turn influenced by sensory perception. Lawless (1990) found two basic sources of individual differences in expression of food preferences. First were *differences in sensitivity* of individuals due to either anosmias to the particular chemical families of the olfactory stimuli (Amoore, 1977) or due to the loss of response to the oral trigeminal irritants (Lawless *et al.,* 1985). Differences in sensory sensitivity of humans were influenced by age as variations in food acceptance between young adulthood and old age were partly attributable to declines in the sensitivity of taste and smell with age (Birch, 1989). The increased preference for the highest concentration of a certain component was explained by a decrease in sensitivity (Murphy & Withee, 1986).

Second were *personality differences* related to the ways people interpret the stimuli in the process of rating. The crucial importance of understanding likes and dislikes of consumers was emphasised by the fact that cultural background is considered as one of the most influential predictors of liking food (Tuorila & Meiselman, 1992). For instance, when the cognitive influences on food choices are considered, it was established that sweets were preferred during experience of the following emotions: amusement, boredom, and worry (Lyman & McCloskey, 1987).

Figure 5.1   Sensory Preference Model

INFLUENCING FACTORS		

- AGE
- PHYSIOLOGY: HUNGER

Differences in | Sensory sensitivity
| Personality

- CULTURAL BACKGROUND
- EXPECTATIONS
- DEGREE OF LIKING
- FREQUENCY OF USE
- EXPERIENCE
- (NUTRITIONAL) INFO
- MOOD
- EXPOSURE
- FAMILIARITY

Sensory **PERCEPTION**

Sensory ATTRIBUTES

Communication

Sensory **PREFERENCE**

Sensory SEGMENTS

FOOD CHOICE
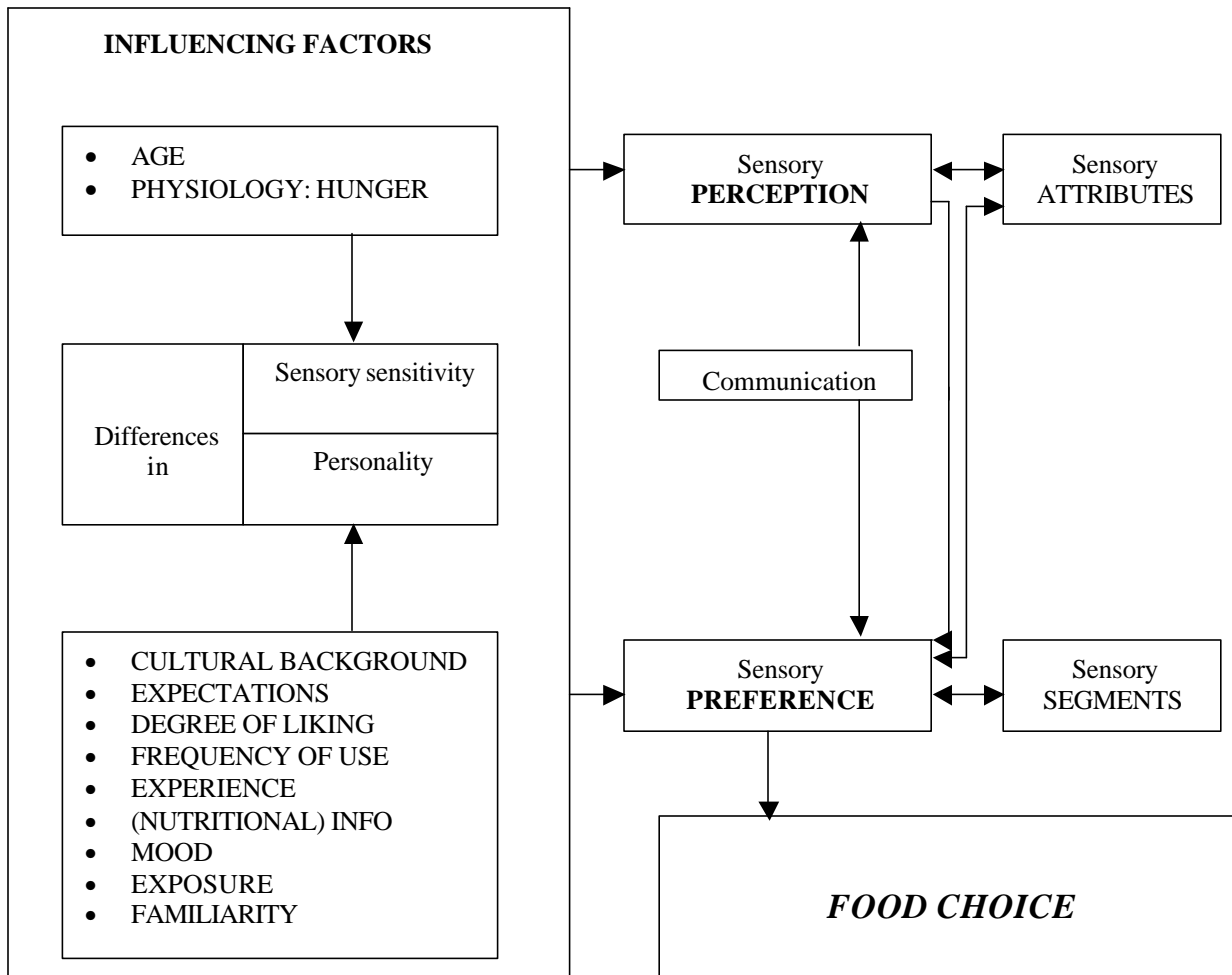
Based on: Van Trijp & Steenkamp (1998)

According to Cardello (1994), human *expectations* contribute to the perceived quality of food and preferences. Generally, there are two types of expectations. First, is the *sensory-based expectation*, i.e. belief that the food product will possess certain sensory attributes, each at certain intensities. Second, is the *hedonic-based expectation* related to belief that the product will be liked or disliked to a certain degree. It was proposed that any mismatch between the expected and the actual perception of the sensory attributes or between the expected and the actual liking results in 'disconfirmation'. Where the actual product is better than expected, it is a positive process. Cardello *et al.* (1985) found that the greater the degree to which

the consumers' experience with the product matches his/her pre-established expectations, the greater is the liking of the product.

Tuorila *et al.* (1998) showed that the *degree of liking* and *frequency of use* of the specific familiar reference products were the main predicting factor in the expected liking. Rozin and Tuorila (1998) showed that the choice was made on *experience* (remembered qualities and pleasures) and the *expectations* (anticipation) of what the actual reaction to the item would be when it was sampled in the future. Hyde and Witherly (1993) pointed out that the palatability of chocolate is considered as a complex change of sensation over time, which they called the "dynamic contrast". This means that the change of the texture from solid to liquid is a critical parameter for discovering pleasure of eating chocolate.

Further, the *context* within which stimuli are viewed has a paramount importance on sensory judgement. Poulton (1988) stressed evidence that qualitative judgement (e.g. sensory scores) was subject to biases from the context in which it appeared. Prescott *et al.* (1997) underlined that hedonic responses to manipulated sucrose levels in three contexts (foods) showed clear differences between the panels drawn from Australian and Japanese cultures with largely dissimilar diets. The same study of revealed a high degree of cross-cultural agreement between these panels for an *optimal level* of sweetness. According to Tuorila (1996) a hedonic optimum is the best liked concentration of the substance in a particular food or beverage and such hedonic optima vary among foods and across cultures.

To investigate the context effect, the concept of *a central point sample* was employed. This sample relates all factors on a scale to some standard, instead of pretending that ratings have absolute meaning (Lawless, 1990). The addition of the central point sample to the experimental design allows an estimate of any curvature in the response, especially when the final product optimisation or investigation of the contextual effects on sensory scores is foreseen (Baxter, 1989). Therefore, the researcher gains an advantage as the sensory quality of other products is judged in terms of the degree of difference from the standard (Cardello *et al.,* 1985).

5.4   Materials and methods

5.4.1   The model of Affection-Related Chocolate Choice (MARCC)

In the first step, the conceptual model of Affection-Related Chocolate Choice (MARCC) was developed from the sensory preference model and concepts (Figure 5.2). The MARCC model is based on the model of decision-making process that is affected by external and individual factors (Loudon & Della Bitta, 1993). It is proposed that three dimensions influence behaviour, related to intake of chocolate: the preference for plain chocolate (*affective dimension*), the environment in which the affections are formed (*culture*) and the individual (*demographics*). The core of the MARCC model relates to the *expected* and the *actual liking* as well as the *physiological state* of the respondents at the moment of the tasting session. Shepherd and Sparks (1994) showed that these elements contribute to the formation of attitudes and the final behaviour, i.e. food intake.

Figure 5.2   Conceptual Model of Affection-Related Chocolate Choice (MARCC)
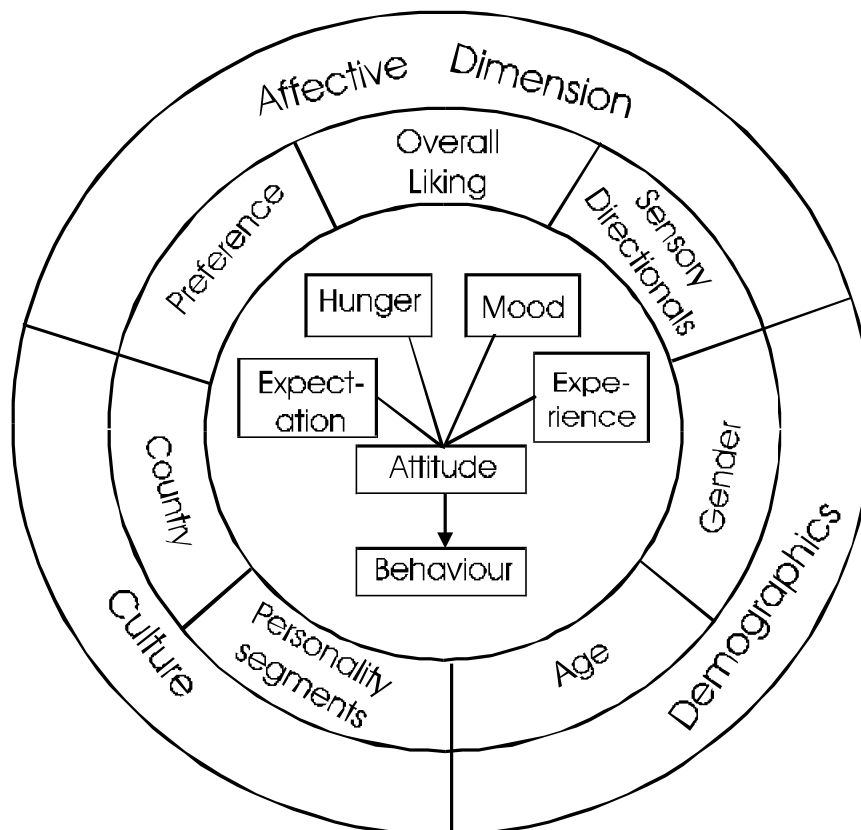
According to Tuorila (1997) the *affective dimension* (sensory preference) is formed from sensory stimuli. Affections can be measured through preference tests and rating of intensities of sensory attributes. Booth (1990) states that preference tests provide no answer on how to improve the product formulation. Therefore, the preference data must be related to those attributes that actually function in the mind of the choice-making respondents. Thus, the *intensity judgements* of sensory attributes are investigated by untrained consumers whose ability to discriminate and scale sensory intensities had been demonstrated in many scientific studies. Sensory directionals (ASTM, 1995; Moskowitz, 1994a) are used when the product is judged in relation to an internal "ideal". *Relative-to-ideal sensory profiling* is a psychologically quantitative form of qualitative market research focusing on the factors that are interesting to the technologists (Booth, 1990).

Cultural influences are the second dimension in the MARCC model. Such influences were analysed through the nationality and psychological traits of the consumers and five personality segments of respondents were found across Belgium and Poland (Januszewska *et al.,* 2000). In this paper, we refer to these personality segments because the cognitive aspects of tasting, such as the criteria the consumer sets for himself, are especially important in the analysis of preference (O'Mahony, 1990). The third *demographic* dimension is limited to age and gender. The target group was between 20 and 30 years old because they are the highest self-stated group for consumption of confectionery products (Viaene & Januszewska, 1999a). The gender of the respondents was represented in equal percentages, as the questionnaires were pre-coded.

5.4.2 Experimental samples

In the second step, the *mixture design* was created (Box *et al.,* 1978; Cornell, 1981; Khuri & Cornell, 1987). In the mixture experiments the combination of ingredients is used to determine what blend of ingredients produces more desirable consumer acceptability. As the proportion of the first component increases (decreases), the proportion of at least one other component must decrease (increase) to keep the total weight of the product the same.

The experimental design allows investigation of the levels of three components for consumers' preference (Table 5.1). These three components sum up to 100% and represent: cocoa mass from the first (B1) and the second (B2) sources of cacao

beans, as well as sugar content. The plain chocolate was manufactured in 13 formulations according to this design. The first six samples (1 to 6) represent plain chocolate produced from cocoa mass of one source. The next seven samples (7 to 13) were manufactured from cocoa mass of two sources. The thirteenth sample is a central point (CP) and represents the medium values of the ingredients between the 12 products (Baxter, 1989). It has to be stressed that the CP is also the centre point of B1 (30%) and B2 (30%). All respondents evaluated the CP that is significant for investigation of the influence of the context.

Table 5.1   Experimental Mixture Design of Plain Chocolate Samples

CONTEXT	SAMPLE	CONTENT (%)		
		SUGAR	B1*	B2**
High-Intensity-Pure	**C1**	30	70	-
(HIP)	**C2**	30	-	70
	C3	40	60	-
Low-Intensity-Pure	**C4**	40	-	60
(LIP)	**C5**	50	50	-
	C6	50	-	50
High-Intensity-Mixture	**C7**	30	50	20
(HIM)	**C8**	30	20	50
	C9	40	40	20
Low-Intensity-Mixture	**C10**	40	20	40
(LIM)	**C11**	50	30	20
	C12	50	20	30
CENTRAL POINT	**C13**	40	30	30

*Note: *B1 – mixture of the cocoa mass of the first source*
***B2 – mixture of the cocoa mass of the second source*
The experimental design is the same as mentioned in Table 7.1 and Table 8.1,
but adapted to the specific research approach.

There are four so-called "*contexts*". In the first context, the component level of cocoa mass is high and is called the high-intensity-pure (*HIP*). The second context represents the low-intensity-pure chocolates (*LIP*). The next one consists of the high-intensity-mixture samples (*HIM*). The last context is called the low-intensity-mixture (*LIM*). Within the *HIP* and *LIP* contexts the sensory perception of chocolates, produced from cocoa mass of one or another place of origin, can be compared at the same quantity level of this component (e.g. C1 and C2, C5 and C6). The same relationship can be made in the *HIM* and *LIM* contexts and then the results can be cross-examined for the samples from different contexts.

According to Booth (1990) *four products* are the minimum needed to interact and bias-minimise two influences (places of origin of cocoa mass) on preference. The first sample is needed to see how far the perception of this sample is from the consumer's personal ideal. The second sample is substantially up or down in level of the influence tested. The third or fourth sample tests another factor in preference by markedly changing its level. For example, in *HIP* context the first sample C1 is produced from 70% of B1. The second sample C2 has 70% of B2, which is paramount for the investigation of the influence of the place of origin of the cocoa mass. The third sample C3 has 60% of B1, which means that sugar content increases and preference is expected to change. To minimise range bias, the samples kept the difference in the percentage composition from the CP equal.

5.4.3   *The cross-cultural sensory questionnaire (CCSQ)*

In the third step, the cross-cultural sensory questionnaire (CCSQ) was developed focusing on the *affective dimension* part of the proposed model. It consisted of an introductory page and the affective part. The *introductory page* contained three selection questions about the consumption of chocolate in general, liking of plain chocolate, and nationality. In the *affective part*, consumers were asked to assess the sensory attributes of plain chocolate. The list of sensory attributes was established through a word-association technique with a sensory panel, which evaluated the whole set of samples at the same time of the research. The panelists were presented with a list of words, one at a time and then were asked to give other words that came to their mind for the characterisation of chocolate qualities (Malhotra, 1996). Eleven sensory attributes were established: colour, melting-in-the-hand, aroma, flavour-release, aftertaste, sweetness, fruitiness, bitterness, cocoa, melting-in-the-mouth, and hardness.

In the current research, the consumers assessed four plain chocolates through three tasks. First, the five sensory *overall liking* attributes (colour, smell, taste, texture, and total impression) were judged on 7-point scales ranging from "extremely dislike", through "is fine" to "extremely like". Second, the 11 above mentioned *sensory directionals* were evaluated on 7-point bipolar semantic scales. The left-hand scale indicated too light (colour), too slow (melting), too soft (hardness) or too weak (taste, aroma, etc.) sensory attribute. The right-hand scale indicated too much of the same attribute. The middle point of each scale represented the "just

right" evaluation, i.e. the ideal point of the attribute perception. Third, the statement on final *preference* of the four chocolates was recorded. The hedonic evaluation was also performed on 7-point scales, ranging from "extremely dislike", through "neither/nor" to "extremely like". All 7-point scales were then transformed to 5-point items with the above explanation of their extreme edges.

Finally, the CCSQ analysed *expectations* associated with taste of the chocolates and checked the fulfilment of expectation after the tasting session. The self-declared current mood and hunger states were also recorded. These two questions were analysed on two 7-point bipolar semantic scales: mood (unhappy vs. happy) and hunger (hungry vs. satiated). All these scales were transformed to 5-point scales during analysis for simplification of data output. The research questionnaire was *translated* from the English version to: Dutch (Gent and Brussels), French (Gembloux) and Polish (Olsztyn, Warsaw, and Kraków).

5.4.4   Market survey

As the fourth step, a *cross-market survey*, based on quota sampling procedure was conducted (Malhotra, 1996). Two hundred respondents took part in the survey in each of six cities, making a total of 1200.

According to Moskowitz and Krieger (1998a), there is need for a minimum of 30 ratings per product when the final aim is product optimisation. This constraint influenced the construction of the quota sampling procedure. Within each context (*HIP*, *LIP*, *HIM* and *LIM*), the samples were presented 24 times in a *completely balanced block order* (Annex 5.1). The order retained the number of samples' presentations under a regime control, i.e. each sample was presented as first, second, third and fourth an equal number of times. Each block was then repeated to obtain 48 ratings per product. Two randomly selected orders were added to make a total of 50 evaluations. Having four blocks of orders, the total number of respondents testing the set of 13 samples was 200.

The *execution* of the CCSQ was similar to the 'in-hall' testing methodology and consisted of three steps. First, the meetings with respondents were arranged in advance. Second, at the beginning of each meeting, the respondents were given a short briefing about the aim of the study and instructed how to self-administer the questionnaire. A clear explanation was essential in relation to the tasting procedure

(the use of water, the specified order of testing, etc.) Third, plates with the four samples of chocolate (the unwrapped and uniformly manufactured pieces), cups with water (to avoid de-sensibilisation) and questionnaires were distributed. The chocolates were presented on plastic trays and coded with three-digit numbers. The CP sample was not identified as a different one from others.

5.5   Data analysis and results

Data analysis starts from data inspection and then proceeds in three steps in regard to the central point sample. First, preference scores are reported and discussed. Second, sensory directionals are analysed through factor, cluster and discriminant analyses. Third, sensory segments are profiled in regard to behavioural measures proposed in the MARCC model.

The total of 1200 respondents was reduced due to selective questions on different nationality (N=49) and the definite dislike of plain chocolate (N=115). Missing answers and extremities contributed to the removal of another 143 cases, which resulted in a total number of 893 valid cases. Annex 5.2 shows that there were no significant differences in distribution of the respondents in the four contexts for all target groups (the countries, the genders, and the five personality-influenced segments). A minimum 30 ratings per product (Moskowitz & Krieger, 1998a) is needed for further product optimisation and this requirement was reached, as ratings vary from 30 to over 60 per personality segment.

5.5.1   Preference for the central point (CP)

The analysis of the CP sample contributes to better understanding of the role of the context, in which the product is served. It should be remembered that only a score above three reflects a liking of the sample. The differences in liking of the CP chocolate between groups of respondents are shown in Table 5.2.

It seems that most of the respondents agreed on the optimal hedonic level within each context indicating the CP as the most liked, which comes from the analysis of the whole spectrum of samples. Another conclusion is that the CP sample scored a little higher in the high-intensity contexts (*HIP & HIM*) than in the low-intensity contexts (*LIP & LIM*). This difference was, however, insignificant and it may only

indicate that the consumers have an easier task choosing from the samples with strong cocoa flavours.

Table 5.2   Means and Standard Deviations of Preferences for the Central Point Chocolate

TARGET	CONTEXT									
	HIP		LIP		HIM		LIM		ACROSS	
	M	SD	M	SD	M	SD	M	SD	M	SD
Total	3.9	*1.2*	3.7	*1.3*	3.9	*1.3*	3.7	*1.3*	3.8	*1.3*
Belgium	3.8	*1.3*	3.8	*1.2*	3.9	*1.3*	3.8	*1.3*	3.8	*1.3*
Poland	4.0	*1.1*	3.7	*1.4*	3.8	*1.3*	3.6	*1.3*	3.8	*1.3*
Male	3.9	*1.1*	3.7	*1.4*	3.9	*1.3*	3.8	*1.2*	3.8	*1.3*
Female	3.9	*1.3*	3.7	*1.3*	3.8	*1.3*	3.6	*1.3*	3.8	*1.3*
Independent	3.9	*1.2*	3.8	*1.2*	4.1	*1.2*	3.9	*1.3*	3.9	*1.2*
Health-Conscious	3.8	*1.2*	3.8	*1.3*	3.8	*1.3*	3.9	*1.1*	3.8	*1.2*
Innovative	4.0	*1.1*	3.9	*1.2*	3.8	*1.3*	3.6	*1.3*	3.9	*1.2*
Restrained	4.0	*1.2*	3.4	*1.3*	3.7	*1.3*	3.3	*1.3*	3.6	*1.3*
Hedonists	3.8	*1.2*	3.7	*1.5*	3.9	*1.4*	3.8	*1.4*	3.8	*1.4*

Note: measured on 7-point scales that were transformed to 5-point scales

Data validation by t-test and the analysis of variance was conducted. There were no significant differences in preference of the CP sample either between countries, genders or personality segments. Additionally, the effect of the presentation order has to be indicated. There was a significant difference between the preference judgement of the CP sample between the two countries, when it was the first sample to taste (x^2=12.17, df=4, p=0.016). While Belgian respondents expressed constant liking for this sample, Poles seemed to be confused and reported more disliking. However, when the CP was presented as the second, third or fourth sample, the answers were constantly positive for most Polish respondents.

5.5.2   *Sensory directionals of the central point*

Following the investigation of the CP, it is necessary to search for the sensory attributes that may help in differentiation between respondents. Therefore, the CP was analysed in-depth through 16 sensory attributes that represent overall liking (5) and sensory directionals (11). The internal reliability (Cronbach's alpha) of the scales related to overall liking (α=0.81) and sensory directionals (α=0.48) was acceptable (Malhotra, 1996). Three types of analyses were computed: factor, cluster and discriminant analysis.

First, the four principal components, with Eigenvalue over 1, were calculated by means of the PCA with Varimax rotation (Figures 5.3a & 5.3b). Data matrix consisted of 5 overall liking attributes and 11 sensory directionals for all valid respondents. The four principal components represented 53% of the cumulative variance. Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was satisfactory (0.765) and the Bartlett's Test of Sphericity was significant (p<0.000).

Figure 5.3a   First and Second Principal Components for the CP Sample's Sensory Attributes
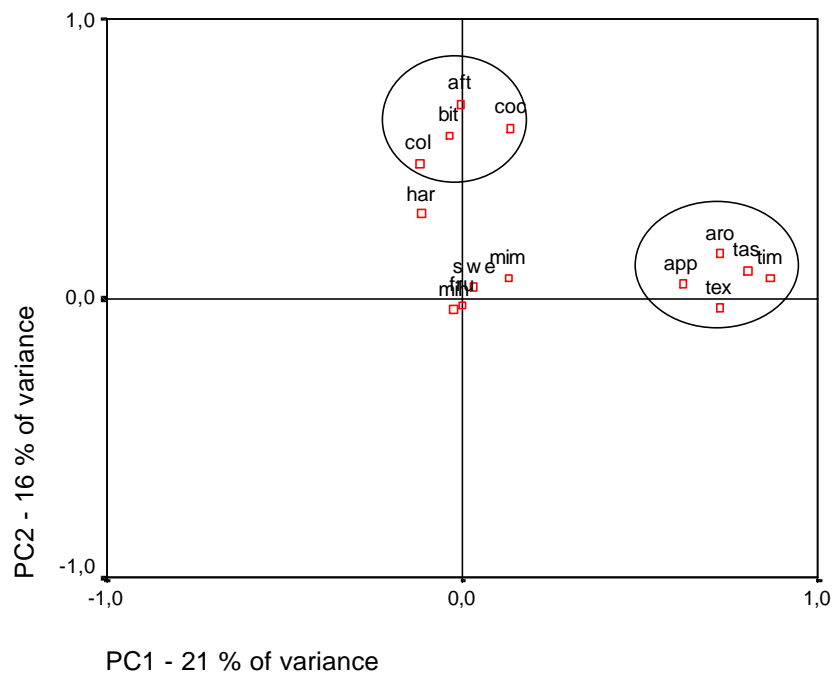
Note: Overall liking: app-appearance, aro-aroma, tas-taste, tex-texture, tim-total impression. Sensory directionals: aft-aftertaste, bit-bitterness, coc-cocoa, col-color, fru-fruitiness, har-hardness, mih-melting-in-the-hand, mim-melting-in-the-mouth, swe-sweetness. Rotation Method: Varimax with Kaiser Normalisation

Two sensory directionals (aroma and flavour-release) were excluded, as they did not significantly contribute to the components' formation.

The components separated overall liking from sensory directionals. While PC1 was related to overall liking, PC2 contained colour, aftertaste, bitterness and cocoa taste. PC3 represented sweetness and fruit-taste and finally, PC4 was related to melting-in-the-mouth and hardness, interpreted as texture attributes.

**Figure 5.3b   Third and Fourth Principal Components
for the CP Sample's Sensory Attributes**
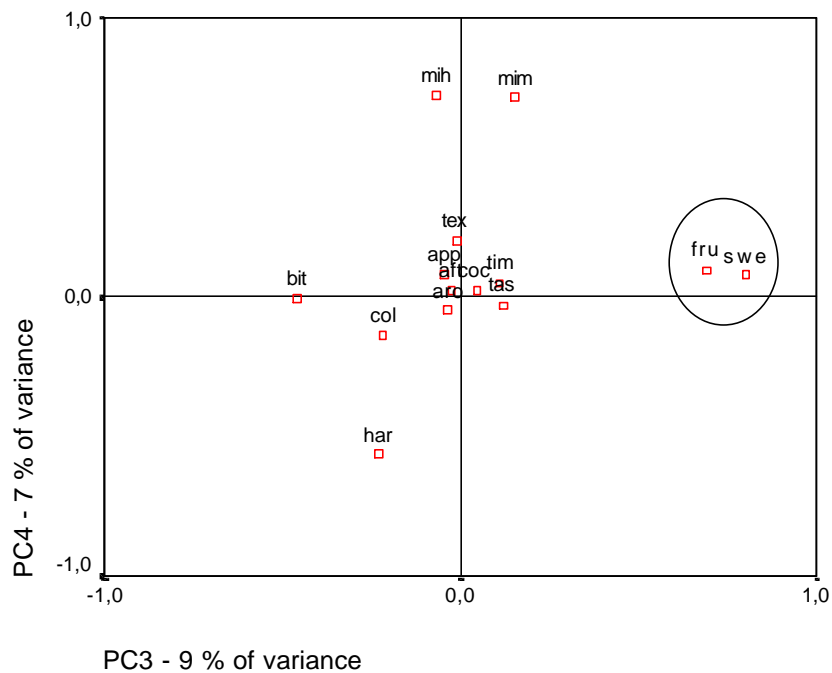
Second, to identify people with similar characteristics, hierarchical cluster analysis was chosen. Ward's procedure that applies calculation of the squared Euclidean distance was used. Data matrix consisted of the four principal components found across all valid cases. Distribution of the respondents in four clusters was as follow: cluster 1 (33%), cluster 2 (17%), cluster 3 (27%), and cluster 4 (23%). These clusters were called the sensory segments.

Third, discriminant analysis with the cross-validation procedure (leave-one-out classification) was applied. It described with an accuracy of 79.6% (cases correctly classified) the groupings of the sensory attributes (Table 5.3).

Each sensory segment was then characterised in terms of sensory attributes based on discriminant analysis. As the observed significance level was low (Wilks' Lambda=0.17, p<0.000) the null hypothesis that the groups have the same means was rejected, and it was assumed that the classification of the respondents into the segments, based on their discriminant scores, was correct.

Table 5.3   Classification Function Coefficients for Sensory Segments*

DESIGN VARIABLES		SENSORY SEGMENTS			
		1	**2**	**3**	**4**
Overall liking	Appearance	1.867	1.737	1.833	1.433
	Aroma	1.175		1.340	
	Taste	1.609		1.564	
	Texture	1.710	1.173	1.553	1.141
	Total impression	1.406		1.190	
Sensory directionals	Colour	2.713	3.687	2.892	2.934
	Melting-in-the-hand	3.562	3.755	2.418	3.489
	Sweetness	2.855	1.868	2.833	3.493
	Fruitiness	2.870	1.972	2.180	3.313
	Bitterness	1.429	2.037	1.414	1.342
	Melting-in-the-mouth	2.951	2.689	1.725	3.320
	Hardness	3.552	3.768	4.493	3.541
RESPONDENTS' DISTRIBUTION (%)		33	17	27	23

*Note: *Fisher's linear discriminant functions*
Wilks' Lambda=0.174, ?²=1396.24, df=39, p<0.000

5.5.3 Profiles of sensory segments

Four sensory segments of chocolate consumers are profiled as follows (see Tables 5.3 and 5.4). The first sensory segment is called "*Rough Judges*" (33%) with the respondents highly scoring on all overall liking attributes, and is represented by majority of Belgians. They show a tendency not to investigate most of the sensory directionals, which is expressed by no variation of these scores from other segments.

The second is "*Appearance-Bitterness-Oriented*" segment (17%), which consists of those who pay most attention to the visual aspects of chocolate (colour and melting-in-the-hand) and do not like plain chocolate consequently indicating the samples as too bitter. This segment is relatively small and equally represented in the two countries.

The third, "*Texture-Oriented*" sensory segment (27%) is similar to the first one as it gives high scores on overall liking. It is also distinct from the others by the greatest value put on hardness of chocolate. Poles represent this segment in a majority.

The fourth segment is called "*Sweetness-Oriented*" (23 %) and is equally distributed in both countries. Health-Conscious people are mostly found to form this segment, as they tend to like less sweet chocolate that is associated with healthy products. They also pay attention to the melting-in-the-mouth characteristic of the chocolate.

The distribution of the sensory segments along the psychological segments is quite uniform. Therefore, any generalisation of the country-specific preferences for plain chocolate may not be appropriate, especially without assessing the cognitive influences on decision-making.

Finally, Table 5.4 shows the experience, mood, frequency of consumption, and varieties to be important factors by which the sensory segments may be discriminated. The expectations appeared to be insignificant as far as sensory segments are considered. However, special attention should be given to the fact that the cross-tabulation between two countries showed the significant difference between expectations of the Belgian ($?^2=42.86$, df=20, p<0.000) but not Polish respondents. Gender differences were also recorded and while male respondents showed significant differences in expectations ($?^2=54.48$, df=20, p<0.000), females did not. There were only two personality segments, which differed in expectations, i.e. Independent (p<0.000) and Hedonists (p=0.051).

5.6 Discussion

The advantage of this research was that respondents in both countries were not familiar with the taste of the experimental chocolates. Thus, the concept of familiarity with the tested product could not bring any prejudice to the respondents. Also, at the time of survey, the Belgian chocolate was not available in the Polish shops and any experience with this product by Poles was limited. Significant difference in liking for the CP sample was observed between sensory segments in regard to the personality segments. The first "Rough Judges" segment consisted of the majority of Belgians who gave more positive scores to the CP sample than other segments.

Table 5.4   Characteristics of Sensory Segments

	SENSORY SEGMENTS (%)				VALIDATION		
	1 Rough Judges	**2** Appearance-Bitterness-Oriented	**3** Texture-Oriented	**4** Sweetness-Oriented	X^2	df	p
Belgium	43	14	22	21	34.19	3	.000
Poland	24	17	33	26			
Male	33	16	26	25	0.31	3	.959
Female	33	16	28	23			
Independent	44	11	24	21	40.58	12	.000
Health-Conscious	37	8	23	32			
Innovative	28	17	34	21			
Restrained	26	24	25	25			
Hedonists	27	21	31	21			
PREFERENCE (CP)					174.35	15	.000
• **Like**	46	6	30	18			
• **Slightly like**	36	11	25	28			
• **Neither/nor**	22	18	29	31			
• **Slightly dislike**	9	39	26	26			
• **Dislike**	7	56	12	25			
EXPECTATION					9.15	6	.165
• Tasty	34	15	29	22			
• Neither/nor	28	19	25	28			
• Not tasty	28	22	20	30			
EXPERIENCE					53.52	6	.000
• Tasty	37	11	29	23			
• Neither/nor	27	17	28	28			
• Not tasty	17	37	23	23			
HUNGER					4.91	6	.555
• Hungry	31	17	29	23			
• Neither/nor	34	21	27	18			
• Satiated	36	14	26	24			
MOOD					15.58	6	.016
• Unhappy	30	30	17	23			
• Neither/nor	41	21	9	29			
• Happy	26	15	33	26			
FREQUENCY					14.34	6	.026
• everyday	38	13	27	22			
• once a week	30	18	30	22			
• < 2 times/month	26	19	24	31			
AMOUNT					5.11	6	.529
• > 4 bars	35	13	26	26			
• 3-4 bars	33	15	30	22			
• < 2 bars	31	19	27	23			
VARIETIES					42.47	18	.001
• Fondant	44	11	20	25			
• Fondant & nuts	41	13	27	19			
• Milk	27	23	27	23			
• Milk & nuts	31	21	25	23			
• White	25	23	29	23			
• All	28	9	35	28			

This result is consistent with the findings of another study where it was concluded that the extent to which inferences could be made about cross-cultural preferences is limited by familiarity with the product (cf. Prescott & Bell, 1995). Laing *et al.* (1994) investigated liking responses of Australians and Japanese towards chocolate. Both cultures gave higher sweetness liking ratings to their own products, therefore, it was suggested that familiarity with the product imposed a major influence on preference. These cultural differences in preference were evident most probably due to various dietary experiences (Prescott & Bell, 1995). It was also concluded that exposures to foods that are typical of the surrounding culture are an important means of transferring taste preferences within a culture, subculture and family (cf. Tuorila, 1996).

The influence of expectations was observed in the current study. It was noticed that sensory judgements could be influenced by expectations because the panel leader had informed respondents about the Belgian origin of the chocolates. It was assumed that information about the country of origin of the samples could have an influence on the actual liking by the Belgian panel. Indeed, there was a significant difference between the expectations of the Belgian but not the Polish respondents.

Consumer tasting panels resemble the work of the sensory panels but the respondents are not trained and their evaluations are considered as affective rather than analytical. In this research, some respondents were, however, more analytical than others. This fact was possible to investigate by means of the principal component analysis, which separated overall liking from sensory directionals. The two sensory segments called "Rough Judges" and "Texture-Oriented" seem to be less analytical as they pay attention to overall liking of chocolate. They could be interpreted as the sensory-seekers, as they gave lower scores, which means "too little", for most of the sensory directionals (except of hardness). "Appearance-Bitterness-Oriented" and "Sweetness-Oriented" people are then the sensory-avoiders. Moskowitz and Krieger (1998a) who noticed that the consumers were divided into two groups arrived at a similar conclusion. They defined these groups as the sensory-seekers, i.e. people who wanted high-impact products such as stronger flavours or darker colours, and the sensory-avoiders preferring weaker and lighter products. These two groups were also called the high- and the low-impact sensory segments.

Prescott (1998) stated that food preferences are very complex as they are formed through sensory and non-sensory influences. It seems that studies that investigate the three aspects of the sensory, hedonic and cognitive dimension within a cross-cultural context are difficult to accomplish. According to Chiva (1999), until recently there were no studies which systematically analysed these three aspects of the same food within the same population. He assumes that "only with an approach of this kind one can examine not only each of the three aspects taken separately, but also the interactions between the three spheres and their reciprocal influences".

Three aspects can be systematically analysed through the proposed MARCC model. To achieve this, two approaches were deployed. The first was the domain of a sensory scientist who explored what the consumer actually experienced while tasting chocolate. The second belonged to the marketeer who was interested in consumers' opinions about the food, its qualities, strengths, defects or dangers. The MARCC model revealed four groups of people who attach attention to different sensory attributes of chocolate. Their responses were basically in agreement with their attitude towards consumption of chocolate, which was demonstrated through the personality segments. Liking increased when positive consequences of the products' consumption was anticipated and affected the preference scores, as the information about the product interacts with sensory responses and liking scores (Shepherd *et al.,* 1993). Associations between the sensory characteristics of food and its particular physiological or psychological effects must be, therefore, considered.

If the MARCC model is adapted to other food product, tasting sessions will have to take place to find out consumers' preferences and sensory directionals. Moreover, a set of questions investigating consumers' thoughts about important values, and benefit beliefs associated with the product in question must be developed. To improve the model, one should consider the possible variations in sensory sensitivity of respondents as they may underlie differences in food preferences. This aspect is tested in Chapter 7.

Finally, it must be stressed that the aim of this study was to discover the sensory preference segments in two countries, which was possible through evaluation of the scores given to the central point sample. The CP was similarly scored through

four contexts and therefore, the contextual effects, as far as the preference scores are investigated, were not proved.

5.7   Conclusions

Four sensory segments were found across Belgium and Poland in the young people target group. The first segment was interested in overall liking attributes and only roughly assessed sensory qualities of chocolate. The second segment consisted of those who paid attention to visual qualities and did not like too bitter chocolate. Texture-oriented consumers formed the third sensory segment. Respondents of the last segment avoided too sweet chocolate products. In spite of the fact that there was a significant difference in distribution of two countries in each sensory segment, they can not be interpreted as country-specific.

The impact of expectations and the psychological state was particularly important. The expectations were different between Belgians and Poles but not in relation to the sensory segments. The physiological measures indicated the importance of mood on preference. Behavioural measures were beneficial while explaining the consumers' attitude towards the process of decision-making. They were also helpful in explaining characteristics of each sensory segment, which makes the best link for co-operation between the R&D and Marketing departments.

The relation between the sensory and personality segments was shown. The advantage of this research was that it comprised the same population, which allowed profiling segments with the same level of confidence.

5.8   Acknowledgements

Annex 5.1   Order of Sample Representation in *HIP* Context

PLATE	ORDER OF SAMPLES			
	1st	2nd	3rd	4th
1	1	2	3	**13**
2	1	2	**13**	3
3	1	3	2	**13**
4	1	3	**13**	2
5	1	**13**	2	3
6	1	**13**	3	2
7	2	1	3	**13**
8	2	1	**13**	3
9	2	3	1	**13**
10	2	3	**13**	1
11	2	**13**	1	3
12	2	**13**	3	1
13	3	1	2	**13**
14	3	1	**13**	2
15	3	2	1	**13**
16	3	2	**13**	1
17	3	**13**	1	2
18	3	**13**	2	1
19	**13**	1	2	3
20	**13**	1	3	2
21	**13**	2	1	3
22	**13**	2	3	1
23	**13**	3	1	2
24	**13**	3	2	1

Annex 5.2   Representation of Respondents in Four Contexts

TARGET	TOTAL (N)	CONTEXT (N)				VALIDATION		
		HIP	LIP	HIM	LIM	Pearson X²	df	p
Belgium	429	114	105	109	101	1.01	3	.798
Poland	464	112	123	115	114			
Male	442	98	118	120	106	3.76	3	.288
Female	442	120	109	104	109			
Independent	208	63	50	53	42	12.82	12	.382
Health-Conscious	175	49	36	48	42			
Innovative	168	42	48	37	41			
Restrained	185	42	46	46	51			
Hedonists	157	30	48	40	39			

CHAPTER 6

Application of the Theory of Planned Behaviour to Consumption of Chocolate: Cultural Differences Across Belgium and Poland

6.1   Abstract

The aim of Chapter 6 is to analyse potential differences between Belgian and Polish consumers in intention to consume chocolate. Research procedure is based on the Theory of Planned Behaviour (TPB), which is a method applied in investigation of performance where a problem of incomplete volitional control exists. With regard to chocolate consumption, there are many studies showing craving or addiction. In this context, the chosen method seems adequate especially after two modifications. First, is inclusion of an affective component, which is analysed through the preference score and the taste index. A second modification lays in addition of self-stated habit. The results are presented in cross-country and cross-segment designs due to the personality-related segments, which were found in previous research (Januszewska et al., 2000). In the current study, the TPB model is only a part of the framework in which affective, conative, and cognitive dimensions are jointly analysed. The proposed Cognition and Affection-Related Behavioural Intention (CARBI) model enables a comparison of the strength of influences between countries and subgroups in the total sample. Data evaluation by correlation, multiple regression and the analysis of variance, is implemented. Results show a clear difference in perceived behavioural control, while the attitude component is a strong predicting variable for both countries. Subjective norms are important only within personality segments. Preference for chocolate does not add to predictive power of consumer intentions in the cross-country design, in contrast to the self-stated habit. There is almost no impact of gender on perception of the CARBI components while the region of living and personality of respondents are considered as good predictor variables.

6.2   Introduction

The importance of cross-cultural research lays in its potential to develop marketing strategies taking into consideration business environment. Marketing people have an increasing interest in factors influencing changes in food-related behaviour and people, who are most responsible for these changes.

Shepherd (1989) concluded that many theoretical models, which describe relationships between the factors influencing food choice, are not quantitative and do not explain the relative importance of, and interaction between various factors. Moreover, factors generated by researchers are not specific for food products or market segments, and these models do not offer a framework to design empirical studies (Raats, 1992). Thus, models that relate attitudes to food consumption have to be less ad hoc, more empirically tested and predictive. Social psychology offers methods, in which the role of attitudes and beliefs are measured in a more structured way. Among useful methods are the framework developed by Krondl and Lau (1978; 1982) and the theory of reasoned action (TRA) proposed by Ajzen and Fishbein (1980), which was further extended to the theory of planned behaviour (TPB) (Ajzen, 1985; Ajzen, 1991).

Hedonics and *pleasure* associated with eating are not sufficiently analysed in none of these models (Shepherd, 1990). However, there is also conflicting evidence to support the conclusion that liking, called a direct measure of attitude, is the most important predictor of intention to consume some foods (e.g. Tuorila-Ollikainen *et al.,* 1986; Tuorila, 1987). It is also suggested that tasting the samples gives extra information only for food, with which the subjects are not especially familiar (Shepherd, 1990). Hereby two aspects are important. First, overall liking of the tested samples may be related to people's attitudes towards consuming a specific food. Second, people's expectations about sensory attributes of a particular food are different and influence the sensory perception. In the current study both aspects of so called the "affection-related component", will be analysed in the extended TPB model.

Further modification relates to measurement of *habit* that is said to be an important factor in frequently performed behaviours (Ronis *et al.,* 1989). Tuorila and Pangborn (1988a) measured habit and found it to be significantly related to the consumption of the studied foods. As habit is multifaced, it can refer to any of the

following concepts: 'past behaviour', 'without awareness', and 'automatic performance' (Raats, 1992). In consequence, it is difficult to create an unambiguous empirical measure of habit and the subject answering the question has usually a great deal of the interpretation (Towler & Shepherd, 1991/92). In this study, the Habit Index is based on the self-reported habit statement and frequency of consumption of chocolate.

The *sample of the population* is of crucial importance in marketing studies. Contento *et al.* (1988) found age to be significantly associated with cluster membership and suggested that age contributed to increased differentiation in food-choice motivations. Two conclusions were drawn: first, the older the person the clearer motivational tendencies, and second, younger persons are often relatively more influenced by social/environmental factors. Therefore, making research on the same age group brings a few advantages. There is a comparable understanding of the questionnaire between respondents and the social influences contributing to attitude may be related, especially when the learning time is approximately equal. Last but not least, the younger and higher educated people rate imported products more favourably than older and less-educated people (Juric & Worsley, 1998). Based on an initial market survey, the target group of people, between 20 and 30 years old, showed the highest interest and consumption of chocolate (Viaene & Januszewska, 1999a).

Chocolate is an interesting food to study for two reasons. First, the belief structure reflecting health, nutrition, functional, and pleasurable aspects of chocolate consumption is found to be not unidimensional between the personality-related segments of Belgian and Polish consumers (Januszewska *et al.*, 2000). Nutritional but not health beliefs were related to a person's attitude towards consumption of chocolate. A similar conclusion was made while investigating belief structure in relation to low-fat milk consumption (Shepherd, 1988).

Second, research about chocolate may be seen from two points of view. On the one hand, consumption of chocolate reflects fully conscious or volitional behaviour (rewarding). On the other hand, it confirms non-volitional nature of behaviour (craving). In this context, the TPB model is preferred above the TRA, as it explains factors associated with weight control and self-awareness. Additionally, an individual can consider that consuming a particular food, like chocolate, gives

pleasure while still believing that the food is bad for health (Shepherd, 1990).

A *cross-cultural* study adds to understanding of the concept of 'life course' (e.g. Furst *et al.,* 1996), during which a variety of experiences contribute to a person's preferences and patterns (Clausen, 1986; Elder, 1991). Peoples' attitudes towards foods result from historical background, cultural and social settings as well as individual experiences (Bordieu, 1986; Devine & Olson, 1991). There is need for discussion on applicability of both the TRA and the TPB in basic attitude publications (e.g. Eagly & Chaiken, 1993) and psychology books. The question is whether different cultures can be compared and if not, due to which factors. By the TPB model, it was found recently that both Chinese and Americans, who are high in collective self, tend to show higher subjective norms - intention consistencies than those nations who are low in collective self (cf. Bagozzi *et al.,* 2000). In this view, it is interesting to investigate whether the TPB can be applied in Belgium and Poland.

The *aim* of this research is threefold. *First,* to test the TPB model in relation to the intention to consume chocolate across Belgium and Poland. *Second,* to compare the TPB model with its extended version called CARBI model, where affective and conative components are added. This is analysed within cross-country and cross-segment designs. *Third,* to examine the impact of gender, the region of living and personality of respondents on the perception of the CARBI model.

6.3 The Theory of Planned Behaviour and its modifications

The Theory of Planned Behaviour (TPB) is applied to investigate the cognitive influences by which the rational behaviour of consumers may be predicted (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980). Figure 6.1 shows the structural framework of the TPB that is operationalised for the purpose of this study. All indicated components correspond to the questionnaire items explained in methodology (Annex 6.1).

The model is analysed through several interrelated components. Behaviour (B) is predicted by intention to perform this behaviour. Subsequently, behavioural intention (BI) is predicted from three components as follows.

Figure 6.1 Path Model to Assess Effects of Attitudes (A), Subjective Norms (SN) and Perceived Behavioural Control (PBC) on Intention (BI) and Final Behaviour (B) Formation in the TPB Model*
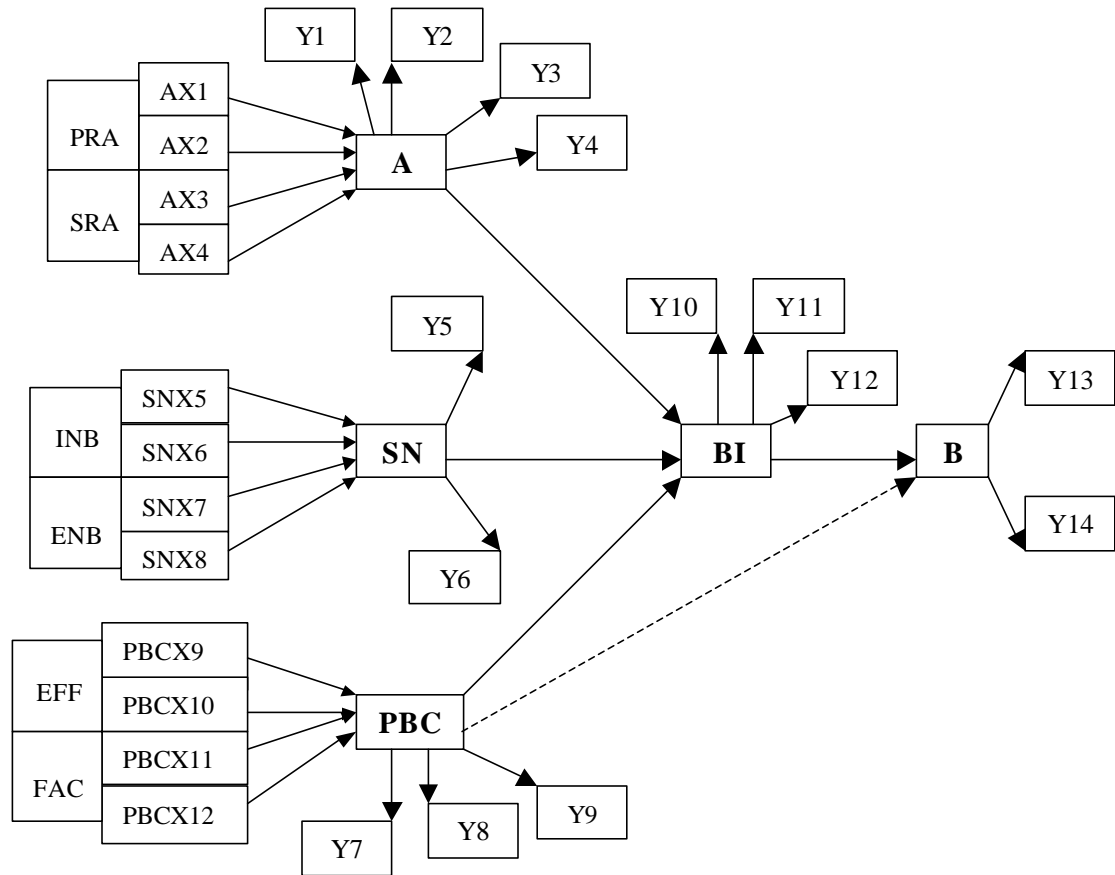
Note: AX1 ¸ PBCX12 are indirect questions,
Y1 ¸ Y14 are direct questions, all presented in Annex 6.1

First, there is an *attitude* (A), explained as evaluation whether the individual sees the behaviour as bad or good, unpleasant or pleasant, harmful or beneficial (Shepherd, 1990). Attitudes are calculated from multiplication of 'salient beliefs' (bi) that performing a certain behaviour will lead to a particular outcome; and the 'expected outcome' (ei) of behaviour, i.e., the evaluation of desirability of that outcome.

The second component stands for *subjective norms* (SN), i.e. the perception by an individual of social pressure from important other people to perform a particular behaviour. The subjective norms are computed from 'normative beliefs' (nbj)

concerning the influence of a referent (e.g. family or friends), and 'motivation to comply' (mcj) with this referent.

The third construct is called *perceived behavioural control* (PBC) and can be calculated from control beliefs (cbk), and perceived facilitation of the control factor in either inhibiting or facilitating the behaviour (pfk). The PBC component can also be explained as the degree to which a person feels that s/he is in control of her/his own behaviour. The following equations are used.

$$A = ?\ bi * ei \qquad\qquad (E1)$$

$$SN = ?\ nbj * mcj \qquad\qquad (E2)$$

$$PBC = ?\ cbk * pfk \qquad\qquad (E3)$$

$$BI = w1 * A + w2 * SN + w3 * PBC$$

$$B \sim w4 * BI + w5 * PBC$$

The TPB model was further extended by several components such as hedonic responses (e.g. Lähteenmäki & Tuorila, 1998), self-identity (e.g. Sparks & Shepherd, 1992; Sparks *et al.,* 1995), moral obligations (e.g. Raats *et al.,* 1995), and habit (e.g. Towler & Shepherd, 1991/92). In the current study, hedonic responses and habit extend the TPB model.

6.4   Methodology

6.4.1   *Subjects and quota sampling*

A target group of 1200 consumers aged between 20 and 30 participated in the market survey and tasting sessions. An equal number of men and women took part in the study. Due to quota sampling, which allows for unconfounded analysis of demographic differences, about 200 consumers in each region (the north, the south and in the capitals) of Belgium and Poland were reached. Therefore, a representative number of the target group was examined throughout the whole market survey.

6.4.2   The model of Cognition and Affection-Related Behavioural Intention (CARBI)

Consumers' intention to eat chocolate was investigated through the proposed CARBI model, illustrated in Figure 6.2. It focuses on investigating of the *attitude dimension* through three components: a/ *affective,* i.e. feelings of like or dislike towards the object; b/ *conative,* i.e. tendency to behave in a certain way towards the object; and c/ *cognitive,* i.e. information or beliefs about the object (e.g. Krecht & Crutchfield, 1948).

Figure 6.2   The Model of Cognition and Affection-Related Behavioural Intention (CARBI)
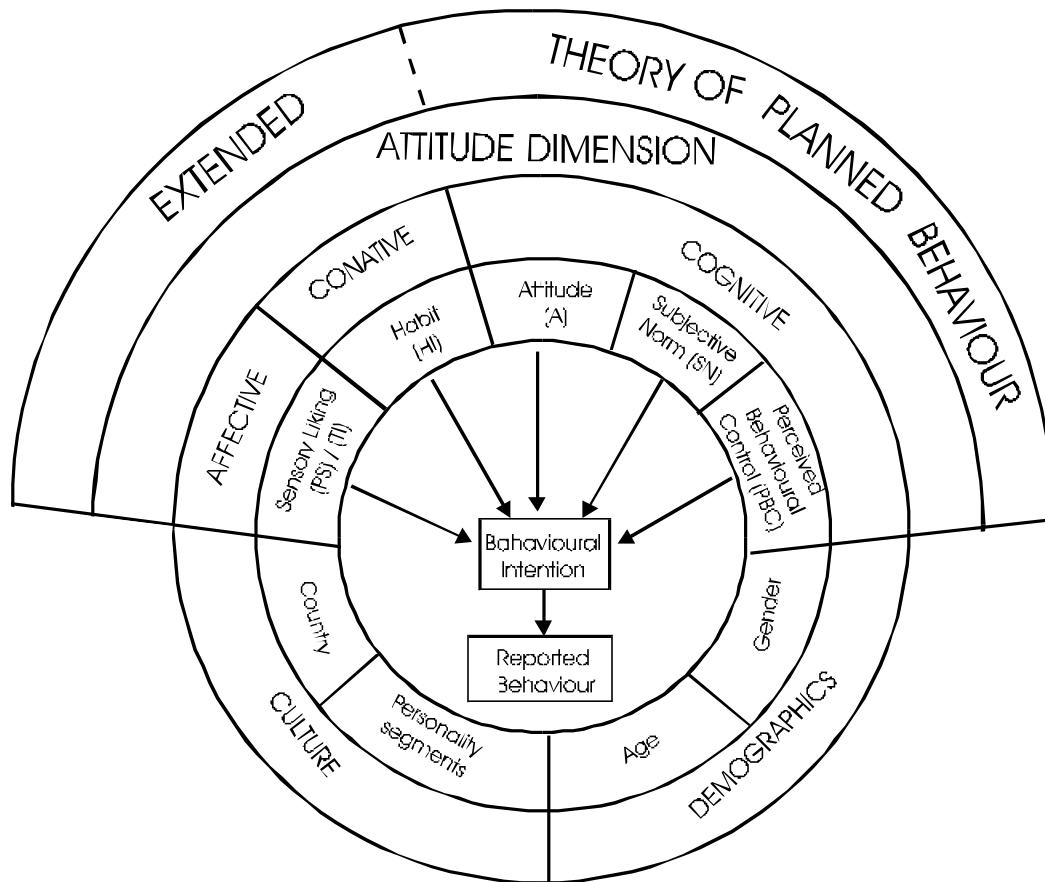
The *affective* component was presented by two constructs. First was the Preference Score (PS), which was a score assigned to the chocolate sample, called the central point, when it was compared to three other ones in the experimental design (Januszewska & Viaene, 2001d). The PS was measured on a 7-point scale (X13 in Annex 1). Second, the Taste Index (TI) was calculated from the expected and the actual overall liking of the four tasted chocolate samples by multiplication of these two items, which were also measured on 7-point scales (X14 and X15).

The *conative* component, i.e. the Habit Index (HI), was calculated from multiplication of the self-stated habit and frequency of chocolate consumption (X16 and Y14). The habit was measured on the 7-point scale while frequency of consumption was reported on the 5-point scale.

The *cognitive* component of the CARBI model is related to the traditional questionnaire applied for the TPB and measures as follows: attitude (A), subjective norms (SN), perceived behavioural control (PBC), behavioural intention (BI), and behaviour (B). Special attention was given to the PBC construct, represented by direct and indirect questions. In direct questions, the control beliefs on restrained eating were assessed (Y7, Y8, and Y9). Through indirect questions, two aspects were measured: *efficacy* (X9, X10), i.e. self-awareness or self-confidence in ability to perform behaviour, and *facilitating conditions* (X11, X12), i. e. potential barriers to obtain the desired product. It is expected that the higher level of efficacy is leading to a greater perceived behavioural control, and the consumer is subsequently more engaged in the studied behaviour. If barriers increase, the consumers are less likely to involve in the behaviour. All the questionnaire items were 7-point scales, with the exemption of frequency and amount of chocolate consumption that were measured on 5-point scales.

Throughout cross-country and cross-segment designs, aspects of *culture* were investigated. *Demographics* were restricted to age and gender in the target group. The *core* of the CARBI model indicates six components (A, SN, PBC, PS, TI, and HI) contributing to the formation of behavioural intention and the resulting self-reported behaviour.

6.4.3   The Theory of Planned Behaviour Questionnaire (TPBQ)

The TPBQ (Annex 6.1) was designed according to the TPB, which has been applied to many food products and environmental issues (e.g. Dennison & Shepherd, 1995; Sparks & Shepherd, 1992; Sparks *et al.,* 1997; Taylor & Todd, 1995). The beliefs (bi) were generated from literature and short interviews with a number of young adults in both countries. The first version of the questionnaire was pilot tested with 50 respondents. The TPBQ was translated from English language to Flemish, French, and Polish. The Flemish version was used in the north of Belgium and in half of the respondents from Brussels. The French version of the questionnaire was used in the south of Belgium and another half of respondents from Belgian capital. In Poland, all respondents received Polish version of the TPBQ.

6.4.4   Administration of survey and tasting sessions

The survey was conducted in the spring of 1999. The research procedure consisted of three steps. First, the meetings with young people were arranged in advance, therefore, the execution of the TPBQ was similar to the "in-hall" testing methodology. Second, at the beginning of each survey, the respondents were briefed about the aim of the study and instructed how to fill in the questionnaire. Explanation was necessary especially about the tasting procedure. As the third, the plates with chocolate samples were distributed with a cup of water and the TPBQ questionnaire (for detailed information see Januszewska & Viaene, 2001d).

6.5   Data analysis and results

The internal reliability of the multi-item components was assessed by Crombach's alpha. Data were calculated using the formulae from Ajzen and Fishbein (1980), i.e. the equations E1 to E3. Then, the degree of association between components (Annex 6.1) was assessed using Pearson correlations and multiple regression analyses. Differences between Belgian and Polish subjects were analysed by means of univariate analysis of variance (ANOVA).

Results are presented in four steps. First, data validation and reliability of scales are reported. Second, the associations between all components in the TPB model

are assessed using simple correlation and multiple regression analysis. Third, the regression coefficients of the TPB model are compared to those of the CARBI model in cross-country and cross-segment designs. Finally, differences from the impact of gender, the region and personality of consumers are tested by ANOVA.

6.5.1   Respondents and reliability of scales

A total of 1200 respondents was reduced due to the selective questions on different nationality (N=49) and the definite dislike of plain chocolate (N=115). The missing answers and the extremities contributed to the removal of another 143 cases, which resulted in a total number of 893 valid cases. Table 6.1 shows the Crombach-alpha (Nunnally, 1978), which is a measure of internal reliability of the scales. If the items are very closely related to each other then the alpha is nearly 1.0. It may be noticed that, in the majority of cases, the scales worked better for Belgian respondents, showing a common underlying response pattern.

Table 6.1   Reliability of Scales Measuring the Components of the CARBI Model

COMPONENTS* OF THE CARBI MODEL	No of items	ALPHA	
		BELGIANS	POLES
A	4	.70	.78
SN	2	.93	.84
PBC	3	.65	.59
BI	3	.78	.66
B	2	.78	.60
PRA	4	.64	.76
SRA	4	.93	.88
INB	4	.88	.83
ENB	4	.58	.48
EFF	4	.67	.45
FAC	4	.72	.70
TI	2	.46	.51
HI	2	.72	.61

Note: - Direct questions (components):
- ➤ *(A) attitude*
- ➤ *(SN) subjective norm*
- ➤ *(PBC) perceived behavioural control*
- ➤ *(BI) behavioural intention*
- ➤ *(B) behaviour*

Indirect questions (components):
- · *(PRA) private relative advantage*
- · *(SRA) societal relative advantage*
- · *(INB) internal normative beliefs*
- · *(ENB) external normative beliefs*
- · *(EFF) efficiency*
- · *(FAC) facilitating conditions*

-(TI) taste index
-(HI) habit index

6.5.2 The TPB between countries

Table 6.2 presents the result of simple and multiple regression coefficients between the items and all components of the TPB model in the cross-country design. Simple correlation coefficients, between direct and indirect questions and the calculated components of attitude and subjective norms, were significant for both countries. In contrast, while correlation coefficients between indirect questions and the PBC were significant, coefficients between direct questions and PBC were not.

Table 6.2   Summary of Path Coefficients between the Items and Components of the TPB Model

PATH	BELGIANS	POLES
A ¬ AX1	r = .622***	.692***
A ¬ AX2	r = .643***	.803***
A ¬ AX3	r = .758***	.639***
A ¬ AX4	r = .733***	.625***
A ® Y1	r = .291***	.351***
A ® Y2	r = .277***	.264***
A ® Y3	r = .301***	.236***
A ® Y4	r = .337***	.317***
SN ¬ SNX5	r = .850***	.803***
SN ¬ SNX6	r = .836***	.834***
SN ¬ SNX7	r = .785***	.746***
SN ¬ SNX8	r = .777***	.737***
SN ® Y5	r = .500***	.344***
SN ® Y6	r = .540***	.434***
PBC ¬ PBCX9	r = .771***	.696***
PBC ¬ PBCX10	r = .746***	.703***
PBC ¬ PBCX11	r = .737***	.617***
PBC ¬ PBCX12	r = .711***	.649***
PBC ® Y7	r = -.185***	-.023
PBC ® Y8	r = -.114**	.033
PBC ® Y9	r = -.092	-.121**
BI ® Y10	r = 1.000	1.000
BI ® Y11	r = .530***	.453***
BI ® Y12	r = .584***	.465***
B ® Y13	r = .647***	.471***
B ® Y14	r = 1.000	1.000
A ® BI	β = .313***	.292***
SN ® BI	β = .049	.084
PBC ® BI	β = .064	.112**
PBC ® B	β = .063	.042
BI ® B	β = .693***	.752***

*Note: r – simple correlation, **b** - multiple regression coefficients, *p<.05, **p<.01, ***p<.001*

In linear regression analyses, the relationship between the behavioural intention (the dependent variable) and the calculated A, SN, and PBC (the independent variables) were examined. Attitude component was the best predictor of intention to consume chocolate regardless the country of consumers. No differences in relation to the subjective norms were found. The perceived behavioural control was important in case of Poles, who reported significantly different answers. In general, the predictive value of the perceived difficulty (PBCX9-PBCX12) and not that of perceived control (Y7–Y9) was observed. Moreover, behaviour was better predicted from BI, but not from PBC.

6.5.3 Comparison of the TPB and CARBI models in cross-country and cross-segment designs

In Table 6.3, the TPB and CARBI models are compared within cross-country and cross-segment designs by means of multiple regression. Five personality segments were called as follows: Independent, Health-Conscious, Innovative, Restrained, and Hedonists (Januszewska *et al.,* 2000). There are three important conclusions in regard to the TPB model. First, it worked better when the segments were contrasted. The subjective norm was significant for the Independent segment, which comprised 87% of Belgians. Second, attitude was an important predictor for all segments, with the exception of Restrained. Third, perceived behavioural control was important when Health-Conscious people were questioned.

The CARBI model, which *did not include the Habit Index*, gave the same significant regression coefficients as the TPB model. In the cross-country design, none of the affective components added to the predictive power of the model. In the cross-segment design, two coefficients were valuable. First, the PS was only important when the group of Hedonists was investigated. This observation is consistent with findings of Shepherd *et al.* (1991/92) who noticed that only full-fat consumers rated taste as a more important attribute. Knowing also that the Hedonists preferred milk chocolate and the tested chocolate was a plain one, this result is not surprising. Second, the TI was an important predictor of the intention to eat chocolate for the Innovative group. This segment consisted of 91% of Poles who showed tendencies to experiment with new food.

In the CARBI model that *included the Habit Index*, the regression coefficients for HI were significant for both countries and all segments. Addition of the HI did not

change the general tendencies in the cross-country design in relation to A, SN and PBC. However, values of attitude coefficients were much lower when compared to the TPB model. In the cross-segment design, the HI diminished the predictive power of attitude in the Independent, Health-Conscious, and Innovative segments. Moreover, the subjective norms were not observed for Independent segment. The control norms were more important for the Health-conscious and Restrained groups. And finally, none of the affective components was important. It is concluded that measurement of habit may change and even hide important elements in the study of behavioural intention.

Table 6.3   Regression Coefficients (ß) in the TPB and CARBI Models Across Countries and Segments

COMPONENTS OF THE MODELS		CROSS-COUNTRY		CROSS- SEGMENT				
		BELGIANS	POLES	1 INDEP	2 HEALT	3 INNOV	4 RESTR	5 HEDON
TPB	A	.313***	.292***	.155*	.254**	.231**	.097	.208*
	SN	.049	.084	.158*	.009	.095	.066	.027
	PBC	.064	.112**	.053	.185*	.089	.129	.033
	Adj. R²	.132	.147	.069	.131	.084	.032	.032
	F	21.839	27.137	5.861	9.488	5.994	2.981	2.713
	p	.000	.000	.001	.000	.001	.033	.047
CARBI	A	.351***	.280***	.189*	.256**	.219**	.116	.256**
	SN	.041	.088	.155*	-.002	.090	.063	.047
	PBC	.075	.111*	.054	.183*	.093	.135	.057
without	PS	-.016	.045	-.011	.057	.063	-.033	.168*
	TI	.052	.043	.052	.084	.150*	-.100	-.075
Habit								
	Adj. R²	.163	.151	.077	.134	.123	.037	.062
	F	16.209	16.914	4.097	6.127	5.484	2.363	2.940
	p	.000	.000	.002	.000	.000	.042	.015
CARBI	A	.169***	.168***	.088	.100	.170*	-.044	.223**
	SN	.026	.073	.106	.046	.081	.043	-.015
	PBC	.074	.097*	.094	.266**	.091	.201**	.131
with	PS	-.004	.034	-.036	.073	.045	.010	.110
	TI	.031	.015	.010	.070	.112	-.031	-.058
Habit	HI	.493***	.379***	.413***	.402***	.346***	.498***	.286***
	Adj. R²	.370	.275	.230	.278	.235	.257	.127
	F	39.091	29.320	10.279	11.575	9.213	11.163	4.550
	p	.000	.000	.000	.000	.000	.000	.000
Respondents (N)		429	463	208	175	168	184	157
Male (%)		52	49	58	59	49	58	21
Female (%)		48	51	42	41	51	42	79

Note: *p<.05, **p<.01, ***p<.001

Annex 6.2 shows the mean values for all CARBI components in cross-country and cross-segment designs. The beliefs in pleasantness (AX1) and improvement of cognitive reactions (AX2) resulting from consumption of chocolate were higher for Poles. The perception of the societal relative advantage (AX3, AX4) in regard to the consumption of chocolate, was low in both countries. This is contrary to the expectation that Belgians are pride because of the world-wide acceptance of 'Belgian chocolate' and would score these items higher.

The normative beliefs were higher for Polish consumers in general (SNX5-SNX8). The influence of doctors (SNX7) was reported as the highest one among Poles, while Belgians pointed to the importance of food industry (SNX8). The control beliefs were also higher for Polish consumers (PBCX9-PBCX12). The possibility to make a right choice (PBCX9) was the most important factor for Belgians and the access to the shops selling chocolate of high quality (PBCX12) for Poles. Finally, the affective and conative components were examined. The fact that the PS was almost the same among all respondents, proofs that consumers could find an optimal product, which satisfied their needs. Further, the TI was a good predictor of the behavioural intention and was higher for Poles than for Belgians. Finally, the HI better explained the behaviour of Belgians than behaviour of Poles, who have less established habits to snack with chocolate.

6.5.4   Impact of gender, the region, and personality on behavioural intention in the CARBI model

In the next step, the impact of respondents' gender, the region of living and belonging to personality segments was investigated. The output of ANOVA with the significant differences between two countries is presented in Table 6.4. The difference in PBC construct was only noticed with regard to *gender* of the Belgian and Polish respondents. Significant difference in scores from Belgian men and women was observed ($?^2$=125.311, p=0.005).

On average, men perceived the PBC construct higher than women, also showing higher values of efficacy and facilitating conditions. As far as the influence of the *region* is considered, the Belgian respondents differed significantly depending on the region, and culture. The Polish consumers slightly differed in attitudes and control beliefs, but not in the normative influences, which can be explained by a more uniform culture in Polish regions than in Belgians regions. Efficacy and

facilitating conditions were more important for the Belgian consumers from the southern part of the country than for those living in the north and Brussels. Last but not least, the impact of belonging to one or another *personality* segment is of paramount importance. Almost all components (A, SN, PBC, TI, and HI) were highly significant with exception of the TI (p<0.05), which was borderline significant for Belgians, and SN (p<0.01) for Poles. The personality of respondents had no influence on perception of the PS.

Table 6.4   One-Way ANOVA: Impact of Gender, the Region and Personality on Perception of CARBI Model's Components

COMPONENTS OF THE CARBI MODEL		INFLUENCE					
		GENDER		REGION		PERSONALITY	
		df = 1		df = 2		df = 4	
		F	p	F	p	F	p
Belgium	A	.087		16.512	***	28.883	***
	SN	1.295		10.323	***	15.568	***
	PBC	6.851	**	6.027	**	13.986	***
	PS	.002		.410		.304	
	TI	.007		.688		3.087	*
	HI	3.145		5.642	**	28.967	***
Poland	A	.036		3.627	*	33.759	***
	SN	3.319		.909		21.526	**
	PBC	.227		4.122	*	4.267	***
	PS	1.233		.216		.919	
	TI	.267		.035		6.753	***
	HI	.068		4.051	*	19.671	***

*Note: *p<.05, **p<.01, ***p<.001*

6.6   Discussion

Tuorila and Pangborn (1988b) found that chocolate was generally believed to be 'not good for you' and that liking was the dominant factor predicting intention and reported consumption of chocolate. Intrigued by this statement, the attitude construct was decomposed to show how multiple benefit beliefs are responsible for attitude formation (Chapter 4). In that research, the Belgian-dominated (Independent) segment showed high and negative public-self consciousness. This observation could be verified in the current study, with the CARBI model, where social influences can be analysed.

The CARBI model was applied in cross-country and cross-segment designs. It appeared that while an individual refuses to admit any public awareness, s/he might still indicate some social reference groups that influence her/his behaviour. The CARBI model was based on the structured framework within which various factors, called components, were measured and related.

While *attitudes* were derived from salient beliefs concerning the consequences of behaviour and their value for a person, the subjective norms were linked to the social consequences of the use of a certain food (Lähteenmäki & Tuorila, 1998). In the current study, as far as the cross-country design is considered, the attitudes were more closely related towards intention to consume chocolate, normative beliefs were not important and the control beliefs were good predictors for Polish consumers. Therefore, the statement that the attitude component in food choice provides the best estimation of behavioural intentions (Stafleu *et al.,* 1991), can be confirmed.

It is also believed that *subjective norms* are important in a specific social context as showed in the study about consumption of garlic (Rosin *et al.,* 1992). Further, pressure from other people is not important in food consumption, but many social factors play an important role at certain stages of the formation and changes of attitudes (Tuorila, 1997). In the current study, the importance of the normative beliefs was only observed within the personality segments and was characteristic for the Independent segment, dominated by Belgians. It can be concluded that for some countries the pressure from important groups is higher than for other countries.

Difference between Belgium and Poland was explained by the *perceived behavioural control* (PBC) component. Two important aspects should be mentioned. First, the dietary restrain reflected in the direct questions (Y7, Y8, and Y9) was a better predictor for Belgian consumers. Second, the PBC calculated from efficacy and facilitating conditions, was a greater predictor for Polish consumers. It seems that efficacy (reflecting person's self-perceived effectiveness and knowledge) as well as facilitating conditions (i.e., barriers to obtain the product) are two important issues for further research.

The PBC adds to the prediction of desires over and above the contribution provided by attitudes (cf. Sparks *et al.,* 1992). The PBC was generally higher for

Polish consumers and it is concluded that Poles expressed desire for self-knowledge and better access to resources. Moreover, the current research is consistent with previous studies, which pointed to the evidence that the high PBC was likely to be a significant factor in people's intentions to participate in health-related behaviours (e.g. Ajzen & Timko, 1986) and behavioural change (e.g. Sparks *et al.,* 1995).

In the CARBI model, the *affective* component was not a good predictor of behavioural intention. The possible explanation relates to three aspects. First, the food analysed was generally very familiar for all young people. As there is a conflicting evidence on whether hedonic responses give extra information to the TPB model, one possible explanation is that for a food with which the subjects are not especially familiar, tasting the samples gives extra information (cf. Shepherd, 1989). The implication that chocolate is a perfectly familiar food, especially for young people, might yield poor results in the current study. However, chocolate is a relevant product for hedonic consumer research, because of symbolic value and emotions it triggers.

Second, the Preference Score for the central point sample did not yield difference in sensory liking, due to the fact that almost all consumers perceived the CP chocolate as the most liked one (Januszewska & Viaene, 2001d). However, if difference between samples tested exists, the hedonic ratings increase the predictive power of the model, and pleasantness decreases attitudes having no influence on perceived control (Lähteenmäki & Tuorila, 1998).

As third, the Taste Index was calculated from the expected and the actual liking of four samples. The TI was created according to the model of motivation, which explains that a stimulus creates a gap between the desired and actual state (Mowen, 1993). When such a gap exists, a goal-directed behaviour is observed. This goal focuses on obtaining an incentive, i. e. moving the respondent from the actual state closer to the desired state. If the perception of stimulus is positive, initial feelings are positive and expectations are high. In the next stage (e.g. tasting the food), the maintaining of optimum stimulation level is activated and the individual's hedonic experiences are weighted against the actual feeling of pleasure or displeasure. The TI appeared to be only significant for the Innovative segment, dominated by Poles.

Triandis (1977) postulated that while behavioural intention is relevant for a new action, the repeated activity is more reflected by *habit*. Habit was found to be an important predictor of intention and behaviour (Towler & Shepherd, 1991/92) and was significantly related to consumption of sweet, salty and fatty foods (Tuorila & Pangborn, 1988a). It seems important to find how strong are the consumers' habits in chocolate consumption. In the current study, although the Habit Index appeared to be a strong predicting component, it decreased the power of attitudes and subjective norms, and also increased the PBC construct.

In the study on *gender* differences in attitude and behaviour towards sweet snacks, the behavioural intention, consumption and dietary restrain components were analysed (Grogan *et al.,* 1997). There were no significant gender differences in the reported consumption frequency of chocolate and confectionery, but women rated significantly higher on pleasantness of these foods. The study also indicated that pleasantness was a better predictor of behavioural intention than healthiness for both genders. Taste seemed more powerful incentive than healthiness when determining intention to eat sweet snacks. The current research showed that control beliefs were scored differently by males and females only in case of Belgian consumers. It should be noticed that the PBC construct was different from the traditional approach of the TPB model. This is related to two-dimensional aspect of the PBC construct. On the one hand, direct questions reflected the concerns about dietary restrain. One the other hand, indirect questions represented the self-awareness and barriers that may exist and stop the consumer from obtaining the desired food. In this sense, the current research examined different aspects then Grogan's *et al.* (1997).

Impact of the *region* was observed in regard to Belgian and Polish consumers. There were significant differences in attitudes, social influences, as well as PBC among Belgians. The difference between both countries lays in the perception of subjective norms, which were not important for Poles.

The consumers' *personality* had the strongest influence on the intention to consume chocolate. In this case, almost all components of the CARBI model are important predictors of behavioural intention. It is worth to notice that the TPB corresponds to the five elements of personality structure proposed by Bandura (1977) as follows: expectancies, internal standards, value orientation, associational

preferences, and self-beliefs of efficacy. In this sense, the value orientation may be compared to attitudes, and the associational preferences to reference groups, and thus normative beliefs. It is also clear that self-beliefs of efficacy are exactly the construct, which was measured within the control beliefs.

In general, both cultures exhibited high differences in the attitude toward consumption of chocolate. Therefore, it might be concluded that both countries have an extended structure of value orientation. However, closer examination of the values and benefit beliefs forming the attitude component showed that one has to be careful with such conclusion (Januszewska *et al.,* 2000). In that study, the Independent segment indicated much higher value orientation than other segments. Moreover, the total score of attitude was greatly influenced by that aspect for the Independent group. The other segments showed more benefit beliefs-oriented structure of attitude.

A *special* feature of Polish consumers is their self-awareness and perception of barriers. Bandura (1977) suggested that information about perceived self-efficacy comes from four sources: personal experience of success and failure, observation of others behaviour, verbal communication about possibilities or capabilities of the individual, and self-observation related to physiological condition (e.g. resistance to stress). He concluded that the perception of self-effectiveness influences the way of thinking and emotional reaction in difficult situations, which may be investigated in future research.

The self-effectiveness of behaviour is the motivational factor, which is supported by the *incentives*. There are four basic types of incentives: primary, social, symbolic, and self-incentives. The primary incentives present the absolute and relative value of the object and situations, and are the outcome of learning process. In the context of the current study, the primary incentives of eating chocolate, called here the Personal Relative Advantage (PRA), present a high value for both Belgians and Poles (Annex 6.2). In contrast, the social incentives, coded as the Societal Relative Advantage (SRA), are not important for the majority of people, as far as the consumption of this food is analysed. The social incentives are more perceived when the social reactions and acceptability as well as non-acceptability rules are developed. It is interesting to notice that only the Health-conscious group indicated the importance of this aspect. The SRA component is especially relevant

to investigate when a particular food is seen as a marker of the populations' identity. The regional specialities distinguish one group of people from another and as these foods represent a given area, people assert a pride (Asp, 1999) as shown by Nielsen *et al.* (1998).

It is recognised that expectancy value models, such as the TPB, suggest that people chose foods on the basis that eating these foods would bring desired consequences. Thus self-reported expectancies, included in the calculation of the Taste Index, yield a high motivation score (Contento *et al.,* 1988). It is especially valid in regard to the process of value negotiations, in which people weight the benefits of particular choices against the potential risks of bad choices (cf. Furst *et al.,* 1996). This decision-making process is either rapid or extensive depending on the respondents and the situation in which s/he is involved. It may also result in formation of more routine strategies, which resemble habit. The *future* challenge is in finding whether personal strategies tend to be stable or flexible in different appropriateness settings.

A few *limitations* may contribute to the potential lack of cross-cultural validity of the CARBI model. First, the cognitive structure of both countries might be culture specific and further validation of the hierarchical causal relations is necessary. It seems that only those countries, which are sufficiently similar, may be properly compared. Second, making all the assessments on one questionnaire may lead to "halo effects" of answering each of the questions in a similar way. This aspect may be however, limited due to the fact that students, who formed the majority of the respondents, have stronger cognitive capabilities than the rest of the population (Sears, 1986). They developed strong test-taking abilities reflected in the consistent and rational responses on the questionnaire.

A few *strengths* of this research can be also mentioned. First of all is that any cultural difference between interviewers behaviour is removed due to the fact that the same person was responsible for the whole survey. Next, the study relates to personality segments and therefore, enables the comparison at the cross-segment level. The major advantage is that the research is done with the same group of respondents, who also took part in the segmentation research.

6.7   Conclusions

Three important conclusions come from this study. First, The TPB model applied in the cross-country design showed a great predictive power of attitudes for both countries, and the PBC for Poles. Second, the comparison of the TPB and CARBI models in the total sample, as well as across-segments, pointed out to many similarities. Third, not gender but the region and personality of consumers mostly influenced the perception of the CARBI components.

In general, this study attempted to identify significant components indicating intention to consume chocolate in cross-country and cross-segment designs. The CARBI model offers means for investigating different influences simultaneously, including affective and conative components. It is suggested that this framework can be used for practical application in food-related issues. This approach may also be adapted for other foods and specific groups of population.

6.8   Acknowledgements

Annex 6.1   The Theory of Planned Behaviour Questionnaire (TPBQ)

Direct questions

ATTITUDE (A)

Y1: Eating chocolate is generally: BAD VS GOOD
Y2: Eating chocolate is generally: UNPLEASANT VS PLEASANT
Y3: Eating chocolate is generally: HARMFUL VS BENEFICIAL
Y4: Eating chocolate is generally: UNDESIRABLE VS DESIRABLE

SUBJECTIVE NORM (SN)

Y5: People who influence my decisions think that I should eat chocolate:
   DISAGREE VS AGREE
Y6: People who are important to me think that I should eat chocolate:
   DISAGREE VS AGREE

PERCEIVED BEHAVIORAL CONTROL (PBC)

Y7: Whether or not I eat chocolate is entirely up to me: DISAGREE VS AGREE
Y8: I have complete control over the amount of chocolate I eat: DISAGREE VS AGREE
Y9: I can stop eating chocolate any moment I wish: DISAGREE VS AGREE

BEHAVIORAL INTENTION (BI)

Y10: How many chocolate bars do you expect to eat in the *next two* weeks?
   1 OR LESS – 2 BARS – 3 BARS – 4 BARS - MORE THAN 4 BARS
Y11: For the *next two* weeks, how often will you snack with chocolate?
   NEVER VS AT EVERY OPPORTUNITY
Y12: I intend to keep chocolate in my household:
   NEVER VS AT EVERY OPPORTUNITY

BEHAVIOR (B)

Y13: Total amount of chocolate bars I ate over *last two* weeks was…
   1 OR LESS – 2 BARS – 3 BARS – 4 BARS - MORE THAN 4 BARS
Y14: Within the *past two* weeks, I ate chocolate…
   NEVER VS AT EVERY OPPORTUNITY

Indirect questions

PERSONAL RELATIVE ADVANTAGE (PRA)

AX1 b1: I enjoy eating chocolate: DISAGREE VS AGREE
   e1: Whether or not I gain a lot of pleasure from eating chocolate is an
   UNIMPORTANT VS IMPORTANT part of my decision to eat it

AX2 b2: I think that eating chocolate improves my cognitive (memory, mood) or psychomotor (reaction time) performance: DISAGREE VS AGREE
e2: Whether or not I can improve my cognitive or psychomotor performance from eating chocolate is an UNIMPORTANT VS IMPORTANT part of my decision to eat it

SOCIETAL RELATIVE ADVANTAGE (SRA)

AX3 b3: I eat chocolate because it belongs to our national heritage: DISAGREE VS AGREE
e3: Whether or not I think that chocolate belongs to our national heritage is an UNIMPORTANT VS IMPORTANT part of my decision to eat it
AX4 b4: I will promote the identity, culture and food tradition of my country by eating chocolate: DISAGREE VS AGREE
e4: Whether or not I promote the identity, culture and food tradition of my country by eating chocolate is an UNIMPORTANT VS IMPORTANT part of my decision to eat it

INTERNAL NORMATIVE BELIEFS (INB)

SNX5 nb5: My family thinks that I should eat chocolate: DISAGREE VS AGREE
mc5: With respect to consumption of chocolate, I want to do what my family thinks I should do: DISAGREE VS AGREE
SNX6 nb6: My close friends think that I should eat chocolate: DISAGREE VS AGREE
mc6: With respect to consumption of chocolate, I want to do what my close friends think I should do: DISAGREE VS AGREE

EXTERNAL NORMATIVE BELIEFS (ENB)

SNX7 nb7: Doctors and nutritionists think that I should eat chocolate: DISAGREE VS AGREE
mc7: With respect to consumption of chocolate, I want to do what doctors and nutritionists think I should do: DISAGREE VS AGREE
SNX8 nb8: Food industry thinks that I should eat chocolate: DISAGREE VS AGREE
mc8: With respect to consumption of chocolate, I want to do what the food industry thinks I should do: DISAGREE VS AGREE

EFFICACY (EFF)

PBCX9 cb9: I cannot figure out how to make the right choice while shopping for chocolate: DISAGREE VS AGREE
pf9: Being able to figure out how to make the right choice in an UNIMPORTANT VS IMPORTANT part of my decision to eat chocolate
PBCX10 cb10: I cannot figure out what is and what is not to be bought while shopping for chocolate: DISAGREE VS AGREE
pf10: Being able to figure out what is and what is not to be bought is an UNIMPORTANT VS IMPORTANT part of my decision to eat chocolate

FACILITATING CONDITIONS (FAC)

PBCX11 **cb11:** Eating chocolate from high quality shops is my daily routine: DISAGREE VS AGREE
pf11: Whether or not I can eat chocolate from high quality shops is an UNIMPORTANT VS IMPORTANT part of my decision to eat it

PBCX12 **cb12:** I have convenient access to the shops selling high quality chocolate: DISAGREE VS AGREE
pf12: Having convenient access to the shops selling high quality chocolate is an UNIMPORTANT VS IMPORTANT part of my decision to eat it

EXTENSIONS TO THE TPB MODEL

Affective components
PS   **X13**   What is your opinion on (this) chocolate? VERY BAD VS VERY GOOD

TI   **X14**   Do you expect the chocolate samples to be tasty? DISAGREE VS AGREE
          X15   Do you assess tested chocolates as being tasty? DISAGREE VS AGREE

Conative component
HI   **X16**   Eating chocolate is a part of my habits. DISAGREE VS AGREE

Annex 6.2   Descriptive Statistics for the CARBI Model*

COMPONENTS OF THE CARBI MODEL		BELGIANS	POLES	PERSONALITY SEGMENT				
				1 INDEP	2 HEALT	3 INNOV	4 RESTR	5 HEDON
PRA	AX1 (PLEAS)	28.6 *(14.0)*	31.9 *(12.6)*	31.6 *(14.2)*	31.0 *(10.6)*	34.3 *(11.5)*	20.4 *(12.6)*	35.1 *(12.0)*
	AX2 (COGNI)	13.9 *(12.1)*	23.1 *(13.3)*	13.5 *(12.1)*	24.5 *(11.3)*	23.3 *(13.3)*	10.3 *(9.6)*	24.0 *(14.2)*
SRA	AX3 (HARIT)	9.0 *(10.6)*	6.8 *(8.1)*	7.0 *(9.3)*	13.4 *(11.0)*	7.6 *(8.2)*	4.3 *(6.2)*	7.1 *(9.4)*
	AX4 (IDENT)	8.1 *(9.6)*	6.7 *(8.2)*	6.4 *(8.9)*	13.1 *(10.2)*	7.5 *(8.1)*	4.2 *(6.0)*	6.0 *(8.2)*
INB	SNX5 (FAMIL)	5.3 *(6.4)*	8.7 *(9.0)*	4.4 *(5.8)*	11.8 *(9.1)*	7.7 *(6.8)*	4.4 *(5.6)*	7.9 *(10.1)*
	SNX6 (FRIEN)	5.1 *(6.2)*	7.8 *(8.3)*	4.1 *(5.3)*	11.0 *(8.6)*	6.8 *(6.9)*	4.0 *(5.5)*	7.2 *(8.7)*
ENB	SNX7 (DOCS)	7.3 *(7.5)*	10.8 *(10.1)*	6.8 *(7.2)*	12.6 *(9.8)*	11.1 *(10.7)*	6.6 *(7.3)*	9.2 *(9.3)*
	SNX8 (INDU)	8.2 *(7.2)*	10.5 *(8.6)*	7.3 *(6.7)*	14.3 *(8.8)*	9.5 *(8.4)*	7.2 *(6.6)*	9.3 *(7.8)*
EFF	PBCX9 (CHO)	10.0 *(9.1)*	18.0 *(12.7)*	9.9 *(10.1)*	16.8 *(10.4)*	16.8 *(13.2)*	12.4 *(9.8)*	16.1 *(14.1)*
	PBCX10 (BUY)	8.9 *(8.4)*	17.5 *(12.6)*	8.6 *(8.9)*	16.1 *(9.6)*	15.2 *(12.0)*	12.9 *(12.0)*	15.0 *(13.9)*
FAC	PBCX11 (DAY)	5.7 *(7.4)*	12.0 *(11.1)*	5.6 *(7.7)*	13.5 *(10.8)*	11.7 *(11.8)*	5.3 *(6.3)*	9.8 *(10.4)*
	PBCX12 (ACC)	9.9 *(9.8)*	22.8 *(14.6)*	11.3 *(11.6)*	17.9 *(12.5)*	22.6 *(15.0)*	13.4 *(12.8)*	19.6 *(15.6)*
PS	Pref. Score	5.0 *(1.5)*	4.9 *(1.5)*	5.1 *(1.5)*	4.9 *(1.4)*	5.0 *(1.5)*	4.7 *(1.5)*	5.0 *(1.7)*
TI	Taste Index	27.2 *(11.0)*	29.6 *(12.4)*	28.4 *(11.1)*	28.4 *(9.8)*	32.2 *(11.9)*	24.1 *(12.4)*	29.8 *(12.5)*
HI	Habit Index	21.8 *(9.9)*	14.6 *(9.0)*	22.9 *(9.4)*	19.6 *(9.4)*	15.7 *(8.9)*	10.6 *(8.2)*	21.3 *(9.1)*

Note: * Means and (*standard deviations*)

CHAPTER 7

Context Effects in Evaluation of Chocolate Quality
Through the Experimental Design - Cross-Cultural Study

7.1   Abstract

The aim of Chapter 7 was twofold. First, to find out whether there are any differences in sensory sensitivity of Belgian and Polish panelists evaluating plain chocolate products. Second, to investigate the influence of quality and quantity of cocoa mass on perception of sensory attributes. Starting from the identical procedure of screening and training, panelists were selected in the two-stage process. Later on, they were subjected to 6 training sessions using reference samples. Spectrum Descriptive Analysis was developed to describe intensities of sensory attributes. Finally, the panelists evaluated all chocolate products that were manufactured according to the experimental design. The central point sample, which represented the medium values of cocoa components, appeared in all tasting sessions (high-, medium- and low-intensity contexts). Data analysis was carried out in four stages. At first, all individual panelists were assessed due to the two-way analysis of variance for all sensory attributes across all chocolate products. Second, after the most sensitive panelists were selected, the chocolates were analysed in three contexts. Descriptive analysis showed cross-cultural differences in the perception of sensory attributes of plain chocolate. In general, Belgian panelists were more acute to flavour and taste attributes while Polish ones to textural characteristics of chocolate. Third, principal component analysis allowed selecting five sensory attributes. These attributes indicated the most appropriate variables for further investigation. Finally, by means of the three-way analysis of variance, the influence of quality or quantity of cocoa mass on perception of chocolate products was investigated.

7.2   Introduction

Booth (1990) stated that descriptive judgement of food characteristics is based on discrimination of differences in intensity and depends on *perceptual differences* of the assessors. Reasons behind such perceptual difference are not clear yet and can be attributed to two aspects.

The first aspect relates to the well-known problem: *differences in panelists' sensitivity* influence product perception. These variations due to the individual panel member scoring are considerably larger than variations due to differences among types of products (Mecredy *et al.,* 1974). There are at least two possible explanations of such differences in individual panelist's response. One of them comes from an inadequate training and difficulty to exclude overall measures or preferences. Another explanation is probably the difference in taste sensitivity, especially to bitter compounds, which is believed to be inherited (Krondl *et al.,* 1983). The second aspect relates to the fact, that the perceptual difference in sensory preference is more likely to be formed due to the *differential exposure* than to innate variability in perception of sensory qualities (Prescott *et al.,* 1992). Dietary influences on chemosensory perception were also indicated (Prescott & Bell, 1995).

The importance of the cross-cultural research in sensory sensitivity of trained panelists is in finding possible *relation of trained panel data to consumer responses*, and therefore *prediction of preferences.* Risvik *et al.* (1992) reported a study in which two British and Norwegian trained panels participated. The same standard criteria of screening and training programme were implemented. By the least square regression it was possible to predict British responses from Norwegian and vice versa. Such an approach was considered as an aid in product development for export purposes.

Rohm *et al.* (1994) stated that the *quantitative descriptive analysis* (QDA) allows describing product differences as well as panel performance and variability between products. This method helps tailoring product's characteristics, such as milder taste, increased aroma or softer texture. The QDA technique is successfully used in various studies evaluating chocolate products (Risvik *et al.,* 1992; Aguilar *et al.,* 1994; Van Kleef & Remigius, 1995; Full *et al.,* 1996; Muñoz & Civille, 1998).

There are two aims of this study. First, to find out if there is any difference in sensory sensitivity of Belgian and Polish panelists evaluating plain chocolate products. Second, to investigate the influence of quality or quantity of cocoa mass on perception of sensory attributes with some implication to the business performance.

7.3   Theoretical concepts

Perception of sensory attributes of foods is influenced by many factors that may be classified into two groups, in general. The first group of factors is associated with the *sensory sensitivity* of panelists or consumers, depending on a type of the undertaken research. In the second group, there are factors contributing to the ways of *identification* of sensory attributes and their *interpretation* (Figure 7.1).

Sensitivity to some sensory attributes may be inherited and later destroyed during life course. The preference for sweet and salty taste is present at birth (Beauchamp & Moran, 1982). Innate rejection of bitter and sour substances was also found (Rozin & Vollmecke, 1986; Bartoshuk & Beauchamp, 1994). It is believed that some individuals may inherit a special sensitivity to bitter compounds (Krondl *et al.,* 1983) and some people show a complete insensitivity to particular chemical families of olfactory stimuli (Amoore, 1977). Other individuals lose responsiveness to oral trigeminal irritants, especially when they consume chilli pepper in high quantities (Lawless *et al.,* 1985) or undergo a particular dietary experience (Mattes, 1994).

It was also found (Birch, 1989) that age of respondents may influence differences in perception of sensory attributes. Particularly, the decline in the sensitivity of taste and smell connected with age explains the increase in preference of the peak concentration (Murphy, 1993). Taste adaptation, explained as fading of the sensation due to uninterrupted stimulus application (cf. Kroeze, 1990), should also be considered when analysing panelists' performance. Inherited differences in sensitivity and dietary influences were seen as the most important factors contributing to differences in sensory perception (Prescott & Bell, 1995).

Figure 7.1 Sensory Output Function

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                    ┌─────────────────────────┐
                    │   PHYSICAL STIMULUS     │
                    │     CONCENTRATION       │
                    └───────────┬─────────────┘
                                │
┌───────────────────────────────▼──────────────────────────────────┐
│                                                                    │
│      POTENTIAL FACTORS INFLUENCING SENSORY PERCEPTION              │
│                                                                    │
│  ┌──────────────────────────────┐    ┌──────────────────────────┐ │
│  │ INNATE:                      │    │        ATTITUDE          │ │
│  │  • PREFERENCE FOR SWEET &    │    └──────────────────────────┘ │
│  │    SALTY                     │    ┌──────────────────────────┐ │
│  │  • REJECTION OF BITTER &     │    │  PERCEPTUAL LEARNING     │ │
│  │    SOUR                      │    │   DUE TO TRAINING        │ │
│  │  • SENSITIVITY TO BITTERNESS │    └──────────────────────────┘ │
│  └──────────────────────────────┘    ┌──────────────────────────┐ │
│  ┌──────────────────────────────┐    │   CONTRAST EFFECTS       │ │
│  │ DUE TO LIFE COURSE:          │    └──────────────────────────┘ │
│  │  • ANOSMIAS/ LOSS OF SMELL   │    ┌──────────────────────────┐ │
│  │  • LOSS OF RESPONSIVENESS TO │    │      MEMORY &            │ │
│  │    SOME TASTES               │    │    IMAGINATION           │ │
│  │  • TASTE ADAPTATION          │    └──────────────────────────┘ │
│  └──────────────────────────────┘                                 │
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             │                                       │
  ┌──────────▼──────────┐               ┌────────────▼────────────┐
  │      SENSORY        │               │    IDENTIFICATION       │
  │    SENSITIVITY      │               │   & INTERPRETATION      │
  └──────────┬──────────┘               └────────────┬────────────┘
             │                                       │
       Internal                                 External
      associations                             associations
             │                                       │
             │         ┌──────────────────┐          │
             └────────▶│    PERCEIVED     │          │
                       │    SENSATION     │          │
                       └────────┬─────────┘          │
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                       │     CODED        │◀─────────┘
                       │    SENSATION     │
                       └────────┬─────────┘
                       ┌────────▼─────────┐
                       │    INTEGRATED    │
                       │     SENSORY      │
                       │    PERCEPTION    │
                       └──────────────────┘
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Based on: Beauchamp & Moran (1982), Lawless (1990), Kroeze (1990), Frijters (1993),

Prescott & Bell (1995), and Januszewska et al. (2000)

Consumer characteristics are recognised as equally important in recent studies. They influence i*dentification* and *interpretation* of sensory attributes. The most important are: attitudes, perceptual learning due to training, contrast effects, and memory with imagination. The attitude is clearly shaped by the personality of respondents, the importance they attach to product's intrinsic (sensory) and extrinsic (price, package, image) attributes, beliefs associated with benefits from products' usage, and expectations (Stevens *et al.,* 1988; Januszewska, *et al.,* 2000). The process of perceptual learning due to training (Lawless, 1984) was indicated as being related to motivation and engagement in the intensity scaling procedure. Furthermore, the contrast effects were stressed (Lawless, 1990) because the sensory-based judgements can be assigned around the rating scale, depending upon the fact which recent stimuli they are contrasted with. Finally, learned sensory preferences and aversions (Rozin, 1991) underlie the process of memorisation and imagination of sensory attributes.

Both groups of factors have different roots: while sensory sensitivity comes from biology, identification with interpretation from cognitions, that is culture. Later on, they integrate through the process of the perceived and coded sensation (Frijters, 1993) and contribute to the final sensory perception of food product (Figure 7.1).

Investigation of the source of differences in sensory perception is important for the food industry focusing on export expansion and market globalisation. There are, however, few international studies involving Polish trained panels and examining their response to taste qualities. Johansson *et al.* (1973) studied detection and discrimination of thresholds in low and high concentrations of salt solutions. There were almost no differences in the perception of saltiness among American, Swedish, Dutch and Polish panelists. Some years later, various concentrations of sucrose in water and orange juice were analysed by the taste panels in the USA, Sweden, Switzerland and Poland (Lundgren *et al.*, 1976). Very little difference in perception of the solutions was observed but a number of differences were found while assessing sweetness in orange juice. Prescott and Bell (1995) concluded that extrapolation of perceptual abilities from 'experimental' solutions to real foods is not appropriate, especially that previous experience or familiarity with a particular food can have an effect on the discrimination between sensory qualities.

Another research involving pectin gel evaluation, in relation to several manipulated

sensory attributes, showed few differences in perception of these attributes between panelists from the USA, the UK, Sweden, Switzerland, Japan, Australia, Finland, France, Germany and Poland (Lundgren *et al.,* 1986). Additionally, sweetness variation in coffee was assessed by taste panels in the USA, Brazil, Japan, Sweden and Poland (Lundgren *et al.*, 1978) and some differences in perception, as well as preference, of sucrose level were shown. The recent research of the European Sensory Network on preference of coffee between the five European countries shows a number of sensory preference segments that are found independently of the country of respondents (McEwan, 1998). Prescott (1998) indicated that the assessors from various cultures differ in their perception of sensory qualities, which can underlie variations in taste or food preferences.

According to Cardello *et al.* (1985) data from the cross-cultural studies show that responses to the tested product depend strongly on the context in which it is presented. Therefore, the concept of the central point sample was employed in some studies (e.g. Baxter, 1989; Ellekjear *et al.,* 1996). Such a sample allows examining the context-influence phenomenon.

7.4   Research design

The concept of research design and data analysis is presented in Figure 7.2. The *first* step is development of the experimental design, manufacturing of the test samples, explanation of 'contexts', within which samples were assessed, and description of experimental conditions. In the *second* step, the procedure of screening and training is explained. The *third* one is Spectrum Descriptive Analysis of main chocolate samples, which is shortly described. Further on, data analysis presents the procedure to select panelists and attributes for further investigation. Two quality‐ and quantity-influence settings are analysed according to the second aim of this study.

7.4.1   The experimental design

The *experimental design* (Table 7.1) allowed the investigation of panelists' perception of the three components of plain chocolate at different levels. These

three components sup up to 100% and represent: the cocoa mass from the first (B1) and the second (B2) source of cacao beans, as well as sugar content.

Figure 7.2   Concept of Research Design and Data Analysis

	QUALITY (QL) INFLUENCE			
SETTING	**QL1**	**QL2**	**QL3**	
	SAMPLES			
B1	C1	C3	C5	
B2	C2	C4	C6	
B1>B2	C7	C9	C11	
B2>B1	C8	C10	C12	
Constant =	*70%*	*60%*	*50%*	

	QUANTITY (QN) INFLUENCE			
SETTING	**QN1**	**QN2**	**QN3**	**QN4**
	SAMPLES			
70%	C1	C2	C7	C8
60%	C3	C4	C9	C10
50%	C5	C6	C11	C12
Constant =	*B1*	*B2*	*B1>B2*	*B2>B1*
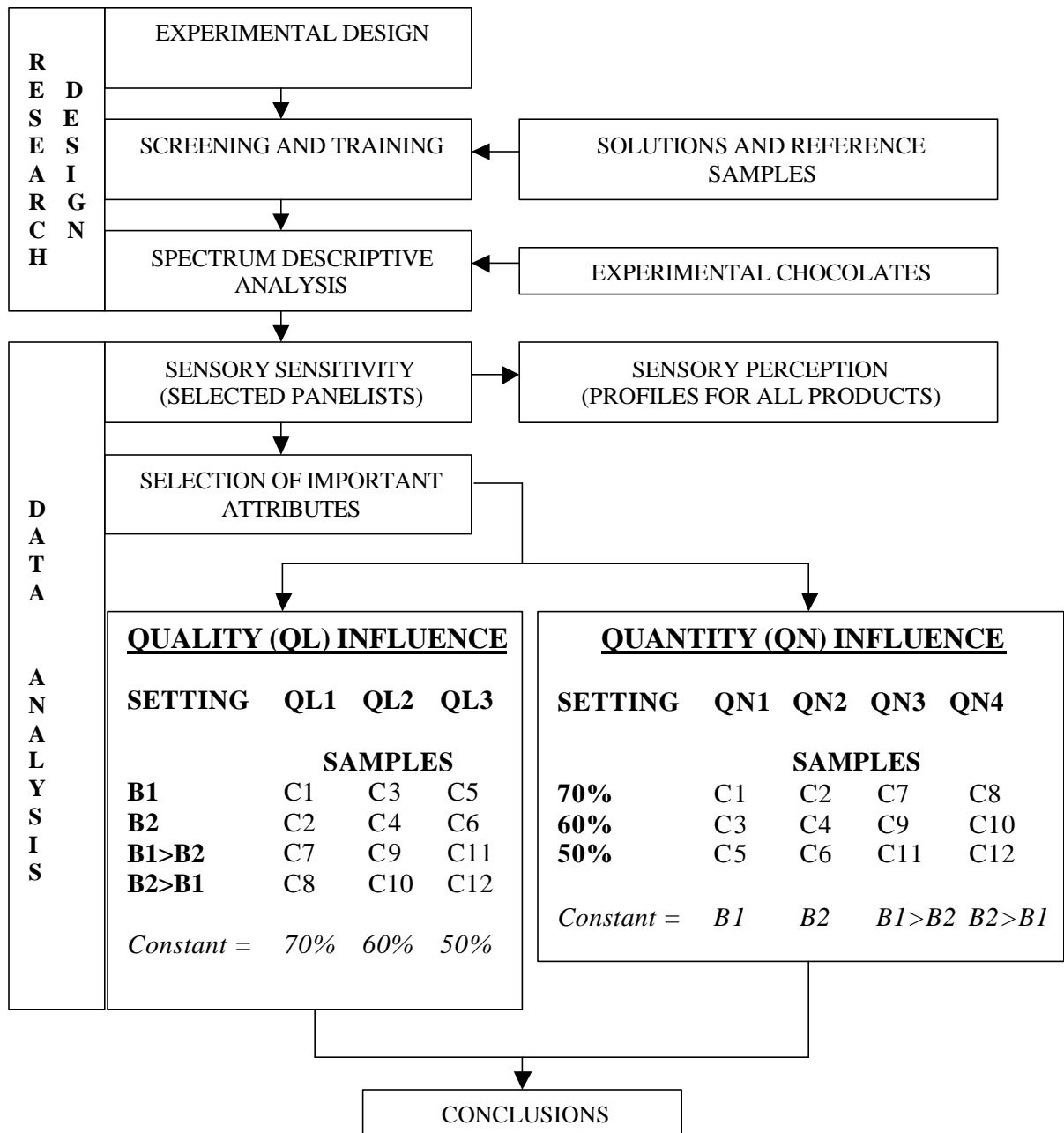
Samples were manufactured according to the experimental design. Therefore, it is possible to compare four products with the same percentage level of cocoa component. Samples 1 - 6 represent plain chocolate produced from cocoa mass of one source, while samples 7 - 13 are manufactured from cocoa mass coming from two sources. The thirteenth sample is *a central point (CP)* and represents the medium values of the ingredients as follows: 30% of B1, 30% of B2 and 40% of sugar (McEwan, 1996a).

Table 7.1   Experimental Design of Plain Chocolate Samples

CONTEXT	SAMPLE	%		
		SUGAR	B1*	B2**
High-Intensity-	C1	30	70	-
Context	C2	30	-	70
(HIC)	C7	30	50	20
	C8	30	20	50
70%	C13a	40	30	30
Medium-Intensity-	C3	40	60	-
Context	C4	40	-	60
(MIC)	C9	40	40	20
	C10	40	20	40
60%	C13b	40	30	30
Low-Intensity-	C5	50	50	-
Context	C6	50	-	50
(LIC)	C11	50	30	20
	C12	50	20	30
50%	C13c	40	30	30

*Note: *B1 – mixture of the cocoa mass of the first source*
***B2 – mixture of the cocoa mass of the second source*
The experimental design is the same as mentioned in Table 5.1 and Table 8.1,
but adapted to the specific research approach.

The aim was to evaluate five samples from three so-called '*contexts*', where the total percentage of the cocoa mass between evaluated samples was constant (Table 7.1). If the randomised order or Latin square block were chosen it might have happen that samples with 70% and 50% of the cocoa mass were compared. In such a case, differences between samples would be too obvious. Therefore, the analysis was done in the first context with the highest level of the cocoa mass that was called the high-intensity-context (*HIC*). Then, the panelists compared samples from the second context with medium-intensity chocolates (*MIC*). And finally,

they evaluated the chocolates from the low-intensity-context (*LIC*). The chosen experimental design allowed the investigation of differences between five samples in each context due to qualitative but not quantitative factor. It should be noticed that all panelists evaluated the CP sample with other four samples in a specific context, therefore it was possible to investigate the influence of each context on sensory perception of this specific sample.

As the *experimental conditions* are important for the trained panel approach, the screening sessions, the final training session, and the main evaluations were carried out in the sensory booths. However, most of the training time was spent on discussion, which aim was to reach consensus on the final list of sensory descriptors.

After *recruitment* of the potential panelists, 20 Belgian and 16 Polish University students were chosen. All of them fulfilled the criteria as follows: no previous experience with sensory tests, good health, availability, and high motivation. At this stage of the experiment, it was difficult to judge the appropriate personality traits that are necessary for work in the sensory panel. All recruited students stated they often consume chocolate products and do not dislike plain chocolate.

7.4.2   Screening and training

The second stage of the research design relates to *screening and training* of potential sensory judges (Figure 7.3). Number of tests and sessions was carefully planned because all panelists had to attend all sessions. The same procedure was carried out for both panels. Two-step screening and 6 training sessions were conducted during two months. The reference samples, representing a wide range of tastes inside a food category, were of great value in this approach.

The first test during the *first-step screening* was the *Basic Recognition Test* (Gridgeman, 1967). The test stimuli were presented in 6 samples of sweet (sucrose), salty (NaCl), sour (citric acid), and bitter (quinine) tastes. Each sample was coded by a three-digit code on a white, plastic cup. Non-sparkling water was provided and panelists were requested to rinse their mouth between samples to avoid de-sensibilisation. This test was considered to be the most important, therefore the qualifying score was 5 out of 6.

Figure 7.3 Screening and Training Procedure

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┌─────────────────────────────┐
│        ANNOUNCEMENT         │
└─────────────────────────────┘
               │
               ▼
┌─────────────────────────────┐
│          INTERVIEW          │
│     FOCUS ON MOTIVATION     │
└─────────────────────────────┘
               │
               ▼
┌──────────────────────────────────────────────────┐
│              1ST-STEP SCREENING                    │
├──────────────┬────────────────────┬───────────────┤
│ BASIC TEST   │   TRIANGLE TEST    │ RANKING TEST  │
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               │
               ▼
┌──────────────────────────────────────────────────────┐
│                 2ND-STEP SCREENING                     │
├─────────────────┬─────────────────┬────────────────────┤
│ SET X           │ 3 x SET Y       │ SET Z              │
│ WATER+SUGAR     │ MILK+SUGAR      │ MILK+SUGAR+CACAO   │
└─────────────────┴─────────────────┴────────────────────┘
               │
               ▼
┌─────────────────────────────┐
│          TRAINING           │
└─────────────────────────────┘
```

Session 1: Building of DESCRIPTORS – Develop a strategy of observation and identification

Session 2: INTENSITY SCALES – Develop ability to scale sensory intensities – **2** samples

Session 3: Intensity scaling in **BITTERNESS** – **3** REFERENCE samples

Session 4: Intensity scaling in **SWEETNESS** – **4** REFERENCE samples

Session 5: Intensity scaling in **FLAVOURING** – **4** REFERENCE samples – Final list of attributes

Session 6: Intensity scaling of **5** MIXED UP, REFERENCE samples

Source: The method developed for this research

The next was the *Triangle Test* that was presented in 5 sets (Barylko-Pikielna, 1975). This test was prepared for sweet taste only. A qualifying score was 4 out of 5. The last, the *Ranking Test* (O'Mahony, 1985) was prepared with the aim to rate sweet and sour solutions on the intensity scale. Each ranking test was done in 4 concentration levels. If the panelist assigned a certain sample to the correct level or close to it, a positive score was given.

The aim of the *second-step screening* was to analyse panelists' perception of sweetness intensity in solutions of water, milk with sugar, and milk with sugar and cocoa. Five sets were presented. *Set X* was water with increasing levels of sucrose. *Set Y* consisted of milk and sucrose, and was repeated 3 times. *Set Z* represented solutions of milk with increasing amount of sucrose and the same amount of cocoa powder. Within each set, 4 levels of sucrose concentration were prepared. One level was repeated, therefore, 5 samples were presented. The qualifying score was given if 4, well assigned levels within each set were recognised. Sixteen Belgians and 12 Poles passed satisfactorily the double-stage screening procedure.

Later on, the panelists were trained during 6 sessions according to the *Spectrum Descriptive Analysis* (Meilgaard *et al.,* 1991). The SDA is a version of the QDA technique and it can be explained as 'a complete, detailed, and accurate descriptive characterisation of the product sensory attributes' (cf. Muñoz & Civille, 1992). It provides information on the perceived sensory attributes, including characters or notes, and the levels or intensities of each. The answers are usually recorded on the absolute or universal scales that allow the comparison of relative intensities between attributes within a product itself and/or among products tested.

The aim of the *first* training session was to develop a strategy of *observation and identification* of sensory attributes appropriate for the assessment of plain chocolate. At this moment, descriptors were classified to 3 sensory categories to examine appearance, flavour, and texture. A primary list of terms was compiled from literature (e.g. Tuorila & Pangborn, 1988a; Viaene & Januszewska, 1999a), although the place for panelists' suggestions was also provided. Further on, the list of sensory attributes was established through a word-association technique with two sensory panels. Each panelist was presented with a list of words, one at a time and then was asked to give other words that come to his/her mind for the characterisation of chocolate qualities (Malhotra, 1996). In this way, 11 sensory

attributes were established as follows: colour, melting-in-the-hand, aroma, flavour release, aftertaste, sweetness, fruitiness, bitterness, cocoa, melting-in-the-mouth, and hardness (Annex 7.1).

The *second* session was designed for development of the *ability to scale* sensory intensities of the selected attributes. Two commercially available plain chocolate products were presented for this purpose. At this stage, it was helpful to compare the scale intensities assigned by each panelist to the whole panel. The *third* session concentrated on training in recognition of *bitterness* intensity. It seemed the right moment to introduce the reference samples with the well-defined levels of cocoa mass. Moreover, the number of samples increased to 3 and the task became more difficult. The aim of this session was to obtain the consensus on the bitterness level in the provided samples. The *fourth* session was similar to the previous one but the scaling procedure focused on *sweetness* intensity in 4 reference samples. The same related to the *fifth* session when *flavour* differences between 4 samples were measured. During the *final* training session, 5 mixed up reference samples were analysed by panelists in the sensory booths. It should be mentioned that appearance was assessed in the condition of red light. The assessment of 5 samples created the same level of difficulty, with which the panelists were faced during all following judgements. Additionally, at the beginning of each training session the panel leader presented results of the previous session stressing individual differences in scaling of the samples.

7.4.3 *Main analysis of chocolate samples by Spectrum Descriptive Analysis (SDA)*

The third stage of research design relates to the evaluation of plain chocolate products by means of the established SDA procedure. The assessment of the chocolate products in *HIC*, *MIC*, and *LIC* contexts was repeated three times by all panelists on the consecutive sessions. Panelists evaluated each of 11 descriptors between all samples according to side-by-side technique. The order of samples' presentation was balanced, i.e., each sample was proceeded by another during the whole experiment (MacFie *et al.,* 1986).

7.5   Data analysis and results

Data analysis is presented in four steps. *First,* panelists' sensory sensitivity is analysed. *Second,* sensory perception of plain chocolate samples is outlined. *Third,* the most important attributes are selected. *Finally,* the experimental design is evaluated in relation to the influence of quality or quantity of cocoa mass on panelists' sensory perception.

7.5.1   *Sensory sensitivity of panelists*

Sensory sensitivity of both panels is presented in Annex 7.2. This table shows the probability levels associated with F-values, calculated individually for each panelist and 11 sensory attributes across all experimental samples. The two-way analysis of variance with all sensory attributes (within-subject variables) and all samples (products) (between-subject factor) was undertaken to calculate these F-values. For example, the first Belgian panelist (b1) has shown high probability to differentiate between all products in relation to investigated sensory attributes, and with reference to three scores for each attribute. The third panelist (b3), however, had problems in the assessment of melting-in-the hand and flavour release therefore s/he was excluded from further analysis. Annex 7.2 presents only 13 Belgian and 11 Polish judges due to the incomplete data set obtained from 4 assessors after the main evaluations by the SDA.

Stone *et al.* (1974) concluded that if the evaluations of the potential judge show the probability level less than 0.50, it means that s/he contributes to discrimination between samples and s/he can be treated as a sensitive judge. In the current research, the selection criterion was stricter (less than 0.35). This criterion corresponds to suggestion of Pastor *et al.* (1996) for whom p<0.30 is an indicator of 'a proper assessor's discrimination on individual descriptors'. Finally, 7 Belgian and 7 Polish panelists were chosen and all the further data analysis was computed from their evaluations. The minimum number of panelists required for descriptive analysis is 5 (ASTM, 1968), therefore, the number of panelists is appropriate.

7.5.2   Sensory perception of samples

Sensory perception of plain chocolate products was measured on 7-point intensity scales. Annex 7.3 presents means and standard deviations for the whole set of experimental samples, in three contexts and between two panels. Description of these thirteen product sensory profiles is the topic of Chapter 8, where the trained panel scores are compared to the consumer panel scores by means of Preference Mapping.

It is logical explanation that more sensitive panelists gave more consistent answer for a certain attribute. This fact is analysed through the level of standard deviations. The value above 1.2 indicates disagreement between assessors or potential insensitivity to the sensory attribute. Some authors (Pillsbury Rutledge & Hudson, 1990) suggest a stricter criterion, i.e. 1.0. The sensitivity of panelists can also be reflected in the high value of mean values. Those panelists who are less sensitive to a certain sensory attribute used to give much higher score to this attribute (Murphy, 1993). On average, means of Polish panelists were higher then Belgians ones for the following descriptors: colour, aroma, flavour release, aftertaste, sweetness, bitterness, cocoa, and melting-in-the-mouth. In addition to that, a majority of standard deviations for these attributes was very high.

All of this indicates lower sensitivity of the Polish panel in perception of chocolate flavour. The assessment of melting-in-the-hand and hardness confirms the previous findings (Januszewska & Viaene, 2001d) that Poles attach special attention to texture attributes of chocolate. In regard to fruitiness descriptor, both panels seemed to be unsure about its intensities in the chocolate.

Another observation is that the CP sample was assessed differently in three contexts. While in the *LIC* context it was perceived as the most bitter and the least sweet sample, in the *HIC* context it was judged as the most sweet and the least bitter one. Thus, the influence of the context was confirmed when analysed by the trained panel. It means that it is very important to find out the optimal level of the ingredients, at which the trained panelist cannot any more recognise differences between samples. Such an information has a direct managerial implication because it suggests that the consumer will neither be able to do it.

7.5.3 Selection of the most important sensory attributes

In the next step, the *most important attributes* were selected by means of the principal component analysis. The analysis was calculated individually for three sets of samples from *HIC*, *MIC* and *LIC* contexts. The Kaiser-Meyer-Olkin Measure of Sampling was satisfactory and Bartlett's Test of Sphericity was significant, in three cases. The cumulative variance, explained by the three principal components, was above 70% for each context.

Five attributes (FLR, AFT, FRU, BIT, MIH - see Annex 7.1), which were associated with more than one principal component are indicated in Table 7.2. If the evaluation of a specific sensory attribute shows larger heterogeneity of variance then it is explained by more than one principal component. Therefore, these five attributes can be interpreted as significantly difficult characteristics of chocolate while differentiating between products. For this reason, they were chosen for further analysis of variance.

Table 7.2   Factor Structure for All Samples in Each Context

ATTRIBUTES		HIC			MIC			LIC		
		PC 1	PC2	PC3	PC1	PC2	PC3	PC1	PC2	PC3
Colour	COL	.742			.566			.713		
Flavour	ARO	.806				.529		.812		
	FLR*	.820				.535	.618	.826		
	AFT*	.783				.615	.549	.781		
Sweet	SWE		.875				.841	.720		
tastes	FRU*		.800				.776	.527	-.588	
Bitter	BIT*	.524	-.776			.860			.933	
tastes	COC	.649				.839			.715	
Texture	MIH*	.620		-.820	.564		.635	.614		
	HAR			.867	.776					.854
	MIM			-.864						-.788
% of variance		42	23	10	48	17	10	39	20	11

Note: Principal Component Analysis, Varimax Rotation with Kaiser Normalisation
* - Attributes chosen

HIC: KMO=0.743; BTS: χ^2=457.3, df=55, p<0.000
MIC: KMO=0.801; BTS: χ^2=493.5, df=55, p<0.000
LIC: KMO=0.700; BTS: χ^2=421.5, df=55, p<0.000

7.5.4   The influence of quality or quantity of cocoa mass on sensory perception

In the last step, two models were built that focus on two aspects (see Figure 7.2). First, the *influence of quality*, i.e. the impact of the source of cocoa mass, on sensory perception was observed. It was done within *3 qualitative settings* (QL1, QL2, and QL3) that correspond to the experimental contexts (*HIC*, *MIC*, and *LIC*), where quantity of cocoa was constant for these three sets of samples (70%, 60%, and 50%, respectively). Second, the *influence of quantity* of cocoa mass was investigated. This time research was focused on the samples, which represented the same source of cocoa mass (B1, B2, B1>B2, and B2>B1) but were analysed in *4* different *quantitative settings* (QN1, QN2, QN3, and QN4). The chosen five sensory attributes were tested by the three-way analysis of variance in each qualitative and quantitative setting.

Table 7.3 shows the main effects and interactions as the probability levels associated with F-values. The three-way ANOVA models focused on quality (QL), [or quantity (QN)], and the five attributes (A), as the within-subject variables. The between-subject factor related to differences between Belgian and Polish panels (P) and the results were interpreted in regard to differences in sensory perception of the five attributes by two panels.

Table 7.3   Three-Way ANOVA: Summary of Probability Levels Associated with F-Values

SAMPLES	MAIN EFFECTS		INTERACTIONS	
QUALITY SETTINGS *When QN = constant*	**A**	**QL**	**A x QL**	**A x P**
QL1 (C1, C2, C7, C8)	.001	.002	.039	
QL2 (C3, C4, C9, C10)	.002			
QL3 (C5, C6, C11, C12)	.000			.049
QUANTITY SETTINGS *When QL = constant*	**A**	**QN**	**A x QN**	**A x P**
QN1 (C1, C3, C5)	.000	.010		
QN2 (C2, C4, C6)	.001			
QN3 (C7, C9, C11)	.001			
QN4 (C8, C10, C12)	.002			

Note: A - attributes, QL - quality setting, QN - quantity setting, and P – panels

The main effect appeared in all settings due to the chosen attributes. Then there was the main effect of the first quality setting (QL1). In this setting all samples represented 70% of B1, which was substantially high for recognition of product differences especially when samples with majority of B1 (C1, C3) were scored as very bitter (Annex 7.3). It suggests that differences between chocolate samples are more likely to be detected when the samples represent high level of cocoa component. From the producer point of view, the samples manufactured from mixtures of bad B1 (30%) and good B2 (30%) quality of cocoa mass would not be easily distinguished by regular consumers, as the trained panelist had problems to do so (settings QL2). In such situation, the masking effect of sugar (40%) was already observed.

The main effect in the first quantity setting (QN1) was also reported. Therefore, it is suggested that the addition of only 20% of B2 to the product made from B1 (like in the QN3) significantly improves the total quality perception, and differences between the samples are no more visible. Additionally, two interactions were reported in the quality influence settings. First, in QL1 there was a significant difference within each panel in regard to the attributes scored. Second, in QL3, there was a critical difference in evaluation of attributes by each panel. In this setting, the samples with 50% of sugar content were compared. It is concluded that behaviour of panelists was influenced by either the masking effect of sugar or preferences for different levels of sweetness in food products.

7.6 Discussion

An advantage of this study was the lack of *familiarity* with taste of the experimental products. This fact might contribute to the reduction of an impact of cognitive factors influencing, in succession, identification and interpretation process. However, to eliminate the individual factors, such as attitude or learned sensory preferences, is almost impossible. The panelists were clearly instructed to avoid hedonic judgement and to focus on the intensity assessment of sensory attributes, but it is extremely difficult to assess this aspect.

After screening and training, there were still *variations in panelists' sensory judgements*. Sources of these variations are usually characterised on five levels

(Arnold & Williams, 1986). *First,* there are variations on the overall level of scores that panelists give to sensory attributes of different samples. *Second,* assessors use different terms or their combinations to describe the same product. Here the influence of culture may be considered. *Third,* assessors vary in their range of scoring and the range-frequency theory (Parducci, 1965) says that some humans tend to distribute their rating across the available scale. *Fourth,* panelists show variation in the use of terms and scales between sessions. And the *last,* in extreme cases assessors perceive different stimuli in the same product, due to insensitivity to a particular taste or note.

Another concern is directed to our *perceptions* and it appears that our sensory terms are often *integrative* (Civille & Lawless, 1986). People tend to synthesise or integrate whole patterns of stimulation as single figures (Garrett, 1930). Dominowski (1974) investigated the concept learning, i.e. the ways in which attributes are identified to classify similar objects together, and the rules by which these attributes are combined into classes. There are several means to facilitate concept learning. In this study, the word-association technique was used to establish sensory attributes. This technique may be compared to the group *discussion* method, which causes 'concept attainment' (Laughlin & Doherty, 1967). The panelists were motivated by the optimal amount of information about the objective of the experiment at each stage, and the feedback of their results was used for discussion (Durr, 1977).

It was very important to use several *reference samples* to represent the concept (Civille & Lawless, 1986) and attain agreement for each descriptive term. The aim was an attempt to align existing sensory concepts or their formation as much as possible, and agree on the labels (terms) for these concepts (O'Mahony, 1990). In this study considerable time was spent to learn about sensations that fall into sensory concepts and the presented training procedure is a kind of the concept alignment method.

The chosen descriptive sensory terms had to fulfil *five basic requireme*nts (Civille & Lawless, 1986). *First,* terms were primary rather than integrated as the elementary words reduce confusion among panelists. *Second,* terms were precisely defined (Annex 7.1) and *third*, they were based on underlying structure. *Fourth,* descriptive terms had to be related to broad reference set and the choice of this set

was critical. Thirteen reference samples, evaluated between the second and the fifth training session represented large variations in appearance, taste, and texture. *Fifth,* terms had to be uncorrelated with each other.

The third requirement, i.e. the underlying structure was influenced by the *frame of reference* of the perceiver. It is a background information and so are reference points that trained panelists refer to during product evaluations. According to Muñoz and Civille (1998) the *qualitative* frame of reference is the person's mental system used to file and organise the terms or words of sensory perception. The *quantitative* frame of reference refers to intensity 'boundaries or limits' that a panelist uses when rating the strength of perceived attributes. The frame of reference was developed during training sessions when definitions of primary attributes were achieved through group discussions and consensus over the reference samples. The list of sensory descriptors was chosen, in both countries separately, and a strong agreement was reached between panels.

Low variability in panel responses is observed if both frames of reference are successfully implemented. However, there is still an '*underlying sensory dimension'* of panelists' judgements, which is emphasised in many studies (e.g. Powers, 1988; Risvik *et al.,* 1992). The psychological factors, such as attitudes and beliefs, have a strong influence on decision-making process. Panelists are, after all, the consumers operating in a certain environment. The cultural experience never disappears and it may even develop due to training procedure. In the current study, personality of panelists was observed only due to their performance during the training process. No investigation was carried out in reference to their possible belonging to preference segments, which were actually found across Belgium and Poland (Januszewska & Viaene, 2001d). This aspect is however, extremely important as the panelist with the health-oriented attitude may tend to overestimate sweetness level in chocolate products, or put more attention to a special class of sensory attributes.

The accelerated training programme is not a new idea (Stone *et al.*, 1974; Pillsbury Rutledge, 1992). Nowadays, five sessions (ninety minutes each) are suggested for optimal productivity since attention span drops dramatically after this time period (Stone & Sidel, 1998). It was noticed that the ability to differentiate decreased and the level of concentration among panelists dropped when the time spent on a single

project was extended (Pillsbury Rutledge & Hudson, 1990). The results of the current study show that the training programme was effective and the panelists could find many differences between samples. These differences were analysed in qualitative or quantitative contexts.

In regard to the influence of quality of cocoa beans on sensory perception, the panelists' reactions confirmed the general characteristics of the cocoa masses. Cocoa mass of the first source (B1) was produced from the cacao beans growing in South America and West Africa. These beans are known from strong bitter notes and some floral notes such as spicy, herbaceous, and even earthy. This fact was clearly seen in scores for intensity of bitterness among samples. Cocoa mass of the second source (B2) was manufactured from the cacao beans of pure West Africa origin that represent pure, medium cocoa flavour and very occasional off-notes (Urbanski, 1992). Hereby, it should be explained that fruity flavours are usually associated with acid taste (Davies *et al.,* 1991) but their identification is a matter of real experts.

It can be concluded that Belgian panelists had more uniform view on sensory characteristics of plain chocolate, as their answers were more similar. It may be that due to many restraints (e.g. economic factors, availability, and different tradition in chocolate consumption), Polish panelists were less sure about the sensory qualities of chocolate and their answers were more spread out.

In multivariate analysis of variance, two or more sensory attributes are considered simultaneously and the interrelationship between them is used to find out how samples differ from each other. This method allows studying any variation, which occurs with respect to each factor specified in the experimental design (Lyon *et al.,* 1992). Different levels of three chocolate components were represented in the design and, in consequence, any particular sensory attribute could be investigated. The *advantage* of this experimental design is that two cocoa masses were systematically varied in concentration and a psychophysical function could be established. This function may indicate how much change in sensory perception can be expected with changes in the component level.

There are several *applications* of such experimental design. The first application is the *quality control*. The cocoa mass of a 'weaker' function (here: 'better quality') shows greater panelists' tolerance, therefore, the producer has relatively low

liability for manufacturing defects (Lawless, 1990). The second one lies in the *cost reduction* of such product formulations, in which the cocoa mass can be reduced in concentration. The answer, how much it can be changed before there is a major impact in sensory perception, may come from a trained panelist or a consumer. The third application is related to the *cross-cultural research*, which is the core of this paper.

There is no great effort or interest in *cross-cultural research* due to several constraints. Two important barriers are: difficulties in organisation and time-consuming character of sensory analysis. Therefore, investigating the origins of differences in sensory perception and preference has to be accompanied by unified objectives (Prescott & Bell, 1995). A joined research of two departments, the R&D and Marketing creates the opportunity to see what the consumer really tastes, and which factors explain his/her sensory perception.

7.7   Conclusions

Considering the question whether there is any difference in sensory sensitivity, it may be concluded that panelists, taking part in this study, differed significantly in sensory sensitivity to chocolate attributes. In general, while Belgians were more acute to flavour and taste attributes, Poles showed more concern for textural characteristics of chocolate.

The following observations are also made. Both Belgian and Polish panels differed due to the sensory perception of five chosen attributes in all qualitative and quantitative settings. Furthermore, the panels differently evaluated all samples in the first quality setting, where all samples represented different qualities of cocoa masses at the highest level (70%). The assessors also gave significantly different scores in the first quantity setting while comparing the samples manufactured from the same bad quality cocoa mass at different quantity levels (70%, 60%, and 50%). It is interesting that the same was not observed for the samples produced from good quality cocoa mass in the second quantity setting. As general conclusion, the trained consumer panel makes clear that a well-perceived product cannot be made from bad quality raw material.

7.8   Acknowledgements

Annex 7.1   Final List of Sensory Attributes of Chocolate

APPEARANCE

1. COL Colour saturation	The **intensity or strength of the colour** from light to dark BROWN, as typical for pure chocolate: *0: not brown* 1: lightest 7: darkest
2. MIH Melting-in-the-hand	**Degree of melting** after certain time **(here 10 seconds)** while sample is kept in the hand (fingers at the bottom and top of chocolate): *0: does not melt* 1: slow melting 7: quick melting

FLAVOUR

3. ARO Aroma	An odour with a **pleasant** association: *0: bad aroma* 1: weak pleasant aroma 7: strong pleasant aroma
4. FLR Flavour-release	The **degree of release** in flavour: *0: no release* 1: weak flavour-release 7: strong flavour-release
5. AFT Aftertaste	**Olfactory and/or gustatory sensation** similar to that which was perceived when the product was in the mouth and which continued for a measurable period of time **(10 seconds)**: *0: no aftertaste* 1: short sensation of chocolate 7: long sensation of chocolate
6. SWE Sweetness	Organoleptic attribute of pure substance or mixtures, which produces the **sweet taste**: *0: no sweetness* 1: low sweetness 7: high sweetness
7. FRU Fruitiness	The sensation of a **fruit taste**: *0: no fruitiness* 1: low fruitiness 7: high fruitiness
8. BIT Bitterness	Organoleptic attribute of pure substance or mixtures, which produces the **bitter taste**: *0: no bitterness* 1: low bitterness 7: high bitterness
9. COC Cocoa	The sensation of **cocoa taste** associated with cocoa powders and/or compound coatings: *0: no cocoa taste* 1: low cocoa taste 7: high cocoa taste

TEXTURE

10. MIM Melting-in-the-mouth	**Rate of melting** of the product after a certain number of chews **(5 times)**: *0: no melting* 1: slow melting 7: quick melting
11. HAR Hardness	Perceived **force required to bite** through the sample: *0: cannot find differences* 1: very soft 7: very hard

Annex 7.2   Summary of Probability Levels Associated with F-Values for Individual Panelist and Sensory Attributes Across All Experimental Samples

**Annex 7.3   Means (M) and Standard Deviations (SD) for Experimental
Samples by Selected Panelists (7-Point Scale)**

ATTRI-BUTES	PANELISTS																							
	b1	b2	b3	b4	b5	b6	b7	b8	b9	b10	b11	b12	b13	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	p11
COL	.115	.215	.055	**.608**	.098	.034	.003	.022	.043	.143	.000	.037	.000	.017	.054	.055	.000	.269	.019	**.422**	.000	.000	.098	.025
MIH	.001	.036	**.985**	.007	.026	.014	**.828**	.095	.000	**.635**	.000	.001	.002	.000	.004	.002	.000	.000	.000	.014	.000	.000	.000	.009
ARO	.011	.020	.037	**.369**	.046	.070	.334	**.635**	.020	.068	.085	.059	.170	.007	.041	.174	.003	.255	.000	.022	**.374**	.135	.023	.104
FLR	.016	.018	**.602**	.179	.051	.214	**.397**	.012	.002	.116	.047	.055	.146	.001	.246	.071	.311	.200	.000	.116	.049	.017	.103	.000
AFT	.000	.029	.066	**.661**	.026	.313	.337	.157	.002	.025	**.641**	.000	.002	.050	.061	.269	.011	.326	.000	.034	.135	.313	.046	.004
SWE	.030	.246	.042	**.611**	.022	.016	.103	.326	.001	.004	.023	.018	.047	.000	.084	.088	.001	.162	.257	.103	.047	.002	.332	.000
FRU	.032	.036	.004	.039	.014	.000	.043	**.745**	.067	.133	.308	.163	.002	.003	.010	.021	.000	.032	.015	.026	.000	.000	.001	.000
BIT	.009	.019	.033	**.653**	.057	.257	**.421**	.000	.001	.022	.001	.055	.087	.000	**.492**	.078	.074	.064	.000	.005	.021	.004	.004	.105
COC	.009	.280	.105	.019	.029	.103	**.427**	.001	.002	.022	.056	.328	.080	.029	.162	.012	.011	.091	.099	.076	.047	.000	.027	.117
MIM	.000	.132	.043	.170	.062	.001	.042	.340	.005	.003	.002	.026	.019	.128	.011	**.723**	.005	.151	.000	.248	.029	.005	.002	.018
HAR	.012	.013	.036	.229	.057	.026	**.476**	.142	.019	.227	.225	.015	.055	.007	.278	.000	.001	.156	.000	.148	.050	.052	.211	.000
Panelists chosen	*1*	*2*	X	X	*3*	*4*	X	X	5	X	X	*6*	*7*	8	X	X	*9*	*10*	*11*	X	X	*12*	*13*	*14*

Note: COL – colour, MIH – melting-in-the-hand, ARO – aroma, FLR – flavour release,
AFT – aftertaste, SWE – sweetness, FRU – fruitiness, BIT – bitterness,
COC – cocoa, MIM – melting-in-the-mouth, HAR – hardness,
Belgian (b1-b13), and Polish (p1-p11) panelists

PANEL CONTEXT			COL		MIH		ARO		FLR		AFT		SWE		FRU		BIT		COC		MIM		HAR	
			M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Belgian	HIC	C1	4.9	1.1	1.7	1.1	3.7	0.8	3.9	2.2	5.5	0.7	1.4	0.8	1.4	1.2	5.8	0.6	4.9	1.7	3.3	1.2	4.7	0.9
		C2	3.8	1.1	2.2	1.3	3.8	0.9	4.2	0.5	3.3	0.4	3.9	0.8	2.7	1.4	3.0	0.4	3.4	0.6	4.0	0.6	3.5	1.4
		C7	4.5	1.2	1.6	0.6	3.5	0.8	3.9	1.5	4.5	0.9	2.6	1.3	1.5	1.2	4.8	0.9	4.6	1.1	4.0	0.9	3.9	0.6
		C8	3.9	1.1	1.8	0.8	3.6	0.9	3.6	1.3	3.9	1.3	3.7	0.9	2.3	1.5	3.1	0.9	3.2	1.4	3.6	0.7	3.9	0.6
		C13a	3.7	1.2	1.9	1.3	4.1	1.1	3.9	0.8	3.4	0.4	5.0	1.1	3.8	1.7	2.2	0.7	2.9	1.4	4.1	1.4	4.3	0.9
	MIC	C3	4.4	1.1	1.8	0.8	3.7	0.9	3.9	1.2	4.3	1.1	2.7	0.8	2.2	1.2	4.0	0.5	3.8	1.0	3.8	0.8	3.8	1.2
		C4	3.6	1.3	2.1	1.0	2.9	0.7	4.0	1.1	3.8	0.8	4.2	1.4	3.2	1.4	2.3	0.7	3.0	1.1	3.6	1.0	3.9	0.8
		C9	4.5	1.3	2.2	1.2	3.5	0.8	4.2	1.2	4.8	0.8	2.7	1.2	2.0	1.6	3.9	1.0	4.2	0.9	3.8	0.9	4.2	1.1
		C10	4.3	1.3	1.8	1.2	3.5	0.4	3.6	1.2	3.6	1.1	3.7	0.8	2.8	1.1	3.1	0.5	3.6	1.1	3.4	0.9	4.1	0.8
		C13b	4.4	1.4	2.0	1.0	3.7	0.6	4.3	0.7	4.0	1.3	3.7	1.0	2.2	1.1	3.3	0.9	3.7	1.2	3.5	0.6	3.8	0.8
	LIC	C5	4.0	1.7	2.1	1.2	4.3	1.1	3.6	0.6	3.5	1.0	4.6	0.8	3.8	1.7	2.4	1.1	3.1	1.1	3.7	0.5	3.6	0.9
		C6	4.4	1.5	1.8	1.0	3.3	0.7	4.2	1.1	3.8	0.7	4.5	1.7	3.6	0.8	2.7	1.0	3.5	0.6	3.5	1.4	4.3	1.1
		C11	3.6	1.3	1.9	0.9	3.5	0.8	3.8	0.7	3.8	0.9	3.9	2.0	3.0	1.2	2.9	0.6	3.2	0.8	4.0	0.9	3.9	0.8
		C12	4.6	1.2	1.9	1.3	3.8	1.0	3.8	1.2	4.2	1.1	4.4	1.5	3.2	1.5	2.8	0.7	3.5	0.6	3.8	0.9	3.7	1.1
		C13c	5.1	1.1	1.9	1.0	3.1	1.0	4.3	1.5	5.1	1.1	2.3	1.4	1.4	0.8	5.2	0.7	5.3	0.8	3.6	1.2	3.8	1.0
Polish	HIC	C1	5.3	1.3	0.5	0.7	4.8	1.7	5.0	1.6	5.5	1.7	2.4	1.7	1.5	1.7	5.3	1.9	4.8	1.9	4.3	1.8	6.0	0.8
		C2	4.7	1.1	0.6	0.9	4.5	1.7	4.7	1.5	4.9	1.5	3.8	2.0	2.0	1.8	3.4	1.4	3.7	1.4	4.4	1.7	6.2	0.6
		C7	5.2	1.4	0.3	0.4	4.6	1.6	4.6	1.7	5.1	1.8	2.4	1.5	1.2	1.6	4.3	1.6	4.6	2.2	4.1	1.8	6.2	0.4
		C8	4.9	1.1	0.5	0.7	4.5	1.6	4.8	1.5	5.0	1.3	3.1	1.4	1.7	2.1	3.8	1.5	4.0	1.8	4.6	1.5	6.4	0.4
		C13a	4.4	1.7	0.4	0.6	4.8	1.5	4.7	1.4	4.7	1.4	4.3	1.8	2.7	2.0	2.8	1.6	3.3	1.5	4.4	1.6	6.2	0.6
	MIC	C3	5.2	1.3	0.5	0.6	4.5	1.4	4.5	1.6	4.8	1.4	3.2	2.0	1.5	2.1	4.4	1.2	4.3	1.7	4.3	1.4	6.0	0.9
		C4	4.4	1.5	0.5	0.7	4.2	1.4	4.5	1.4	4.4	1.5	3.8	2.1	2.0	1.5	3.6	1.3	3.7	1.3	4.3	1.5	6.1	0.9
		C9	5.0	1.5	0.5	0.7	4.4	1.9	4.7	1.2	4.8	1.5	3.2	1.8	1.7	2.2	4.4	1.5	3.9	1.9	4.5	1.3	6.3	0.5
		C10	4.7	1.7	0.4	0.5	4.3	1.6	4.4	1.4	4.6	1.3	4.1	2.1	1.8	2.2	3.6	1.3	3.7	1.5	4.3	1.5	6.2	0.7
		C13b	4.9	1.2	0.5	0.6	4.4	1.5	4.4	1.6	4.3	1.6	3.7	2.0	1.5	2.0	4.0	1.4	3.9	1.7	4.5	1.3	5.9	0.8
	LIC	C5	4.4	1.7	0.6	0.7	4.8	1.7	4.5	0.8	4.9	1.1	4.6	1.2	2.5	2.2	3.2	1.5	3.5	1.3	4.2	1.1	5.5	1.1
		C6	4.9	1.5	0.5	0.8	4.5	1.6	4.6	1.2	4.9	1.5	4.1	1.1	2.1	1.5	3.5	1.2	3.7	1.7	4.5	1.0	5.5	1.2
		C11	4.3	1.4	0.6	0.8	4.7	1.7	4.6	1.0	4.9	1.2	4.4	1.2	2.3	1.6	3.5	1.3	3.4	1.3	4.0	1.5	5.7	1.0
		C12	4.9	1.2	0.6	0.8	4.7	1.6	4.4	1.2	4.9	1.7	4.8	1.4	2.0	1.8	3.1	1.4	3.5	1.3	4.0	1.0	5.7	1.1
		C13c	5.6	1.1	0.6	0.7	4.8	1.6	4.5	1.2	5.3	1.6	3.6	1.3	1.9	1.7	4.6	1.9	4.1	1.8	4.0	1.4	5.8	1.2

Note: HIC – high-intensity-context, MIC – medium-intensity-context, LIC – low –intensity-context,
COL – colour, MIH – melting-in-the-hand, ARO – aroma, FLR – flavour release,
AFT – aftertaste, SWE – sweetness, FRU – fruitiness, BIT – bitterness,
COC – cocoa, MIM – melting-in-the-mouth, HAR – hardness

CHAPTER 8

Acceptance of Chocolate by Preference Cluster Mapping
Across Belgium and Poland

8.1 Abstract

There are four aims in Chapter 8. First, to discover which sensory characteristics of plain chocolate drive preference in five personality segments (Chapter 4) and four sensory preference segments (Chapter 5) established in the market survey conducted across Belgium and Poland. Second, to compare the Preference Mapping approach between trained and consumer panels with the objective to see if the consumer is able to characterise product in an objective way. Third, the paramount influence of quality, i.e., the source of origin of the cocoa mass, is explained in experimental samples. Finally, the importance of intrinsic (sensory) and extrinsic (package, price, novelty etc.) cues among the nine segments is mapped. The research is based on an experimental design for 13 plain chocolates. A total of 1200 respondents evaluated their preference towards plain chocolate and the perception of an ideal level of sensory attributes. Each respondent judged four chocolates, among which there was a central point sample (CP). This sample represented the medium level of sugar and cocoa mass within all experimental samples in four contexts. The chocolates were presented in four completely balanced blocks keeping the order of presentation under a strict control. Data evaluation by ANOVA, principal component analysis, correlations and cross-tabulations was made. Results show that both perceptual sensory maps achieved by trained and consumer panels are very similar. Major difference lies in perception of aroma, which is clearly associated with cocoa-taste and bitterness by the consumers, and with sweetness and fruitiness by the trained panel. Also a significant difference exists in weights given to intrinsic and extrinsic cues in relation to the consumption of chocolate.

8.2   Introduction

The use of *cross-cultural* approach in the case of food product is paramount as was shown that results from one country may not be readily generalised to other ones (Grunert, 1997). Moreover, the importance of the cross-cultural research lays in forecasting the ultimate preferences of consumers belonging to different groups. These preferences have to be explained by many characteristics of the product. In the current research, the sensory (intrinsic) cues of plain chocolate are evaluated by the consumers and trained panels. Additionally, the consumer panel evaluates the extrinsic cues (importance of package, novelty), in respect to consumption of chocolate.

It is believed that the consumers' response may be predicted from the *acceptability viewpoint* and from the *sensory viewpoint* (Fishken, 1983) and that the sensory evaluation cannot be useful for business without using panels of consumers. In many situations, both hedonic and sensory questions are asked to consumers and their answers are taken into account when analysing answers from trained panels.

In the frame of the *previous research*, related to analysis of attitudes, behaviour and preferences for chocolate among Belgian and Polish consumers, five personality (Chapter 4) and four sensory (Chapter 5) segments were established. The current study presents information gathered along the same market research for the consumers' perception of sensory characteristics of plain chocolate. These sensory cues correspond to the eleven sensory attributes developed and assessed by the trained panel, which is described in Chapter 7.

The current research has four main aims. *First,* to discover which sensory characteristics of plain chocolate drive preference in four sensory-segments and five personality-segments that have been described before. *Second,* to compare the preference mapping approach between trained and consumer panels with the objective to see whether the consumer is able to characterise product in an objective way. *Third,* the attempt is made to explain the influence of quality, i.e. the source of cocoa mass, on perception of major sensory attributes. *Four,* the importance of intrinsic and extrinsic cues is mapped to see the relation of them with all segments.

8.3   Theoretical concepts

'Acceptability, as measured by the degree of liking a product on a hedonic scale, reflects the preference of an individual for the product being tested' (cf. Jones *et al.,* 1989). The objective of the sensory acceptance test is to identify the liking or non-liking of a stimulus or product by consumers (Meilgaard *et al.,* 1991). Acceptance and hedonic scores are measured on different scales with a different cognitive approach behind them. The acceptance data points to the 'just-right' level while the preference data indicates the order of most liked samples. The acceptance scaling is used for trend prediction, which can be measured by establishing a particular level of acceptance of the sensory attribute in a specific food, which in turn will influence choice. The knowledge of which attributes are important to consumer quality perception provides a basis for an effective use of sensory description in the process of new product development.

Preference mapping refers to a group of methods, which are used to relate product acceptability data from consumers to sensory characterisation of the same product by a trained sensory panel (McEwan, 1995). Generally, there are two approaches: internal and external preference mapping. In the current study, the second option is developed as it helps to project the acceptability data from consumers onto an existing sensory map derived from panelists. The changes in the perception of sensory characteristics correspond to preference directions.

Moskowitz (1994c) says that 'researchers use *mapping to identify which products compete* with each other, as well as to discover whether or not there exist in the category unfilled holes that have promise'. The mapping technique locates stimuli in a geometrical space, in which more qualitatively similar stimuli lie closer to each other and vice versa. The mapping is used to develop hypotheses, and modelling to confirm them. The modelling represents functional relations among variables, i.e. 'describes, predicts and identify the salient dimensions along which consumers differentiate products in the category' (cf. Moskowitz, 1994c).

Preference cluster mapping is interpreted as the extension of preference mapping (Lundahl & Kolsky, 1998). A cluster analysis is performed on the respondents, segmenting them into a number of clusters based on hedonic response patterns to products, i.e. preference clusters. Then, the factor loading scores from descriptive evaluations of the products are used to build either linear or quadratic regression

models. Regression coefficients of each preference cluster are plotted in the geometrical space of sensory attributes' perception as in preference mapping. The result is a set of 'ideal products' for each of the clusters of respondents with different product preferences.

Response surface procedures (Box *et al.,* 1978) use experimental design to keep combinations of independent factors under strict control of the scientist. The descriptive data on the perceived intensities of intrinsic and extrinsic attributes are then subjected to modelling due to the independent variables, which are chosen to be statistically independent of each other. The linear or polynomial equations from specific combinations of factors (e.g. ingredients) are then created. These equations are used to estimate the likely consumer response to the combinations of factors, also those factors that are not directly tested, or to optimise consumers' response. The attribute profile corresponding to the optimum is of core interest to the R&D practitioner.

8.4   Methodology

8.4.1   Target segments

In the first step, a *target group* of population was established (Chapter 3). It appeared that age is particularly important factor as far as consumption of chocolate is considered. Therefore, a group of people between 20 and 30 years is chosen, who states the highest consumption of chocolate products, and is characterised by high involvement in consumption of chocolate. Following this, a large-scale market study was designed across Belgium and Poland. The selected group was, then, clustered into five personality-related segments due to investigation of their beliefs, attitudes and behaviour (Chapter 4) and four sensory segments due to preference patterns (Chapter 5). Both cluster analyses were based on previous factor analysis of the respective variables. The nine consumer segments became a target of further investigation to see whether the respondents can effectively indicate the reasons of their preferences by means of the descriptive scaling technique.

8.4.2 Experimental samples

In the second step, the *mixture design* was created (Box *et al.,* 1978; Khuri & Cornell, 1987) and is presented in Table 8.1. In the mixture experiments the combination of ingredients is used to detemine what blend of ingredients gives more desirable consumer acceptability. As the proportion of the first component increases (decreases), the proportion of at least one other component must decrease (increase) to keep the total weight of the product the same. The developed experimental design allowed investigation of the impact of three components (B1, B2, and sugar) on the consumers' preference.

Table 8.1   Experimental Mixture Design of Plain Chocolate Samples

		Content (%)					Content (%)			
Consumer Panel Context	Sample	Sugar	B1 *	B2 **	*Trained Panel Context*	Sample	Sugar	B1 *	B2 **	Consumer Panel Context
	C1	30	70	-	*HIC*	C7	30	50	20	
HIP	C2	30	-	70		C8	30	20	50	HIM
	C3	40	60	-	*MIC*	C9	40	40	20	
	C4	40	-	60		C10	40	20	40	
LIP	C5	50	50	-		C11	50	30	20	LIM
	C6	50	-	50	*LIC*	C12	50	20	30	
Central Point (CP)	C13 a, b, c, d	40	30	30						

Note:
HIP –high-intensity-pure (C1, C2, C3, C13a)   *B1 – mixture of the cocoa mass of the 1st source
LIP – low-intensity-pure (C4, C5, C6, C13b)   **B2 – mixture of the cocoa mass of the 2nd source
HIM – high-intensity-mixture (C7, C8, C9, C13c)

LIM – low-intensity-mixture (C10, C11, C12, C13d)
HIC –high-intensity-context (C1, C2, C7, C8, C13a)
MIC – medium-intensity-context (C3, C4, C9, C10, C13b)
LIC – low-intensity-context (C5, C6, C11, C12, C13c)

The experimental design is the same as presented in Table 5.1 and 7.1,
but it is adapted to the specific research approach.

According to Booth (1990) *four products* are the minimum needed to interact and minimise two influences (i.e. sources of origin of cocoa mass) on preference. Helgesen *et al.* (1997) strongly advised that in the consumer panel testing 'using a small number of samples is important to ensure reliability of the data, especially for samples with strong flavour'. Carpenter *et al.* (2000) also suggested that 'fewer products can be assessed if they have strong flavours or odours or if the aftertaste

lingers'. Additionally, it was stated that the samples to be compared by the consumer panel should be as similar as possible to prevent differentiating for extraneous reasons such as colour, texture, etc. (Hofberger, 1993). For these reasons, the four samples tested by each consumer consisted of 70-60%, 60-60% or 50-60% of the cocoa mass. More strict conditions were designed for the trained panelists who evaluated the five samples in contexts of 70%, 60% or 50% of the cocoa mass.

Within all contexts, *a central point* (CP) sample was introduced with intention to keep the intercept to which all the evaluations would be compared (Table 8.1). This sample relates all factors on a scale to some standard, instead of pretending that ratings have absolute meaning (Lawless, 1990). In this way, the researcher gains an advantage as the sensory quality of other products is judged in terms of the degree of difference from the standard (Cardello *et al.,* 1985). An addition of the central point sample to the experimental design allows an estimate of any curvature in the response, especially when the final product optimisation or investigation of the contextual effects on sensory scores is foreseen (Baxter, 1989).

8.4.3   Trained panel

In the third step, the 14 trained panelists evaluated all experimental samples. The descriptive vocabulary used to evaluate chocolate samples together with methodology of trained panel approach has been described (Chapter 7). Eleven sensory attributes were found due to the word-association technique. These are as follows: colour saturation, melting-in-the-hand, aroma, flavour release, aftertaste, sweetness, fruitiness, bitterness, cocoa, melting-in-the-mouth, and hardness. The samples were analysed in three contexts: high-intensity-context (*HIC*), medium-intensity-context (*MIC*), and low-intensity-context (*LIC*) (Table 8.1), because if the randomised order or Latin square block were chosen it might happen that samples with extremely different cocoa level were compared. In such a case, differences between samples would be too obvious for trained panelists. The chosen experimental design helped to investigate differences between four samples in each context (as the CP sample was always added) due to qualitative (source of cocoa mass) but not quantitative (amount) factor.

8.4.4   Consumer panel

In the fourth step, the tasting sessions with consumers were undertaken (Chapter 5). Eleven sensory attributes assessed by the consumer panel correspond to those developed by the trained panel. Three of them were modified for better understanding by consumers, as follows: taste (instead of flavour release), fruit-taste (instead of fruitiness), and cocoa-taste (instead of cocoa). The sensory attributes are hereby called sensory directionals, as they show the direction of consumers' preferences being reported on the 'relative-to-ideal' scales. Ratings on this type of scale have been shown to agree with conventional hedonic ratings (Shepherd *et al.,* 1985). Each consumer indicated the sensory directionals and preference scores. The consumer panel judged the experimental samples in another four contexts: *HIP*, *LIP*, *HIM*, and *LIM* (Table 8.1).

In the current research, 11 *sensory directionals* were evaluated on 7-point bipolar semantic scales, which are also described as 'relative-to-ideal' scales. The left-hand scale indicated too light (colour), too slow (melting), too soft (hardness) or too weak (taste, aroma, etc.) of a certain sensory attribute. The right-hand scale indicated too much of the same attribute. The middle point of each scale represented the 'just right' evaluation, i.e. the ideal point of the attribute perception. With only four samples to test, the consumers reacted more instinctively than analytically while indicating the strength of a certain attribute. Relative-to-ideal sensory profiling was chosen because it is strongly believed that it is least misleading when it is done with untrained consumers and can be explained as 'a psychologically quantitative form of qualitative market research that focuses on the factors of interest to the technologists' (cf. Booth, 1990).

Then, a final statement on *preference* of four chocolates was recorded. As the sensory comparison is impossible during the process of purchasing and is generally rare in consumer behaviour, the four samples were not compared, but assessed on the relative-to-ideal scales, one by one, and only then, preference scores were asked for all samples. The hedonic evaluation was also performed on 7-point scales, ranging from "extremely dislike", through "neither/nor" to "extremely like". All 7-point scales were then transformed to 5-point items with the above explanation of their extreme edges.

A *cross-market survey,* based on quota sampling procedure was conducted (Malhotra, 1996). Initially, 200 *respondents* took part in the survey in each of 6 cities that represented the north, the south and the capitals of each country, making a total of 1200. The research questionnaire was translated from the English version to Dutch (Gent and Brussels), French (Gembloux) and Polish (Olsztyn, Warsaw and Kraków) languages. The execution of the questionnaire was similar to the 'in-hall' testing methodology. The chocolates were presented on plastic trays and coded with three-digit numbers. The CP sample was not identified as a different one from other samples.

According to Moskowitz & Krieger (1998b), there is need for a minimum of 30 ratings per product when the final aim is product optimisation. This constraint influenced the construction of the quota sampling procedure. A special *completely balanced block order* of sample presentation was designed for the purpose of this study (Chapter 5). Within each context (*HIP, LIP, HIM* and *LIM*), the samples were presented 24 times in this block order. The order retained the number of samples' presentations under a regime control, i.e., each sample was presented as first, second, third and fourth an equal number of times. Each block was then repeated to obtain 48 ratings per product. Two randomly selected orders were added to make a total of 50 evaluations. Having four blocks of orders, the total number of respondents testing the set of 13 samples was 200.

8.5   Data analysis and results

Data analysis starts from data inspection and validation, and then proceeds in four steps. *First,* the analysis of variance for sensory perception and preferences is discussed. *Second,* preference cluster mapping is described. *Third,* rejection points in consumer acceptance of chocolate are explained. *Fourth,* important cues in relation to consumption of chocolate are established on the perceptual map by all segments.

A total of 1200 respondents was reduced due to selective questions on different nationality (N=49) and the definite dislike of plain chocolate (N=115). Missing answers and extremities contributed to the removal of another 143 cases, which resulted in a total number of 893 valid cases. Then, after segmentation of the

respondents into four sensory preference segments (Chapter 5), 85 cases were excluded making the total final sample number of 808. No significant difference in distribution of the respondents was observed in four contexts and between nine segments. About 20 to 30 ratings per product were achieved, which was advised by Moskowitz & Krieger (1998b). The internal reliability of the scales (Cronbach's alpha coefficients) measuring 11 sensory directionals and 13 extrinsic cues between all respondents, was satisfactorily above 0.4 (Malhotra, 1996).

The one-way ANOVA from the descriptive sensory directionals indicated that all attributes, except 'aroma' (p=0.276), significantly discriminated (p<0.000) the chocolate samples. The ANOVA for the preference data showed that a majority of samples was similarly preferred, apart from the CP sample, which received significantly different (p<0.000) preference scores while being evaluated in four contexts by the sensory preference segments.

8.5.1 Key sensory attributes

Before a crucial relationship between key ingredients in the food product is explained, it has to be decided, due to which of the sensory attributes the products were differentiated in the best way. To achieve this, the range (difference between the highest and the lowest ratings) was computed because the higher the range the better descriptor (Moskowitz, 1994b). In the current study, the highest range values were found for sweetness (1.1) and bitterness (1.2). Therefore, the following discussion is limited to explanation how the content of sugar, B1 and B2 influenced the perception of sweetness and bitterness by the total consumer panel.

Figure 8.1 presents perception of sweetness and bitterness in relation to sugar content. The more sugar the higher perception of sweetness and lower perception of bitterness. The middle of the 5-point scale in the relative-to-ideal scaling indicates the most preferred sweetness or bitterness of a certain product, which is marked as a 'just fine line'. It should be remembered, that there is not always one sample representing the total perception of the sweetness and bitterness depicted at 30, 40, and 50% of sugar content (Table 8.1).

Figure 8.1   Relation Between Sugar Content and Perception of

Sweetness (swe) and Bitterness (bit) by the Consumer Panel
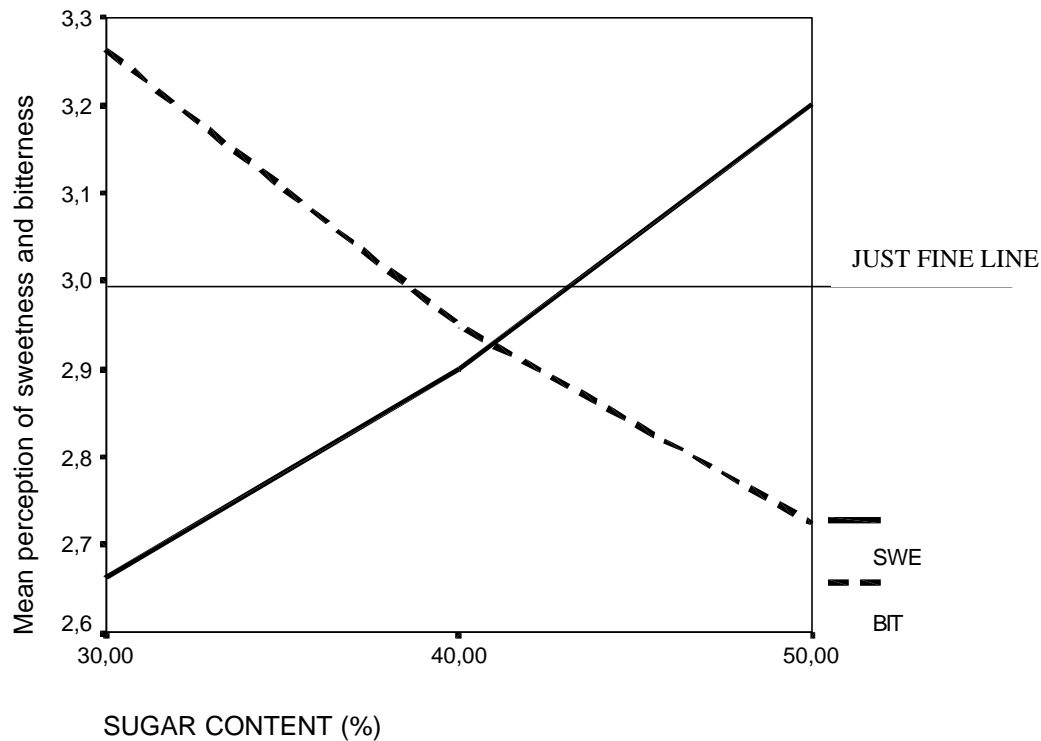
The relationship between cocoa mass (B1) (Figure 8.2), cocoa mass (B2) (Figure 8.3), and sweetness or bitterness is striking. Figure 8.3 shows that more B2 (and less B1 – according to the experimental design) the perception of bitterness is higher. When the opposite situation is considered the perception of bitterness is oscillating around 'just fine line' up to 60% B1 (Figure 8.2). Then a huge increase of this perception is observed for the sample with 70% of B1 and this is associated with decrease of sweetness perception. It is concluded that perception of sweetness and bitterness is associated not only with the quantity of cocoa masses, but most importantly with their quality (e.g. mildness or harshness, off-notes, floral-notes, etc.). Therefore, the cocoa mass B1 can be called as the *'dominant component'* as it clearly determinates the total intensity of the experimental chocolate samples.

Figure 8.2   Relation Between Cocoa Mass (B1) and Perception of Sweetness (swe) and Bitterness (bit) by the Consumer Panel
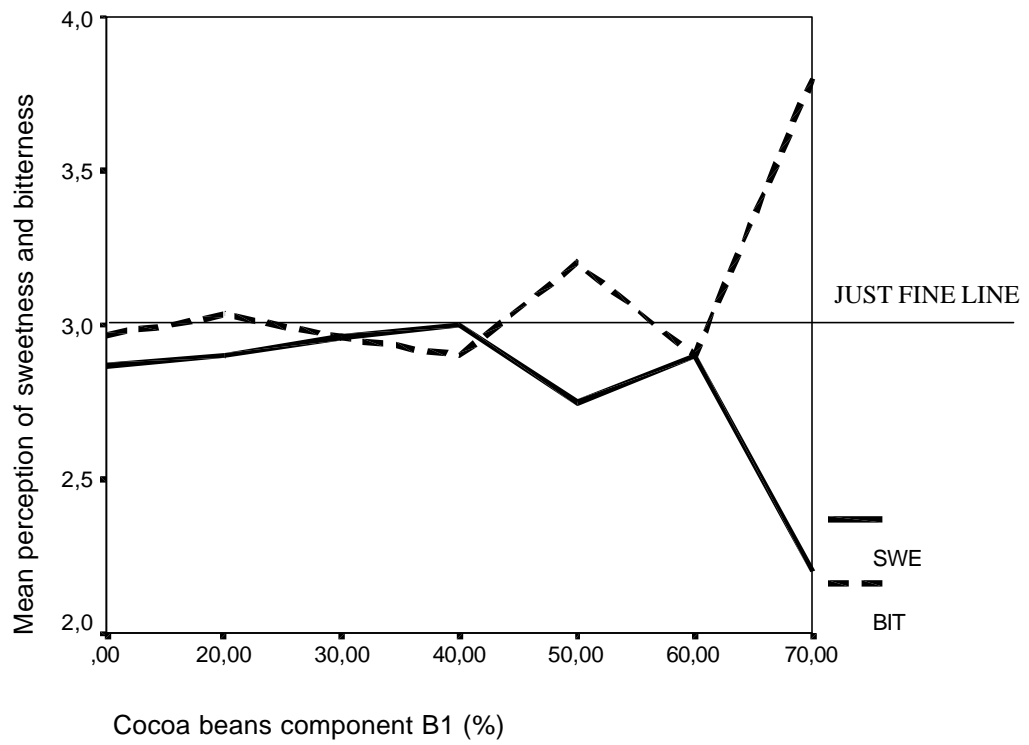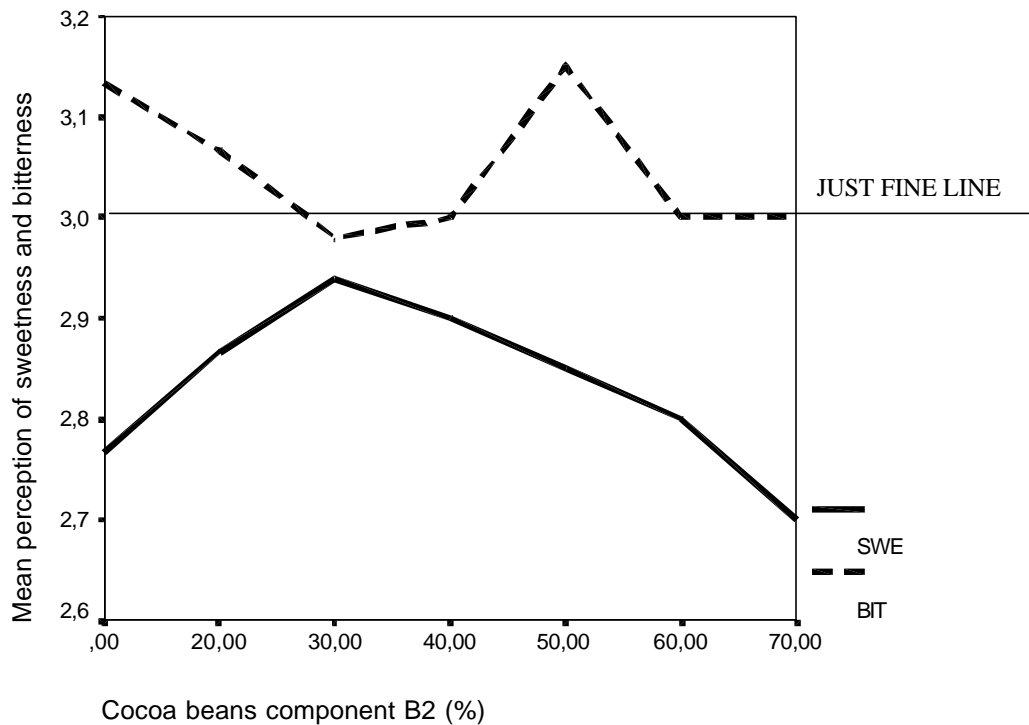

Cocoa beans component B1 (%)

Figure 8.3   Relation Between Cocoa Mass (B2) and Perception of Sweetness (swe) and Bitterness (bit) by the Consumer Panel

Cocoa beans component B2 (%)

8.5.2 Preference cluster mapping

Preference cluster mapping was realised in three steps. *First,* the principal component analysis was accomplished, due to which complex (multi-attribute) sensory data could be represented in a few underlying sensory dimensions. Principal components with Eigenvalue over 1 were calculated and Varimax rotation was implemented. The analysis was separately calculated for the consumer and trained panel data related to eleven sensory directionals. Two principal components from the consumers represented 80% of the cumulative variance. Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was satisfactory (0.744) and the Bartlett's Test of Sphericity (BTS) was significant ($p<0.000$).

Two principal components (PC) calculated from the trained panel showed 68% of variance (KMO = 0.361 and BTS $p<0.000$). These four components had many similarities on the first and second axes. While the PC1 was related to bitterness, cocoa-taste and aftertaste, the PC2 contained sweetness, fruitiness, and melting-in-the-mouth (Figures 8.4 and 8.5).

In the *second* step, Pearson correlation analysis of mean preference scores for each segment with principal factor loadings was calculated. Such approach allows positioning the respondents in respect to their perception of products and the products' sensory characteristics.

In the *third* step, the scatter plotting was chosen to understand the relationship between the products and descriptive attributes. The external configuration is taken from the first two principal component dimensions of a sensory profile by the consumers (Figure 8.4) and trained panelists (Figure 8.5). The attributes that are found in the same general direction are positively correlated, while those lying in opposite directions are negatively correlated (Popper *et al.,* 1997). Therefore, the strength of correlation between any two attributes can be explained by the angle between their biplot rays, which may be drawn from the point where two zero axes meet. It means that while there is a strong correlation between sweetness and fruitiness, there is no correlation between sweetness and bitterness. The distance of the attribute, from meeting point of two zero axes, is proportional to the standard deviation of the attribute, i.e. the longer distance, the larger standard deviation. It can be seen that this distance is longer for sweetness or bitterness than for instance hardness, on both figures.

Figure 8.4 Preference Map Explained by Sensory Directionals Assessed by the Consumer Panel
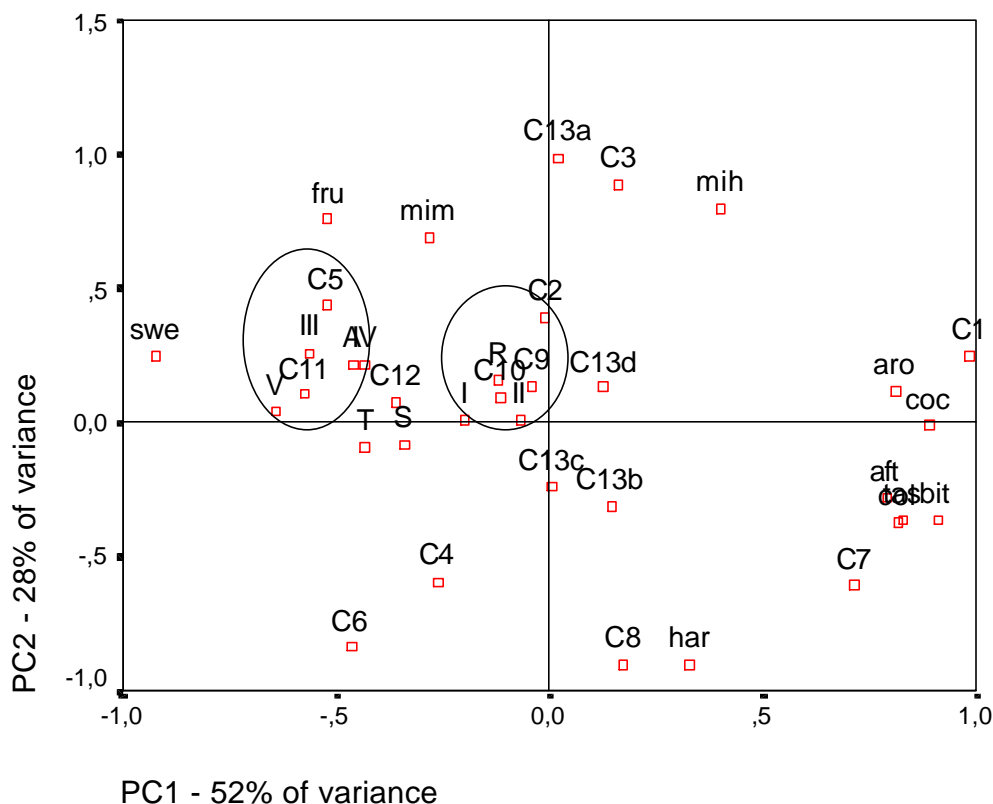
Note: Chocolate samples: C1 – C13;
Sensory directionals: col-colour, mih-melting-in-the-hand, aro-aroma, tas-taste, aft-aftertaste, swe-sweetness, fru-fruit-taste, bit-bitterness, coc-cocoa-taste, mim-melting-in-the-mouth, har-hardness;
Segments: I – Independent, II – Health-Oriented, III – Innovative, IV – Restrained, V – Hedonists, R – Rough Judges, A – Appearance-Bitterness-Oriented, T – Texture-Oriented, S – Sweetness-Oriented.

The position of the *products* (C1-C13) explains how they fall with respect to each other and with respect to the sensory attributes. The products situated in the left-hand side of both Figures 8.4 and 8.5 are perceived in negative correlation with the products from the right-hand side. For instance, chocolates C5, C11 and C12 are perceived as very sweet products and C1 and C7 as extremely bitter (Figure 8.4). The samples from the middle of the experimental design are perceived as neither/nor sweet or bitter (C2, C3, C8, C9 and C10). Samples C4 and C6 are too hard to be accepted by consumers.

Figure 8.5   Preference Map Explained by Sensory Directionals Assessed by the Trained Panel
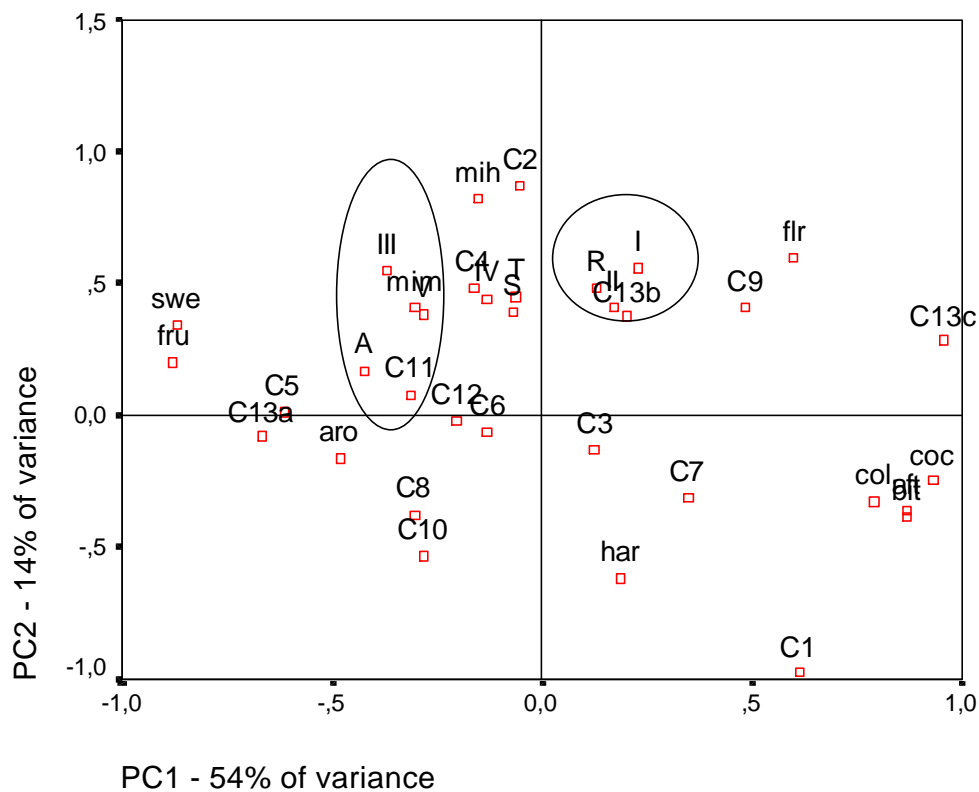
The trained panel observed a similar trend for the most sweet and most bitter samples (Figure 8.5). However, there are *a few differences*. First, the samples C4 and C6 are not scored as 'hard' but vice versa. At this moment, samples C8, C10 and two most bitter ones C1 and C7 are evaluated as very hard ones. Second, the samples C4 and C6 are perceived as more sweet ones when assessed by the trained panel than by the consumer panel.

The *sensory directionals* are situated in the same regions, except of aroma, which is associated with bitterness and cocoa-taste by consumers and with sweetness and fruitiness by the trained panel. It should be remembered that all respondents scaled this attribute very similar between products. The conclusion is that aroma, which was explained as 'the smell of chocolate' in the research questionnaire, is a very difficult descriptor. This may indicate that a majority of respondents showed low sensitivity or even loss of smell capabilities. It can also be noticed that the standard deviations of sensory directionals for the trained panel are lower than for the consumer panel, as almost all attributes lie closer to the maps' centre (Figure 8.5).

The location of the final *preferences* suggests, which products are preferred by which segment. The segments that appear close together have more similar product ratings (Shiffman *et al.,* 1981). Almost the same information can be read from both perceptual maps. On the one hand, the preference of Hedonists (V), Innovative (III) and Appearance-Bitterness-Oriented (A) (don't like bitter) segments is positively influenced by sweetness and fruitiness. On the other hand, the preference of Independent (I), Health-Oriented (II) and Rough Judges (R) is related to bitter chocolate samples. The segments between, i.e. Restrained (IV) (those who generally avoid chocolate), Sweetness-Oriented (S) (don't like sweet) and Texture-Oriented people (T) show a light tendency towards preference of sweet products.

Two interesting observations can be made about the *CP sample*. First, the preference map achieved by the consumers indicates the CP sample was perceived as extremely sweet only when it was compared to very bitter chocolate in the *HIP* context (C13a). The other three CP representatives are perceived more equally. Second, the preference map explained by the sensory attributes from the trained panel shows that the CP sample is seen as: a very sweet chocolate in *HIC*, an extremely bitter chocolate in *LIC*, and the balanced-taste chocolate in *MIC* context.

Finally, a few *strategies* for the R&D department can be suggested. First, if a company wants to improve the preference for highly bitter samples, it may either relay on the good quality of the cocoa mass, which is demonstrated by the relatively high acceptance of chocolate C2, or work out the poorly perceived 'hardness' of C8. In case the market target belongs to one of the sweetness-liking segments (V and S), the producer's efforts should be directed towards samples C4 and C6, which appeared to be highly disliked for their blind taste (neither bitter nor sweet).

8.5.3   Rejection points in consumer acceptance

The knowledge of rejection points, where attributes dominate consumer acceptance ratings may be helpful in determining the product concepts adapted to consumer segments. Therefore, in the next step, the attempt is made to explain relationship between factors influencing chocolate choice and how much impact they have on the final perception of its quality. Such approach helps the R&D people to innovate or reformulate the product (Helgesen *et al.,* 1997). Lawless (1990) suggests that it is possible to predict hedonic optima on the basis of ingredients.

Because the shapes of sweetness and bitterness lines (Figures 8.1, 8.2, and 8.3) suggest that there is no linear relation between B1 and B2, therefore, a quadratic model was estimated (Table 8.2). It is the full quadratic model (1) plus a cross-product term that locates the position of an ideal product on the profile space.

$$Y_i = a + b_1B1 + b_2B2 + c_1B1^2 + c_2B2^2 + dB1B2 \qquad (1)$$

where: Y_i – response surface (preference);
             a, b_1, b_2, c_1, c_2, d – coefficients of the model;
             B1 and B2 – cocoa masses of two sources (%).

This model was calculated for three segments (A, T, and S), which can be found between those respondents who definitely like sweet chocolate and those who definitely dislike bitter chocolate (Figure 8.4). It seems that these respondents are increasingly critical to the products containing greater or lesser intensities of sweetness. For them it is possible to establish an ideal point of sweetness or bitterness. The model was not calculated for Restrained respondents (IV) as they typically avoid chocolate in their diet and do not present a potential market target.

Table 8.2 shows that both estimations of the quadratic coefficients are negative for Appearance-Bitterness-Oriented segment (A), and in such a case the ideal point is called *'negative'* (Schlich, 1995). It can be noticed that the model is highly significant for Texture-Oriented (T) but not for Sweetness-Oriented (S) segment.

**Table 8.2   Relationship Between Preference and Cocoa Masses
(B1 and B2) in Three Sensory Preference Segments**

SEGMENT	COEFFICIENTS (PROBABILITIES)						MODEL VALIDATION	
	a	*b1*	*b2*	*c1*	*c2*	*d*	Multiple R^2	p-value
A	11.614	-0.247	-0.276	0.002	0.002	0.004	0.626	0.048
	(0.073)	(0.237)	(0.190)	(0.296)	(0.196)	(0.308)		
T	-4.752	0.313	0.285	-0.003	-0.002	-0.005	0.853	0.000
	(0.204)	(0.025)	(0.037)	(0.013)	(0.032)	(0.035)		
S	-2.267	0.195	0.207	-0.002	-0.002	-0.003	0.572	0.086
	(0.485)	(0.095)	(0.078)	(0.084)	(0.064)	(0.086)		

Note: A - Appearance-Bitterness-Oriented, T - Texture-Oriented, S - Sweetness-Oriented - segments

Quadratic model: Preference = a + b₁B1 + b₂B2 + c₁B1² + c₂B2² + dB1B2

The contour plot drawn, on the basis of calculated model, showed the ideal preference point (3.9) for the segment Texture-Oriented (T). The corresponding response surface (Annex 8.1) is very flat however, its shape clearly shows that the respondents have an optimal product they like (Danzart, 1998). This surface appears to be elliptical, being non-parallel to the sensory axes. The most important sensory direction for preference is neither B1 nor B2. Texture-Oriented consumers prefer products having B1 and B2 at medium levels (around 30% each), i.e. they like chocolate made with about 60% of cocoa mass and 40% of sugar content. If one of the basic dimensions B1 or B2 increases in a new formulation, then another one should compensate by increasing - to keep preference at the highest level possible (Schlich, 1995).

8.5.4   Important cues in relation to consumption of chocolate

In the next step, thirteen intrinsic and extrinsic cues with regard to consumption of chocolate are mapped together with the positions of all segments (Figure 8.6).

The location of each cue is explained by the factor loading scores calculated in principal component analysis, and the location of each segment is determined by its score on a particular cue.

This figure shows that flavour and texture cues are important to Hedonists (V), while Innovators (III) pay attention to appearance of chocolate. Neither of these seems to have any value for Independent (I), Restrained (IV) and Health-Oriented (II) people. The last segment shows some concern about the 'country-of-origin' of chocolate. A very week relation between the intrinsic or extrinsic cues and sensory preference segments is observed. The statement of Greenhoff and MacFie (1994) that 'the characteristics that are not related to the preference space are unlikely to play a major role in determining consumers' acceptance', seems to be confirmed in the current research.

**Figure 8.6   Perception of Intrinsic and Extrinsic Cues in Relation to
Consumption of Chocolate by Personality and Sensory Segments**
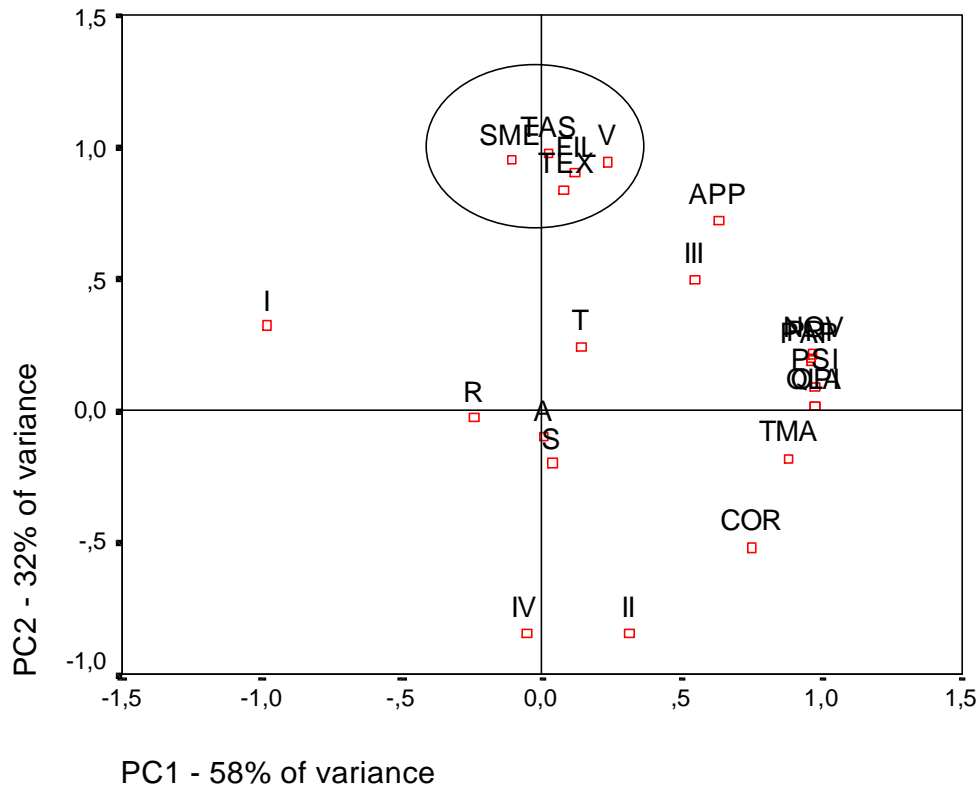
*Note: Intrinsic-extrinsic cues: app-appearance, sme-smell, tas-taste, tex-texture, fil-filling,
                pri-price, pap-pack-appearance, psi-pack-size, cor-country-of-origin, tma-
                trademark, qla-quality-label, nov-novelty, opi-opinion
         Segments: I – Independent, II – Health-Oriented, III – Innovative, IV – Restrained,
                V – Hedonists, R – Rough Judges, A – Appearance-Bitterness-Oriented,
                T – Texture-Oriented, S – Sweetness-Oriented.*

Some studies suggest that 'consumers make their liking decisions, primarily on the
basis of flavour, but no consumer makes any liking decision primarily on the basis
of texture or appearance' (Moskowitz & Krieger, 1993). In Chapter 5, it was
found, which personality characteristics of respondents may be linked with sensory
attributes being responsible for the liking decision made by each sensory
preference segment. The current research confirms the observation that what the
consumer values mostly, in his/her attitude towards a particular product, it strongly
matches the cognitive side of his/her personality but has no relation with the
sensory preferences.

Means, standard deviations and the analysis of variance of the intrinsic and extrinsic scores are presented in Table 8.3. It may be noticed that on the one hand, there are few differences in perception of the extrinsic cues between sensory preference segments. On the other hand, all cues are very well differentiated between personality segments.

Table 8.3   Means (M), Standard Deviations (SD) and Analysis of Variance for Intrinsic and Extrinsic (IN-EX) Cues Associated with Chocolate

IMPORTANT IN-EX CUES	Label	M *(SD)*	Five Personality segments			Four Sensory Preference segments		
			F	df	p	F	df	p
Appearance	APP	4.2 *(1.1)*	13.5	4	0.000	1.9	3	0.127
Smell	SME	4.5 *(0.9)*	7.5	4	0.000	1.7	3	0.156
Taste	TAS	5.0 *(0.2)*	5.1	4	0.000	2.0	3	0.107
Texture	TEX	4.1 *(1.1)*	2.9	4	0.022	0.7	3	0.542
Filling	FIL	4.4 *(1.0)*	5.1	4	0.000	0.9	3	0.417
Price	PRI	3.9 *(1.2)*	11.8	4	0.000	2.7	3	0.047
Pack-appearance	PAP	3.5 *(1.4)*	48.1	4	0.000	4.4	3	0.004
Pack-size	PSI	2.9 *(1.5)*	33.9	4	0.000	1.0	3	0.384
Country-of-origin	COR	2.9 *(1.6)*	11.7	4	0.000	2.6	3	0.048
Trademark	TMA	3.5 *(1.5)*	9.2	4	0.000	0.5	3	0.652
Quality-label	QLA	3.8 *(1.4)*	9.8	4	0.000	2.4	3	0.062
Novelty	NOV	3.2 *(1.4)*	16.6	4	0.000	2.7	3	0.045
Opinion	OPI	2.5 *(1.4)*	21.0	4	0.000	2.7	3	0.042

8.6   Discussion

Following the conclusion that 'the *acceptability* of a single food item cannot be reliably predicted only from hedonic responses to it, in an isolated sensory test' (cf. Tuorila, 1986), the current research was designed. Indeed, it shows that almost all acceptability scores of sensory directionals are significantly different between personality and sensory preference segments, while differences between preference scores are not crucial.

In this study, afford was made to focus on the *promising target* segment (Texture-Oriented segment), which consists of Poles in the majority, who also belong to Innovative segment (III). Other segments were also analysed and the *preference mapping method* enabled to position personality and preference segments in proximity of the most preferred samples, while negative samples were depicted outside the 'preference space'. In the business approach the objective is to find the factor that influences consumers' choices, and it is quite visible that the source of cocoa mass is this critical factor. It was then concluded that the data best fitted the quadratic model.

The *response surface method* allowed testing hypothesis drawn from the mapping technique, due to the systematic variation of variables in the experimental design. The quadratic model was calculated for the selected segments showing that the ideal chocolate should be produced with about 60% of cocoa mass. The quality of cocoa mass has a great influence on the perception of sweetness and bitterness, which are mostly associated with the first and second principal components. Additionally, it was shown that Texture-Oriented people pay more attention to appearance of chocolate than other segments.

Lawless (1990) puts a question whether the data from a *descriptive* panel, which should not be involved in hedonic estimates, can be *related to acceptability estimates* of consumers. He also suggests that correlations present a form of predictive validity of the hedonic scores from the descriptive data obtained from this panel. As the answer to his question, it often appears that the relationship of consumers' scores to the scores of the laboratory panel is consistent (e.g. Shepherd *et al.,* 1988; Jones *et al.,* 1989; Moskowitz, 1996).

Stevens (1953; 1975) showed that *untrained panelists could easily scale* perceived intensities. Since then, many studies proved that untrained consumers can scale intensity of sensory stimuli. Moskowitz (1996), comparing the experts and the consumers, strongly concludes that 'consumers are not only capable of validly rating the sensory aspects but they are those who are the most appropriate individuals to profile liking and image characteristics of the products'. However, it is well known that the consumers use different points of reference to rate the intensity of attributes because of their lack of training. Thus, the consumer data usually span the entire range of an attribute intensity scale (Muñoz & Civille,

1998). In the current study, the standard deviations of sensory directionals and preferences were very low because the samples were evaluated in four contexts, where the quantitative distance between cocoa masses was reasonably low.

It also appeared that *acceptance ratings for sensory attributes presented a great difference* between all segments. The similar result was found in the study of Laing *et al.* (1994) who investigated liking responses of Australian and Japanese towards chocolate. Both panels disagreed about 'sweetness liking' for two of the Australian chocolates and 'liking' for sweetness of plain, white and dark chocolate from each country. They also found that both cultures gave higher sweetness liking ratings to their own products, as in this study the respondents were informed about the origin of the samples. Therefore, it was suggested that familiarity with the product imposed a major influence on preference. In this view, the current study avoids the problem of familiarity because the experimental samples were especially manufactured for the purpose of this research. I can also be concluded that no marketed attributes added to modification of preferred sensory attributes since the samples were presented without packages.

The study shows that *hedonic ratings did not extremely differ* between segments. The same observation was made in regard to not significant differences in overall liking of the steaks between English consumers (Nute *et al.,* 1988). Another observation is that there was more agreement between panels for the least liked chocolate samples C1 and C7 (the lowest standard deviations). McEwan (1996b) made a similar conclusion while reporting on the study about crisps.

The research about the consumer behaviour (Verbeke & Viaene, 1998) revealed a strong agreement towards the *importance of taste* between Belgians and Poles. In the current study, it appears that all intrinsic cues of chocolate are of high importance to taste-driven consumers called Hedonists (V) (65% of Poles) and medium importance to Innovative consumer (III) (91% of Poles). It is a surprising notice, that the sensory cues are relatively important to Texture-Oriented segment (T) but not to other sensory preference segments (Figure 8.6).

A type of research like this presents *the challenge* 'in creating psychological methods that sensory evaluators can use to design successful products' (Booth, 1990). This is why the personality segments were studied as first, then, the sensory preference segments, and finally a total concept in relation to consumers'

acceptance of the product was developed. A lot of information was learned from these three studies.

For example, Health-Oriented people (II) seem to like more bitter chocolate, as well as pay attention to its country of origin. The Hedonists (V) are driven by the intrinsic qualities of chocolate, and they tend to like more sweet products and prefer milk chocolate. The next possible step would be to find how different sorts of consumers' preferences relate to proposals in the marketing mix.

Booth (1990) says that 'the *sampling* of panelists must be tuned to the business aim, such as exploration of the diversity of consumers or the response of the market, and must be a representative sample'. The quality, reliability, and relevance of the data is improved by having a larger panel size when conducting acceptance tests (Carpenter *et al.,* 2000). At the beginning of this research, a total sample consisted of 1200 respondents. This was further reduced due to the filter questions that allowed establishing an interesting target group, which was highly involved in the product whereas still differing in attitudes, beliefs, preferences, and perceptions. In this way, it is hoped that 'an attempt was made to quantify the erratic or unreliable contributors to the data' (cf. Greenhoff & MacFie, 1994).

One of the possible *limitations* of the current approach is the fact, that the consumers' tested only four products. However, all products differed significantly between each other in perceived sensory characteristics. A similar result was established by Shepherd *et al.* (1988) who concluded that 'there were significant differences between samples regardless of whether all eight products were included or just the four tested by the consumers'. That study showed that while differences were highly statistically significant with the relative-to-ideal ratings, they were not with the hedonic ratings. The same trend is observed in the current research.

It is hoped that this study may be seen as *a tool for more effective interface* between the R&D and Marketing departments. It is concluded that gathering information on the presence and intensity of sensory attributes can be done directly from the consumers, proving to be a valuable approach. It seems also possible to characterise the segment that is most interesting from the business perspective. One should remember that 'the interest of market research with food products

focuses on innovators and early adopters' (Scharf, 1995) whose perceptions and preferences can be easily translated into manageable product properties.

8.7   Conclusions

To prepare this research the authors started from the selection of the target market, which was further segmented into the personality and sensory preference segments. In the current study, *first,* it is concluded that sweetness and bitterness are key attributes driving consumers' preference for plain chocolate. *Second,* it was shown that the descriptive sensory analysis done with untrained consumers corresponds to the trained panel evaluations. This fact gives a support to many similar studies, in which consumers' ratings of sensory cues are highly appreciated. *Third,* due to the quadratic model, it appeared that preference for an ideal formulation of chocolate strongly depends not only on the amount and the source of cocoa mass, but also on a type of market segment. *Finally,* it was presented which of intrinsic and extrinsic characteristics, associated with consumption of chocolate, are important or unimportant to all segments. This approach helps both the R&D and Marketing practitioners to learn about the 'holes' in product category and to design new chocolate products.

8.8   Acknowledgements

Annex 8.1   Response Surface of the Ideal Preference Level and Composition of Cocoa Mass

COCOA MASS B1 (%)

COCOA MASS B2 (%)

COCOA MASS B1 (%)

COCOA MASS B2 (%)

COCOA MASS B1 (%)

COCOA MASS B2 (%)

CHAPTER 9

**Innovation Potential in Small and Medium Enterprises
Manufacturing Confectionery Products in Poland**

9.1   Abstract

The general aim of Chapter 9 is to find and explain the innovation potential among small and medium enterprises (SMEs) manufacturing confectionery in Poland. The study has four specific objectives. First, to find the impact of environment, entrepreneur, and enterprise on the strategic behaviour of the SMEs' owners, and establish specific groups of entrepreneurs. Second, to make the relationship between the above three elements and the firm's performance. Third, to discover additional significant factors contributing to the differentiation of SMEs. Fourth, to give some recommendations for improvement of entrepreneurs' styles in the firm's management. To achieve this, face-to-face interviews with 40 Polish owners or managers were carried out in Kraków region. The target was a group of confectionery producers, who employ less than 50 people. Therefore, they are regarded as the owners of the small or medium enterprises (Donckels & Mok, 1990). The questionnaire was based on the 7Ss framework (Peters & Waterman, 1982), and an approach of Loudon and Della Bitta (1993). Data evaluation by principal component, cluster, discriminant, and regression analyses, as well as cross-tabulation, was made. Results show that there are three distinct groups of entrepreneurs. The first group is called 'Conservative Owners' and needs to undergo an extensive training in managerial skills, to develop ability to cooperate as well as to have some financial support. The second group is labelled 'Radical Entrepreneurs' since its representatives are most dynamic in maximising the profit through focus on new products and suppliers, thus having the strongest marketing strategies. The third group resembles the second one but is less dynamic, therefore, it is named 'Moderate Entrepreneurs'.

9.2   Introduction

Today, an ability to develop and introduce new products is a fundamental condition for companies to hold their positions in intensified market competition. *New product innovation* is conducted for a number of reasons such as: to stabilise sales, to contribute to company's growth or to reduce risk through diversification. Only a true innovation and creativity drive competition that, in turn, contributes to growth of income and economy. Creativity together with comparative advantage thinking, unique local knowledge, and increased voluntary exchange are the key elements of entrepreneurial culture (Urban & Hauser, 1993). Such culture is specific to small and medium enterprises (SMEs) that are focused on relationships and learning. The entrepreneurial firm is aggressive and innovative, continually searching for risky environments, but also careful to remain in market niches or environments, that are both dynamic and simple (Mintzberg, 1983).

The importance of the study of SMEs is related to five *potential roles* they fulfil as follows. *First,* they create jobs. *Second,* they provide opportunities for people who are economically vulnerable (e.g. women, ethnic minorities, handicapped people, etc.). *Third,* SMEs are frequently considered to be dynamic, innovative, and more adaptable to changing economic conditions. *Fourth,* small firms are regarded as a means of achieving sustainable economic growth in a local economy. *Fifth,* SMEs may limit the ability of larger firms to monopolize and charge excessive prices (McDonagh & Commins, 1999b).

The focus of the current study is on *SMEs manufacturing confectionery products* and the goal is to see possible barriers to innovation in the current condition. Such barriers are investigated through two kinds of capabilities. On the one hand, the extrinsic capability to innovate is related to environment. On the other hand, the intrinsic capability to innovate is influenced by the entrepreneur and the way s/he organised his/her enterprise. The question is what structural (the enterprise's organisation and interaction with the environment) and behavioural (the entrepreneur's values, attitudes, perceptions and strategies) factors determine innovation and how it improves the firm's performance (Diederen *et al.,* 2000).

This study has four main objectives. *First,* to find and explain the impact of environment, entrepreneur, and enterprise on the strategic behaviour of SMEs' owners, i.e. to establish specific groups of entrepreneurs. *Second,* to define a

relationship between the environment, entrepreneur, enterprise and the firm's performance. *Third,* to see additional and significant factors contributing to the differentiation of entrepreneurs. *Fourth,* to give some recommendations for improvement of different entrepreneurs' styles in business management, leading to higher performance.

9.3   Theoretical Concepts and Proposed 3EN-Model

Successful enterprises develop a special organisational *culture* and *climate.* The company's culture is defined as 'the values, norms, beliefs and assumptions embraced by members', while the company's climate reflects 'the feelings, attitudes and behavioural tendencies, which may be measured through the perceptions of its members' (Nyström, 1990). *Innovation* can only take place in the appropriate culture and climate of an organisation, where the multifunctional and disciplined management process occurs (Kuczmarski, 1988). Porter (1990) considers the innovative process as central for upgrading competitiveness. In his view, external, environmental conditions can stimulate innovation and he discovered that successful companies are often clustered in the limited geographical areas, called 'industrial districts'. Also internal elements, such as 'the role of the cross-functional new product development teams is viewed as vehicle for integration and successful innovation' (Grant, 1995). The winners are those who 'have learned to combine the push of new technology from their R&D operations with the demand pull from the consumer, and developed the culture and leadership values that support continuous creativity' (Hoban, 1998).

At the SME level, innovation depends on a culture and climate that is mostly influenced by the *entrepreneurial spirit* of the manager/owner. Entrepreneurship is seen as 'the visualisation and realisation of new ideas', while creativity is 'the intellectual unfolding and converging of experience' (Nyström, 1990). There is a wide body of literature indicating the characteristics of the entrepreneur. In general, such a person has a special 'way of thinking, learning, and behaving that links knowledge with actions, which create new ventures or turns tired firms into vibrant companies' (cf. Caslin, 2000). The entrepreneur is a visionary activist, sometimes called 'an agent of change', who has a crucial role in the creative destruction, transformation or renewal of his/her company (Nyström, 1990). Specifically, the entrepreneur sets clear goals, has a high amount of personal

energy and drive, a high level of self-confidence, attaches a special meaning to money, prefers moderate risk, and has a desire to solve problems (Gaedeke & Tootelian, 1980).

During the early stages of the *creative process*, the entrepreneur increases business risk through an active search for new opportunities, experiments and rethinking of all alternatives. His/her level of ambiguity tolerance in such situations is very high. In the later stages of the process, s/he is active, focused and directed towards explicit solutions that lead directly to innovation. The key is the feeling of the entrepreneur that success is the result of blending business analysis and knowledge with intuition and creativity (Kuczmarski, 1988) and knowledge that innovation is an active creation of the future. Nyström (1990) concluded that entrepreneurship is a balancing act between strong risk creation and strong risk elimination.

Figure 9.1 shows a general *framework* for studying innovation potential at the company level. Both, the company's strategy and structure, influence the formation of company's culture and climate. This has an impact on the style of the R&D and Marketing departments that start to cooperate between themselves. Innovation and innovativeness is regarded as an outcome of this cooperation and leads to better consumer acceptance and improved business performance (Nyström, 1990; Trail & Grunert, 1997). It is suggested that this framework can be operationalised through analysis of external and internal factors that have an impact on the entrepreneur's creative process.

The *external* determinants come from the environment, while the *internal* determinants are associated with the individuality of the entrepreneur and the performance of the enterprise s/he creates. Additionally, the external factors may include rivalry and cooperation, both of them regarded as the driving forces of competition (Porter, 1990). Håkansson (1992) concluded that successful companies are strongly aware of the fact that 'ability to cooperate is important for the ability to compete'. Fanfani and Lagnevik (1995) suggested that full understanding of the dynamics of competitiveness might be accomplished while 'breaking down the analysis to the regional level and getting better insight into socio-economic conditions and division of work'. They also point to the importance of 'better understanding of the role of entrepreneurs, local and regional governments and unique competitiveness-creating actions'.

Figure 9.1 Framework for Studying Innovation Potential in the Company
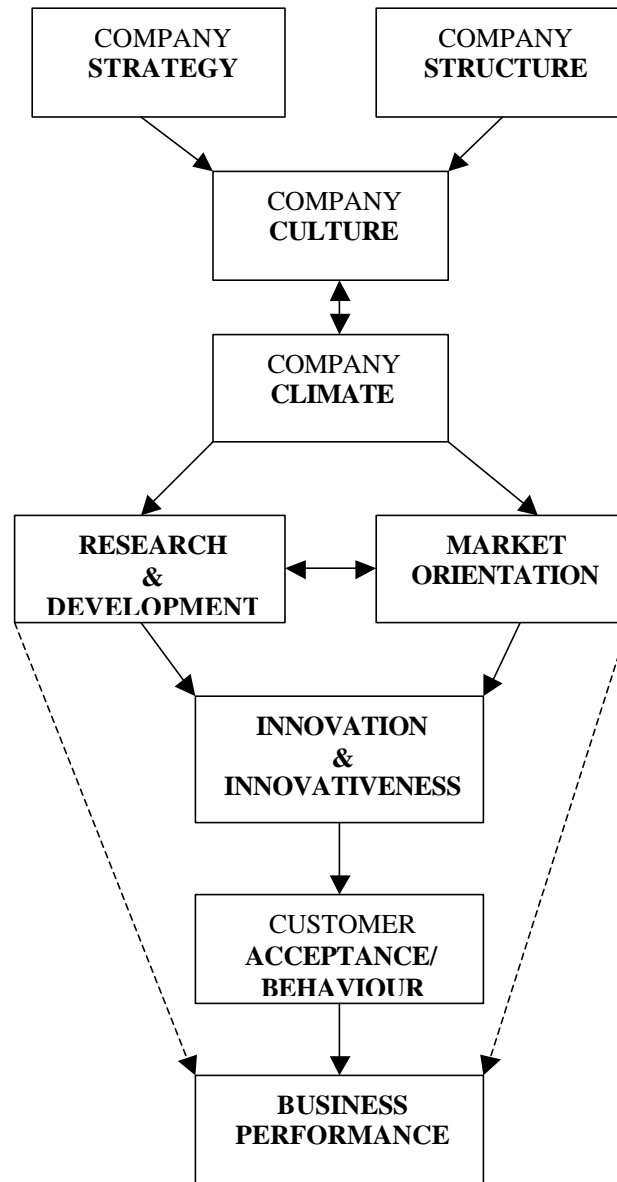
Based on: Nyström (1990), Trail & Grunert (1997)

The actions of entrepreneurs have many similarities with the process of *decision-making by consumers*, since both external environment and individual determinants shape the scheme of problem recognition and the final purchase behaviour (Loudon & Della Bitta, 1993). The external determinants may be those of cultural, social, or personal influences, while the internal ones are attitudes,

values or personality. For the entrepreneurial firm, both determinants can be studied within McKenzie 7Ss framework (Peters & Waterman, 1982).

The *conceptual model* was developed with the aim of focussing on the 7Ss as follows: structure, systems, style, skills, shared values, strategy, and staff (Figure 9.2). It was called the *3EN-model* because it brings all variables into three levels. The first level (*1E*) consists of *en*vironmental variables while the second level (*2Ea – 2Eb*) relates to the *en*trepreneur's characteristics. The third level *(3E)* indicates how the *en*terprise is organised and works.

Figure 9.2 The 3EN-Model for Studying Innovation Potential in the SMEs
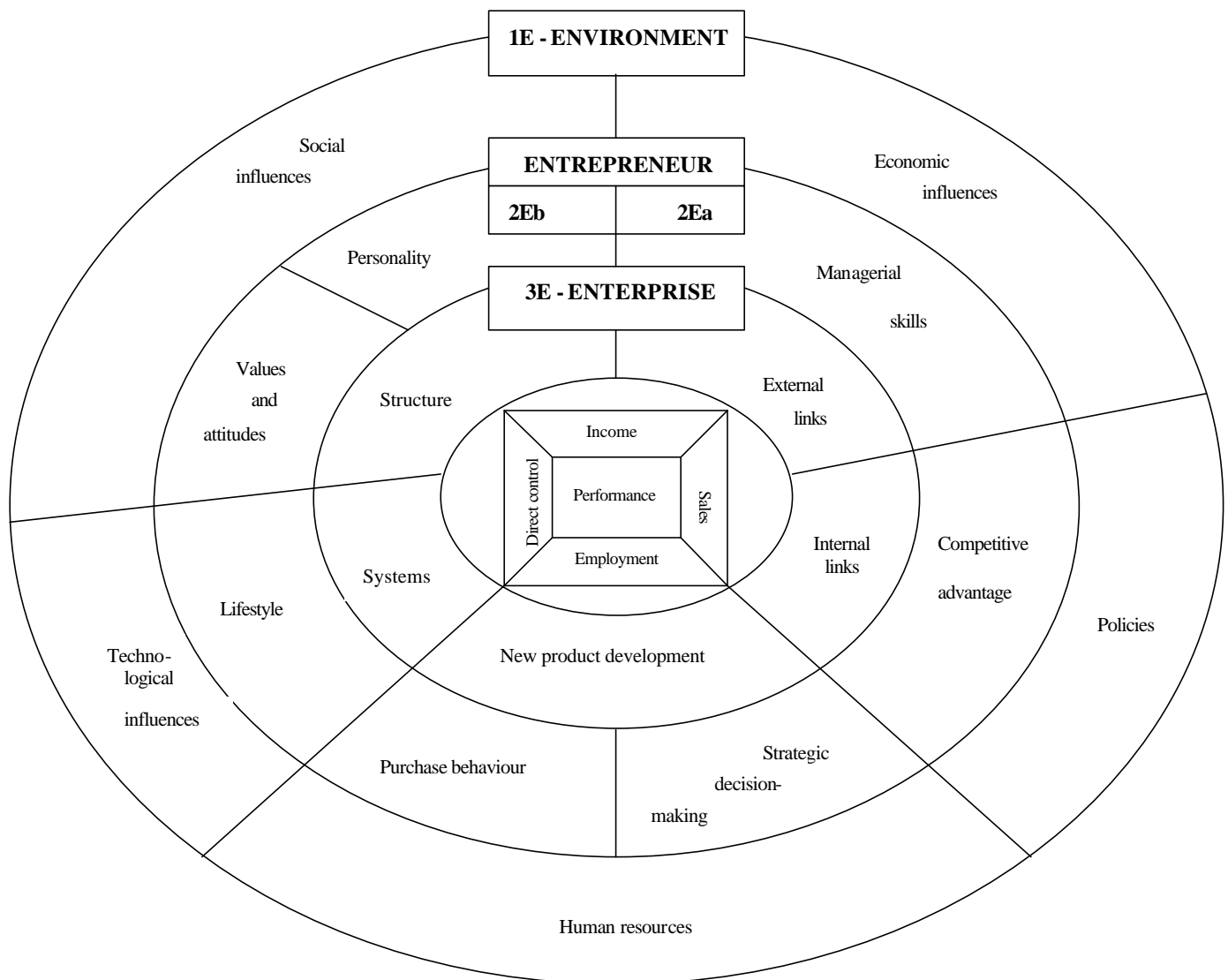
Based on: Peters & Waterman (1982), Loudon & Della Bitta (1993)

In relation to the 7Ss framework, it may be noticed that the structure, systems (internal and external links) and style (involvement of top management) are studied at the *3E* level. The skills are analysed at two levels, i.e. managerial skills of the entrepreneur (*2Ea*) and technical skills of staff (*1E*). Both shared values and strategies relate to the *2Ea* level, as the entrepreneur is a driving force of all changes inside his/her firm having a decisive impact on its formation. Level *2Eb* cannot be explained by the 7Ss framework, since personality, values, lifestyle and purchase behaviour were not originally measured within this approach. These variables are added to the 3EN-model to find relation between entrepreneurs' personality traits and performance of their firms.

All items from *1E* and *3E* levels are constructed according to two studies indicating general situation of Polish SMEs (Soloducho, 2000; Mizgajska, 2000). These external variables are also suggested by other authors (e.g. Bradley, 1991; Herbig, 1994; Herbig & Day, 1994; McCarthy & Pereault, 1993). However, the scales developed for 1E and 3E levels do not represent any specific study.

Variables of *2Ea* level represent managerial skills and perception of competitive advantage as well as strategic decision-making. All of these variables come from the study of STRATOS Group (Bamberger *et al.,* 1990). Variables of *2Eb* level analyse personality (e.g. Januszewska *et al.,* 2000), values and attitudes (Bamberger *et al.,* 1990; Bass, 1990), lifestyle and purchase behaviour (Piirto, 1992) of the entrepreneur.

Donckels and Mok (1990) suggested items measuring performance, as well as those included in a Data Matrix.

9.4   Methodology

9.4.1   Target sample and the survey

The target sample was a group of SMEs' owners from the confectionery sector in Kraków region, in Poland. In this region high competition is observed due to a great concentration of such firms. Initially, a pilot test was conducted to check the validity of the questionnaire that was used as the guide during face-to-face

interviews. Interviews were finally made with a total of 40 owners between November and December 2000. The ad random sample is not large, but still reliable enough to show the present situation of the firms, as well as the entrepreneur's strategies and perception of barriers to development or innovation.

9.4.2   The questionnaire

A questionnaire was based on the 3EN-model. The three levels of variables studied were: the environment (*1E*), the entrepreneur (*2Ea & 2Eb*), and the enterprise (*3E*).

The *first* level (*1E*) of the 3EN-model consists of environmental barriers, which were studied through five elements: economy-influences, policies, human resources, technological-influences, and social-influences (Annex 9.1). *Economy-influences (Eco)* reflect financial barriers to setting up the firms, perception of the current financial capability or participation of foreign investors. *Policies (Pol)* indicate legal barriers in inadequate environmental or employment policies. Lack of the *human resources (Hur)* may also create the barrier to business performance. *Technological-influences (Tec)* are analysed through the current state of an equipment or application of modern technologies in confectionery production. *Social-influences (Soc)* focus on the cultural connection of the entrepreneurs with the local environment.

The *second* level relates to the entrepreneur who is considered to have a decisive impact on formation of his/her enterprise's image or the organisational style (Carson *et al.,* 1995). This level splits into two sub-levels. The sub-level *2Ea* explains how previous experience helps the entrepreneur in running the firm (Annex 9.2). There are three elements to study: *managerial skills (Mas),* perception of the *competitive advantage (Cad)* and *strategic-decision making (Sdm).* The sub-level *2Eb* consists of four individualistic entrepreneur's characteristics: *personality (Per)*, *values and attitudes (Vat)*, *lifestyle (Lif)*, and *purchase behaviour (Pub)* (Annex 9.3).

The *third* level (*3E*) of the 3EN-model indicates how the enterprise is organised and works in the environment. The following five elements are studied: external links, internal links, new product orientation, systems and structure (Annex 9.4). *External links (Exl)* point to the barriers in cooperation with scientific institutions, suppliers or other firms, participation in the confectionery fairs, etc. *Internal links*

(Inl) reflect the flow of information inside the firm. The scales measuring a *new product orientation (Npd)* are especially important as they explain the sources of new product ideas, shared value and the basis of the system for product development. Next, the *structure (Str)* element shows the basic organisation structure inside the firm as well as the major role of the entrepreneur. Finally, the items reflecting *systems (Sys)* show the communication and control style.

Performance was analysed through four questions related to the increase of income, sales, number of employees during the last three years, and whether a manager/owner controls the firm's performance himself/herself. The last element is regarded as the measurement parameter and a direct motivational factor (Mintzberg, 1983). Additional information about enterprise and the entrepreneur were included in the Data Matrix at the beginning of the questionnaire. Enterprise-related variables were included as follows: enterprise type, production mode, assortment, main customers, age of firm, number of employees, state of ownership, production amount. The entrepreneur variables were: age, gender, education, business experience, and the question 'Who will take over your firm after you retire?'

Four types of *scales* were applied in the questionnaire. The first scale with edges 'strongly disagree' (1) and 'strongly agree' (5) was used for a majority of items (Eco, Pol, Hur, Tec, Soc, Mas, Cad, Exl, Inl, Npd, Sys, and Str) as well as questions about Performance. The frequency of the entrepreneur's behaviour (Sdm, Pub, and Lif) was measured on the second type of scale with the edges marked 'never' (1) and 'always' (5). The values and attitudes (Vat) of entrepreneurs were measured on the third type of scale with edges 'extremely unimportant' (1) and 'extremely important' (5). Finally, the personality traits of the entrepreneurs (Per) were analysed on 5-point, bi-polar scales (see Annex 9.3).

9.5   Data analysis and results

Data analysis starts from analysis of reliability of scales. The internal reliability (Crombach's alpha) is shown in all Annexes. The values are high and acceptable for a majority of scales (Malhotra, 1996). However, the values for Social-influences and Systems are lower (.29), indicating difficulties in measuring some

social and organisational barriers. Later on, data are analysed in four steps: factor, cluster, discriminant, and regression analyses. Finally, cross-tabulation points to a few significant differences between the groups of entrepreneurs.

9.5.1 *Latent perceptions of innovation potentials*

In the *first* step, the principal component analysis, with Varimax rotation, was calculated for Z-scores of the variables. Determination of the number of factors (underlying constructs) is based on Eigenvalues greater than 1. The factors loading scores indicate how these constructs are related to the measured variables. More specifically, the loadings are correlations between the factors and the variables. Nine principal components (PC) from *1E* level, eleven from *2Ea*, thirteen from *2Eb*, and eleven from *3E,* were established. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is an index for comparing the magnitudes of the observed correlation coefficients to the magnitude of the partial correlation coefficients (Norusis, 1993). The KMO is acceptable and Bartlett's Test of Sphericity (BTS) is significant. Also the cumulative percentage of variance explained by a number of factors is satisfactorily high (Annexes).

The nine factors extracted from *1E* relate to the perception of economic, technological, and social potentials to innovate and develop the firm. Also opinion about current policies for the setting up of business, environment and employment was studied. Examples of the factors are the self-perception of 'Economic Stability', 'Humanistic & Generous', 'Resource Restricted & Influential' or 'Involvement in Culture'.

The eleven factors established from *2Ea* show dimensions such as 'Creativity & Quality Perception', 'Management Quality' or 'New Partners & Education'. A special factor is called 'New Orientation' and includes the entrepreneurs' new recruitment methods, trials in delivery of confectionery products through the Internet, and the use of computers on a day to day basis. It is considered as the most advanced approach among many firms, which do not have skills in Information Technology. Next, thirteen factors calculated from *2Eb* show the relation between the entrepreneurs' purchase behaviour, lifestyle, values, attitudes, and personality. Examples of the factors are 'Broad Interests', Not Dynamic & Aesthetic' or 'Intuition'.

Finally, eleven factors from *3E* show the connection between the way the firm is organised and indicate how the entrepreneurs are involved in new product development. Some factors such as 'Cooperation & Shared Values', 'Teamwork' or 'NPD Organisational Structure' indicate the positive structure for further development of the firm.

9.5.2 Groups of entrepreneurs

Second, a cluster analysis was computed to identify the entrepreneurs with similar characteristics. Ward's hierarchical procedure, which involves calculation of squared Euclidean distance, was used. The distances, at which clusters were combined, were used to determine the final number of clusters. This procedure led to a three-cluster solution with 25 people in the first cluster, 10 persons in the second and 5 in the third cluster.

9.5.3 Characteristics of the groups of entrepreneurs

Third, the discriminant analysis with cross-validation procedure (leave-one-out classification) was applied to characterise the groups of entrepreneurs. The classification result is not high (40%), which is a consequence of the low number of cases in two groups. However, Wilk's Lambda is very significant (p<0.000) and indicates the rejection of null hypothesis about the groups having the same means. Therefore, it is assumed that classification of cases into groups is correct. Seven principal components from the entrepreneur (*2Ea*) level were excluded from further analysis.

The total mean discriminant score (D) indicates the hypothetical impact of three levels of variables in the 3EN-model on performance and innovation inside the firm (Table 9.1). In general, the Group One (D=-19) is characterised by negative potential to innovate, while Groups Two (D=39) and Three (D=16) show positive potentials. More specifically, Group One indicates positive influence of the environment and the entrepreneur (*2Eb*) on performance of the firm. The same group also shows the negative influence of the enterprise and other characteristics of the entrepreneur (*2Ea*). Groups Two and Three are very similar. Both of them indicate the positive influence of the entrepreneur's (*2Ea*) and the enterprise, as well as a negative influence of the environment and the entrepreneur (*2Eb*). The magnitude of responses from Group Three is lower than from Group Two.

Table 9.1   Classification Function Coefficients from Discriminant Analysis

FACTOR	LABEL	FACTOR EXPLANATION	GROUPS		
			1	**2**	**3**
		ENVIRONMENT	**Mean 116**	**-256**	**-69**
1E-1	ECOST	economic stability	148	-336	-71
1E-2	HUMGE	humanistic & generous	290	-560	-327
1E-3	RESIN	resource restricted & influential	51	-75	-105
1E-4	OPTNF	optimism & not foreign-oriented	-27	46	46
1E-5	IMPOM	imported machinery	409	-902	-241
1E-6	TECHIN	technological information	396	-834	-313
1E-7	HIGHS	higher salary	-162	312	183
1E-8	INVCU	involvement in culture	686	-1528	-371
1E-9	SELFS	self-support	-744	1572	578
		ENTREPRENEUR			
		Skills, perceptions & strategies	**-323**	**684**	**247**
2Ea-1	CREQU	creativity & quality perception	317	-739	-108
2Ea-2	MGMTQ	management quality	-518	1130	329
2Ea-3	NBRAT	new brands & technology	-338	713	263
2Ea-7	NPAED	new partners	-755	1634	505
		ENTREPRENEUR			
		Personality & values	**114**	**-259**	**-52**
2Eb-1	EXPAC	important to experiment	928	-2054	-531
2Eb-2	CREAN	creative & nature-oriented	-107	220	95
2Eb-3	BROAD	broad interests	-1	4	-2
2Eb-4	DYNAE	not dynamic & aesthetic	580	-1279	-341
2Eb-5	COGST	cognitive style	627	-1368	-400
2Eb-6	HOMAU	home activities & authenticity	289	-651	-145
2Eb-7	TRADC	tradition & success as confectioner	-331	692	270
2Eb-8	REALE	real experimenter	-461	1008	292
2Eb-9	GOOUT	go-out type	532	-1168	-323
2Eb-10	SECOE	self-confident & not ecologist	78	-142	-104
2Eb-11	POLIT	politics-oriented	-582	1241	430
2Eb-12	TRUST	trust & easy relations	356	-763	-253
2Eb-13	INTUI	intuition	-427	897	341
		ENTERPRISE	**-175**	**397**	**83**
3E-1	HCOSV	hypothetical cooperation & values	172	-336	-189
3E-2	TEAMS	teamwork	327	-721	-192
3E-3	NPDOR	npd organisational structure	526	-1122	-387
3E-4	RCOCO	real cooperation & consumer analysis	-558	1202	388
3E-5	PROSU	job procedures & new suppliers	-394	885	201
3E-6	FREMA	free time & MOW* does marketing	-7	74	-112
3E-7	PROTF	prototype & functions	75	-158	-60
3E-8	PLARD	planning & MOW does R&D	-913	2022	520
3E-9	FARTB	fairs & tech-broadcasting	-1271	2741	874
3E-10	RCOSC	real cooperation with science	241	-498	-210
3E-11	SCOIN	socialising & info-exchange	-125	274	81
D**		hypothetical impact of 3E's	**Total**		
		on a firm's performance	**mean -19**	**39**	**16**
N		number of cases	25	10	5

Note: Fisher's linear discriminant functions
100% of original (40% of cross-validated) grouped cases correctly predicted
MOW - manager/owner*
*D** - Discriminant Score*

9.5.4 The impact of environment, entrepreneur and enterprise on performance

Fourth, regression coefficients between principal components for each level of research variables and performance measures were calculated (Table 9.2).

Table 9.2 Coefficients (ß) Between Components of the 3EN-Model and Performance for All Firms

COMPONENTS OF THE 3EN-MODEL	PERFORMANCE			
	Income growth	Sales growth	Employment growth	Direct control of MOW*
ENVIRONMENT 1E-1 – 1E-9	ns	ECOST= .435 INVCU= .311 RESIN= -.295 $R^2 = .432$ *ANOVA p=.027*	ns	ns
ENTREPRENEUR Skills, perceptions & strategies 2Ea-1 – 2Ea-11	ns	ns	NBRAT= .386 MGMTQ= .306 NPACK= .286 PERDE= .261 $R^2 = .517$ *ANOVA p=.016*	NMARP= -.547 NPAED= .440 $R^2 = .640$ *ANOVA p=.001*
ENTREPRENEUR Behaviour, lifestyle, values, attitudes & personality 2Eb-1 – 2Eb-13	ns	ns	ns	ns
ENTERPRISE 3E-1 – 3E-11	NPDOR= .397 FARTB= .392 RCOSC= .322 $R^2 = .493$ *ANOVA p=.026*	ns	PROSU= .369 RCOCO= .367 RCOSC= .302 $R^2 = .464$ *ANOVA p=.045*	ns
NEW PRODUCT DEVELOPMENT Npd1 – Npd10	ns	Npd10= .356 Npd2= .355 $R^2 = .269$ *ANOVA p=.003*	ns	ns

Note: Linear regression analysis
MOW - manager/owner*

The sample size did not allow the investigation of differences between groups of entrepreneurs, therefore, the regression analysis was calculated for all respondents. Four directions of performance were measured and all of them relate to the last three years. These are the growth of income, sales and employment as well as a direct control of the manager/owner.

The growth of *income* was predicted from the way the enterprise is organised (Npd) and linked to external sources of information (FARTB, RCOSC).

The growth of *sales* was related to the perception of the environment (ECST, RESIN, and INVCU). Additionally, the organisational structure for new product development at the enterprise level (Npd10, Npd2) has influenced the sales growth.

The growth of *employment* was influenced by the managerial skills, perceptions and strategies of the entrepreneur (MGMTQ, NBRAT, PERDE, NPACK). Employment was also influenced by the enterprise (RCOCO, PROSU, RCOSC).

Direct control of manager/owner was related to the skills of the entrepreneur (NMARP, NPAED). Interestingly, purchase behaviour, lifestyle, values and attitudes and personality of entrepreneurs were not directly influencing the performance of the firm. It is concluded that both the managerial skills of the entrepreneur, and the way s/he manages the enterprise, are the most important elements influencing business performance.

9.5.5   *Profiling of groups and recommendations to improve performance*

The major characteristics of the entrepreneurs in three groups are described in relation to discriminant (Table 9.1) and regression (Table 9.2) analyses. The First Group was labelled the *'Conservative Owners'* (COW) due to the following factors: involvement in culture (INVCU=686), cognitive style of life (COGST=627), low dynamics and attention to aesthetics (DYNAE=580), preference of home activities and attention to authenticity (HOMAU=289). Despite the COW entrepreneur is willing to cooperate and share values (RCOSC=241, HCOSV=172), in reality s/he does not do it (RCOCO=-558) and is afraid of new links with suppliers of raw materials (PROSU=-394). It seems that s/he only cooperates with science (RCOSC=241). The COW group does not often go to confectionery fairs and does not develop new products due to technological broadcasting (FARTB=-1271). Planning is rare (PLARD=-930) but the structure for new product development is positive (NPDOR=526) in his/her firm. Family relations are strong and expressed through trust and easy relations (TRUST=356) as well as teamwork (TEAMS=327). The pessimism of the COW group is shown by a negative value on optimism to set-up the firm (OPTNF=-27), lack of faith in continuation of Polish confectionery tradition (TRADC=-331), lack of self-support

(SELFS=-744), and having an imported (and old) equipment (IMPOM=409).

The Second Group was called the *'Radical Entrepreneur'* (REN) since his/her firm either started from scratch or rapidly acquired new technology (Nyström, 1990). The REN entrepreneur is a real experimenter (REALE=1008) who knows the value of management quality (MGMTQ=1130), the importance of new brands and technology (NBRAT=713), as well as the significance of participation in fairs and technical broadcasting (FARTB=2741). S/he focuses on real cooperation with other firms (RCOCO=1202) but not scientific institutions (RCOSC=-498). S/he is also constantly searching for new suppliers (PROSU=885), and admits a horizontal cooperation with new partners (NPAED=1634). The organisational style of the REN group is positively related to planning and strong involvement in the R&D activities (PLARD=2022), but the structure for NPD activities is highly negative (NPDOR=-1122). S/he recognises the value of marketing (FREMA=74), a fact which makes him/her specific among other entrepreneurs. Due to high risk-taking, the REN does not feel financially secure (ECOST=-336) but believes in his/her self-support (SELFS=1572). S/he thinks that his efforts should be reflected in a higher salary (HIGHS=312). Finally, the REN is interested in politics (POLIT=1241) and uses intuition to run the enterprise (INTUI=897).

The label of Third Group reflects the *'Moderate Entrepreneur'* (MEN). Representatives of this group have almost the same characteristics as the REN entrepreneurs except for the following two facts. First, the MEN perceives himself/herself as less money restricted than the REN, but also less influential (RESIN=-105). Second, the MEN entrepreneur does not consider marketing as a tool in product development and does not understand the role of sharing company values between employees (FREMA=-112).

A cross-tabulation was done to determine significant differences between the three groups of entrepreneurs and other variables related to the performance, the enterprise, and the entrepreneur that were included in the Data Matrix of the questionnaire (Table 9.3). It is noticed that the COW group runs a typical Polish confectionery firm (called "Cukiernia") where a wide range of cakes is produced in relatively small quantities, and sold in own shop. S/he did not wish to employ more people during last three years and is pessimistic about the future of his/her enterprise.

Table 9.3   Cross-Tabulation Analysis in the Groups of Entrepreneurs

In %	GROUPS			VALIDATION		
	1 COW	2 REN	3 MEN	X^2	df	p
Significant growth in employment during last three years				*15.87*	*8*	*.044*
Strongly agree	4	-	40			
Agree	8	30	-			
Neither/not	56	50	40			
Disagree	8	20	-			
Strongly disagree	24	-	20			
Assortment				*9.73*	*4*	*.045*
Small cakes	-	20	-			
Very small cookies	-	10	-			
All cakes (big & small)	100	70	100			
Enterprise type				*6.0*	*2*	*.050*
Confectionery	88	80	40			
Confectionery-bakery	12	20	60			
Succession after your retirement				*5.25*	*2*	*.072*
Nobody/ don't know	52	30	-			
Children/ relatives	48	70	100			
Production amount (tonnes/month)				*10.86*	*6*	*.093*
Less than 1	36	10	-			
Between 1-5	44	60	80			
Between 5-10	20	10	-			
More than 10	-	20	20			
Main customers				*7.87*	*4*	*.096*
In own shops	68	20	60			
In other shops	28	60	20			
Wholesales	4	20	20			

The REN and MEN entrepreneurs show many similarities and are very different from the COW group. Both employ more people and are focused on the production of very small cookies that involve less craft skills but more machinery and organisational control. They also produce some bakery products (buns, bread, etc.). The amount of production is high and sold to many other shops, including wholesalers (supermarkets). The REN and MEN optimistically indicate the succession of their firms by relatives. The REN entrepreneurs are the most dynamic group in strategic-decision making and taking risk in new initiatives.

Finally, based on the overall results of this study, some recommendations to improve the performance of each type of SME, are formulated (Table 9.4). Since it was noticed that business-related behaviour of the Conservative Owners is definitely different from the REN and MEN entrepreneurs' approach, the recommendations vary. The COW group needs to improve his/her managerial skills, and develop cooperation with other partners. S/he also needs some financial support even though s/he states the current situation reflects 'economic stability'. This support and new managerial skills would help to take new risk in changing the strategic thinking and development of the firm.

Table 9.4   Recommendations to Increase Performance

GROUPS		
CONSERVATIVE OWNERS (COW)	**RADICAL ENTREPRENEURS (REN)**	**MODERATE ENTREPRENEURS (MEN)**
TRAINING IN MANAGERIAL SKILLS	UNDERLINE THE VALUE OF NETWORKING	VERY SIMILAR TO RADICAL ENTREPRENEURS
UNDERLINE THE VALUE OF REAL COOPERATION	INVOLE THEM IN CULTURE	ADDITIONALLY STRESS IMPORTANCE
UNDERLINE IMPORTANCE OF OWN BRANDS, VOICE OF CONSUMER, TECHNOLOGICAL BROADCASTING	INFLUENCE THEIR ACHIEVEMENT AND AESTHETIC VALUES TRAINING IN DELEGATION SKILLS SO THEY CAN TRUST	OF MARKETING & SHARED VALUES
INFLUENCE THEIR PESSIMISTIC VIEW OF FUTURE	STRESS THE IMPORTANCE OF NPD	
FINANCIAL SUPPORT	STRUCTURE & A TOTAL CONCEPT	

The REN and MEN entrepreneurs are distracted from the surrounding culture, and lack of trust and delegation skills. Surprisingly, they indicated experimentation as not important, but they seem to be ambitious in plans and seek changes in their business. REN entrepreneurs, in particular, are either satisfied with the current state of their firms or unable to take further risks to continue development.

Moreover, they cooperate with other confectionery firms but do not like the idea of networking or 'keeping together'. Unfortunately, it seems that these real entrepreneurs are afraid of competition and it will be difficult to change their values.

9.6   Discussion

The firms' *measure of success* can be indicated through growth of sales and profit. Increased employment also reflects prosperity for a company and has a specific value for the overall wealth of society. It is believed that competitive sales growth is related to internal product development and is the outcome of a mix of strategic and operational factors (Johne & Snelson, 1990). The current study presents the opportunity to confirm this statement, as an attempt to describe the strategies of the confectionery firms, operating in a turbulent transition economy in Poland. The major observation is that the two main groups of entrepreneurs can be described as low (COW) and high (REN) achievers.

Johne and Snelson (1990) explain that *the high achievers* 'have an explicit product development strategy, pursue a proactive competitive strategy, and explore a wide range of product development options'. They also 'have formal product planning procedures, distinguish themselves by using simultaneous loose-tight methods, and use a business-centred organisation structure rather than a functionally based one'. Additionally, in the high achiever businesses top management directly controls new ideas and monitors the performance of the firm.

These findings can be confirmed in the current study. On the one hand, the *COW entrepreneurs* possess only a few characteristics of the potential achievers-innovators such as personal and trustful contacts with the society (RCOSC=241, TRUST=356), and positive attitude to the networking concept (HCOSV=172). According to Piirto (1992), they show social altruism (HUMGE=290), home-style activities with attention to authenticity (HOMAU=289), and attention to aesthetics (DYNAE=580). They are also oriented towards inner-growth (EXPAC=924) and show cognitive style-life (COGST=627).

On the other hand, the *REN entrepreneurs* are recognised as typical innovators

who are less integrated into social groups (INVCU=-1528) and feel more free to break group norms by adopting new products very early in their life cycle (cf. Mowen, 1993). They also show all the traits of high achievers, even they indicated low importance of seeking changes in business, making ambitious plans, etc. (EXPAC=-2054). They have clear and open strategies (NBRAT=713, NPAED=1634), are very dynamic and first on the market with all changes (RCOCO=1202), and produce a wide range of confectionery. The REN people indicate formal planning structures (PLARD=2022), use some form of loose-tight methods (TEAMS=-721, PROSU=885), and highlight the unstructured nature of their firms (PROTF=-158). Moreover, it was found that direct control by managers/owners is related to their managerial skills, perceptions and strategies (Table 9.2). As the skills of entrepreneurs appeared to be positively related to the firms' performance of both REN and MEN entrepreneurs (MGMTQ=1130, PLARD=2022, FREMA=74), it can be concluded that these two groups are involved in direct control of their firms.

Such management commitment is one of the features of *innovative strategies* (cf. Trail & Grunert, 1997) and innovation has the potential to occur in the REN's firm. However, there are two contradictory aspects that need attention. A positive aspect relates to the fact that the REN entrepreneurs show commitment into both R&D and Marketing, and the interaction of these two orientations is expected to be a major determinant of innovation and innovativeness (Grunert *et al.,* 1995; Trail & Grunert, 1997). A negative aspect is reflected in the REN entrepreneurs' behaviour explained by the 'incorporation concept' (McDonagh & Commins, 1999a). This concept means the future expansion of the producers' markets, engagement with the large group chains, entering the global markets, and mass-market production. In the worst scenario, the erosion of craft skills can be predicted and the culinary heritage neglected.

It is proposed that focus on the integrated development of both *strategies for the R&D and marketing* can contribute to a more favourite innovation culture at the level of any SME. To improve the consumer-approach, the SMEs should learn about customer needs and look for special *niche markets,* in which they can best fit to be in an advantageous position (Broom & Longenecker, 1979). To enhance *product quality and variety*, they can diversify their products into chocolate-based products and pralines that are well known to the West European consumer. At the

moment, very few SMEs in Poland produce similar chocolate-based products. The suggestion is that they should prepare a radical change in their assortment if they wish to impress consumers, who are in daily contact with local confectionery products. They also have to focus on quality and service-oriented policy, which can have a multiplier effect on investment, employment and value added for Polish SMEs.

Additionally, a change in the firm's internal organisational culture and establishment of *networks* for creative collaboration is necessary. Especially the last concept presents a great challenge for Polish manufacturers because even in West Europe, 'the network is still an innovation in terms of organisation and in terms of marketing channel' (Nicholls & Sargent, 1996). The pioneering spirit is evident between Poles, but they have still to realise the comparative advantage of being the first and the best and actively design the future of their firms. The local and regional networks are believed to strengthen the innovative capacity of the small firms, and the importance of knowledge infrastructure and technology diffusion is a key element of regional innovation systems (Keeble & Wilkinson, 1999). The networks, like other innovation systems, may be partially supported by Structural Funds of the EU.

Poland is recipient of this *structural intervention funding*, but little evidence was found of the local or regional innovation trajectories in Polish firms (Cooke, 1998). The constraints pointed to the lower frequency of learning from consultants, industry associations, technology transfer centres or universities. The funding and training environments operate less than optimally, suggesting the need for policy attention. Cooke (1998) suggested that 'innovation should be focused on three pillars: enhancing quality, enhancing skills, and minimising cost, thus price in the market'. Moreover, the same study showed that 'SMEs may benefit from being encouraged to form self-managing networks, through which they can engage in informal know-how trading, benchmarking, and identification of possible innovation projects'. It was also suggested that SMEs, working in networks and being supported by innovation organisations, should be the main recipients of such funding from the EU. The main reason behind this is that high networking-capabilities of firms create competitive force (Fanfani & Lagnevik, 1995).

The successful Japanese managers/owners believe that networking and competition brings a lot of *joy* to the innovator because his/her work includes three elements. These elements are as follows: creativity (the joy of thinking), physical activity (the joy of working with sweat on the forehead) and sociality (the joy of sharing pleasure and pain with colleagues). The entrepreneurial firm possesses all the possible dimensions of joy. First, creativity may prosper because there are few job descriptions and specifications, or the centralising control. Second, activity may be increased since there is usually no overstaffing. Third, sociality can be cultivated because of easy communication channels and flat organisational structure (Ho, 1999).

It is also suggested that entrepreneurs should develop the concept of *emotional intelligence (EQ)* that is achieved through authentic trust, ability to perform under pressure, and a risk-taking attitude (Goleman, 1995). The leaders of successful companies show integrity, trust, empathy, purpose, and the ability to be role models. Creative and dynamic leaders bring the EQ concepts of perceiving, learning, creating, trust, initiative, and conscience to their employees. They trust their intuition to find solutions outside the traditional schemes as 'solving innovative problems requires divergent thinking that breaks away from old routines and standards' (Mintzberg, 1993). They have skills to lead with emotional influence vs. control, logic, and analysis. High EQ leaders perceive problems as challenges, and their work as series of opportunities to create solutions, not just an endless succession of problems that need to be fixed. Entrepreneurship alone is not the key to innovative processes. There is a growing body of evidence that the leadership dimension is such a key as it ensures continuing success of the enterprise.

In the current and anonymous study, *true leaders* in the confectionery sector in Kraków region, were not found. Nevertheless, a few creative ideas to improve the performance of SMEs were proposed during the interviews. One of them was the proposal to set-up an award system (incentives) for those confectioners who would take part in the collaborative network. A policy of high safety and quality of confectionery products would be adopted. The collaborators would be involved in preparation of training courses for their employees and managers. Delegation skills would be learned and mutual trust gradually built up. Contact with experts preparing the software for consumer segmentation, electronic data exchange, and

production management, would be established (Chaston, 2000). The network would organise internal fairs and small competitions, sponsor special cultural events while looking for investors and business angels. The logo of this network would appear in a promotional package of the participating SMEs making a direct link with loyal consumers. Also consumer-needs directed mini-projects would be realised since it is well known that most innovations come from product users, not manufacturers or salesmen (Urban & Hauser, 1993).

The future leaders of such organisation would be conservative in pursuing the sector's goals and radical in finding them outside the current operational space. As true leaders, they would take pleasure in the development of other people, possess high ethics and status quo in the society (Bass, 1990). They would be real facilitators of risk-taking and experiential learning at sector level that would lead to innovations in the products, processes, services and enterprises themselves.

Finally, they would advance the consumer-sensitive approach that can help to develop cultural sensitivity and ability to fulfil needs of EU consumers. It was already recognised that for confectionery firms, the most difficult aspect of dealing with foreign markets was that of understanding consumer tastes (Loseby, 1996). Also 'Polish consumers are becoming more sophisticated because of global communications and increased foreign travel with resulting exposure to better products and services' (Winer, 2000). Two examples of recent studies explaining differences in the consumers' attitude towards chocolate (Januszewska *et al.,* 2000) and tastes preferences across Belgium and Poland (Viaene & Januszewska, 1997; Januszewska & Viaene, 2001d), can be mentioned.

The possible *limitation* of the 3EN-model is the fact that seven factors, from the *2Ea* level, were excluded from the discriminant analysis (see Table 9.1). This confirms the observation that it is very difficult to ask entrepreneurs about their perceptions of competitive advantage and current strategies. The validity of the 3EN-model should also be examined in another cultural setting. Finally, it is believed that the 3EN-model is a *tool* to understand relations between the firms' culture, and barriers or potentials to innovate at the SME level.

9.7 Conclusions

Innovation potential is described by reference to three groups of entrepreneurs that were found among the Polish confectionery SMEs. First are the *Conservative Owners,* who showed strong connection with the local environment. They admitted a lack of cooperative practices but also expressed the willingness to do so in the future. The Conservative Owners lack the managerial skills and financial resources to organise their enterprises in such a way that innovation would have a favourable opportunity to occur. Their strongest innovation potential is their closeness to the environment, and their personality.

Second are the *Radical Entrepreneurs,* who have many qualities of 'high achievers'. They are collaborating with few partners but generally do not understand the ideas of competitiveness and networking. The Radical Entrepreneurs create the most advantageous conditions for innovation practices. However, these conditions may lead to removal of craft skills, especially when the disconnection of entrepreneurs from their surrounding culture, continues. The third group is called the *Moderate Entrepreneurs*, since they act in a similar but moderate style like the second group. Finally, they miss opportunities for innovation through market segmentation.

9.8 Acknowledgements

Annex 9.1   Environment Variables in 3EN-Model and Factor Loadings

VARIABLES	LABEL	EXPLANATION
1E – Eco	Eco1	-we had *no financial problems* in setting up a firm
Economy	Eco2	-we do not have problems in *accessing credits*, loans etc.
influences	Eco3	-our firm shows *financial capability*
a =.58	Eco4	-*foreign investors* help our firm
1E – Pol	Pol1	-*governmental institutions* help in development of o ur firm (...last 5 years)
Policies	Pol2	-*'hire & fire' policies* are too strict for employers
a = .39	Pol3	-*environmental policies* don't restrict development of confectionery firms
	Pol4	-general *politics* related to *setting up* a confectionery firm are profitable
1E – Hur	Hur1	-managers should *earn significantly more* than employees
Human	Hur2	-there are plenty of well *educated workers* in the confectionery sector
resources	Hur3	-our employees are *willing* to participate in additional training courses
a = .39	Hur4	-it is easy to *motivate* our employees to more effective work
1E – Tec	Tec1	-we have easy access to *information* about new technologies
Technological	Tec2	-we don't use *achievements* of new technologies, materials etc.
influences	Tec3	-we have more than 50% of *imported* machinery
a =.40	Tec4	-our machinery is constantly *adapted/changed*
1E – Soc	Soc1	-*knowledge about the local environment* helps in business performance
Social	Soc2	-firms, such as ours, should help cultural institutions by *financial support*
influences	Soc3	-firms, such as ours, should *be involved in cultural events*
a =.29	Soc4	-our managers/owners *participate in local/national institutions*

77 % of variance

1E-1 (ECOST)	.777	Eco3	**1E-6 (TECHIN)**	.906	Tec1
ECONOMIC	.739	Eco2	**TECHNOLOGICAL**		
STABILITY	.698	Tec2	**INFORMATION**		
1E-2 (HUMGE)	.799	Soc1	**1E-7 (HIGHS)**	.920	Hur1
HUMANISTIC &	.771	Hur3	**HIGHER SALARY**		
GENEROUS	.532	Hur2			
	.529	Soc2			
1E-3 (RESIN)	-.761	Pol2	**1E-8 (INVCU)**	.918	Soc3
RESOURCE RESTRICTED	-.600	Tec4	**INVOLVEMENT IN**		
& INFLUENTIAL	.555	Soc4	**CULTURE**		
	.486	Hur4			
1E-4 (OPTNF)	.781	Pol3	**1E-9 (SELFS)**	.863	Eco1
OPTIMISM &	.648	Eco4	**SELF-SUPPORT**	-.464	Pol1
NOT FOREIGN-ORIENTED	-.598	Pol4			
1E-5 (IMPOM)	.897	Tec3			
IMPORTED MACHINERY					

Note: Principal component analysis, Varimax rotation
1E-1 – 1E-9: KMO=.427, TS p<.039

Annex 9.2 Entrepreneur (a) Variables in 3EN-Model and Factor Loadings

VARIABLES	LABEL	EXPLANATION
2Ea – Mas **Managerial** **skills** a =.62	Mas1	-I have high *skills to manage/organise* my firm
	Mas2	-I have high *skills to execute* tasks of my employees
	Mas3	-I can find new and *interesting information* for my business
	Mas4	-I use a *computer* for my business management on a day to day basis
	Mas5	-I can find information through the *Internet*
	Mas6	-I have a *certificate* of additional education in business management
	Mas7	-I tolerate *ambiguity* during difficult moments in my firm
	Mas8	-I often provide *additional training* for my employees

I see our competitive advantage through...

VARIABLES	LABEL	EXPLANATION
2Ea – Cad **Competitive** **advantage** a =.60	Cad1	-better *prices*
	Cad2	-lower *production costs*
	Cad3	-*variety* in products' assortment
	Cad4	-better *quality* of our products
	Cad5	-quick and reliable *delivery*
	Cad6	-good *local image* of our firm
	Cad7	-*personal contacts*
	Cad8	-*skills of our workers*
	Cad9	-special *distribution channels*
	Cad10	-*creativity* & imagination
	Cad11	-good *image of our brands*
	Cad12	-*flexibility* of our firm to consumer's requirements
	Cad13	-higher *quality of management*
	Cad14	-*financial capability*

In our firm, we focus on...

VARIABLES	LABEL	EXPLANATION		
2Ea – Sdm **Strategic** **decision** **making** a =.61	Sdm1	-new *machinery*	Sdm6	-new products *to eat differently*
	Sdm2	-new *products*	Sdm7	-new *recruitment methods*
	Sdm3	-new *markets/clients*	Sdm8	-new *ways of delivery* (Internet)
	Sdm4	-new *packages*	Sdm9	-new *consumers out of a country*
	Sdm5	-new *product brands*	Sdm10	-new *firms/partners*

78 % of variance

2Ea-1 (CREQU) **CREATIVITY &** **QUALITY PERCEPTION**	.750	Cad10	**2Ea-6 (N2001)** **NEW ORIENTATION**	.875	Sdm7
	.739	Cad8		.813	Sdm8
	.712	Cad6		.520	Mas5
	.587	Cad4		.419	Mas4
2Ea-2 (MGMTQ) **MANAGEMENT** **QUALITY**	.832	Mas1	**2Ea-7 (NPAED)** **NEW PARTNERS**	.733	Mas6
	.748	Cad14		-.693	Cad12
	.745	Cad13		.644	Mas8
				.492	Sdm10
2Ea-3 (NBRAT) **NEW BRANDS &** **TECHNOLOGY**	.895	Cad11	**2Ea-8 (PERDE)** **PERSONAL CONTACTS &** **DELIVERY**	.834	Cad7
	.877	Sdm5		.680	Cad5
	.534	Sdm1		.523	Cad9
2Ea-4 (NMAPR) **NEW MARKETS &** **PRICE**	.782	Sdm9	**2Ea-9 (NMAPR)** **NEW MARKETS &** **PRODUCTS**	.904	Sdm3
	-.740	Cad3		.485	Sdm2
	.514	Cad1			
2Ea-5 (EXECO) **EXECUTIVE SKILLS&** **HIGH COSTS**	.818	Mas2	**2Ea-10 (NPACK) NEW** **PACKAGES**	.762	Sdm4
	-.655	Cad2			
	.586	Mas3			
			2Ea-11 (NWAYS) **NEW CONSUMPTION WAYS**	.847	Sdm7

Note: 2Ea-1 – 2Ea-11: KMO=.310, BTS p<.000

Annex 9.3   Entrepreneur (b) Variables in 3EN-Model and Factor Loadings

VARIABLES	LABEL	EXPLANATION		
2Eb – Pub		*When shopping, I pay attention to...*		
Purchase	Pub1	*-ecology*	Pub4	-a *special style* of products
behavior	Pub2	*-authenticity* (country of origin)	Pub5	*-home-made* products
a =.62	Pub3	*-aesthetics*	Pub6	*-unique/ very new* products
		In my free time, I...	Lif6	-do *hobbies*
2Eb – Lif	Lif1	-read *literature*	Lif7	-listen to *classical music*
Lifestyle	Lif2	-read the sector *magazines*	Lif8	-go to the *cinema*
a =.60	Lif3	-participate in *cultural events*	Lif9	-take interest in *art/crafts*
	Lif4	-participate in *politics*	Lif10	-cook/*do-it-yourself*
	Lif5	-watch the *educational TV*	Lif11	*-travel*
		For me to...is...		
2Eb – Vat	Vat1	-be involved in *various activities*	Vat6	-experiment - *new things*
Values and	Vat2	-have *broad interests*	Vat7	-seek *changes* in business
attitudes	Vat3	-have a natural, *healthy life*	Vat8	-be *ambitious* in plans
a =.83	Vat4	*-improve the world*	Vat9	-achieve *success* in a sector
	Vat5	-be *rebellious* in life	Vat10	-play an *active role*
			Vat11	-sustain *Polish traditions*
		I perceive myself as...		
2Eb – Per	Per1	-timid vs. *self-confident*		
Personality	Per2	-suspicious vs. *trusting*		
a =.45	Per3	-conservative vs. *experimenting*		
	Per4	-socially passive vs. *socially active*		
	Per5	-slow vs. *dynamic*		
	Per6	-not-creative vs. *creative*		
	Per7	-not-impulsive vs. *impulsive*		
	Per8	-not using intuition vs. *using intuition*		
	Per9	-working 'step by step' vs. *with many problems*		
	Per10	-difficult vs. *easy relations with employees*		
	Per11	-my life is externally controlled vs. *I control my life*		

80 % of variance

2Eb-1 (EXPAC)	.904	Vat6	**2Eb-7 (TRADC)**	.838	Vat11
IMPORTANT	.881	Vat7	**TRADITION & SUCCESS**	.644	Vat9
TO EXPERIMENT &	.810	Vat8			
ACHIEVE	.785	Vat5	**2Eb-8 (REALE)**	.834	Lif10
	.463	Per11	**REAL EXPERIMENTER**	.700	Per3
2Eb-2 (CREAN)	.828	Vat3	**2Eb-9 (GOOUT)**	.883	Lif8
CREATIVE &	.745	Per6	**GO-OUT TYPE**	.553	Lif3
NATURE-ORIENTED	.653	Vat4			
2Eb-3 (BROAD)	.914	Vat2	**2Eb-10 (SECOE)**	.755	Per4
BROAD INTERESTS	.900	Vat1	**SELF-CONFIDENT &**	.578	Per1
			NOT ECOLOGIST	-.525	Pub1
2Eb-4 (DYNAE)	-.745	Per7	**2Eb-11 (POLIT)**	.850	Lif4
NOT DYNAMIC &	-.663	Per5	**POLITICS-ORIENTED**	.517	Vat10
AESTHETIC	.612	Pub3			
	.527	Pub4			
2Eb-5 (COGST)	.828	Lif7	**2Eb-12 (TRUST)**	.867	Per10
COGNITIVE STYLE	.769	Lif9	**TRUST &**	.511	Per2
	.436	Lif11	**EASY RELATIONS**		
2Eb-6 (HOMAU)	.785	Pub5	**2Eb-13 (INTUI)**	.836	Per8
HOME ACTIVITIES &	-.634	Lif6	**INTUITION**		
AUTHENTICITY	.499	Lif2			
	.458	Lif1			
	-.434	Pub2			

Note: 2Eb-1 – 2Ea-13: KMO=.297, BTS p<.000

Annex 9.4 Enterprise Variables in 3EN-Model and Factor Loadings

VARIABLES	LABEL	EXPLANATION
3E – Exl **External links** a =.40	Exl1 Exl2 Exl3 Exl4 Exl5 Exl6	-we co-operate with *scientific institutions* -we regularly participate in *fairs and demonstrations* of confectionery -we continuously look for *new suppliers* -small firms, such as ours, should *keep together* to avoid competition -*co-operation* is important, even if a part of independence is lost -our firm *co-operates* with other firms in the same sector
3E – Inl **Internal links** a =.30	Inl1 Inl2 Inl3 Inl4	-managers should regularly *inform employees* about the firm's aims -in our firm, we have a lot of *information exchange* -our employees spend a part of their *free time together* -we organise some *social events* for our employees
3E – Npd **New product** **orientation** a =.74	Npd1 Npd2 Npd3 Npd4 Npd5 Npd6 Npd7 Npd8 Npd9 Npd10	-new ideas are born in a specially delegated *teams* -we prepare a *plan* for a new product development (npd) -we always have a *prototype stage* for a new product -we have an *internal system* for monitoring of npd activities -we have full *documentation* for npd activities -the *strategy for npd* is regularly *explained* to our employees -our employees are encouraged to *come up with new ideas* -new products are created as result of *consumer analysis* -new products are created as result of *brainstorming sessions* -new products are created as result of *technology broadcasting*
3E – Sys **Systems** a =.29	Sys1 Sys2 Sys3 Sys4	-there are written *procedures* for every employee in our firm -our continuous *planning* helps in the firms' performance -managers/owners *communicate* with employees *on daily basis* -*strong control* helps to keep order in our firm
3E – Str **Structure** a =.39	Str1 Str2 Str3 Str4	-we have a *distinct division* of functions in our firm -when necessary, our employees perform *different tasks* -main *manager/owner* is highly involved in *marketing* activities -main *manager/owner* is highly involved in *R&D* activities

82 % of variance

3E-1 (HCOSV) **HYPOTHETICAL** **COOPERATION &** **SHARED VALUES**	.903 .902 .643	Exl4 Exl5 Inl1	**3E-7 (PROTF)** **PROTOTYPE &** **FUNCTIONS**	.848 .489	Npd3 Str1
3E-2 (TEAMS) **TEAMWORK**	-.855 .719 .644 .514	Sys4 Npd7 Npd6 Npd1	**3E-8 (PLARD)** **PLANNING &** **MOW DOES R&D**	.804 .777	Str4 Sys2
3E-3 (NPDOR) **NPD ORGANISATIONAL** **STRUCTURE**	.909 -.823 .580 .474	Npd2 Sys3 Npd9 Npd4	**3E-9 (FARTB)** **FAIRS & TECH-** **BROADCASTING**	.742 .523	Exl2 Npd10
3E-4 (RCOCO) **REAL COOPERATION &** **CONSUMER ANALYSIS**	.848 .694 .523	Exl6 Npd8 Str2	**3E-10 (RCOSC)** **REAL COOPERATION** **WITH SCIENCE**	.921	Exl1
3E-5 (PROSU) **JOB PROCEDURES &** **NEW SUPPLIERS**	.850 .735 .687	Sys1 Npd5 Exl3	**3E-11 (SCOIN)** **SOCIALISING &** **INFO-EXCHANGE**	.806 -.562	Inl4 Inl2
3E-6 (FREMA) **FREE TIME & MOW** **DOES MARKETING**	.742 .660	Inl3 Str3			

Note: 3Ea-1 – 3Ea-11: KMO=.406, BTS p<.000

CHAPTER 10

General Discussion

10.1 Introduction

The title of this thesis is '*Food product development by integrating marketing and sensory analysis: a tool to the EU-integration challenge*'. Generally, the research focuses on tools for integrating the R&D and marketing analyses, which are developed in relation to the four following aims.

First, the approach of Quality Function Deployment with the idea to develop the House of Quality was applied to chocolate couverture. In this way, an integration of the R&D and Marketing was realised, the initial 'voice of consumer' understood, and the market target established (*Chapter 3*).

Second, the main research started from the marketing approach to achieve consumers' segmentation and obtain a strategic tool focusing on competitive advantage. The segmentation was made in the cross-country perspective and applied to two theoretical concepts: personality-attitude (*Chapter 4*) and affection-attitude (*Chapter 5*) formations. Findings were confirmed across established segments through the extended version of the Theory of Planned Behaviour (*Chapter 6*).

Third, the experimental design to test different formulations of chocolate was developed and the samples were tested across Belgium and Poland in relation to both descriptions of products (*Chapter 7*) and the sensory preference segments (*Chapter 5*). Relationship between perceptions and preferences was established by the comparison of trained and consumer panels approaches (*Chapter 8*).

Fourth, a model has been developed for analysing the innovation potential at the level of small or medium-size enterprises (SMEs). This was realised by integrating the influence of environment, entrepreneur, and enterprise. The model was applied among Polish manufacturers of confectionery products.

10.2 General discussion and main research contributions

10.2.1 Revision of approaches

In *Chapter 2*, the revision of both marketing and R&D approaches is made. First, as the *marketing approach* to sensory analysis focuses on what is perceived in the product irrespective of whether these perceptions originate from the intrinsic or extrinsic cues, the consumer test include questions for both cues.

Second, the *R&D approach* to sensory analysis concentrates on the characteristics that are perceived irrespective if they have significance for consumers in the market. In another words, the integrated test put much more importance on the questions developing the relationship of major sensory cues to consumer behaviour.

As the result of integration between the R&D and marketing, new methods or tools are suggested that explicitly relate sensory analysis to consumer behaviour. During the design of these methods, it is important to focus on five basic aspects referring to differences in sensory and marketing practices. These are as follows: type of respondent, methodology, type of stimuli, scaling procedure, and test circumstances.

10.2.2 The House of Quality (HoQ) for chocolate couverture

In *Chapter 3*, three *types of needs* are discussed within the HoQ. Integration of two quality concepts - perceived (subjective) and functional (objective) qualities - into product development shows that requirements of consumers are matched with technological capabilities of tested product samples. Thus, a manufacturer can develop a product with precisely those qualities that create consumer satisfaction.

Figure 10.1 shows important observations made during design of the HoQ. Starting from *consumer demand*, it was established that respondents differ in perception of the product, situation and package. Positive relations between variables are indicated by $\oplus$ and negative by $\ominus$. *Technical relations* are positively significant ($\oplus$) because the products chosen for this study represented considerably different chocolates. *Sensory relations*, tested by a group of trained panelists, indicate great difference in perception of cocoa body and smokiness ($\oplus$), but not texture and appearance attributes ($\ominus$).

Figure 10.1   The HoQ for Chocolate Couverture - a Concept Revised
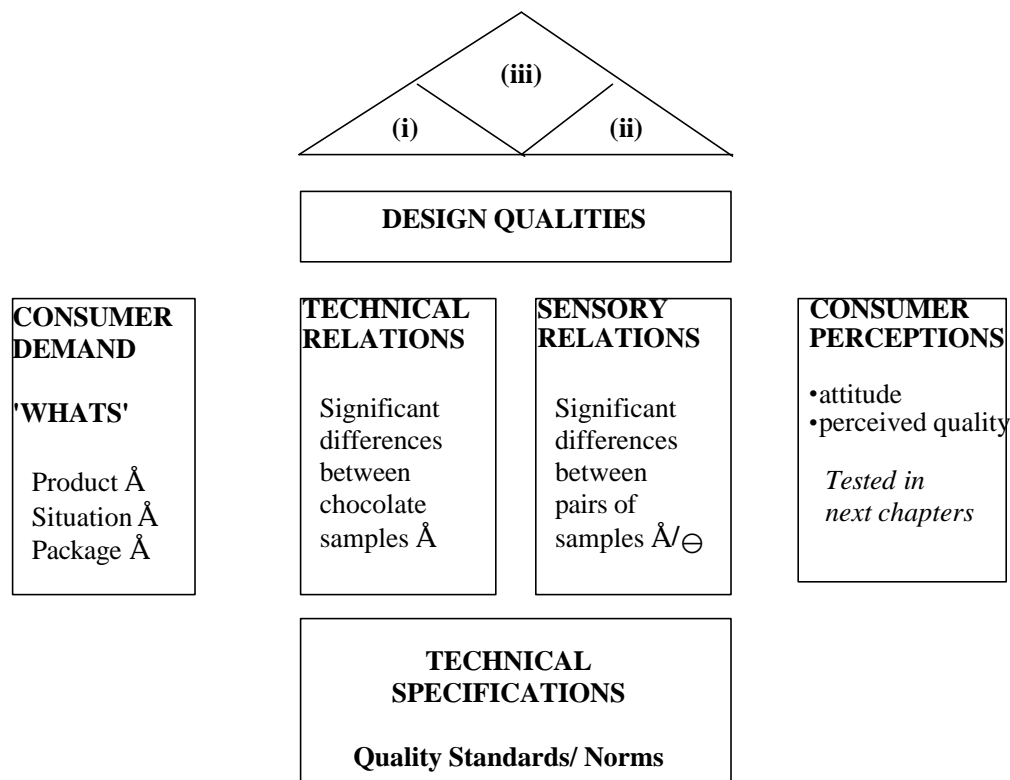
In-depth analysis of *consumers perceptions* are developed in next chapters because the questionnaire used in this study did not develop cognitive aspects of consumers behaviour, as well as did not test consumers taste preferences towards chocolate.

In general, sensory perception of chocolate assessed by the trained panel depends on four intrinsic factors: clear chocolate aroma, sweet taste, smooth texture and luxurious melt-in-the-mouth quality. Extrinsic cues such as package attractiveness, luxury image or social acceptance serve as benefits or consequences of behaviour towards chocolate consumption.

The limitation of this study is that only four products were analysed and compared. The HoQ model can be, however, developed for more products in a certain experiment. Each of these Houses will show significant differences between the designed variables, i.e. the particular preferences and real sensorial perceptions. The most practical approach is to build the House, which reflects the optimal preferences and perceptions. Therefore, a market target should be established in advance. A creative approach for many segments, including more products in the experimental design is also possible.

10.2.3 Cognitions and personality

In *Chapter 4*, the Conceptual Model of Chocolate Choice (COMCC) is developed. Five segments of consumers with significantly different views on consumption of chocolate are established as follows: *Independent*, *Health-Conscious*, *Innovators*, *Restrained*, and *Hedonists*. Figure 10.2 shows that differences between these segments are found due to the following factors: country and region of living ($\oplus$), gender ($\oplus$), self-stated identity ($\oplus$) with chocolate, self-control ($\oplus$), importance of chocolate's attributes ($\oplus$), and beliefs ($\oplus$) related to benefits of chocolate consumption. Three behavioural measures: amount ($\oplus$), frequency ($\oplus$) of consumption and preferred varieties ($\oplus$) of chocolate, also contribute to the predictive power of the model. Both $\oplus/\ominus$ signs are indicated with psychological factors because they differentiate between segments, but not between Belgians and Poles.

The impact of psychological characteristics of respondents on this attitude structure was evident. Rational (economic) vs. emotional (guilt, addiction) motives are strongly related to psychological characteristics of people.

Figure 10.2   Cognitions and Personality - COMCC Model Revised
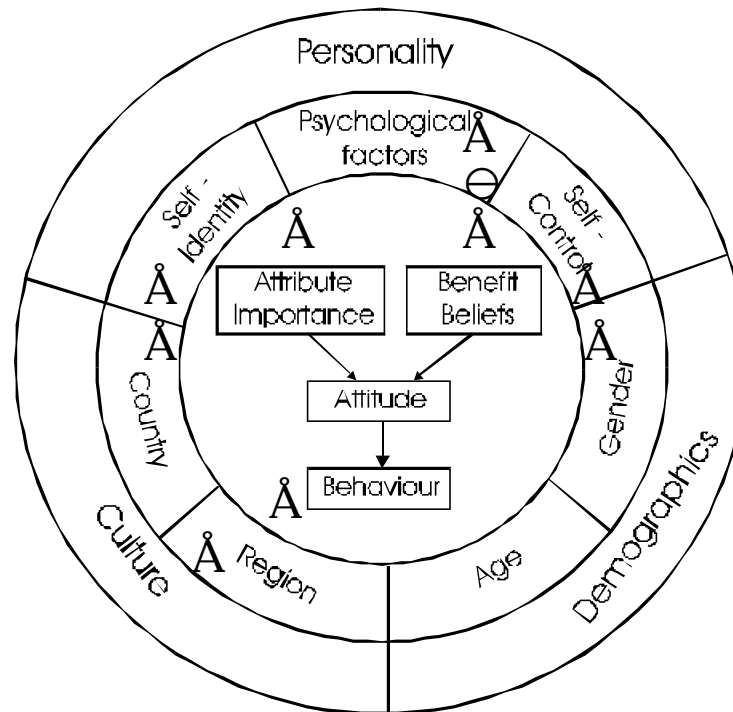
In conclusion, the *Belgian consumer of chocolate* is self-controlled, anticipates affective reactions related to chocolate (sickness, hyperactivity), likes fondant chocolate, considers its brand and price. S/he neither pays a lot of attention to the package of chocolate, nor believes in nutritional value of chocolate in relation to its high content of magnesium and caffeine. The Belgian consumer is more suspicious towards common belief that chocolate satisfied craving, released stress or is socially appropriate. Finally, s/he does not think that chocolate is too expensive.

The *Polish respondent* expresses quite contradictory beliefs about chocolate. S/he pays a lot of attention to the package of chocolate and strongly believes in positive nutritional value of chocolate. This consumer holds belief in the positive functional impact of chocolate and is price-oriented. S/he does not perceive herself/himself as self-controlled but also does not anticipate addiction to chocolate. Generally, s/he believes that fondant chocolate does not bring pleasure and is expensive.

10.2.4 Affections and preferences

Chapter 5, presents the study in which the Model of Affection-Related Chocolate Choice (MARCC) is designed. This model is tested with a set of experimentally designed chocolate samples between Belgian and Polish respondents. Four sensory preference segments are found as follows: *Rough Judges*, *Appearance-Bitterness-Oriented*, *Texture-Oriented*, and *Sweetness-Oriented.*

Figure 10.3 shows that the preference segments are significantly differentiated due to the following factors: country of respondents (⊕), belonging to five personality-related segments (⊕), all three variables in the affective dimension (⊕), mood (⊕), and experience (⊕). The sensory preference segments are not linked to the consumers' hunger state (⊖), expectations (⊖), and gender (⊖). The amount of chocolate consumed is not correlated with the segment membership (⊖), while the frequency of consumption and chocolate varieties are linked to affections (⊕).

Figure 10.3   Affections and Preferences - MARCC Model Revised
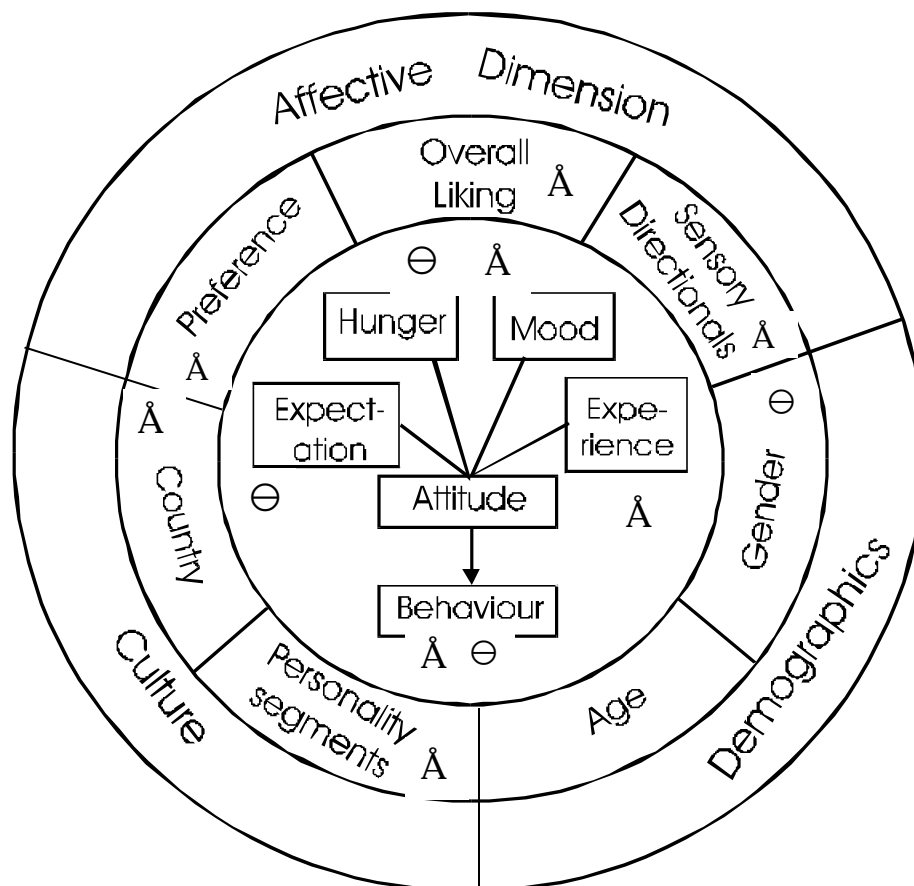
There are three main observations in this study. First, Rough Judges and Texture-Oriented segments are less analytical and can be interpreted as the *sensory-seekers,* i.e. people who want high-impact products such as stronger flavours or darker colours. Second, Appearance-Bitterness-Oriented and Sweetness-Oriented people are the *sensory-avoiders*, preferring weaker and lighter products.

Third, there is a link between sensory and personality segments. When a positive consequence of chocolate consumption is anticipated the liking score increases. However, since distribution of sensory segments along the psychological ones is uniform, therefore, no generalisation of the country-specific preferences for plain chocolate is appropriate.

Moreover, the impact of expectations and the psychological state is particularly important. Expectations are different between Belgians and Poles but not in relation to the sensory segments. Physiological measures indicate the importance of mood on preference. Behavioural measures are helpful in explaining characteristics of each sensory segment, which makes the best link for co-operation between the R&D and Marketing departments.

10.2.5 Cognitions vs. affections

In *Chapter 6*, the Cognition and Affection-Related Behavioural Intention Model (CARBI) is developed according to the Theory of Planned Behaviour (TPB). The proposed model is analysed in cross-country and cross-segment perspective. Figure 10.4 shows that the attitude dimension is composed of affective, conative and cognitive parts.

The *affective* part*,* is represented by preference score (PS) and taste index (TI), both of which contribute to prediction to consume chocolate only for Innovative and Hedonist segments. Therefore, both $\oplus$ /$\ominus$ signs are indicated. In the *conative* part, habit appears to add to predictive power of the CARBI model ($\oplus$). Finally, in the *cognitive* part, the attitude construct is the best predictor of behavioural intention ($\oplus$). Subjective norms are not important for all respondents ($\ominus$). The Perceived Behavioural Control (PBC) discriminates between Belgian and Polish consumers of chocolate. While it is a very important psychological component for Poles ($\oplus$), it is not significant for Belgians ($\ominus$).

Figure 10.4   Cognitions vs. Affections - CARBI Model Revised
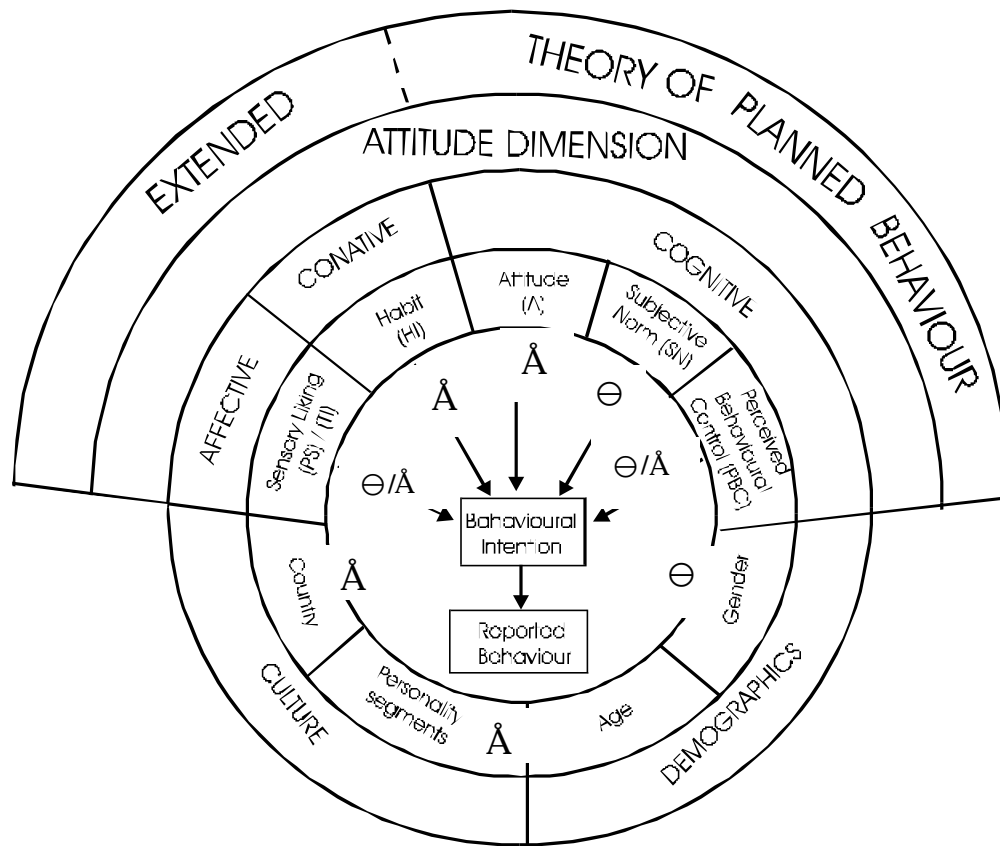
Gender differences were not important in the total sample (⊖) but important in case of Belgian consumers, who scored differently on the control beliefs. Impact of the *region* was observed (⊕) in regard to both Belgian and Polish consumers. In regard to *personality segments,* almost all components of the CARBI model were important predictors of behavioural intention (⊕).

In general, *both cultures* exhibit great differences in attitude towards consumption of chocolate. However, both countries do not have a similar structure of value orientation, which is understood by closer examination of the values and benefit beliefs forming the attitude component in Chapter 4.

A *special feature of Polish* consumers is their self-awareness and perception of barriers, which is influenced by the way of thinking and emotional reactions, and may be investigated in future research.

10.2.6 Sensory sensitivity and perceptions

Chapter 7 presents the result of sensory analysis of chocolate made by trained panelists in Belgium and Poland. Figure 10.5 presents the outline of this study. Both *perceived* (⊕) and *coded sensations* (⊕) are different between panels that indicate cultural influences.

With regard to *sensory sensitivity*, Belgians were more acute to flavour and taste attributes, while Poles showed more concern for textural characteristics of chocolate. In relation to *sensory perception*, Belgian and Polish panels differed significantly due to the sensory perception of five chosen attributes in all qualitative or quantitative settings. Both panels differentiated only the samples with the highest cocoa content.

Figure 10.5   Sensory Sensitivity and Perceptions - an Approach Revised
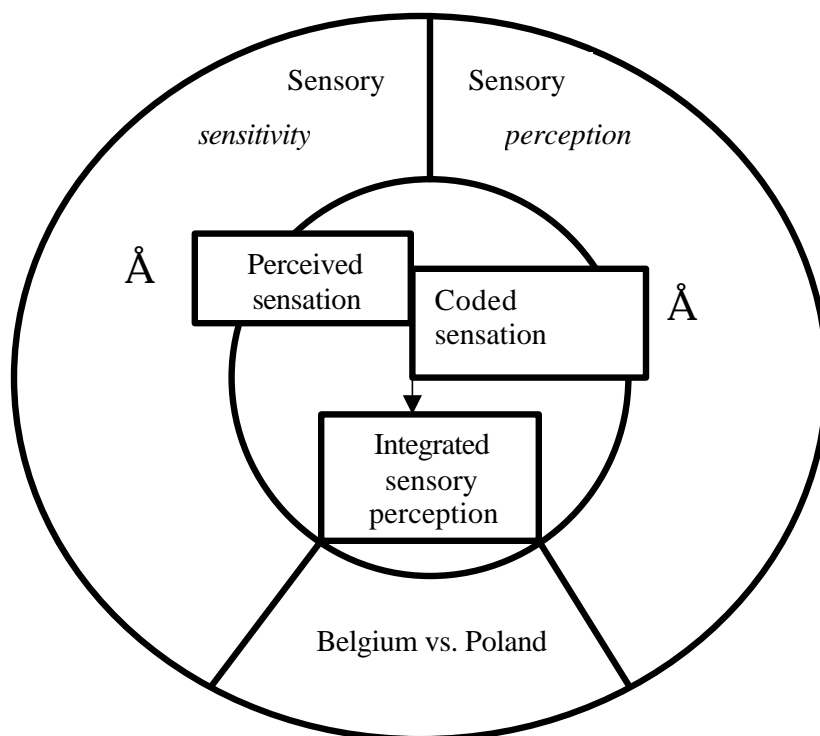
Multivariate analysis of variance allowed studying variations that occur with respect to the factors specified in the experimental design. In the developed design, two cocoa masses were systematically varied in concentration and a psychophysical function could be established.

10.2.7 Preferences vs. perceptions

Chapter 8 describes the study based on the preference mapping technique. The comparison is made between consumer panels across Belgium and Poland, and the Belgian trained panel. Figure 10.6 shows the results from analysis of preferences, acceptability of sensory attributes, perception of intrinsic and extrinsic cues of chocolate. Two major conclusions are drawn from this study.

First, while *preference (hedonic) scores* are similar, *acceptance levels of sensory attributes* present a great difference between personality (⊕) and sensory segments (⊕). Second, all intrinsic cues are only *perceived* as important by the taste-driven Hedonists segment (⊕). Other personality and sensory preference segments did not indicate importance of neither intrinsic nor extrinsic cues of chocolate (⊖).

The conclusion is that collecting information on the presence and intensity of sensory attributes directly from the consumers is a valuable approach. It is also possible to adapt the study to the segment, which is most interesting from the business perspective. This approach helps both R&D and Marketing to learn about the 'holes' in product category and design new products.

Figure 10.6   Preference vs. Perceptions - Impact on Consumer Behaviour
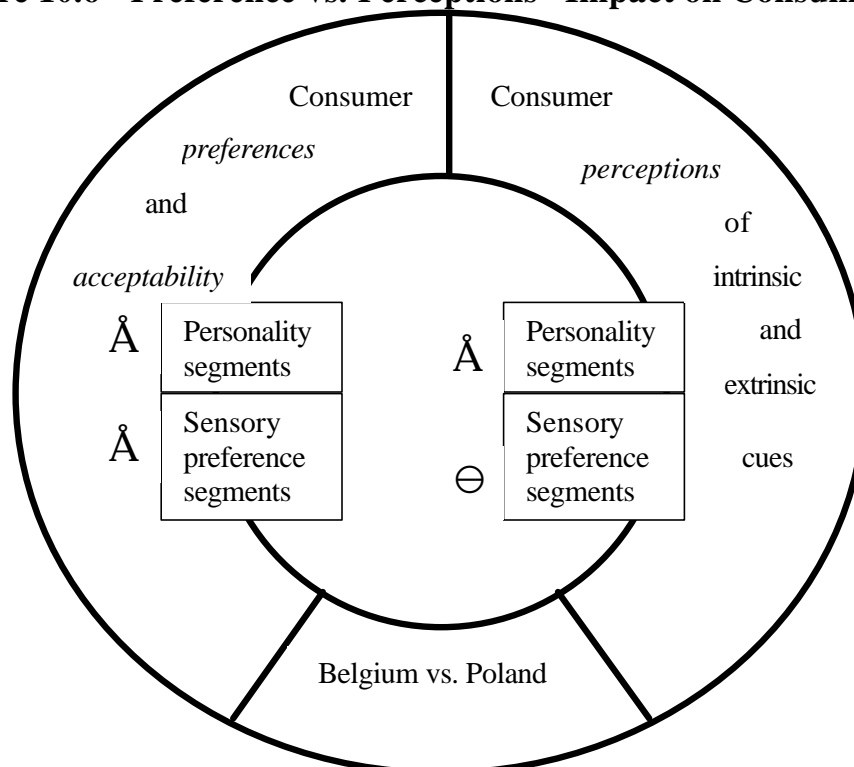
10.2.8 Innovation potential in the entrepreneurial firm

In *Chapter 9*, the 3EN-model is developed to analyse innovation potential of small and medium enterprises (SMEs) manufacturing confectionery products in Poland. The model is a tool to understand the impact of environment, entrepreneur and enterprise on performance: sales, employment and income. Three major groups of entrepreneurs are found: the *Conservative Owners*, the *Radical Entrepreneurs*, and the *Moderate Entrepreneurs*.

Figure 10.7 shows the main findings of this study. The environment influences sales growth (⊕), while the way enterprise is organised has an impact on employment growth (⊕) and income growth (⊕). The characteristics of entrepreneurs are interpreted in relation to two aspects. First, the entrepreneur's skills, perceptions and chosen business strategies are found to influence the growth of employment (⊕), and whether a direct control of the owner is exercised over the firms' performance (⊕). Second, there is no relation between the entrepreneur's market-place behaviour, lifestyle, values, attitudes and personality traits, and performance of the enterprise (⊖).

Figure 10.7 **Innovation Potential - 3EN-Model Revised**
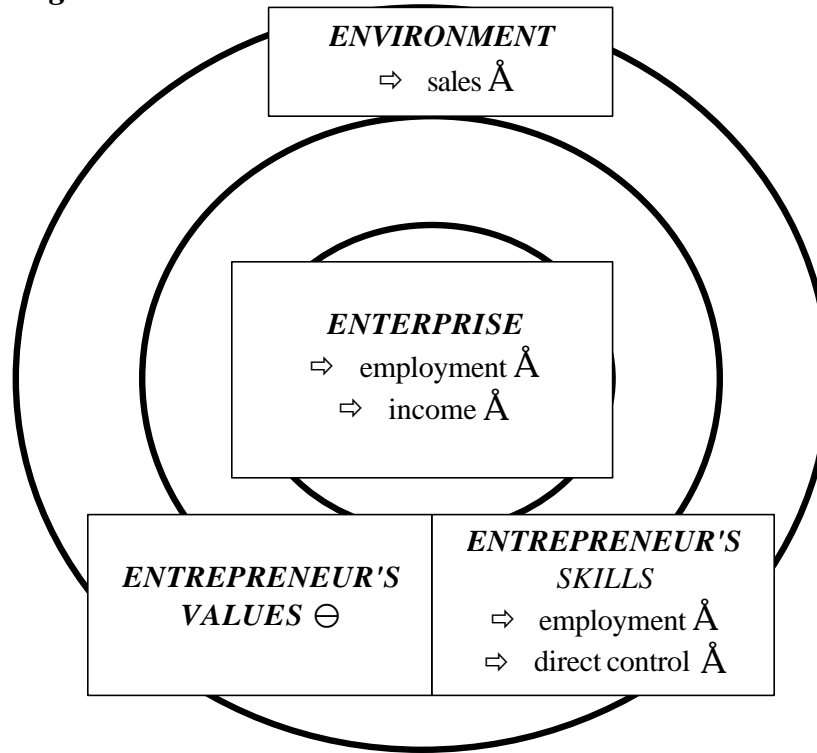
In general, the *Conservative Owners* show strong connection with the local environment. They admit the lack of cooperation practices, managerial skills and financial resources to organise their enterprises in such a way that the innovation would have a favourable climate to occur. Their strongest advantages are closeness to environment and the entrepreneur's personality.

The *Radical Entrepreneurs* have many qualities of 'high achievers'. They are collaborating with a few partners but generally do not understand the concept of networking through increased competitiveness. Finally, the *Moderate Entrepreneurs* act in a similar style but they miss the opportunities of innovation through market segmentation. These two groups of entrepreneurs show high management commitment, a characteristic of *innovative strategies* and thus, an innovation has a potential to occur in their firms.

10.3 Conclusions

H1 Integration of marketing and R&D operations improves understanding of consumers 'needs' and 'wants'. Analysis of intrinsic and extrinsic cues in the House of Quality leads to recognition of the consumer voice and forces improving competitive advantage in product development.

H2a-H2c Segmentation is a strategic tool in competitive marketing. Attitudes towards food products are formed through benefit beliefs, values and personality traits of consumers, and are related to perception of extrinsic cues in food products.

H3a-H3b The experimental design brings the competitive advantage to the R&D in understanding of consumers' preferences. Taste preferences of the individuals are related to perception abilities of intrinsic cues in food.

H4 At enterprise level, product innovation is linked to the firm's organisational structure and culture. The environmental, individual and enterprise factors contribute to perception of competitive advantage, the choice of strategies for innovation, and culture.

10.4 Final remarks and recommendations

This doctoral thesis shows the results of a challenge to create methods that could be used to design successful products, by both R&D and Marketing departments. The personality segments were studied as first, the sensory preference segments as second, and finally a total concept in relation to consumers' acceptance of the product was analysed. A lot of information was obtained from these studies. For example, Health-Oriented people like more bitter chocolate, as well as pay attention to its country of origin. The Hedonists are driven by the intrinsic qualities of chocolate, but they tend to like more sweet products and milk chocolate. Therefore, it seems quite possible to find out how different kinds of consumers' preferences may be related to proposals in the marketing mix.

Usually, there is no great interest in cross-cultural research due to several constraints. Two important barriers are the difficulties to organise and the time-consuming character of sensory analysis. A joined research of two departments, the R&D and Marketing must have potentials of unified business objectives. In such a way, the opportunity to investigate what the consumer really tastes, and which factors explain his/her sensory perception, can be created. Efforts of entrepreneurs must be directed into the creation of such opportunities, where explanation of consumers' perceptions and preferences is challenging for innovation practices.

An approach like the QFD emphasises the voice of the consumer as the starting point of product development. This thesis shows that recognition of consumers' behaviour is the most important factor to start the research. The result is that no optimal product satisfies consumers' acceptance, in general. Optimality gives no direction to the decision-making process because the entrepreneur can decide about the optimal product only after all the alternatives are known and have been evaluated and compared. In a practical situation, goals explicitly stated as optimum solutions appear to be rare (Hauschildt, 1986). The entrepreneur being a decision-maker needs a goal concept that enables him/her to take shortcuts and economise on information available. Such a concept relates to an acceptable level or the expected satisfactory level of the particular ingredients in food.

The best possible formulation, given a fixed set of ingredients, can be found for a specific segment of consumers but not for all consumers. Each consumer holds different views on food products and has his/her own taste preference for some

products. For people who do not change living place so often, all the investigated factors are of paramount importance and can be systematically analysed by tools offered in this doctoral research. For cosmopolitan consumers living in global markets, the external determinants of behaviour are more difficult to recognise.

The psychographic research, such as this presented in Chapter 4, helps in strategic planning and product innovation by bringing the manufacturer of confectionery one step closer to real people. It helps in creation of effective advertising, because it provides cues about how to communicate with those who are predisposed to buy the product. However, there is a common opinion that the best research is multi-disciplinary and the entrepreneurs who focus on only one aspect of consumer behaviour may not increase their business performance (Piirto, 1992). The complexity of the human behaviour, and of market place experience, is paramount and cannot be discovered within one magic tool.

It should be stressed that while marketing focuses on aspects of a product that principally act upon consumer psychology and, the R&D concentrates on the physical features (ingredients, formulation, and manufacturing), sensory evaluation addresses itself to both aspects. The consumer sensory tests rely on human perceptions, which are regarded as 'the psychology of interaction of the physical object, or the physical energy coming from it, and the perceiving organism' (cf. Martin, 2000). The experimental design is a key element in the sensory research since it enables to isolate the strategic variables, and to identify which of them are decisive to the acceptance of the product. Thus, sensory evaluation is a valuable business tool for the technical developer and the marketeer.

The psychographic segmentation supported by the sensory segmentation will help to understand the consumers in a new way. This doctoral research confirmed the previous studies that the sensory segmentation shows groups that are most likely to be independent of demographic differences. Indeed, there was no significant difference in distribution of males and females between sensory segments. The cognitive schemata that people use to chose products are organised pieces of world knowledge that include expectations about what will occur in a given situation and what opinions or alternatives exist. These schemata reflect the decision-maker's beliefs about the importance of issues, knowledge and previous experience in a certain area. Since people are reluctant to change their cognitive schemata, even

when faced with powerful counter-evidence, the total of individuals' characteristics is stable over different situations and time. (Noorderhaven, 1995).

Segmentation is a weapon providing greater understanding and opportunity for targeting, by identifying more clearly the particular nature of the target markets (Blamires, 2000). A simple way of data calculation through standard tabulations in relation to demographic data is called implicit segmentation. More sophisticated way of data analysis uses factor, cluster and discriminant analyses to show underlying dimensions of consumers' behaviour and acceptance. In this doctoral research all mentioned statistical methods were applied.

The COMCC and MARCC models are quite similar in positioning as they focus on attribute importance, benefits and claimed preferences. They present a way of operating to gain competitive advantage over competitors. And even the models discover segments of small size, the marketeer knows that the competitive marketing is sometimes about targeting niche markets that are mostly small groups (Adcock, 2000).

Additionally, the COMCC and 3EN are compensatory-type models, in which the scores on the various attributes are in some way combined into an overall score, hereby discriminant score (D), showing general attitude of consumers and entrepreneurs. A descriptive relevance is achieved since all activities described in the developed models were performed (Noorderhaven, 1995).

In many other models that focus on cognitions, while neglecting affect, the causal relations between cognitive and affective aspects of decision-making behaviour are not developed (Van Veldhoven, 1988). This is especially dangerous since psychological research strongly suggest that affective reactions often precede cognitive deliberations (e.g. Van Raaij, 1988). A continuous loop system is also advised to conceptualise the relations between cognitive appraisal and affective experience because both spheres of human mind constantly influence one another and it is impossible to state which is more superior to the other (Cadland, 1977). Therefore, the models developed in this thesis are not sequential but multi-layered.

From the integrated point of view, the perception of either intrinsic or extrinsic cues of the food product is an activity, in which the perceiver selects, organises and interprets information. Three phases of perceptual process are distinguished. First,

only those stimuli that are above certain thresholds are consciously perceived. Second, the selected information is organised, for example according to the similarity principle, which means that stimuli are organised in favour of their resemblance. Third, coherent wholes of stimuli are interpreted. Current impressions are matched with past experiences to give meaning to perceptions, and familiar patterns of information are sorted into categories. Perception is a basic process that has influence on consumer behaviour (Noorderhaven, 1995).

The mapping technique shows the relationships between perceptions and preferences for a set of products but does not intend to segment respondents. It is only one stage in a global 'segmentation' study. Therefore, this doctoral research proposes first to segment consumers based on psychographics or sensory preferences and then to explain the respondents' behaviour by the perception of product cues. Both, segmentation and mapping are important tools in identifying differences in products of increasing commercial interest and building future markets, and are widely applied in food industry (Blamires, 2000).

Last but not least, each of the models developed in this thesis may be seen as the business approach to the EU-integration challenge, as it helps to understand the consumers and manufacturers. The proposed models attempt to interact with business in matters relating directly or indirectly to innovation, therefore, they may affect the pressure for change, including *competition policy*. The models create 'learning to learn' capability in a special entrepreneurial environment. However, if the entrepreneurial firms are not prepared for the forthcoming changes of re-organisation, the outcome may be not 'creative destruction' but just plain destruction. Competition pressure must match the ability to absorb change, which is part of human resource development (Lundvall & Borrás, 1997). In this sense, there is still a lot to accomplish among the Polish entrepreneurs in the confectionery sector challenging the EU integration.

Finally, the proposed comparative, cross-country, approach is quite useful because it creates awareness among policy makers and agents for change within national and local systems and institutions. Such awareness is crucial for designing new policies in the New Economy, in which people put value on intellectual capital and recognise its role in changing a company's culture.

There are at least two *limitations* of this research. The first relates to the lack of situational aspects in chocolate consumption. This has been neglected because of the vast amount of the variables in the current research that prohibited inclusion of an additional set of items. It should be remembered that the questionnaire, realised for the study described in Chapters 4, 5, 6, and 8, was filled in by the respondents at the same occasion. It was also the basic strength of this interrelated approach.

Second, the proposed models do not indicate the steps in decision making to consume chocolate. This aspect was elaborated through the descriptive research when it appeared that various steps in the decision making process are closely connected and the process is of interactive rather than sequential nature. The design of models is, however, alien to most of the normative strategy literature (Noorderhaven, 1995). The 3EN-model, especially, had to be presented in the multi-layered process, since organisational culture is a dynamic system. All elements of this model are, therefore, linked (Hatch, 1993; Baligh, 1994).

Recommendations for future research are threefold. *First,* the offered models should be validated for other food products. A new range of research variables may be developed and applied within the proposed tools. This can also be done within the cross-country perspective to make the future affords comparable.

Second, consumer panels should test the experimentally designed samples, however, new designs may be developed and applied. The order of testing is crucial in such an approach and, therefore, a special care should be taken for this aspect.

Third, the researcher may design a simpler version of the House of Quality at the level of the entrepreneurial firm. The suggestion is to focus on core capabilities of the business and make consumer tests with a representative number of respondents. The target consumers might be initially speculated, but finally they should be established through psychographic or sensory segmentation tools. In this way, the assumption that innovation and knowledge are key drivers of business growth in the New Economy could be confirmed. The entrepreneurs must foster innovation practices through experimentation at the consumer, product and organisational levels. This doctoral thesis offers tools to advance such experimentation.

SUMMARY

This doctoral research presents the tools to investigate consumers' behaviour towards food product by small and medium enterprises (SMEs). The proposed models are applied to chocolate-choice behaviour however, they may be adapted to other food products.

The study consists of five parts throughout ten chapters. In *Part I* the theoretical background of the research is presented, while in *Part II* Quality Function Deployment is developed. The latter is considered as the best approach for integration marketing and sensory analysis to improve understanding of the 'voice of consumer' but it needs a formal division of both methods.

Since this is unrealistic in SMEs, the proposed models investigating consumers' needs and wants, are developed in *Part III* and *IV* of the thesis. There are three models based on cognition-personality (COMCC-model), affection-preferences (MARCC-model), and cognition vs. affection theory (CARBI-model). These models can bring marketing competitive advantage to the SMEs that decides to improve business performance through consumer analysis. Finally, the sensory study and preference mapping technique are developed for chocolate-choice behaviour. Both of them are considered as the R&D competitive advantage.

In *Part V* of the thesis, a model investigating innovation potential in the SMEs is proposed. The 3EN-model gives an indication about macro (environment) and micro-factors (entrepreneur, enterprise) that influence the final business performance. More importantly, this model indicates what capabilities are present to fulfil the consumers' needs and to improve products offered by the enterprise.

The research methodology comprises descriptive, explorative and conclusive studies. Descriptive research is undertaken at the first part. The QFD model is based on an explorative method in the second part. The proposed models and techniques are based on theories and hypotheses proposed by scientists of various domains. The models are validated in large-scale and cross-country survey, and therefore, they are called conclusive studies. Finally, the 3EN-model is seen as the explorative study and should be confirmed within other food sectors.

Results show that it is possible to create effective marketing (*Part III*), R&D (*Part IV*) or integrated marketing-R&D (*Part II*) tools for analysing consumers' cognitive maps, affective responses and resulting food product preferences. The study applied in the cross-cultural setting showed principal differences between young generations of chocolate consumers. These differences have their roots more in the cognitive-perceptual meaning of food products than in the sensory taste preferences.

At the company level, investigation of cognitive or affective dimensions in the consumer target group is only realised when specific firms' structure and culture are present. Since the 3EN-model proposes a tool to find about the firms' potential and so to reach consumers' likes, the results of this model are interpreted in regard to innovation practices for product development. They show, in which areas the firm is strong, and here it should build its competitive advantage over other firms, and in which areas it needs improvement.

The main *conclusions* of this research are threefold. *First,* final product choice is influenced by many factors of cognitive and affection-related characteristics of consumers. Personality of respondents has also a paramount influence. The groups of factors should be investigated in separate models, since each of them gives vast information about the consumer from different points of view.

Second, the integrated approach towards understanding of consumers is possible through the Quality Function Deployment. This model can be applied for all kinds of food products however, a direct link and intensified information exchange between the R&D and Marketing departments, are necessary. These conditions are not present in case of Polish confectionery SMEs therefore, the QFD model is not advised. Instead of this, models proposed in *Part III* and *IV*, are suggested.

Third, the innovation potential at SMEs level can be investigated through the 3EN-model. It means that, those entrepreneurs who are confident in marketing practices are encouraged to apply the cognition and personality-related COMCC-model. Those who can prepare a range of food products based on the experimental design are advised to discover consumers' taste preferences through the MARCC-model. The entrepreneurs, who are strong in both capabilities, can apply the CARBI-model. And finally, those who can conduct sensory evaluations are able to implement preference mapping technique.

SAMENVATTING

Onderhavig doctoraatsonderzoek geeft de instrumenten om consumentengedrag te onderzoeken voor voedingsmiddelen op het niveau van kleine en middelgrote ondernemingen (KMO's). De voorgestelde modellen worden toegepast op het keuzegedrag voor chocolade, alhoewel ze kunnen aangepast worden voor andere voedingsmiddelen. De studie omvat vijf delen over tien hoofdstukken verdeeld. In Deel I wordt de theoretische achtergrond van het onderzoek gegeven, terwijl in Deel II KwaliteitsFunctie-Ontplooiing (QFD) wordt ontwikkeld. Dat laatste wordt beschouwd als de beste benadering voor integratie van markt- en sensorische analyse, gericht op het beter verstaan van de "stem van de consument", alhoewel een formele opdeling van beide methodes noodzakelijk is.

Aangezien dat onrealistisch is in KMO's, worden de voorgestelde modellen, die de consumenten behoeften en wensen onderzoeken, ontwikkeld in Deel III en IV van de thesis. Er zijn drie modellen, die gebaseerd zijn op kennis-personaliteit (COMCC-model), affectie-voorkeuren (MARCC-model) en kennis versus affectie theorie (CARBI-model). Deze modellen kunnen comparatief marktvoordeel brengen voor KMO's, die beslissen hun zakelijke prestatie op te voeren door middel van consumentenanalyse. Uiteindelijk, worden de sensorische studie en Preferentiële Kaart Techniek ontwikkeld op het keuzegedrag voor chocolade. Beide worden beschouwd als R&D met een concurrentie voordeel. In Deel V van de thesis wordt een model voorgesteld dat het innovatie potentieel van KMO's onderzoekt. Het 3EN-model geeft een aanduiding van de macro (milieu) en microfactoren (ondernemer, onderneming) die de finale zakelijke prestatie beïnvloeden. Nog belangrijker, het model duidt aan welke karakteristieken aanwezig zijn om de behoeften van consumenten te voldoen en om de producten aangeboden door de onderneming te verbeteren. De onderzoeksmethodiek omvat beschrijvende, exploratie en conclusievormende studies. Beschrijvend onderzoek wordt ondernomen in het eerste deel. Het QFD-model is gebaseerd op een exploratie methode in het tweede deel. De voorgestelde modellen en technieken zijn gebaseerd op theorieën en hypotheses, ontwikkeld door wetenschappers uit verschillende disciplines. De modellen worden getest in een grootschalige tussen de landen opgezette enquête en bijgevolg worden ze conclusievormend onderzoek genaamd. Uiteindelijk wordt het 3EN-model als een exploratie studie gezien en zou moeten bevestigd worden voor andere voedingssectoren.

Resultaten tonen aan dat het mogelijk is effectieve marketing (Deel III), R&D (Deel IV) of de integratie marketing-R&D (Deel II) instrumenten te ontwikkelen, gericht op de analyse van consumenten kennis kaarten, affectieve reacties en de daaruit voortvloeiende voorkeuren voor voedingsmiddelen. Het toegepast onderzoek op de twee landen vertoonde

belangrijke verschillen tussen chocoladeverbruikers van jonge leeftijd. Deze verschillen hebben hun wortels meer in de kennisopvatting betekenis van voedingsmiddelen dan in de sensorische smaak voorkeuren. Op het niveau van het bedrijf, wordt onderzoek van kennis en affectieve dimensies in de consumentendoelgroep enkel gerealiseerd, wanneer een specifieke ondernemingsstructuur en cultuur aanwezig zijn. Aangezien het 3EN-model een instrument voorstelt om het ondernemingspotentieel te vinden en zo de consumentenbehoeften te bereiken, worden de resultaten van het model geïnterpreteerd in de optiek van toegepaste innovatie voor productontwikkeling. Zij tonen aan in welke gebieden de onderneming sterk is en hieruit moet het concurrentie voordeel uitgebouwd worden over ondernemingen en in die gebieden waar verbetering nodig is.

De voornaamste besluiten van onderhavig onderzoek zijn drievoudig. Ten eerste, de keuze van het eindproduct wordt beïnvloed door verschillende factoren die verband houden met de kennis en affectieve karakteristieken van consumenten. De personaliteit van respondenten heeft eveneens een bijzondere invloed. De groepen factoren zouden moeten worden onderzocht in afzonderlijke modellen, aangezien elk van hen duidelijke informatie geeft over de consument van uit verschillende gezichtspunten. Ten tweede, de geïntegreerde benadering over het verstaan van consumenten is mogelijk door middel van de KwaliteitsFunctie-Ontplooiing (QFD). Dat model kan worden toegepast voor alle soorten voedingsmiddelen, alhoewel een direct verband en intense informatie-uitwisseling tussen de marketing en R&D afdelingen noodzakelijk zijn. Deze voorwaarden zijn niet aanwezig in het geval van de Poolse confiserieproducenten op het niveau van de KMO's, waardoor het QFD model niet wordt aanbevolen. In plaats daarvan, worden de voorgestelde modellen in Deel III en IV gesuggereerd. Ten derde, het innovatiepotentieel op KMO niveau kan worden onderzocht door middel van het 3EN-model. Het betekent dat de ondernemers die vertrouwd zijn met marketingpraktijken worden aangemoedigd om het kennis en personaliteits verbandhoudend COMCC-model toe te passen. Deze die een gamma voedingsproducten kunnen ontwikkelen gebaseerd op experimentele design, worden aanbevolen de consumenten smaakvoorkeuren te vinden door middel van het MARCC-model. De ondernemers die sterk zijn voor beide karakteristieken, kunnen het CARBI-model toepassen. En uiteindelijk, deze die sensorische evaluaties kunnen uitvoeren, zijn in de mogelijkheid van Preferentiële Kaart Techniek uit te voeren.

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Publications

1. Fortuna, T., Januszewska, R. & Palasinski, M. (1996). Retrogradation of low substituted monostarch phosphates. *Polish Journal of Food & Nutrition Sciences, 5(46),* 49-54.

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PART I

CHAPTER 1

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Towards an Integration of R&D and Marketing in Product Development

This chapter is adapted from:

Viaene, J. & Januszewska, R. (1999b). Towards an integration of R & D and marketing in product development. *Journal of International Food & Agribusiness Marketing, 10(3),* 79-98.

PART II

CHAPTER 3

Quality Function Deployment
in the Chocolate Industry

This chapter is adapted from:

Viaene, J. & Januszewska, R. (1999a). Quality function deployment in the chocolate industry. *Food Quality and Preference, 10,* 377-385.

PART III

CHAPTER 4

Market Segmentation for Chocolate
in Belgium and Poland

This chapter is adapted from:

Januszewska, R., Viaene, J. & Verbeke, W. (2000). Market segmentation for chocolate in Belgium and Poland. *Journal of Euromarketing, 9(3),* 1-25.

CHAPTER 5

Sensory Segments in Preference for Plain Chocolate Across Belgium and Poland

This chapter is adapted from:

CHAPTER 6

Application of the Theory of Planned Behaviour to Consumption of Chocolate: Cultural Differences Across Belgium and Poland

This chapter is adapted from:

Januszewska, R. & Viaene, J. (2001b). Application of the Theory of Planned Behaviour to consumption of chocolate: cultural differences across Belgium and Poland. *Submitted: Journal of Euromarketing.*

PART IV

CHAPTER 7

Context Effects

in Evaluation of Chocolate Quality

Through the Experimental Design

- Cross-Cultural Study

This chapter is adapted from:

Januszewska, R. & Viaene, J. (2001c). Context effects in evaluation of chocolate quality through the experimental design – cross-cultural study. *Submitted: Journal of Euromarketing.*

CHAPTER 8

Acceptance of Chocolate
by Preference Cluster Mapping
Across Belgium and Poland

This chapter is adapted from:

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PART V

CHAPTER 9

Innovation Potential
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Manufacturing Confectionery Products in Poland

This chapter is adapted from:

Januszewska, R., Viaene, J. & Gellynck, X. (2001). Innovation potential in small and medium enterprises manufacturing confectionery products in Poland. *Submitted: Journal of Small Business Management.*

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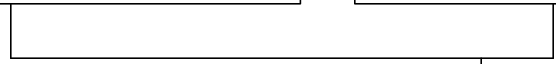| *Chapter 4* Market segmentation for chocolate in Belgium and Poland **H2a**	*Chapter 5* Sensory segments in preference for plain chocolate across Belgium and Poland **H2b**
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