



รายงานฉบับสมบูรณ์

การพัฒนาแนวคิดผลิตภัณฑ์ข้าวสำหรับผู้บริโภคชาวยุโรปที่มี
ศักยภาพในการส่งออกโดยการวิเคราะห์แบบคอนจอยท์

โดย รศ.ดร. ปรีศนา สุวรรณภรณ์

สิงหาคม 2554

รายงานวิจัยฉบับสมบูรณ์

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ภาควิชาวิทยาศาสตร์และเทคโนโลยีการอาหาร
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ABSTRACT

Project Code: RMU 5180050
Project Title: Rice product concepts development for selected rice export potential European consumers using Conjoint Analysis
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Rice consumption was expected to continue to increase in Europe. These indicated the chance of rice market in the EU. Four European countries which were UK, France, Belgium and the Netherlands were the focus of our study. This study aimed to investigate belief and attitude towards rice compared to potato and pasta in order to seek substitution possibility for rice. Rice product design was also analyzed using conjoint analysis. A quantitative questionnaire was designed to access consumer attitudes in rice, potato and pasta with respect to taste, healthy aspect, price, calorie, harmful substance, trustworthy, special food, digestibility, and allergy. Rice's attitudes about taste, healthy and cheap price were among the highest perceptions in rice whereas specialty was the lowest. Rice gained positive and superior attitudes than potato and pasta in almost every attitude. Intention to increase rice consumption in the near future was significantly associated with rice perceptions on four attributes which were good taste, healthy, low calories and specialty. These perceptions could be promoted for the beneficial characteristics of rice since they were already existed in consumers' mind within these countries. The relative importance obtained from conjoint analysis presented that European consumers preferred non-GMO Jasmine rice in Asian cuisine and should be cook before serve in a well known brand respectively. Segmentation by utility value in rice product interest obtained four segments which were; Jasmine / Basmati lover, GMO phobia, Asian fever and Convenience cooker. It appeared that age, personal income and nationality were the main socio-demographic characteristics that impose different consumer interesting towards rice product. Rice was certainly gained positive attitudes in four target European consumers. Superior quality of rice should be differentiated and promoted to help increase consumers demand and preferences in rice.

Keywords: rice, attitude, European, product concept

บทคัดย่อ

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โดยการวิเคราะห์แบบคอนจอยท์

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การบริโภคข้าวในยุโรปมีแนวโน้มเพิ่มขึ้นอย่างต่อเนื่อง ซึ่งเป็นการแสดงถึงโอกาสของตลาดข้าวในยุโรป ประเทศที่สนใจศึกษาครั้งนี้คือ ประเทศอังกฤษ ฝรั่งเศส เบลเยียม และเนเธอร์แลนด์ การวิจัยนี้มีวัตถุประสงค์ศึกษาทัศนคติของผู้บริโภคที่มีต่อข้าวเมื่อเปรียบเทียบกับมันฝรั่งและพาสตาเพื่อหาโอกาสในการทดแทนการบริโภคด้วยข้าว นอกจากนี้ยังทำการศึกษาทัศนคติเพื่อใช้ในการออกแบบผลิตภัณฑ์ข้าวโดยวิธีการวิเคราะห์แบบคอนจอยท์ แบบสอบถามได้ออกแบบมาเพื่อให้ได้มาซึ่งทัศนคติที่มีต่อข้าว มันฝรั่งและพาสตา ในหัวข้อที่เกี่ยวกับ รสชาติ การเป็นอาหารสุขภาพ ราคา พลังงานต่ำ สารปนเปื้อนที่เป็นอันตราย ความน่าเชื่อถือ อาหารในโอกาสพิเศษ อาหารย่อยง่าย และอาหารก่อกัมมิแพ้ ทัศนคติที่มีต่อข้าวที่เกี่ยวกับ รสชาติ การเป็นอาหารสุขภาพและราคา เป็นปัจจัยที่ผู้บริโภครับรู้ได้มากที่สุดโดยความคิดที่ว่าข้าวเป็นอาหารในโอกาสพิเศษได้คะแนนต่ำที่สุด ข้าวได้รับคะแนนเป็นบวกและเหนือกว่ามันฝรั่งและพาสตาในเกือบจะทุกทัศนคติ ความตั้งใจในการเพิ่มการบริโภคข้าวในอนาคตอันใกล้จะเพิ่มขึ้นถ้าทัศนคติที่เกี่ยวกับ รสชาติ การเป็นอาหารสุขภาพ พลังงานต่ำ และการเป็นอาหารในโอกาสพิเศษเพิ่มขึ้น ปัจจัยเหล่านี้ควรได้รับการสนับสนุนเนื่องจากการรับรู้ที่อยู่ในความคิดของผู้บริโภคอยู่แล้ว ค่าความสำคัญเปรียบเทียบ (relative importance) ของผลิตภัณฑ์ข้าวจากการวิเคราะห์แบบคอนจอยท์พบว่า ผู้บริโภคชอบผลิตภัณฑ์ข้าวเรียงตามลำดับคือ เป็นผลิตภัณฑ์ข้าวที่ผลิตจากข้าวที่ไม่มีการตัดต่อพันธุกรรม เป็นข้าวหอมมะลิ รูปแบบอาหารเอเชีย ควรปรุงหรือให้ความร้อนก่อนบริโภค และขายในตราสินค้าที่มีชื่อเสียง เมื่อนำค่าการใช้ประโยชน์ (utility value) มาแบ่งกลุ่มผู้บริโภคได้ 4 กลุ่มคือ กลุ่มที่ชอบข้าวหอมมะลิ/บาสมาดิ กลุ่มที่กลัวอาหารตัดต่อพันธุกรรม กลุ่มที่ชอบอาหารเอเชีย และกลุ่มที่ชอบความสะดวก โดยพบว่าอายุ รายได้ และเชื้อชาติ เป็นลักษณะที่ทำให้เกิดความสนใจในผลิตภัณฑ์ข้าวที่แตกต่างกัน จากผลการศึกษา เป็นที่แน่ชัดว่าข้าวได้รับการยอมรับในเชิงบวกในกลุ่มผู้บริโภคชาวยุโรป ลักษณะเด่นของข้าวควรได้รับการตอกย้ำให้เกิดความแตกต่างเพื่อใช้ในการสนับสนุนทางการตลาดของข้าว เพื่อเพิ่มอุปทานและความชื่นชอบในข้าวและผลิตภัณฑ์ข้าวในกลุ่มผู้บริโภคชาวยุโรปให้เพิ่มขึ้น

คำหลัก: ข้าว ทัศนคติ ผู้บริโภคชาวยุโรป แนวคิดผลิตภัณฑ์

EXECUTIVE SUMMARY

Rice has certainly gained in positive attitudes among consumers in the four target European countries. Perceptions of rice – either in terms of health, price, calories, harmful substances, trustworthiness, digestibility and allergenicity – were superior to those of potatoes and pasta. Attitudes about rice's taste, health benefits and low price were among the highest, whereas specialty foods received the lowest ratings. Rice was rated more positively than potatoes and pasta for almost every attitude. Consumers' intentions to increase rice consumption in the near future were significantly associated with perceptions regarding four attributes of rice: good taste, healthfulness, low calorie content, and specialty. The relative importance obtained from conjoint analysis presented that European consumers preferred non-GMO Jasmine rice in Asian cuisine and should be cook before serve in a well known brand. Segmentation by utility value in rice product interest obtained four segments which were; Jasmine / Basmati lover, GMO phobia, Asian fever and Convenience cooker. It appeared that age, personal income and nationality were the main socio-demographic characteristics that impose different consumer interesting towards rice product.

As rice consumption per capita in Europe still comparatively lower than that of potatoes and pasta, Thai rice has a potentially large demand to fill. Superior quality of rice should be differentiated and promoted to help increase consumer demand and preferences in rice. Good taste, health benefits, low calories and specialty could be promoted as the beneficial characteristics of rice, since these perceptions were claimed to help increase consumer intention to buy more rice.

1. INTRODUCTION

The European Union Rice Market

The European citizen was eating more rice nowadays. Rice consumption was expected to continue to increase in Europe (FAO, 2007). Rice imported by the EU was expected to reach 1.35 million tones in 2011, 12.5 percent increased from the level estimated in 2010. Much of the increase was assigned for the enlargement of EU members from 15 to 27 countries (USDA, 2010), and also the unlimited duty-free access to the African Caribbean and Pacific (ACP) countries for agricultural products. The EU imported 111,356 tones of milled rice from Thailand in Janury to March 2011, 12.4 percent increase in quantity import in 2010 at the same time. It increased 15,400 tones annually by average during year 2000-2006 (Eurostat, 2007) (Fig. 1). Top ten EU countries imported Thai rice year 2010 was France, Belgium, United Kingdom, the Netherlands, Spain, Germany, Italy, Sweden, Switzerland, and Georgia (USDA, 2010). In a contrarily, rice production in EU decreased by 5.3 percent in 2005 to 2.55 million tones in 2006 (FAO, 2006) and further decrease to 1.90 million tones in 2010 (USDA, 2010). These indicated the chance of rice market in the EU. Four countries which were UK, France, Belgium and the Netherlands were the focus of our study. These four countries imported rice from Thailand more than 4.4 billion baht (about 140 million US dollar) in 2010 comparing to 2.3 billion bath (about 65 million US dollar) in 2005.

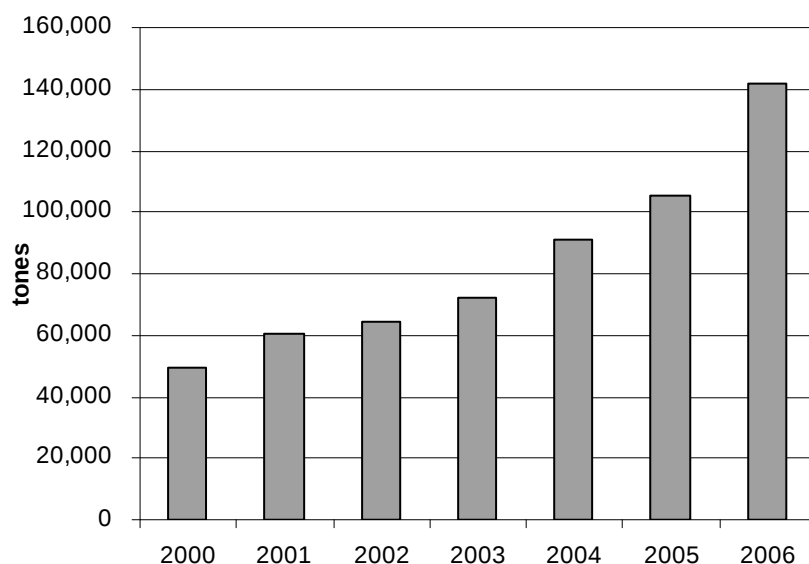


Figure 1 The EU's importation of Thai milled rice in quantity during year 2000-2006.

Source: Eurostat (2007b)

EU Rice Consumption

The main rice consumption in EU was for human consumption (85%), animal feed (7%), industry uses (3%), seeds (3%) and loss (5%). Human consumption has increased, while other uses were stable or decreasing (Commission of the European Communities, 2002). European consumed only 20.5 grams of rice per capita per day in 2005 comparing to 85 grams in America, 78 grams in Africa and 334 grams in Asia (FAO, 2007). Rice consumption increased higher in Northern European countries such as the UK, Belgium, Germany and the Netherlands (CBI, 2010). EU top rice consumption countries during 2000-2005 were Italy with a share of 13.13% followed by the UK (12.76%), France (13.89%), Spain (12.23%) and Germany (12.22%). Top rice consumption per capita per day was Portugal (77.2 g), Spain (30.9g), Denmark (26.8g), Greece (26.7g) and Sweden (26.1g) (FAO, 2007). Spanish and French ate rice only 0.9 times a week but the consumption quantities in Spain were more than France (Hatae *et al.*, 1997). The EU consumption of milled rice reached 2.7 millions tones in 2006/07 which were 50,000 tones more than the previous year.

Starchy Food Consumption and Attitude in EU

Starchy foods were generally viewed as a “boring but filling”. They were perceived as nutritious and good for health but high in energy and not help in weight control (Stephen *et al.*, 1995, Monteleone *et al.*, 1997, Stubenitsky and Mela, 2000, Englyst and Englyst, 2005). Only half of the UK respondents recognize the increase intake of complex carbohydrate such as bread, pasta and rice as general health guidelines to achieve dietary goal recommended by the UK Department of Health (Cannon, 1992; Goode *et al.*, 1995). The British adult believed that starchy foods were good value for money, easy to prepare, had good taste and contained nutritional value. But they did not agree that starchy foods were not fattening and that most people should eat more of these foods (Adamson *et al.*, 2000, Englyst *et al.*, 2008).). Consumer had extremely low intention to increase starchy food in the UK (Stubenitsky and Mela, 2000). In the UK, potatoes were still their basic starchy food and had not been replaced to a significant extent by other starchy products (Mitchell, 1999).

Quantities of starchy food consumption were affected by age, income and gender. Both men and women in UK aged 19 to 24 years consumed larger quantities of pasta, rice and other cereals includes pizza than aged 50 to 64 years (Hoare *et al.*, 2004). High dietary female restrainers reported to have lower consumption in energy food such as pastry and starchy foods than low restrainers. But there was no difference in starchy food consumption in men (Moreira *et al.*, 2005). Low income people in France consumed more starchy food but lower in fruit and vegetable because it is comparatively low price (Roux *et al.*, 2000). French fries consumption in children remained high but

decreased with age and was lower in girls than boys (Nicklaus *et al.*, 2004). In Portugal, female university students had lower consumption of starchy foods than male students. These differences should accommodate for the individuals seeking a better body weight control (Moreira *et al.*, 2005). However, starchy food did not shown significantly different in consumption frequency by gender in the UK (Beardsworth *et al.*, 2002).

Researches studied concerning consumers' attitude in rice were mostly done by Suwannaporn *et al.* (2008). Result showed that consumers' buying criteria in rice grain were marketing activities, quality, price and country of origin. In rice eating countries, rice was not a substitute to other staple foods due to price change (Suwannaporn and Linnemann, 2008b). Jasmine rice had its unique quality, which was highly differentiated between people who prefer and not prefer. Its aroma was a desirable quality trait for those who prefer. The soft and sticky characteristic of Jasmine rice was an undesirable quality among consumers from non-rice eating countries (Suwannaporn and Linnemann, 2008a). The image of rice quality has changed since Uncle Ben entered EU market. Uncle Ben tried to promoted American long grain which was harder and non sticky. As a consequence, most French consumers impressed that good quality rice should not stick together. This eating behavior was quite strong among European that make Thai fragrant rice in a difficult position (Suwannaporn and Supakornchuwong, 2011). Convenience, grain varieties, and naturalness were the important factors concerning rice products preference. These three product categories were correlated with consumers' ideas concerning health-supporting character of processed food (Suwannaporn *et al.*, 2008). This study aimed to investigate belief and attitude towards rice compared to those of potato and pasta consumption in the target European countries in order to seek substitution possibility for rice and find means for market promotion.

Research Towards Consumer Beliefs and Attitudes

Arvola *et al.* (2007) investigated consumer's beliefs in whole grain and refined grain product. Consumers were segmented based on these beliefs in whole grain and refined grain product. The objective of this study was to understand consumers' attitudes related to expectations that may influence their willingness to use whole grain foods. Data was collected with self-completion questionnaires in the UK (n = 552), Italy (n = 504), and Finland (n = 513). The differences between the rating scores of "whole grain" and "refined grain" were significant ($p < 0.001$). Whole grain product category was seen as more nutritionally balanced, healthier, more natural, more filling and releasing energy more slowly than refined grain. Moreover, digestibility of whole grain was rated slightly easier than refined grain. Although difference among product categories in pleasantness and

inexpensiveness were small but was statistically significant. In summary, the category of whole grain products was rated more favorable than refined grain products on health and physiological function attributes but not on price and taste.

Lampila and Lähteenmäki (2007) studied consumer's attitudes towards high pressure freezing technology measured by eight semantic differentials. A five-point scale was used to ask respondents' ratings for these attribute pairs on a five-point scale (1 = inappropriate; 5 = appropriate). A total of 936 consumers from four countries; the Netherlands, Belgium, Spain and Finland completed a questionnaire. Data from the Netherlands and Belgium were combined to represent middle European consumers. The attributes contained affective attribute pairs (unpleasant – pleasant and undesirable – desirable), rational attribute pairs (unnecessary – necessary and beneficial – harmful), moral attribute pairs (right – wrong and ethical – unethical), and safety-related attribute pairs (safe – risky and unnatural – natural). Decreasing the probability of microbial spoilage was regarded as the most appropriate reason to adopt high pressure freezing. However, Spanish respondents were less willing to accept high pressure freezing compared to respondents in other countries. Increasing product cost of high pressure freezing was thought as less appropriate. However only few consumer thought that it was inappropriate. Spanish respondents were most ready to accept high pressure freezing, thus showing less sensitivity to either advantages or disadvantages.

Verbeke and López (2005) study the attitude and behaviour of Belgians towards Latin-American ethnic foods, and Hispanics living in Belgium towards mainstream Belgian food. A survey with 119 Belgian and 127 Hispanic participants was performed. The overall opinion and satisfaction of Belgian consumer towards ethnic food were favourable. Latin-American food consumption and attitude of Belgians are negatively correlated with food neophobia, and positively correlated with openness to new cultures. Taste and appearance were key attributes that determined Belgians' preference for ethnic foods. Hispanics' general perception towards Belgian mainstream food was favourable as well, although they considered their own food as being better in taste.

Food Product Concept Research Using Conjoint Analysis

In recent years researchers have begun working extensively with experimental design of ideas. Experimental design lays out the different combinations of the concept features that across many concepts. A set of elements are combined in different ways. Each concept contains only a limited number of these elements. Through regression analysis, done either at group or individual level, could identify which particular elements drive the response (Howard *et al.*, 2006).

1. Conjoint Analysis as tools for concept development

Conjoint analysis was used to design and analyze the results (Martínez *et al.*, 2006). It was conducted on ranked pleasantness ratings of each person to estimate the relative importance of the experimentally manipulated factors on the food pleasantness of the individual (Kremer *et al.*, 2006). Different stimuli were shown to consumers. These are formed by combinations of attribute levels (each combination representing existing and potential product profiles). Conjoint analysis is a multivariate technique which different attributes describing goods, service, or policy are combined in different levels to construct hypothetical bundles of attributes (Mueller *et al.*, 2006).

Conjoint measurement begins with a simple set of independent variables called 'elements', which are classified into categories or 'silos' of related ideas. Product features may be classified into those dealing with appearance, flavor, health/nutrition etc. Once the researcher identifies the silos and the elements, the next step was to mix and match these elements into a short and easy to understand combinations called concepts or vignettes. Each vignette contains either one or no elements from a given silo. The experimental design underlying the study dictates how vignettes are created, and what elements get into each vignette. Two elements from the same silo cannot appear together in a vignette but a specific element may appear many times with different elements from other silos. In some cases the researcher creates one set of combinations and tests these combinations among a group of respondents, with all respondents seeing the same combinations, although in different orders. A respondent may see all or just some of the vignettes.

Each respondent receives a set of test concepts, and rates the concepts, one at a time, on a question (e.g., likelihood to buy, interest in the product described, etc.). Computerized stimulus creation and data addition, lies at the heart of today's conjoint studies because the computer can create the test combinations quickly, with less error, and can obtain data from many respondents simultaneously. Recent advance technology enable conjoint measurement to be done in the internet, under the complete control of the individual researcher, without any need for additional parties other than the respondents themselves and an internet link (Moskowitz *et al.*, 2001).

For the sensory professional, conjoint analysis represents an entirely new area, consonant with the migration of interest from pure product description to a more statistical design of products on the one hand (science), and insights about the consumers on the other (consumer research). As sensory researchers search for newer, more promising areas in which to work, concept development as an experimental science is becoming increasingly attractive (Moskowitz *et al.*, 2006).

2. Process of Conjoint Analysis (Kotri, 2006 Model)

Conjoint analysis uses customer's preference-estimations towards a set of experimental product concepts as an input. Hypothetical product concepts are presented as the descriptions of the products in the form of a bundle of particular product attributes. Based on data gathered with conjoint analysis it is possible to find the utility of the examined product attributes to a particular customer and thereby calculate the relative importance of different product attributes. Because of the complexity of the conjoint method there are various approaches to data gathering as well as to data analysis available to a researcher. In order to construct the appropriate framework and substantiate the chosen approach for investigating customers' needs, the different conjoint techniques and phases are next analyzed. The main conjoint analysis phases are pointed out together with the most commonly used alternative approaches. It is important to clarify that the stages are not independent; decisions made in every phase affect the next phases and next decisions as shown by table 1.

Table 1: Main phases and alternative approaches of conjoint analysis.

Phase	Alternative approaches
1. Choosing the product attributes to be investigated	Customer needs vs. interests of the company; less than 7 or more than 7 parameters
2. Choosing the data gathering method	Full-concept or paired comparison
3. Composing the concept cards (in full-concept approach)	All possible combinations or certain choice amongst them
4. Choosing the presentation format of product attributes	Graphical or verbal (paragraphs or keywords)
5. Assigning a measurement scale	Ranking, rating scale or paired comparison
6. Data gathering	Mainly interviewing personally or in groups
7. Modeling the preferences	Vector, ideal-point or part-worth model

Source: Kotri, 2006

In data gathering phase, each subject is asked to rank a set of concept cards or a concept combination based on purchasing preference. Every card describes an existing or hypothetical product in terms of a bundle of product attributes. Regression can be used to analyze the data to determine the part-worth utilities for different product attributes (more precisely, to certain attribute

levels). Part-worth utilities are used to determine the relative importance of different product attributes to the customer.

Phase 1 Choosing the product attributes to be investigated

To create concept combinations (concept cards) it is necessary at first to choose the five to ten most relevant product attributes, preferably corresponding to the customer's most important needs; though company's intention for altering certain product attributes may also be decision criteria. The number of product attributes examined is limited in conjoint method. Greater numbers of product attributes necessitates a greater number of concept cards (in order to get reliable estimates of utility function parameters). At the same time the number of concept cards that a respondent can effectively rank is quite small. In different studies it is found that the tolerance level of a respondent is between 12–30 concept cards and 6–8 product attributes, depending on the motivation and product awareness of the respondent. For initial identification of customer wishes different techniques are used. The easiest perhaps is to use information gained from past customer interactions. Mail questionnaires, focus groups and in-depth interviews can also be used.

In addition to picking out the most relevant product attributes, the examinable performance levels for every attributes have to be determined. A majority of studies have used 2–4 performance levels for every attribute. Two criteria are usually kept in mind when choosing the product attributes and their performance levels.

1) The attribute levels should describe as closely as possible the real-life situation facing customers; attributes should be closely related to those products that are available to customers.

2) It is worthwhile to include factors which are considered to be company's key competencies in gaining a competitive edge.

Bernabéu and Tendero (2005) studied preference structure for lamb meat consumers in Spain. In order to determine these preferences by using; price (9, 12 and 16 €/kg), certification (yes, no), origin (Castilla-La Mancha, Rest of Spain, and imported) and type (suckling, "ternasco" and feeder lambs) as attributes and selected levels to define lamb product.

Phase 2 Choosing the data gathering method

Two broad types of conjoint analysis are traditional and choice-based conjoint analysis. Traditional conjoint analysis typically uses data collected from sequential ratings, rankings or graded (rated) paired comparisons followed by an analysis using simple linear models. Choice-based conjoint

analysis uses data collected from a series of choices (from “choice sets”), followed by an analysis using probabilistic choice models (Louviere *et al.*, 2005).

As an alternative to the rank-ordering of concept cards previously described, it is possible to gather data using paired comparison. By this approach, a customer is asked to choose between two attributes which are presented with specific levels. Although the paired comparison exercise is less difficult for respondents, the paired comparison approach has also several disadvantages. The main deficiency is the higher divergence of the research situation from real life decision making. Consumers are not in real life comparing only two product attributes, but entire products (the whole bundle of product attributes). Another shortcoming is the large number of questions (paired comparisons) that are needed for analysis. Therefore paired comparison approach is justified mostly when the number of product attributes is large and it is not possible to apply the full concept method (Kotri, 2006).

Phase 3 Composing the concept cards (in full-concept approach)

It is more practical to use only small part of all possible concept combination alternatives in the full-concept approach. For example, six product's attributes with three performance levels in each attribute made the total alternative concept cards to be $3^6 = 729$. Researchers should used only the minimum number of concept cards that is needed to efficiently estimate the main effect of different attributes on the dependent variable (eg. consumer's stated purchasing preference). Normally, possible interaction effects are omitted from analysis, assuming that they are not strong. It has been found that the gain from including interaction variables in the model hence raising thereby the descriptive power will not compensate the loss in predictive power of the model. Use of orthogonal design (partial factorial planning) can reduce the number of concept cards (in the case presented above) from 729 to 18, which is enough to efficiently estimate the main effects. A more sophisticated design of concept combinations is needed when some product attributes are technically closely related. For example, a concept of “rapid acceleration” and “low petrol consumption” would sound really unbelievable. Researcher has to pick an orthogonal plan, which does not include technically unfeasible product concepts and there is always more than one orthogonal plan possible. The orthogonal design procedure in SPSS version 12 (SPSS Inc., 2005), which used a fractional factorial design made it possible to gather information on a large number of beverage concepts although purchasers only rated a limited number of beverage concepts.

Phase 4 Choosing the presentation format of product attributes

Researcher has to choose which format is used to present the product concepts. It is possible to employ product descriptions in text paragraphs which can give a complete and realistic picture of the product. But these may make the comparison of information in the descriptions difficult. Also the small number of paragraphs that can be read and sorted through by respondents makes the parameter estimated unreliable. It is more common to use a systemized format which presents product attributes as keywords. Keywords are easily comparable and do not include as much rhetoric. Pictorial presentations or actual product prototypes can also be used for presenting visual attributes, but are nevertheless seldom operated.

Phase 5 Assigning a measurement scale

Sayadi *et al.* (2005) compared and debated the results obtained using two commonly employed preference expression techniques, ranking and rating in the application of Conjoint Analysis. They concluded that both evaluation techniques are equally valid when it used for detecting the ordinal structure of preferences. But the ranking method revealed more intensely investigated differences between levels than the rating method. But utility model obtained by the rating method represents the preferences expressed better than the ranking method. In principle, if we wish to obtain a represented utility model for the preferences with the least effort in data gathering, rating scale is advisable. In the other hand, if we aim to segment the preferences of the individuals according to socio demographical features, ranking is more preferable. A paired comparison measurement is to ask respondents to compare two profiles using a graded rating scale that represents strong preference for one profile at one end of the scale, and strong preference for the second profile at the other end of the scale, with "indifference" in the middle of the scale (Louviere *et al.*, 2005).

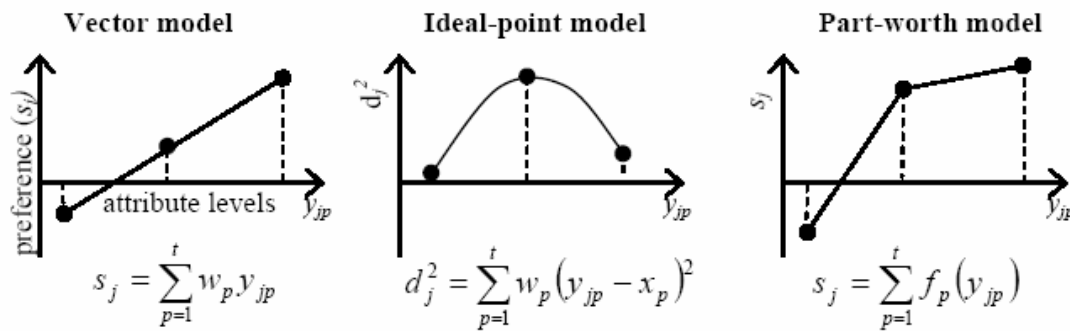
Phase 6 Data gathering

The procedure of sorting concept cards or concept combinations in questionnaire is usually perceived by respondents as complicated and tedious. Consequently data are best gathered through personal or group interviews. In the interview each respondent is asked to look through all the concept cards as possible products on sale and rank them according to their personal purchasing preferences. Interview helps to avoid distrust, give guidelines, control the ranking process and eventually get better data. The advantage of conjoint analysis compared to usual interviews is that it does not ask the respondent directly "what is the importance of different product attributes for you." Rather the importance is based on sequential choices made in ranking of the cards. This method can

therefore minimize response error. For example, a respondent who is asked “how important is it that your car has low pollutant emissions” might, because of social pressures, say that it was more important than it really was. However, in conjoint analysis, the importance would be inferred from the rankings and the respondent is not directly asked the question.

Phase 7 Modeling the preferences

Consumers’ needs and preferences are usually modeled by using one of the following three utility function forms: vector model, ideal-point model or part-worth model (figure 2).



where

t – number of product attributes,

j – number of concept card,

y_{jp} – level of p -th product attribute in the j -th concept card,

s_j – consumer preference toward j -th concept card,

w_p – partial utility parameter of the p -th product attribute

x_p – ideal point of the respondent (ideal level of p -th attribute),

d_j^2 – negatively related to consumer’s preference for j -th concept card (basically $-s_j$),

f_p – part-worth function of p -th product attribute.

Figure 2 Preference function forms.

Source: Kotri, 2006

The part-worth model is most flexible and the vector model is most rigid in terms of the shape of the preference function. However, the number of parameters to be estimated increased in the opposite direction. If the actual preference function is linear, the vector model can give results with highest statistical reliability. Therefore it is always useful to find out a priori the actual shape of preference function. In the case of car “petrol consumption”, one can usually expect a fairly linear utility function - the larger the consumption is, the less utility it creates. In case of car body length on

the other hand one can expect that there is only one level that is preferred by the consumer (neither too short nor too long is good). It is common to estimate the preference functions in conjoint analysis by ordinary least squares regression. Research has shown that the efficiency (predictive power) of this technique is often quite similar to more complex techniques like Logit, Manova, Linmap etc., but the results are easier to interpret.

The aim of the conjoint analysis is to predict consumers' purchasing patterns, so the model's predictive power is more important than its statistical significance. But, on the other hand, this method produces significantly more accurate results than any alternative research method. To assess the model's validity, the correlation between predicted rank/rate order of cards and actual (consumer given) rank/rate order of cards is applied. In different studies the average correlation has been between 0.7–0.8 or up to 0.99.

Based on the utility attached to product attributes' single performance levels the global utility (relative importance compared to other attributes) of every attribute can be calculated. The ratio of particular attribute's utility to the sum of all the attributes' utility is used to reveal the global utility of a particular attribute by the equation below:

$$O_p = \frac{(\max u_p - \min u_p)}{\sum_{p=1}^t (\max u_p - \min u_p)}$$

where

O_p – the relative importance of the product attribute

$\max u_p$ – utility of the attribute's most preferred level of the attribute and

$\min u_p$ – utility of least preferred performance level of the attribute.

The implementation of conjoint analysis can be greatly assisted by modern software packages. The individual level conjoint analysis procedure in SPSS calculated coefficients, expressed as utility values, which linked the attribute levels to changes in product ratings. The derived utility values were then used to determine the importance of each attribute.

The Previous Research and Its Methodology

Schnettler *et al.*, 2007 used conjoint analysis to determine the effect of food origin on consumer purchasing decisions on rice and beef in Chile. The aim of this study was to investigate the reasons that determine the consumption of imported food, the importance of origin in relation to other

extrinsic product clues (price and packaging) in the decision-making process and the differences between population segments in the central and southern Chile.

In this particular experiment, the attributes were origin, package and price. The attribute levels are determined based on the levels that consumers might realistically face. The levels defined for beef origin (domestic, Argentinean and Brazilian); attribute packaging (unpackaged cut beef and beef packed on tray). Definitions of levels for rice were: domestic and imported, packaged in either bags or boxes and the same price levels used for meat. Data were collected using total profile procedure which 18 and 12 cards respectively were made up with a specification for each attribute. Consumers were asked to order the cards from most to least preferred using a scale of 1–18 and 1–12 (Schnettler *et al.*, 2007).

The results of the conjoint analysis indicate that, for the whole sample, the most important factor when purchasing beef was country of origin (48.41%), followed by price (30.09%) and packaging (21.50%). For rice, the importance scores of three product attributes were roughly equal, with origin being slightly more important (34.16%) than price (33.23%) and packaging (32.60%). This information indicates that there are no specific factor dominates consumer preferences (Schnettler *et al.*, 2007)

Martínez *et al.* (2006) used conjoint analysis to determine the relative importance of a set of attributes which influence purchase decision of quality wine among Spanish consumer which were designation of origin (D.O.), type of wine, price and occasion. They have considered two different purchase places (restaurants and retailers) and three segments that differ in consumption frequencies (habitual, occasional and sporadic). Significant differences have been found in preference structures between purchase places and among segments. Consumers are specially price conscious in restaurants where formal occasions are more valued but in the other hand, the higher consumption frequency, the lower D.O. and relative price importance.

Lampila and Lahteenmaki (2007) studied whether consumers were ready to accept a new high pressure freezing food which its benefits are attached to the processing method. Consumer attitudes towards high pressure freezing were surveyed in The Netherlands, Belgium, Spain and Finland. Conjoint analysis was used to estimate the relative influences of processing methods, price, sensory quality and environmental quality on the acceptability of vegetables. For each attribute two or three different descriptions were given. Conjoint analysis estimates utility values that reflect the

relative importance of each level of attribute in preferences. The four product attributes were processing methods (two levels: conventional freezing or high pressure freezing) sensory quality (two levels: standard or extra freshness), price (three levels: 25 percent lower than market price, market price or 25 per cent higher than market price), and environmental quality (three levels: 25 percent less than standard amount of water, standard amount of water or 25 percent more than standard amount of water). Overall twelve descriptions of products were given and respondents were asked to rate their willingness to buy these products on a seven-point scale (1 = I would definitely not buy; 7 = I would definitely buy). In general, consumers' attitudes towards various food processing methods were positive.

Kremer *et al.* (2006) studied the compensation for age-associated chemosensory losses and its effect on the pleasantness of a custard dessert and tomato drink using conjoint analysis. Differences between elderly subjects (n = 52, 60-85 years) and young subjects (n = 55, 18-35) in their food liking and olfactory capability were investigated. Flavor enhancement/enrichment, textural change, and/or irritant addition were incorporated as compensatory strategies into these foods. The addition of low concentrations of both cherry flavor and cream flavor to the custard desserts influenced their pleasantness for the majority of the elderly. The addition of cream topping increased the pleasantness of the custard desserts for both elderly and young consumers. This study does not support the assumption that age-associated impairment in olfactory capability will inevitably lead to changes in food liking.

Bernabéu and Tendero (2005) studied preference structure for lamb meat consumers in Spain. In order to determine these preferences, the questionnaires were carried out on a stratified random sample per number and age of inhabitants of every province in Castilla-La Mancha. Consumers were asked to evaluate different attributes and levels such as price (9, 12 and 16 €/kg), certification (yes, no), origin (Castilla-La Mancha, Rest of Spain, and imported) and type (suckling, "ternasco" and feeder lambs). By combining these 4 attributes with 11 levels, altogether 54 potential profiles were obtained. Therefore an orthogonal design was used to reduce the combinations to nine. The questionnaire was presented to consumers in the form of cards. They were asked to arrange cards according to their preferences, by assigning a rank from one to nine. These partial utility scores were used to describe the characteristics which most influence the overall preference of the product as well as its relative importance. Results obtained by means of conjoint analysis techniques show that regular consumers as well as occasional ones show a preference for lamb meat type. In this sense, a conjoint simulation of preferred (suckling and "ternasco") types proved that regular

consumers generally prefer suckling lamb to “ternasco” lamb when they are from Castilla-La Mancha (Bernabéu and Tendero, 2005).

Moskowitz *et al.*, (2005) study sensory benefits, emotions and usage patterns for olive using Internet-based conjoint analysis and segmentation to understand patterns of response. Conjoint analysis was used in an Internet-enabled format in order to understand the drivers of interest at the concept level for olive. The study comprised 36 descriptive phrases covering sensory properties; uses, product origins and emotions. The basic experimental design comprised 60 combinations, with 2–4 elements in each combination describing the olive. The experimental design structure was permuted in order to create 20 different variations. By permuting the design structure, the researcher ensures that no single combination of concept elements could ever dramatically influence the results. Each respondent evaluated the 60 elements in the design in a unique randomized order, which further eliminated the possibility of order bias. The respondent rated the concepts on a single attribute scale. The question read ‘How intense is your craving for this olive?; 1 = Not crave able at all, 9 = Very intense’. After completing the evaluation of the 60 systematically varied concepts, the respondent completed a classification questionnaire dealing with geo-demographics and attitudes towards olives. The utility values revealed differences in interest level when respondents rated the test concepts on an intensity of scale. Although there were some differences in response pattern due to other variables such as hunger, the concept–response segmentation showed the largest differences, and provides an analytic strategy to uncover groups of individuals with interest in mainstream or more narrow food categories who demonstrate heightened response to specific messages and product features (Moskowitz *et al.*, 2005).

The research that used conjoint analysis, did not limit to only food product but also include another product or service such as online service (Mueller *et al.*, 2006), e-business on air travel markets in Korea (Yoon *et al.*, 2006) even hospital service (Yoo, Shin and Yang, 2006).

2. RESEARCH METHOD

2.1. Research Framework and Hypothesis

Research Framework and Hypothesis was set to proof these hypotheses;

H1: Rice can partly substitute for potato and pasta

H2: Rice has some attribute superior than potato and pasta.

H3: Develop new product concepts of rice using target consumer attitude and preference gained more consumer acceptance

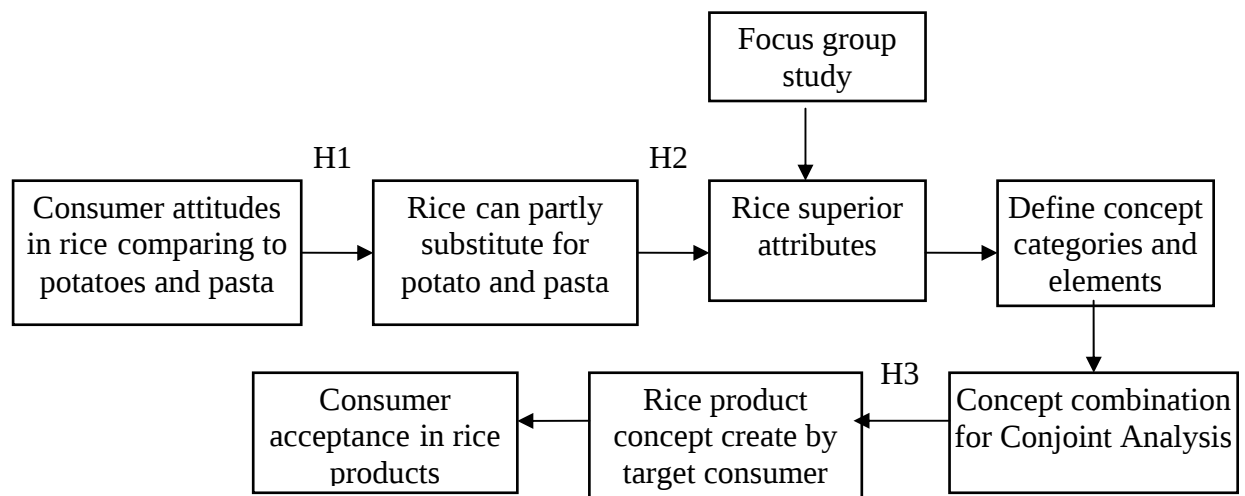


Figure 3 Research Framework and Hypothesis

2.2. Exploratory Surveys of Rice Supply Chain Operators and Its Market Products

The secondary data includes exploratory surveys of rice and its products which conduct in France and Italy as our pilot countries. Interview with rice supply chain operators included rice manufacturer, trader, distributor, NGO, rice association, public organization and university professor were summarized in table 2.

Table 2 Interview with rice supply chain operators

Country	Activities	Location	Institutional Name	Interviewee Name	Position
France	Trader	Paris	RILEG SA	Mr. Olivier Daban	Director
	Trader	Lyon	Eridan SAS	Mr. Eric Sarrazin	Director
	Manufacture	Lyon	Panzani	Mr. Yann Ducrot	Rice Product Chief
	Distributor	Paris	Carrefour	Mr. Guillaume Durand	Product Manager
	NGO	Paris	National Operators Office for Cereals Products (ONIC)	Mrs. Genevieve	Edition Manager
	Association	Paris	Syndicat de la Rizerie Francaise	Mr. Guy Coudert	President
	Public org.	Arles	Syndicat Des Rizicultures de Franch et Filiere	Mr. Francois Callet	President
	University	Montpellier	National School of Agronomy(ENSAM)	Prof. Francois D'Hauteville	Professor
Italy	Association	Pavia	Italian Association of Rice Operator	Mr. Roberto Carriere	Director
				Mr. Ugo Rolla	Director
	Miller/Trader	Milan	Montferrato	Mr. Francesco Vignola	General Manager

Rice products market survey was conducted in supermarkets, Asian grocery stores and Asian restaurants. Survey places in France were Paris (north), Lyon (south east), and Vaucluse (south) and Milan in Italy (table 3). The market products' characteristics from the exploratory research was collected as a set of product attributes that represented various ideas such as features, utility, health/nutrition, taste etc.

Table 3: Points of sales visited in the market survey.

Retailers in France (Paris)	Retailers in Italy (Milano)
Carrefour	Benett
Monoprix	Esselunga
Casino	
ED	
Franprix	
Netto	
Intermarché	
Auchan	

2.3. Focus group study in French, Belgian and Italy consumers

Exploratory primary data were collected through qualitative focus group research. Focus group provided insights in consumer decision making and attitude towards rice and rice products. Focus group studies were moderated follow the focus group moderating training procedure of the Burke Institute (1993). Focus group study conducted in France (Paris and Vancluse), Italy (Milan) and Belgium. Number of panelists and group characteristics were summarized in table 4. The native participants were encouraged to give their opinions on topics such as their every day meal, how they prepared foods, types of rice they preferred, what they thought about Jasmine rice and about selected rice market samples etc. The purpose of this study was to collect a comprehensive view of eating and cooking behavior and attitudes towards rice and rice products. Data from the focus group studies helped understanding rice eating preference of each target countries. And the product ideas from market survey were used to develop product concepts that could represent their preferences and attitudes in rice. All information was then applied for developing a questionnaire to use in a larger follow-up study in a quantitative survey.

Table 4: Focus group study of rice products in selected European consumers

Nationality	Gr.	Group Characteristic	Number of Panelists	Location
French	1	Working people	6	Paris
	2	Housewife	4	Paris
	3	Working people	6	Vaucluse
	4	Elderly	8	Vaucluse
Italian	1	Working people	8	Milan
	2	Elderly / Housewife	8	Milan
Belgian	1	Elderly / Housewife	6	Milan

2.4. Quantitative Survey to Investigate Consumer Attitudes in Rice

A quantitative questionnaire was designed to access consumer attitudes with respect to rice. Non rice users were preliminary screened out. Respondents were selected using a quota sampling plan with nationality, age and gender as quota control variables. Target respondents were native European in UK, France, Belgium and the Netherlands. Questionnaires were distributed using internet survey and person-to-person contact in the departure lounge, Suvarnabhumi International Airport, Thailand. According to Moskowitz, *et al* (2005), the minimal number of sampling size recommended for the 7-point scale, estimated variance 3 at 95% confident interval should be more than 100 respondents which will represent the true population mean (Churchill, 2001). In this study we aimed at about 150 respondents per country or 600 persons by total.

2.4.1. Preference and Attitude towards Rice, Potato and Pasta

Consumer's attitudes used in this study applied from those of Verbeke and Viaene (1999) and Monteleone (1997) who studied the consumer attitudes of fresh meat in Belgium and the perception of starchy foods in the UK respectively. Attitudes were rating using a 7-point semantic differential scale with end points associated with bipolar labels. The scale had a semantic meaning, such as bad-good quality, bad-good taste etc. Attributes used in our study were presented in table 5. Data was analyzed using SPSS (version 12) pairwise t-test and Duncan ANOVA to make a comparison of means of rice with potato and pasta in each attribute among consumers in four target countries.

Table 5 Semantic differential attributes of rice, potato and pasta

Negative pole	Positive pole
Bad Taste	Good Taste
Not healthy	Healthy
Expensive	Cheap
High calorie	Low calorie
With harmful substance	Without harmful substance
Not trustworthy	Trustworthy
Everyday food	Special food
Difficult to digest	Easy to digest
Allergic	Not allergic

2.4.2. Product concept development toward rice

Conjoint Analysis was used to design and analyze the data to test H3 hypothesis. In this study, the attributes and levels were selected to define the rice product would be combined to the concept combination; namely concept silo of related elements, and concept elements within each silo (table 6).

By combining these 5 attributes and 11 levels, 48 potential combinations would be obtained, which is considered the number of products. Therefore an orthogonal design (SPSS Inc., 2005) was used to determine the minimum number of combinations needed to calculate a consumer preference function that reduced to 8 combinations. The question will ask about intense of interesting for each rice product by; 1 = Not interest at all, 10 = Very interest. The scale will present at the bottom of every concept. The respondents read the concept, and rate the concept by check on the appropriate scale button which was identified with a numerical value from 1 to 10. The result of this step would be the optimal rice product concept for consumer in each EU country.

In order to explore the existence of specific consumer types (clusters) within the consumers based on their utility values about rice product concept, the method of Cluster Analysis was followed. The eleven element of rice product attribute as factors were used as clustering variables. Segmentation of the panel was conducted using k-means cluster analysis, with the option to identify 2–6 clusters, according to the size of the respondents. The number of clusters will be select, base on

the easiness of clusters' profile development and the number of statistically significant variables between them by one-way ANOVA test. Then, a cross-tabulation process took place between these clusters and the demographic variables that exhibited statistically significant differences among the clusters by χ^2 test.

Table 6 Concept Silo and concept element in rice product

Concept Silo	Concept Element
Cultivate system	From Non-GMO rice farm From Organic rice farm
Grain type	Jasmine rice an aromatic rice from Thailand which is soft and sticky when cooked. Basmati rice ; Indian long grain rice, with a characteristic flavour and texture. Long grain rice ; rice from USA which is averaging about 7 millimeters in length and separates easily when cooked.
Convenience	Ready-to-eat ; food products that are prepared in advance and can be eaten as sold Cook before serve ; food products that can be eaten after heating or cooking.
Cuisine	Asian cuisine European cuisine
Brand	Well known brand New brand

2.4.3. Rice product preference

After completing the evaluation of the 8 systematically varied concepts, all rated by consumers against the intensity of interesting scale. The respondent complete a hedonic 7- point scale questionnaire, dealing with the type of rice products such as rice grain (white rice), brown rice grain, organic rice grain, parboiled rice grain, easy to cook rice grain, seasoning rice grain, rice grain with vitamin or mineral added, rice grain sold with ready to eat dish, cooked rice in can, cooked rice in plastic bag (pouch), microwavable cooked rice dishes, frozen or chilled cooked rice dishes and low fat cooked rice dishes

The independent samples t-tests was used for comparison of attribute ratings means among countries which indicated product attributes that most effect the interesting in consumer's rice product.

2.5. Experimental design

To obtain the data that used in the study, a survey about 150-200 consumers per country was carried out (random sampling), recommended by Moskowitz *et al.* (2005) for the sampling size of the 7-point scale, estimated variance equal to 3 and 95% confident interval that will contain the true population mean (Churchill, 2001) . The surveys were carried out at the international airport interned. Targets consumers were French, Dutch, Belgium and British.

3. RESULT AND DISCUSSION

3.1. Exploratory Surveys of Rice Supply Chain Operators and Its Market Products

3.1.1. French Supply Chain Operators

Uncle Ben's rice has been described as the easiest rice to cook for years. The image of rice quality has changed since Uncle Ben entered EU market. Uncle Ben tried to promoted American long grain which was harder and non sticky. As a consequence, most French consumers impressed that good quality rice should not stick together, cooked rice grain should be separated. This eating behavior was quite strong among European that make Thai fragrant rice in a difficult position as it was naturally sticky. Therefore, the rice processors try to find some compromise to make fragrant rice suitable for French consumer. Rice processors offered, instead, parboiled fragrant rice which was less sticky. Or try to mix with other variants such as semi to long grain non-fragrant rice. Despite the European regulation concerning rice mixes, there was little control on quality and purity of rice imported to Europe. It was a dilemma; rice mixed or adulterated with other rice varieties could damage the image of product quality of Thai rice. It will loosen its authentic quality. Few French panelists especially those ever associated with Asian preferred to buy Thai rice in Asian grocery stores because the rice quality was better and closer to rice they used to eat in Thailand. However this was exceptional case since most French bought rice from supermarket under local packers' or distributors' brand name.

The interviewees emphasized that marketing activities had impact on consumer buying decision. Distributors and processors do most of the promotion activities. They proposed rice promotion patterns as:

- Faster cooking and more convenience food (ready-to-eat or easy to prepare) should be promoted to convenience sensitive consumers.
- Authenticity and rice quality associated to various cuisines should be promoted to more quality sensitive or health conscious consumers. Rice grain was mostly diversified by its authenticity

such as country of origin. Rice was often associated with Asian countries and cuisine. Customer needed recommended cuisine for specific rice varieties. They recommended a cuisine leaflet attached to the rice package. Moreover cooking demonstration and food stand sample testing in supermarkets was a good trial especially in some Asian festival such as Chinese New Year.

3.1.2. Italian Supply Chain Operators

The Italian rice operators emphasized on the good agricultural practices and the organic crops, as chemical residues became more and more concern in Europe. Basmati rice was start promoted and sold in the supermarkets. Long grain rice was more suitable for side dish. The long cooking time of Risotto could be an advantage for fragrant rice especially for young generation who did not want to spend much time in the kitchen.

The interviewees clearly concerned about rice quality and purity. Similar to France, Italian operators advise Thailand to control rice purity and quality. The Basmati rice production countries had better control on their rice quality and purity. For example, only certain rice varieties were allowed to be called Basmati. The interviewees suggested that rice promotion should be associated with Asian cuisine. Italian consumers should be taught on how to cook rice, as until now, the only rice they cook was Risotto (which was much different from cooking fragrance rice). Recipe on leaflet, cooking demonstration and promotion should be done in supermarkets. The Thai embassy in Milan organized a Thai food demonstration altogether with Thai dance and Thai massage at Hilton Hotel in October, 2005. Their purpose was to present Thai culture and cuisine to Italian businessman.

Recommendation

This study showed different results between French and Italian market. It would therefore be recommended to adjust the product offer depending on the country.

For France, the marketing strategy should take into account both the convenience and traditional consumer orientations. The first group was currently buying ready-to-eat or easy-to-prepare rice products. There are continuously increasing trends in these rice products offered in France. There were some concerns about health for the ready-to-eat products since it contained other unhealthy ingredients such as meat or cheese. Traditional consumer was usually more health conscious and seeks authentic food. Thai cuisine should be promoted as authentic taste and recipe combine with its strong culture image with many herbs and spices. Rice quality and adulteration should be more controlled in order to promote the real characteristics of Thai fragrant rice in term of

texture and taste. Cooking demonstrations should be performed. As French were more and more looking for new culture and cooking experience. These marketing activities should be organized with the supermarkets. Given that the organic products consumption was increasing in France, Thailand may differentiate its products using fair trade or organic concept.

Good quality rice should not stick together as it was a defect for its appearance not its taste. Packaging used such as plastic pouch or boiling bag had a bad quality image. French consumer accepted more of canned food but Italians preferred more of frozen food. Thai rice was already existed in the market but lacked of promotion both from local traders or Thailand government. Basmati rice was better in this sense.

For Italy, the study showed that food preparation time was not a main concern. They have adequate knowledge about Risotto rice but not other types of rice. However, Risotto was strong preference among Italian and difficult to change since it was combined with their every day rice meal. Therefore, Thai fragrant rice could be promoted as a specific variety with specific characteristics. Value-added Thai rice products such as ready-to-eat or easy-to-prepare products should be promoted to younger generation consumers. These consumers were still in the trial stage and opened-mind for new things. They have higher potential to shift their preference than the middle age and elderly who strongly fixed their preference with Risotto. The risk was that if they do, it had high possibility to develop a preference towards Basmati rice. Basmati rice was long time be promoted by Italian rice importers and processors. Any how, even Italian market itself was not sound promising but Thai rice should be targeted at Italian millers, traders and importers. These agents usually a big exporters and millers of various rice grains exported to other EU countries. They knew EU markets and their preferences. Moreover they have advantage of applying existing facilities of Risotto milling plant to mill other types of grain and re-export to EU market with less trade barrier and tax.

3.2. Market Surveys of Rice Products

3.2.1. French Market

Rice products market survey were conducted in supermarkets, Asian grocery stores and restaurants in Paris (north), Lyon (south east), and Vaucluse (south). The distributional channels of rice in France were supermarket, Asian grocery stores and traders. Asian expatriates in France usually bought rice in big bag (5-10 kgs) from Asian grocery stores, French consumer bought small packs (0.5-2 kgs) from supermarkets and French catering industry (restaurant) purchased rice in bulk (15-25 kgs) both from wholesalers and traders. Supermarkets bought rice mainly from French

importers who deal directly with local exporters or manufacturers. The market shares were more or less the same for these different channels. But supermarkets have the largest diversity offered.

Rice products offered in France were diversified by genetic varieties and product characteristics. In supermarkets, rice products can be found in the grocery section (e.g. rice grains, canned rice, rice in pouch, instant rice etc.), refrigerated section (mostly frozen / chilled ready-to-eat rice dishes) and the ready-to-eat section. Only a few brands presented in the market and rice operators usually were big companies such as Masterfoods Company (Uncle Ben's brand), Panzani-Lustucru Company (Taureau Ailé, Lustucru brand). Retailers' brands and hard discount products were also regularly appeared on shelves. Details of major brands and its product characteristics were shown in Table 7.

Table 7: Rice products sold in French supermarkets.

Section	Types of rice	Brand	Packaging Size (g)	Price € / kg	Product Characteristics
Frozen	Cantonese style	Retailers' brand,	500-1,000	2-4.5	Cooked Rice mixed with eggs, meat and vegetables
	Asian style	Marie, Maggi			
	"Paella"	Sveltesse, Marie Maggi	500-1,000	4 – 5	Traditional Spanish dish (Fried rice with seafood, chicken and vegetables)
	Prepared with meat or fish	Retailers' brand, Sveltesse, Marie, Fleury Michon	1 serve (300 g)	4 – 7	Cooked meat or fish in sauce with rice as side dish
Grocery products	Plain rice in carton box / paper bag	Retailers' brand, Uncle Ben's, Lustucru, Taureau, Ailé, Perliz	500-2,000	2 – 3	Various rice grain
	Fragrant rice	Retailers' brand,	500-2,000	1 - 4	Rice grain
	Local rice	Uncle Ben's, Lustucru, Taureau Ailé, Perliz			

Table 7: Rice products sold in French supermarkets.

Section	Types of rice	Brand	Packaging Size (g)	Price € / kg	Product Characteristics
	Boil in bags	Retailers' brand, Uncle Ben's, Lustucru	500-1,000	0,7- 3	Parboiled rice in plastic boiling bags
	Rice in pouch (Retort pouch)	Uncle Ben's, Lustucru	150-250	3 - 5	Pre-cooked rice in pouch
	Canned "Paella"	Garbit, Zapetti			Traditional Spanish dish in can sold with rice grain
Ready to eat	Rice prepared with meat or fish	Fleury Michon, Weight watcher, Spanghero, Marie, Maitre coq, Knorr, William Saurin	300-1,000	2 - 22	Cooked meat or fish in sauce with rice as side dish
Take away	Rice Salad	No brand	Consumer required	10 -16	Boiled rice with meat and vegetables
	Rice prepared with meat or fish "Paella"				Cooked Meat or fish in sauce with rice Traditional Spanish dish
Desserts	Rice with milk (Rice Pudding)	Mont blanc, La laitière, Yabon, Perliz	Up to 500	2 - 6	Boiled rice in milk mixed with caramel

Rice products displayed in grocery section mostly rice grain. It was diversified merely by different genetic varieties, packaging and brand name. Similar to French market, consumer did not have much knowledge about rice varieties and quality. Local manufacturers or, in fact, packer's brand were the most important criteria used for consumer's buying decision. Price varied according to brand rather than quality since customer associate quality with brand. Well known and established brand such as Uncle Ben, Lustucru were sold at higher price. In a contrarily, Asian expatriates living in these countries usually bought rice grain in large quantity from the Asian grocery store as it suit better, familiar taste and much cheaper. Rice growers' brand (such as Thai's brand) was not found in any supermarkets except Asian grocery stores.

3.2.2. Italy Market

Rice was Italian's staple food. Italian consumers did not eat rice as side dish. According to Italian traditional rice cooking style, called Risotto, rice was usually prepared by mixing altogether with vegetables, meat or fish. Rice consumed in Italy was obviously Risotto type. Risotto was a refined dish made with European semi-long rice. It required cooking attention since the preparation time was quite long (about thirty minutes). Risotto and its products such as rice flour, rice milk, rice pudding, rice pasta and gluten free bakery product were promoted by many Italian companies found in ANUGA trade fair, Germany.

Table 8: Rice products sold in Italian supermarkets.

Section	Types of rice	Brand	Packaging Size (g)	Price € / kg	Product Characteristics
Grocery	Roma	Scotti	500-5,000	1 - 5	Various rice grain
	Carnaroli	Riso Gallo			
	Ribe	Riso Noster			
	Vialone nano	Fidel			
	Arborio superfino	Agnesi			
	Fast cooking rice	Misura			
	Basmati	Suzi Wan			
	3 cereali	Uncle Ben's			
	Insalate	Distributor			
	Parboiled	brand			
Frozen	Risotto	Panigada	500-2,500	2 - 7	Italian traditional rice dish (boiled rice and mixed with meat and vegetable) Traditional Spanish dish
	Minestrone	Buitoni			
	Paella	Findus			
Dessert	Rice cream	Fage Müller	(Serving size)	5 - 8	Boiled rice in milk mixed with caramel
	Rice in milk	Scotti			

Italian consumers mainly purchased rice from supermarkets. It was noticed that there was very few value added rice products sold in Italian market. Most of them sold as rice grain. Few value added rice products such as cooked rice in boiling bag, microwavable pouch and frozen ready to-eat could be seen in supermarkets. Most of them made from Risotto as a result from the strong

Risotto's preference as ever mentioned. However, it was very few and the focus group study did not show a big interest in these kinds of product. The main differences between the French and Italian market were the range of products displayed in the supermarkets. In France, rice products were more diversified and more value added. Details of major brands and rice product characteristics sold in Italy market were shown in Table 8.

Recommendation

Study on market product survey could come to the conclusion that French market was more promising in term of market opportunity for more value added rice products. However Italy market was less attractive due to its strong Risotto preference and less value added products. But Italy was a very large rice importer and exporter to the European countries. Italy had large scale rice milling facilities. Basmati and Thai rice were imported and milled in Italy. Most of them were exported to other EU countries. As a consequence, Italian market was still an important market in term of the distribution channels to EU countries. They applied strong marketing activities. Rice operators in Italy were not numerous and mainly big companies such as Montferrato, Riso Gallo and Scotti. Masterfoods (Uncle Ben's brand) was also presented in Italy but aimed at other EU market rather than Italian market as the reason ever mentioned.

3.3. Focus group study

3.3.1. French Consumer

Rice product information was less educated among French consumers due to its small local production. Long grain rice was grown in southern part of France particularly "Carmargue" area. Productivity was quite low and so did its eating quality. They grow rice mainly for environmental purpose. Since rice can grow in flooding area which help protecting soil surface. However, there was still some French who preferred their own local rice. As a result, most French had little knowledge about rice and how to cook rice. French panelists did not know the difference between Basmati rice and Thai rice. Fragrant rice was perceived as better quality comparing to rice produced in Europe. Rice was mainly used as a side dish. There were no typical French dish which rice was the main ingredient as there were in Italy (Risotto) and Spain (Paella).

1) Rice Cooking Method

Rice was considered as convenient food. It was easy to cook comparable to traditional potato. French panelists consumed more than one type of rice. Historically, only semi long and short

grain varieties were sold and mostly were parboiled. Nowadays, these types of rice were still consumed but fragrant and brown rice were becoming more accepted. French panelists preferred long grain rice such as Basmati and Thai rice for their sensory quality. Thai rice consumption seemed to decrease slightly while Basmati rice was still increasing because of more customer communication and advertisements. These two kinds of rice were perceived as not very sticky. There was an opposition in stickiness of fragrant rice as mentioned earlier. Parboiled rice was widely used and was perceived as fast cooking rice, as so, it was appreciated for its convenience rather than its taste. Boil in bag and fast cooking rice was other types of rice sold for its conveniences and easy cooking.

French panelists agreed that rice cooking was not difficult but it was time consuming and need some attention. There were many ways to cook rice and the respondents ever tried more than one method. Overall, cooking rice was the most important step to get satisfying sensory quality. Some French panelists thought that way of cooking to get good quality rice was difficult. The panelists underlined this difficulty as a problem. Knowledge about rice was still low (such as varieties, process, and cooking methods) for example most panelists questioned that fragrant rice's aroma was naturally or artificial flavoring.

2) Rice Eating Pattern

The eating frequency varied from once a week to once every two weeks. Rice was described both as staple and specialty (exotic) food. They always mentioned that rice was used as a side dish and suited with their every day meal. But they can accept rice as main dish if it was presented in the Asian cuisine. The Spanish "Paella" which was fried rice with seafood, chicken and vegetables was the only European cuisine mentioned as a main rice dish. Some elderly respondents used rice for dessert such as sticky rice in milk or rice pudding while the younger less discussed about this. However, panelists seemed to use specific rice for specific application. Parboiled rice was used as "every day meal" while fragrant rice was used more in special occasion.

3) Brand name

Brand name was also mentioned as important buying criteria. For parboiled rice, Uncle Ben's was the most famous brand and every respondent still remembered its advertisement slogan that "it is impossible to be unsatisfied with Uncle Bens' rice" with the picture of rice that totally separated dropping from the fork. Some panelists still hesitated about the correct cooking time, need of rinsing rice before cook, the correct amount of water needed etc. Some respondents followed the instructions

on the package, others ignored the instructions and use their own experience. Rice stickiness was always described as inferior quality as the impression of Uncle Ben's unsticky rice as ever mentioned. Most panelists underlined that rice should not be too much stick together because it did not look more appetite and did not go well with French dishes even the taste was acceptable.

4) Rice as healthy food

Rice was not specially associated with healthy aspect. However, the image of rice was a natural product. It was common for French to eat rice when they were sick. Rice was also favorable among starchy foods such as potato, pasta, etc. The focus group study clearly confirmed the bad image of plastic such as rice in plastic pouch. Rice was thought as healthy as other carbohydrates such as potato or pasta and was considered as low fat food. There were discussions about the fattening effect of rice as source of carbohydrate but it was not a main concern. Most ready-to-eat rice products had a bad image among panelists apart from its conveniences. They were afraid of high amount of food additives and fat in such products. It was interesting to notice that canned food was more accepted by French panelists. In their opinion, canned food was less processed and less additive than other preserved food. Chilled rice dish in plastic tray with meat or fish was more acceptable than frozen rice dishes. Rice prepared by the catering industry was also perceived as unhealthy. The respondents had some bad experience with the rice consumed in company's restaurants and restaurant chains.

3.2.2. Italian Consumer

In the past, Italy had a different eating culture between north and south. Rice was grown only in the north whereas wheat was produced in the south to make pasta. As a result, rice was consumed mainly in the north and pasta mainly in the south. Nowadays, the immigration of southern Italian into the northern part made rice and pasta more versatile. Italian either from north or south both eat rice and pasta. However, Rice variety from northern Italy was still preferred. Opposite from British and French, Italian consumers had better knowledge about rice e.g. its cultivation, process and varieties. Cooking Italian rice was their routinely. It was quite remarkable that Italian rice market was mature, and was not easy to change their eating habit.

Unlike UK and France, Italy have never colonized any Asian countries, therefore, its Asian community was small and mainly the Philippines. Asian culture and cuisine were not as remarkable as UK and France. There were very few Asian restaurants. Panelists showed a little interested in these food since many Italian restaurants serving various Italian foods with cheaper price. For

example, a pizza in Italy was cheaper than a Chinese dish. To solve this problem, some Asian restaurants had to offer both Asian and Italy cuisine which loosen the authentic Asian food. Most panelists commented that price was still high comparing to its quality. Rice promotion via Asian culture could be partly applied for product development; however it may not have strong effect as in the UK or France. Rice was also considered as a healthy product in a broad sense. Similar to French, it was mentioned as an appropriate dish when one got stomach sickness.

Rice was a main ingredient in the Italian cuisine followed pasta. It was the “Primo piatto” (main dish in Italian dish sets). The eating frequency was at least twice a week. Rice was used in Risotto, salad and soup. Vegetables, meat, fish, cheese and sauce were mixed with rice. “Paella”, the traditional Spanish fried rice, was mentioned as an alternative to other rice dishes. Rice was also presented in the Asian cuisine.

Apart from Risotto, there was no specific preference for other rice varieties. However rice varieties were associated with its usage. They used specific rice for specific application. Consumers had some knowledge about different rice varieties and therefore were more involved in the buying process. Some respondents preferred whole grain rice (“integrale”) for its unique taste and nutrition. The panelists knew Basmati rice as Asian rice but consumed less than Italian rice. As Italian associated the production area with rice variety so respondents know that Basmati was from India. Sensory quality of Basmati was described as acceptable but India had an image of remote country that may use too much chemicals (as Italy used to do in the past). This could be a concern for Thai rice promotion in Italy.

Rice quality was described to depend on the dish. The common quality characteristic was related to texture, for example, sticky and firm texture for Risotto and salad, soft texture for soup and jelly-liked texture for desserts. For Italian rice, there was not much cooking instructions need as it varied with different rice varieties and preferred texture. Italian respondents did not mind spending time cooking rice. Rice was a dish prepared when more time was available or when having guests at home. For fast meal, pasta was preferred. Therefore, decrease cooking time of rice was not really a priority. Most panelists said that there was no necessity about that. Italian consumers accepted more frozen food than French. Similar perception was also found among Dutch consumers which arose from the consumer education campaign which stated that frozen food was the best process to preserve food nutrients.

3.4. Quantitative Survey to Investigate Consumer Attitudes in Rice

Respondents' demographic data was shown in table 9. The respondents were almost equally spread over nationality, age and gender due to quota sampling plan. Consumer attitude towards rice was compared across-countries using Duncan ANOVA.

Table 9 Characteristics of the respondents (n=634)

Characteristics		Nationality				Total
		British	French	Dutch	Belgian	
<u>Gender</u>	male	99 (54.7%)	66 (48.9%)	84 (51.2%)	85 (58.6%)	334 (53.4%)
	female	82 (45.3%)	69 (51.1%)	80 (48.8%)	60 (41.4%)	291 (46.6%)
<u>Age</u>	under 30	108 (59.0%)	79 (58.1%)	66 (39.5%)	77 (52.0%)	330 (52.1%)
	over 30	75 (41.0%)	57 (41.9%)	101 (60.5%)	71 (48.0%)	304 (47.9%)
<u>Education</u>	Below bachelor degree	75 (42.6%)	33 (24.8%)	46 (27.9%)	33 (22.4%)	187 (30.1%)
	Bachelor degree	62 (35.2%)	46 (34.6%)	75 (45.5%)	74 (50.3%)	257 (41.4%)
	Master's degree and above	39 (22.2%)	54 (40.6%)	44 (26.7%)	40 (27.2%)	177 (28.5%)

3.4.1. Preference and Attitude towards Rice, Potato and Pasta

Result showed that consumers' attitudes about rice in calorie, harmful substance, digestibility and allergy were not significant different across nations and was in a positive side (table 10). Taste, healthy, cheap price and hypo-allergic of rice were among the highest positive attitudes. Respondents thought that rice was neither an everyday food nor special food. This actually implied that rice was consumed regularly in these countries even not every day. Comparing across nationalities found that British consumer trended to rate lower than the others in almost every items but still in positive site. British has long experience in Asian food as a result of colonization especially India. As a consequence, attitudes towards rice were not new or special, or they already perceived it as a common commodity. The Dutch was the second lowest positive rating with similar reason in colonization of Indonesia and Surinam. Belgian was the highest positive rating in most aspects.

Consumer attitudes of rice compare to potato and pasta in each country were shown in table 11. Result showed that, in general view, rice was higher positively perceived than pasta and

potatoes in almost every attributes. By general, rice was not viewed as special food however it was still got better score than potatoes and pasta which were perceived as rather boring everyday starchy foods. British consumers thought that rice was not as tasty as potatoes but it was lower in calorie, less harmful substance and less allergic. French consumers thought that pasta had better taste than rice. But rice was cheaper, less allergic, easy to digest and lower in calorie than potato and pasta. Dutch and Belgian's perception were quite similar. Both had positively perception in rice in almost every attitude. They perceived that rice was healthier, cheaper, easy to digest, lower calorie, less allergic and contain less harmful substance. But the taste of rice was preferred similarly to potatoes and pasta. Even tough rice could not perfectly be substituted for potatoes and pasta. But result showed that rice was certainly gained positive attitudes among these four target European consumers. Perception in rice either about health, price, calorie, harmful substance, trustworthy, digestibility and allergy gained superior quality than potato and pasta. As rice consumption per capita in Europe still comparatively lower than potato and pasta, Thai rice has large demand to fill in. Proper marketing means that could differentiate superior quality of rice will help increase consumers demand in rice.

Table 10 Consumer perception of rice attributes in each countries.

Attributes	UK	France	Netherlands	Belgium	Grand means
Bad - Good Taste	1.97±1.19 ^a	2.14±1.1 ^{ab}	2.13±1.06 ^b	2.24±0.89 ^{ab}	2.11±1.07
Not healthy - Healthy	1.87±1.33 ^a	1.95±1.16 ^{ab}	1.97±0.96 ^a	2.19±0.95 ^b	1.99±1.12
Expensive - Cheap	1.87±1.58 ^{ab}	2.16±1.33 ^b	1.82±1.29 ^{ab}	1.95±1.17 ^a	1.94±1.36
Allergic - Not allergic ^{ns}	1.88±1.53	1.67±1.23	1.68±1.22	1.82±1.13	1.77±1.30
Difficult - Easy to digest ^{ns}	1.33±1.51	1.51±1.23	1.56±1.22	1.52±1.14	1.47±1.30
With-Without harmful substance ^{ns}	1.41±1.47	1.44±1.45	1.26±1.32	1.54±1.23	1.41±1.37
Not trustworthy - Trustworthy	1.54±1.47 ^a	1.58±1.32 ^a	1.13±1.39 ^{ab}	1.29±1.25 ^b	1.38±1.38
High - Low calorie ^{ns}	0.98±1.48	1.24±1.52	1.32±1.51	1.32±1.53	1.21±1.51
Everyday - Special food	0.03±1.94 ^a	-0.14±1.81 ^a	0.60±1.76 ^b	0.67±1.69 ^b	0.29±1.84

^{a,b,c} Mean values in the same column followed by a different superscript letters were significantly different (P<0.05).

ns = not significant.

Scale: bipolar semantic scale (7 points, 0 middle point)

Table 11 Consumer attitude mean score of rice compared to those of potatoes and pasta in each countries.

Bipolar semantic	United Kingdom			France			Netherland			Belgium			Total		
	Rice	Potato	Pasta	Rice	Potato	Pasta	Rice	Potato	Pasta	Rice	Potato	Pasta	Rice	Potato	Pasta
Bad-Good Taste	1.98	2.21*	2.16	2.14	2.20	2.38*	2.13	2.02	2.13	2.24	2.30	2.27	2.11	2.18	2.23*
Not healthy-Healthy	1.87	1.65	1.70	1.94	1.79	1.82	1.96	1.84	1.61*	2.18	1.95*	2.01	1.98	1.80*	1.78*
Expensive-Cheap	1.88	1.76	1.75	2.16	2.09	1.87*	1.81	1.57*	1.38*	1.95	1.66*	1.54*	1.94	1.76*	1.63*
High-Low calorie	0.96	0.49*	0.57*	1.24	0.87*	0.83*	1.32	0.96*	0.52*	1.32	0.88*	0.51*	1.20	0.79*	0.60*
With-Without harmful substance	1.41	1.05*	1.26	1.44	1.50	1.39	1.25	0.79*	0.98*	1.54	1.20*	1.03*	1.41	1.11*	1.16*
Not trustworthy-Trustworthy	1.56	1.45	1.53	1.58	1.50	1.5	1.12	0.96	1.06	1.29	1.12	1.03*	1.38	1.25*	1.28*
Everyday-Special food	0.03	-0.41*	-0.13	-0.14	-0.32	-0.42*	0.60	-0.15*	0.12*	0.68	-0.06*	0.07*	0.29	-0.24*	-0.08*
Difficult-Easy to digest	1.31	1.36	1.17	1.51	1.15*	1.42	1.56	1.06*	0.85*	1.52	1.24*	1.23*	1.47	1.21*	1.16*
Allergic-Not allergic	1.90	1.96	1.67*	1.67	1.46*	1.38*	1.68	1.59	1.48*	1.82	1.78	1.53*	1.78	1.71	1.52*

*Significant different from rice at $p < 0.05$

Scale: bipolar semantic scale (7 points, 0 middle point)

3.4.2. Claimed Past and Future Intention to Increase Rice Consumption

The associations between attributes rating and claimed past and future intention to increase rice consumption were assessed through independent samples t-tests for comparison of means of each attribute. Claimed rice consumption increase from the past was not significantly associated with any rice attributes ($p < 0.05$) (Table 12). It implied that, in reality, when consumers buy more rice, they may not have any perceptions in mind or there were actually no true reasons why they increase consumption. Whereas when they were asked for future intention which actually still did not happened yet. They tried to think about what were the beneficial characteristics of rice.

Table 12 Associations between claimed past behavior and consumer attitude mean score of rice

Rice bipolar semantic differential labels	Did you increase rice consumption as compared to last year?		
	Yes (n =321)	No (n =270)	p-value
Bad-Good Taste	2.16	2.01	0.12
Not healthy-Healthy	1.98	2.00	0.81
Expensive-Cheap	1.87	1.96	0.38
High-Low calorie	1.26	1.04	0.08
With-Without harmful substance	1.50	1.39	0.31
Not trustworthy-Trustworthy	1.54	1.40	0.22
Everyday-Special food	0.27	0.14	0.39
Difficult-Easy to digest	1.43	1.61	0.08
Allergic-Not allergic	1.84	1.78	0.57

Intention to increase rice consumption in the near future was significantly associated with rice perceptions on four attributes which were "good taste", "healthy", "low calories" and "specialty" ($p < 0.00$) (Table 13). The overall intention to increase rice intake was 46% of all respondents. However consumption intention to increase rice consumption in the near future was strongly different between those who perceived the benefit of the above rice attributes and those who did not. Rice perceptions about good taste, healthy, low calories and specialty should be a good starting point to promote beneficial characteristics of rice since they were already existed in consumers' mind within these countries.

Table 13 Associations between claimed future buying intention and consumer attitude mean score of rice

Rice bipolar semantic differential labels	Do you intend to increase rice consumption in the near future?		
	Yes (n =271)	No (n =371)	p-value
Bad-Good Taste	2.28	1.93	0.00
Not healthy-Healthy	2.13	1.86	0.00
Expensive-Cheap	2.00	1.83	0.13
High-Low calorie	1.44	0.91	0.00
With-Without harmful substance	1.49	1.40	0.43
Not trustworthy-Trustworthy	1.49	1.46	0.76
Everyday-Special food	0.55	-0.08	0.00
Difficult-Easy to digest	1.58	1.46	0.25
Allergic-Not allergic	1.82	1.81	0.90

3.4.3. Preference and Attitude towards Rice Products

Consumers' interest in rice product's attributes in different countries were compared using one-way ANOVA and Duncan pairwise multiple comparisons. There was not significantly different among nationalities in three less processed rice products; white rice, brown rice and easy to cook rice grain (Table 14). Overall, British rated the lowest interest in more processed rice products while Belgian and Dutch rated higher score. There was not any research about minimally processed rice perception but the result shown the tendency of interesting in this concept especially British. Interested score of cooked rice in can was extremely low when compared to rice grain. In Belgium, top importance levels of minimally processed fruit and vegetable were attributed to freshness, taste, and some aspects of labeling (e.g. shelf life date) (Ragaert *et al.*, 2004).

Table 14 Consumer interested score of rice product of each country.

Interested in rice product	UK	France	Netherland	Belgium	Grand means
Rice grain (white rice)	3.93±1.14 ^{ns}	3.85±1.01 ^{ns}	3.72±1.03 ^{ns}	3.86±0.98 ^{ns}	3.84±1.05
Organic rice grain	3.26±1.42 ^a	3.53±1.15 ^{ab}	3.62±1.12 ^b	3.37±1.06 ^{ab}	3.44±1.21
Brown rice grain	3.36±1.32 ^{ns}	3.39±1.02 ^{ns}	3.48±1.05 ^{ns}	3.30±1.18 ^{ns}	3.38±1.16
Easy to cook rice grain	3.08±1.35 ^{ns}	3.29±1.11 ^{ns}	3.22±1.09 ^{ns}	3.29±1.14 ^{ns}	3.21±1.19
Seasoning rice grain	2.67±1.28 ^a	2.93±1.16 ^{ab}	2.91±1.05 ^{ab}	3.03±1.13 ^b	2.87±1.17
Low fat cooked rice dishes	2.67±1.43 ^a	2.43±1.17 ^a	2.97±1.25 ^b	2.99±1.09 ^b	2.77±1.27
Parboiled rice grain	2.24±1.15 ^a	2.89±1.12 ^b	2.90±1.14 ^b	3.01±1.21 ^b	2.74±1.20
Rice grain with vitamin/mineral	2.40±1.30 ^a	2.66±1.21 ^{ab}	2.80±1.22 ^b	2.87±1.24 ^b	2.68±1.25
Rice grain with ready to eat dish	2.47±1.31 ^a	2.54±1.13 ^a	2.93±1.13 ^b	2.71±1.12 ^{ab}	2.67±1.19
Microwavable cooked rice dishes	2.35±1.33 ^a	2.53±1.18 ^{ab}	2.91±1.36 ^c	2.76±1.09 ^{bc}	2.63±1.27
Frozen/chilled cooked rice dishes	2.17±1.25 ^a	2.45±1.11 ^b	2.82±1.23 ^c	2.64±1.14 ^{bc}	2.51±1.21
Cooked rice in plastic bag (pouch)	2.27±1.27 ^a	2.48±1.23 ^{ab}	2.53±1.23 ^{ab}	2.59±1.14 ^b	2.46±1.23
Cooked rice in can	1.78±1.11 ^a	2.10±1.20 ^b	2.54±1.23 ^c	2.55±1.28 ^c	2.23±1.25

^{a,b,c} Mean values within the same row followed by a different superscript letters were significantly different at $p<0.05$.,
ns = Not significant at $p<0.05$.

Scale: Hedonic scale 1 (not interest) 5 (very interest)

Claimed increase rice consumption from the past was significantly correlated with rice products' interest in three products; rice grain, easy to cook rice and seasoning rice grain. The more consumers interest the higher in claimed increase rice consumption from the past (Table 15).

Table 15 Associations between claimed past behavior and consumer interested score of rice product

Interested in rice product	Did you increase rice consumption as compared to last year?		
	Yes (n =321)	No (n =270)	p-value
Rice grain (white rice)	3.95	3.68	0.002
Brown rice grain	3.32	3.43	0.251
Organic rice grain	3.39	3.44	0.632
Parboiled rice grain	2.66	2.73	0.540
Easy to cook rice grain	3.32	3.07	0.014
Seasoning rice grain	2.96	2.74	0.023
Rice grain with vitamin or mineral added	2.69	2.61	0.434
Rice grain sold with ready to eat dish	2.65	2.61	0.718
Cooked rice in can	2.21	2.13	0.449
Cooked rice in plastic bag (pouch)	2.52	2.33	0.068
Microwavable cooked rice dishes	2.63	2.59	0.698
Frozen or chilled cooked rice dishes	2.48	2.49	0.898
Low fat cooked rice dishes	2.81	2.70	0.302

Table 16 Associations between claimed future behavior and consumer interested score of rice product

Interested in rice product	Do you intend to increase rice consumption in the near future?		
	Yes (n =271)	No (n =371)	p-value
Rice grain (white rice)	4.01	3.67	0.000
Brown rice grain	3.47	3.29	0.075
Organic rice grain	3.64	3.23	0.000
Parboiled rice grain	2.89	2.53	0.000
Easy to cook rice grain	3.38	3.06	0.001
Seasoning rice grain	3.08	2.69	0.000
Rice grain with vitamin or mineral added	2.88	2.47	0.000
Rice grain sold with ready to eat dish	2.80	2.50	0.003
Cooked rice in can	2.46	1.93	0.000
Cooked rice in plastic bag (pouch)	2.70	2.22	0.000

Microwavable cooked rice dishes	2.80	2.46	0.001
Frozen or chilled cooked rice dishes	2.68	2.32	0.000
Low fat cooked rice dishes	3.02	2.53	0.000

Increase rice consumption intention for the near future was also significantly associated with rice product interest in all rice products ($p < 0.01$). Consumers intended to increase their rice consumption as they interest increase (Table 16).

3.4.3. Rice Product Concept Development using Conjoint Analysis

The respondents' ratings score (1 to 10; 1 is "not at all interested" and 10 is "very interested") were adequately described by the conjoint model with the association measures, Pearson's r and Kendall's tau, which provide measures of the correlation between respondents' ratings and estimated in the overall sample among different countries.

3.4.3.1. Overall consumer's relative importance of rice attributes

The relative importance of rice attributes were ranking from grain type (31.6%), convenience (19.3%), cuisine (18.0%), cultivated system (17.7%) and brand name (13.3%) respectively. Grain type with a combined relative importance of 31.6%, dominated preference of all rice products' attributes (table 17).

Table 17 Results of conjoint analysis of total respondents.

Attributes	levels	Part-worth	Relative importance (%)
Grain type ^a	Jasmine rice	0.0760	31.60
	Basmati rice	0.0514	
	Long grain rice	-0.1274	
Convenience ^a	Ready-to-eat	-0.2558	19.33
	Cook before serve	0.2558	
Cuisine ^a	Asian cuisine	0.0216	18.04
	European cuisine	-0.0216	
Cultivated system ^a	Non-GMO	0.0907	17.71
	Organic rice	-0.0907	
Brand	Well known brand	0.0745	13.33
	New brand	-0.0745	
Pearson's <i>r</i>	0.998 ^b		

<i>Kendall's tau</i>	0.929 ^b
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^a Significant at $p < 0.05$ when compared to zero in a two-tail t-test.

^b Significant at $p < 0.001$.

Displayed liking of Jasmine and Basmati rice showed by positive part-worth of 0.0760 and 0.0514 respectively. Less liking was US long grain rice with negative part-worth -0.1274. These utility values presented that European consumer more preferred Jasmine rice and Basmati than American long grain (significantly different from zero at $p < 0.05$).

The positive part-worth for convenience attributes of “cook before serve” (part-worth 0.2558) indicated consumers’ preferences for rice product that can be eaten after heating or cooking than ready to eat rice products (-0.2558). Cardello *et al.*, (2007) found that the phrase “minimally processed” had negative utility for American consumers because this term might imply, instead, that the product had not been processed sufficiently, and therefore might pose some microbiological or other safety risk. Therefore, “cook before serve” may applied in this sense.

With regard to cuisine attribute, European cuisine with rice had a negative part-worth (-0.0216), while Asian cuisine had a positive part-worth (0.0216). This agreed well with result from focus group study that they preferred to eat rice in Asian cuisine.

For cultivated system attribute, a non-GMO rice product had positive part-worth (0.0907) comparing to organic rice (-0.0907). The lowest relative importance was brand name, however, well known brand gained positive part-worth comparing to new brand name. The ideal rice product concept should be prepared from Jasmine/Basmati rice varieties in a cook before serve Asian cuisine and non-GMO.

3.4.3.2. Relative importance of rice attributes among consumer of different nationality

Consumers in all countries gave similar highest importance in “grain type” attribute while “brand” obtained the least importance value. Schnettler *et al.* (2007) studied the importance scores of three rice product attributes in Chile. Origin was slightly more important (34.16%) than price (33.23%) and packaging (32.60%). Among consumers in different countries, British consumers gave the lowest importance in cultivated system. Belgian and Dutch rated lowest in convenience attribute while French ignored cuisine attribute for rice products.

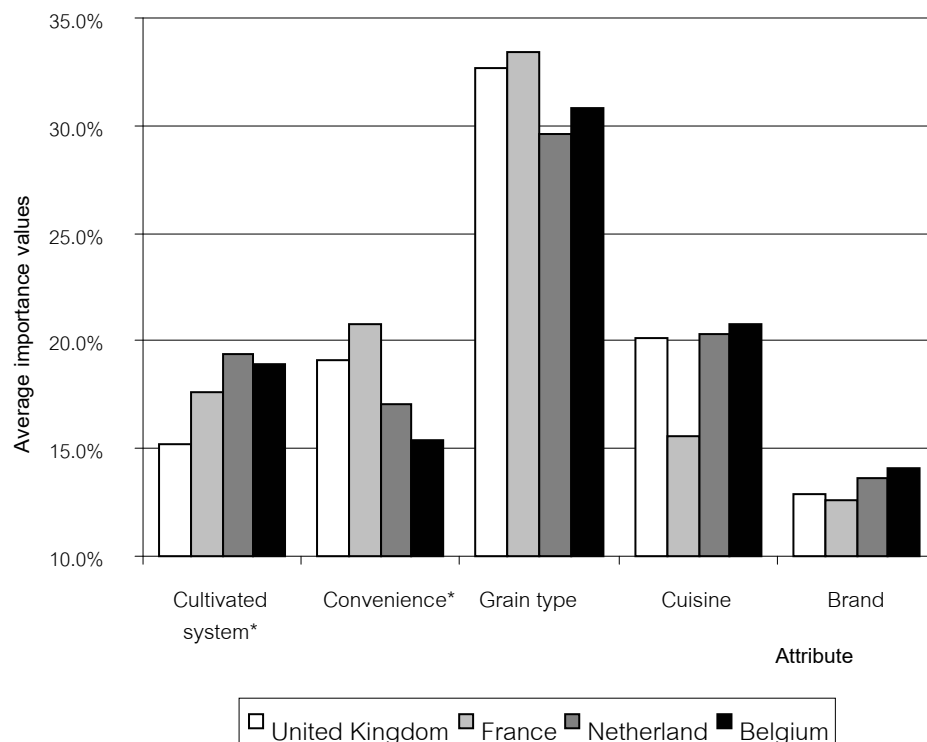


Figure 3 Average importance values for the attribute contributing to consumer interest in rice product concepts in each countries.

Letter (*) above the attribute name reflect significant differences between respondent countries at $p < 0.05$

1) Utility levels of “cultivated system” attribute

The part-worth utility scores of two cultivated systems, “non-GMO” and “organic”, in each country were shown in figure 4. The highest utility score in every country was the “non-GMO” rice product. French and Belgian preferred rice product from a non-GMO rice than organic rice (significant differences from zero at $p < .05$). Similar trend found in British and Dutch consumer but with insignificant differences from zero ($p < .05$). UK have a relatively long history of organic production, until the mid-1980s and early 1990s, while half of the market share of organic foods in the Netherlands was in the general health shop (Torjusen *et al.*, 2004). Therefore British and Dutch consumption of organic foods has become “normalised” in the sense.

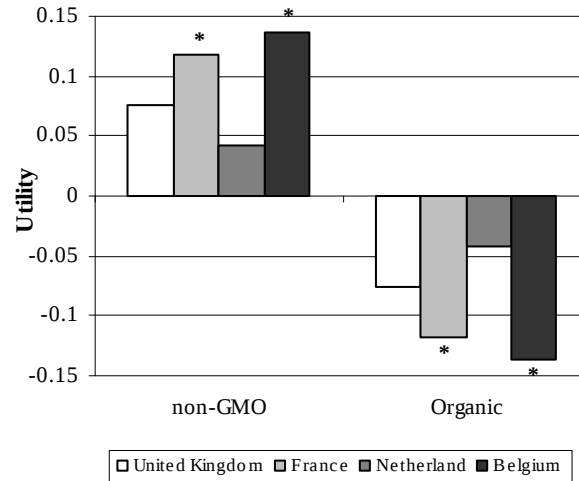


Figure 4 Utility values for “cultivated system” attribute of rice product concept.

Letter (*) above the bars reflect significant differences from zero at $p < 0.05$

2) Utility levels of “cuisine” attribute

The part-worth utility scores of “Asian cuisine” and “European cuisine” in each country was not revealed in the same tendency (figure 5). British and French gave much greater utility value for “Asian cuisine”. Dutch and Belgian, on the other hand, showed greater utility values in rice products designated to “European cuisine”. British and French have long cross cultural mix up with Asian cuisine and preferred the authentic style of foods. Dutch and Belgian, rather closed economy, preferred Asian cuisine that adjusted to their taste. Verbeke and López (2005) studied the attitudes of Belgian towards their ethnic food and found that taste and appearances were the key attributes that determined Belgians’ preference.

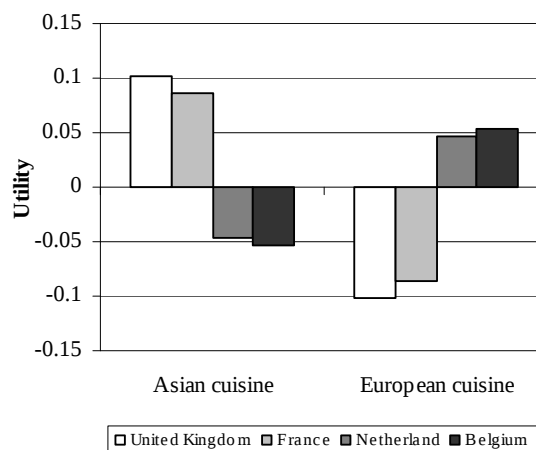


Figure 5 Utility values for “cuisine” attribute of rice product concept.

Letter (*) above the bars reflect significant differences from zero at $p < 0.05$

3) Utility levels of “grain type” attribute

Jasmine rice gained positive utility scores in all nationalities except French. While American long grain got negative utility scores in all studied countries (figure 6). Both Belgian and Dutch consumers had highest utility values for rice product made from Jasmine rice with significantly different from zero at $p<0.05$, followed by Basmati rice. Belgian consumers had extremely negative utility values for U.S.A. long grain rice product. French consumers gave negative utility values for Jasmine and U.S.A. long grain and highest utility values for Basmati rice product. British gave moderate utility values for Jasmine and Basmati rice product.

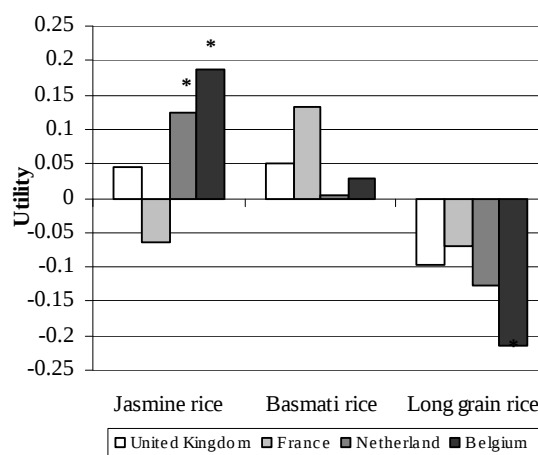


Figure 6 Utility values for "grain type" attribute of rice product concept.

Letter (*) above the bars reflect significant differences from zero at $p<0.05$

4) Utility levels of “convenience” attribute

Similar trend in utilities values of “convenience” was found in all nationalities (figure 7). The utility value was significantly different from zero at $p<0.05$ for British, Dutch and Belgian consumers. The result indicated that rice product that have to heat or cook before eaten was more preferred. According to Pettinger *et al.* (2004), convenience factor was more important when choosing food in UK rather than in France where people willing to spend more time in cooking. Moreover, the phrase “minimally processed” food had negative utility for American consumers because this term might imply, instead, that the product had not been processed sufficiently, and therefore might pose some microbiological or other safety risk (Cardello *et al.* 2007). Hence further heating process may need to reassured food safety. The meal provider naturally wanted to please those they were feeding which cause they to feel a sense of satisfaction and pride (Devault, 1991). They would feel better to put little effort to prepare food for their families rather than serving them with ready to eat food.

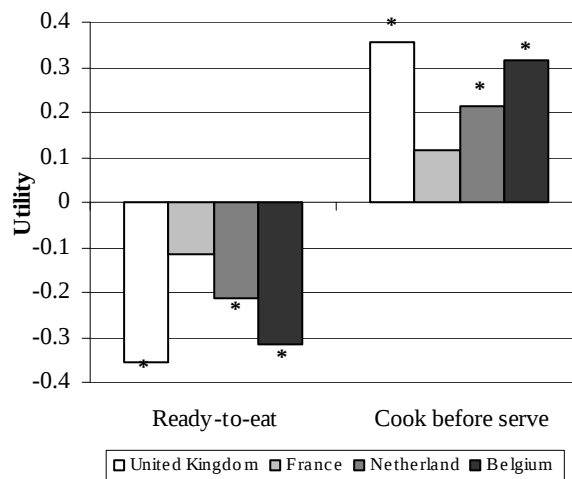


Figure 7 Utility values for "convenience" attribute of rice product concept.

Letter (*) above the bars reflect significant differences from zero at $p < 0.05$

5) Utility levels of "brand" attribute

"Brand" was the attribute that gain less importance values comparing to the other attributes (figure 8). The preferences for well known brand rice product were higher than those of new brand. The utility values for brand name was not significant different from zero at $p < 0.05$. Therefore, French consumers were ready to buy products from the new brand. In a contrarily, Javalgi *et al.* (2005) found that French consumers were more likely to buy certain products because of the reputation and brands. Rice was a commodity with no established well known brand in French market comparing to the UK (Uncle Ben) and the Netherlands ().

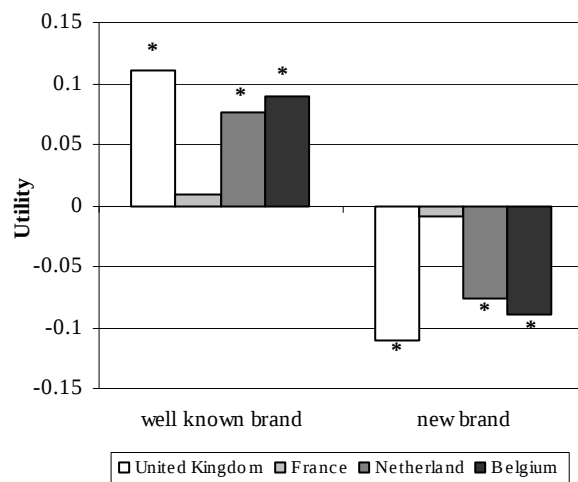


Figure 8 Utility values for "brand" attribute of rice product concept.

Letter (*) above the bars reflect significant differences from zero at $p < 0.05$

3.5. Market segmentation

The four clusters were finally selected, based on the clusters' profile development and the number of statistically significant variables between them. Each of the four clusters had a distinctive set of elements that best described the group (Table 18). A representative name was selected to the nature of the segment, based on the winning elements for the segment. Segments were characterized ranking from the highest important value as 1) Jasmine/Basmati lover, 2) GMO phobia 3) Asian fever 4) convenience cooker.

Table 18 Means of important values and utility scores on five rice product attributes by cluster

Attributes	Levels	Part-worth (%)			
		Jasmine / Basmati lover (n = 260)	GMO phobia (n = 196)	Asian fever (n = 106)	Convenience cooker (n = 39)
Grain type	Jasmine rice	0.01	0.23	-0.07	0.18
	Basmati rice	0.74	-0.66	-0.26	-0.12
	Long grain rice	-0.75	0.43	0.34	-0.06
	<i>Relative importance</i>	52%	31%	19%	5%
Cultivated system	Non-GMO	-0.18	0.59	-0.10	-0.05
	Organic rice	0.18	-0.59	0.10	0.05
	<i>Relative importance</i>	13%	34%	7%	1%
Cuisine	Asian cuisine	0.01	-0.43	0.84	0.14
	European cuisine	-0.01	0.43	-0.84	-0.14
	<i>Relative importance</i>	1%	25%	52%	4%
Convenience	Ready-to-eat	-0.24	0.17	-0.19	-2.71
	Cook before serve	0.24	-0.17	0.19	2.71
	<i>Relative importance</i>	17%	10%	12%	89%
Brand	well known brand	0.24	0.00	-0.17	0.00
	new brand	-0.24	0.00	0.17	0.00
	<i>Relative importance</i>	17%	0%	11%	0%

3.5.1. Jasmine/Basmati lover segment

The Jasmine/Basmati lover consumer was the largest segment found in this study, about 43 percent of the respondents belonging to this segment (table 18). Differences within the clusters in terms of demographic characteristics were small and spread over the gender, age, education and nationality except personal income (table 19). 53.7% of this segment were younger than 30. Most of them was earned lower than 2,500 €/month that included over 70 percent of this segment. British and Dutch were slightly belonging to this group more than other nationality accounted for its long experience with Asian cuisine through colonization.

Table 19 Demographic details of the identified clusters

Demographic characteristics		Segment frequency (%)				χ^2
		Jasmine / Basmati lover (n = 260)	GMO phobia (n = 196)	Asian fever (n = 106)	Convenience cooker (n = 39)	
Gender	Male	52.7	50.3	55.3	56.4	0.97
	Female	47.3	49.7	44.7	43.6	
Age	Under 30	53.7	57.1	57.5	20.5	18.79**
	Over 30	46.3	42.9	42.5	79.5	
Education	Below bachelor degree	25.5	34.4	32.4	34.2	21.81*
	Bachelor degree	38.2	48.7	41.0	34.2	
	Above bachelor degree	36.3	16.9	26.7	31.6	
Personal income	Less than 500€/month	16.3	25.4	18.2	11.1	46.3**
	500€-1,500€/month	33.7	23.8	21.2	11.1	
	1,500€-2,500€/month	21.1	32.3	25.3	27.8	
	2,500€-3,500€/month	8.9	10.6	17.2	27.8	
	3,500€-4,500€/month	12.2	3.7	13.1	11.1	
	More than 4,500€/month	7.7	4.2	5.1	11.1	
Nationality	British	27.3	20.9	36.8	38.5	23.1*
	French	21.2	23.5	26.4	5.1	
	Dutch (Netherland)	28.1	28.1	21.7	20.5	
	Belgian	23.5	27.6	15.1	35.9	

3.5.2. GMO phobia segment

The GMO phobia segment was the second largest segment. These consumers most preferred the product that made from non-GMO rice in cultivated system attribute while the others

more preferred organic rice product, with accounted for over 30 percent of importance weight, and they also most preferred long grain rice product with grain type attribute important value more than 30% (table 18). Furthermore, they responded to the cuisine attribute in European cuisine and also responded to convenience attribute in ready-to-eat rice product.

57.1% of this segment was younger than 30. And 81.5% got personal income lower than 2,500 €/month (table 19). Younger consumers were said to be more pressed for time, value the ethical aspect in a product and there was a willingness to pay for ethical products (Pelsmacker *et al.*, 2005 and Vermeir and Verbeke, 2008).

3.5.3. Asian fever segment

Asian fever segment was the second smallest segment, about 18 percent of respondents was fall in this group. This segment contained slightly fewer Belgian consumers than the others (table 19). These consumers value the Asian cuisine concept of rice product attribute (table 18). Cuisine attribute have strongest importance, with its important value of 52%.

57.5% of consumers in this segment were younger than 30. These consumers also preferred rice product that made from the U.S. long grain rice. Moreover, they were the only segment that gave positive utility value for new brand since young people trend to allow new brand to harbor their current behavior, values and attitudes (Spero and Stone, 2004).

3.5.4. Convenience cooker segment

The convenience cooker segment was the smallest segment (6.5% of all respondents). They place greater weight on the convenience image of the product that can be eaten after heating or cooking which this attribute contributed 89% of the relative importance. They rated other product attributes quite low. These consumers showed little preference towards Jasmine rice and Asian cuisine.

Consumers in this segment were significantly older than the other segment ($p < 0.001$) (table 19). Nearly 80% of this segment was older than 30. And 74% of this segment was British and Belgian while only 5% were French. According to previous study of Pettinger *et al.* (2004) found that French consumer gave less importance to convenience factor when choosing food and they were still valued making time for shopping and cooking.

4. CONCLUSION

Consumer attitude towards rice was compared across-countries revealed that most attitudes were not significant different across nations and were in a positive side. Attributes about taste, healthy and cheap price were among the highest positive attitudes. Comparing across nationalities found that the British tended to rate lower than the others in almost every item but still in a positive attitude while Belgian was the highest positive rating in most aspects.

Consumer attitudes of rice compared to potato and pasta showed that, in general view, rice got higher positively perceived than pasta and so did potato except taste and allergy attribute. Most European consumers thought that rice was lower in calorie than pasta and potatoes and less allergic than pasta.

Claimed rice consumption from the past was not associated with rice perception in any attributes. But intention to buy in the near future was associated with rice perception on four attributes which were good taste, healthy, low calories' and special food. European consumers were interesting in relatively less processed rice product. Consumers from every countries showed most interest in white rice grain and least interest in can rice.

The relative importance obtained from conjoint analysis presented that European consumers preferred Jasmine rice for grain type attribute, non-GMO rice for cultivated system attribute, Asian cuisine for cuisine attribute, cook before serve for convenience attribute and well known brand for brand attribute respectively. French and Belgian preferred rice product from a non-GMO rice significantly different from zero. British and French had a much greater utility value for "Asian cuisine" than "European cuisine" and preferred U.S. long grain rice.

Segmentation by utility value in rice product interest obtained four segments which were ranking from large to small segment as following; Jasmine / Basmati lover, GMO phobia, Asian fever and Convenience cooker. It appeared that age, personal income and nationality were the main socio-demographic characteristics that impose different consumer interesting towards rice product.

5. RECOMMENDATION

This study faced some limitations that were inherent to the research method. One of the primary limitations of this study resulted from the lack of primary data from European countries. As a consequence the major source of this type of primary information was gathered from tourist surveying in Thailand at the international air port. Thus, because of this bias, individuals may see information about rice and have the attitude (including Jasmine rice) more in a positive attitude than those from web survey.

The results demonstrate that consumers differ in the way they differentiate rice. This will allow the manufacturers to target the specific segment(s) in terms of product development or marketing. Further research should be conducted in order to get more information about European consumers' perception of rice product in one or more of the countries. Future studies are needed to understand the effect of convenience attribute on European consumers' acceptance of rice product. The method provides a useful tool to group consumers and discuss the different communication approaches that need to be adopted when promoting rice product. However, the relevance of four clusters in different countries still needs further verification with another dataset.

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7. OUTPUT จากโครงการวิจัยที่ได้รับทุนจาก สกว.

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Assessing new product development success factors in the Thai food industry

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Abstract

Purpose – The aim of this paper is to measure new product development (NPD) success factors in the Thai food industry.

Design/methodology/approach – The quantitative research was designed based upon previous qualitative analysis by Suwannaporn and Speece. A total of 114 questionnaires sent to medium and large food companies were returned (17.5 percent of companies).

Findings – Managers' perceptions of the important success factors differ by job function, so that data about what is important cannot distinguish higher vs lower success rates. Manager perceptions of what factors are important do not match actual practice very closely, but they do report what is actually done in the NPD process consistently. Reported practices can distinguish success rates. Discriminant analysis shows that the use of marketing research is most critical in this industry. Internal communication in the NPD process and supplier linkages are also predictors of success rate, and strategy and planning plays a weak role.

Practical implications – NPD is context-specific. The food industry is strongly market-driven, so rapid adaptation to customers is critical. Strategy and planning is less important than an ability to remain flexible and move quickly in response changing consumer tastes. Most local companies have strong business secrecy, which is likely to inhibit collaborative research and development (R&D). However, supplier linkages do contribute in distinguishing companies with higher vs lower success rates.

Originality/value – This paper demonstrates that what managers involved in the NPD process believe to be the important success factors cannot always predict NP success rates.

Keywords New products, Product development, Critical success factors, Food industry, Thailand

Paper type Research paper

Introduction

The topic of success factors in new product development (NPD) has received extensive discussion, as a continuous flow of new products is essential to competitiveness in many industries. The food processing industry is a case in point. The industry is characterized by rapidly changing consumer tastes and continuously advancing technology. Under such dynamic market conditions, food processing companies need a continuous stream of new products and improved versions of old products (Mark-Herbert, 2002; Stewart and Martinez, 2002; van Kleef, 2006; Winger and Wall, 2006). However, much NPD investment is wasted, as new food products frequently fail. Many observers cite new food product failure rates of 70 to 80 percent (Gresham *et al.*, 2006; Winger and Wall, 2006). Definitions of success and failure may differ, of course,



leading to somewhat different figures. van Kleef (2006), for example, cites industry research showing that about one-third of fast-moving consumer goods in Dutch supermarkets succeed. Nevertheless, the two-thirds that do not is still quite a high failure rate, and better understanding the key success factors in food NPD certainly remains an important issue.

Observers have long suggested that more new products would succeed if food processors changed the way they approach NPD, such as more careful adaptation of NPD strategies and processes to market and technology changes (Surak, 1996; Hollingsworth, 1996, 1998; Hoban, 1998). A decade later, not too much progress seems to have been made, as failure rates are still high. Researchers continue to make similar recommendations about the need for companies to pay careful attention to markets, technology, and the strategic role of new products, in addition to ensuring that the NPD process is effectively organized (Benner, 2005; Gresham *et al.*, 2006; van Kleef, 2006). Any such recommendations, of course, continue to imply that food companies must understand exactly what factors in NPD play an important role in new product success, so that they can better focus on performing these success factors well.

Some observers have called for more research on NPD in lower innovation industries, as well as in different cultural contexts. Much work focuses on more highly innovative industries, such as high tech where truly new products are more common. However, most product development, especially in lower tech industries, is incremental. Only about 2 percent of new food products can probably be characterized as high-innovation breakthrough products (Francis, 2006; Winger and Wall, 2006). Success factors in higher technology or other more innovative industries may not necessarily be applicable to food companies and various other lower tech industries (Karakaya and Kobu, 1994; Henard and Szymanski, 2001). Furthermore, success factors may differ in different cultural management contexts (Nakata and Sivakumar, 1996; Henard and Szymanski, 2001; Sivakumar and Nakata, 2003). While we are primarily interested here in the methodological issue of how to ask managers about success factors, it is useful to examine this issue in the food industry of a competitive developing country, a somewhat under-researched area in NPD studies.

Another important element in understanding how NPD success factors actually impact new product success rates seems to be actually measuring the success factors carefully. Much of the extensive discussion of success factors is based on qualitative research rather than statistical verification. Qualitative work certainly provides much richer and deeper detail, and is usually essential in the early stages of developing knowledge about key problems, phenomena, attitudes, and influences (Healy and Perry, 2000; Imms and Ereaut, 2002; Gummesson, 2005). It continues to be used very effectively to understand in some depth how companies conduct food NPD in specific situations (Mark-Herbert, 2002; Francis, 2006). However, quantitative work is also needed to verify the broader applicability of results developed from small sample qualitative approaches. Observers in some business fields now recommend mixed approaches to gain the depth of the qualitative side and the breadth of the quantitative methods (Coviello, 2005; Hurmerinta-Peltonmäki and Nummela, 2006).

Finally, a small proportion of NPD success factor studies are quantitative; but the key issue here is that studies, even when quantitative, often ask managers to report their perceived importance of various elements in the NPD process. Henard and Szymanski (2001) note two possible difficulties related to using managerial perceptions

to measure success factors. One is that perceptions may not always accurately reflect actual practice in NPD, so objective measures are likely to work better. Certainly, others have also pointed this out (Kleinschmidt and Cooper, 1995). But there is also evidence demonstrating that perceived importance of a factor is usually related to how well the activity is actually performed (Rochford and Rudelius, 1997). One concern of Henard and Szymanski (2001) is simply that perceptions tend to have somewhat higher variance than objective measures, so that it is more difficult to accurately estimate the exact strength of relationships.

A bigger problem may arise when researchers get perceptions from respondents who work in different business functions. Rochford and Rudelius (1997), for example, show that many non-marketing managers perceive marketing stages of NPD as less important than other stages; therefore the marketing stages are less likely to be performed if a company's marketing division does not have strong involvement in the process. In their meta-analysis, Henard and Szymanski (2001) show that parameter estimates of success factor impact may differ when different sets of managers are inconsistent in what they think are the important drivers of NPD success. Gresham *et al.* (2006) even propose that the measure of a firm's overall market orientation in NPD must be diminished when there is a gap between the views in marketing and research and development (R&D), because such gaps inhibit real internal communication about customers.

This study demonstrates that what managers involved in the NPD process believe to be the important success factors cannot always predict NP success rates. Managers view the importance of various factors through their own biases, and hence do not always agree across functions about exactly what is necessary in the NPD process. However, simply asking managers what the firm does, rather than what is important, yields results that are similar across functional positions in NPD. Thus, the reported extent to which practices are part of NPD, while still subjective, does allow better prediction of success rates. Essentially, we argue that researchers can better investigate NPD success factors by asking managers what their firms actually do, rather than what they think is important.

Thailand provides a good context for examining food NPD. The Thai food processing industry is strong and internationally competitive. According to the *Thailand Investment Review (TIR)*, Thailand's 9,000 food-processing companies earn over US\$25 billion, and account for about 15 percent of manufacturing output (*TIR*, 2007). Domestic consumers are sophisticated and demanding (Silayoi and Speece, 2004, 2007), and domestic demand continues to rise steadily, with packaged food sales increasing by about 6 percent in 2006 (AP-Food Technology, 2006). This strong domestic base translates into international competitiveness.

Thailand is the only net food exporter in Asia, with food exports of about US\$7 billion in the first half of 2006 (*TIR*, 2007), when it was the eighth-ranked food exporter internationally (ETNA, 2007). The country has even become a production base for some foods, which Thailand does not produce itself (*TIR*, 2007). Maintaining this strong competitiveness requires constant adaptation to domestic and foreign markets. Thai companies are rarely competitive purely on price, as there are many lower wage Asian countries now active in international food products markets (Ngamkroekjoti *et al.*, 2005).

NPD is also important in Thailand's vibrant domestic food market. Modern retailing and changing consumer preferences foster demand for standardized goods, high quality products, longer shelf life and better packaging. Foreign brands which were previously imported for a high-income minority are now manufactured locally and are affordable by the average Thai (Silayoi and Speece, 2004, 2007). Localization of multinational corporation (MNC) operations brings in world standard NPD. Even if the most innovative NPD is not done inside Thailand, local subsidiaries and joint ventures (JVs) have access to new products developed anywhere by MNCs. Many food MNCs have local R&D facilities in Thailand, so that products can easily be adapted to local markets. While not all local companies have responded to the challenge, overall the level of food R&D expertise is quite high (Suwannaporn and Speece, 2003; Ngamkroekjoti *et al.*, 2005).

Success factors in NPD

There have been several thorough reviews of NPD. Brown and Eisenhardt (1995) summarized research on NPD success/failure factors into three broad research streams, which can roughly be characterized as: rational planning, communication webs, and disciplined problem solving. Disciplined problem solving is essentially the imposition of a careful, structured, disciplined approach to the elements related to strategy and planning, and internal and external communication. Success factors listed in Poolton and Barclay (1998) roughly correspond, although they divide factors into tactical and strategic categories.

A firm's strategy and process characteristics, as noted in Henard and Szymanski (2001), generally relate to these principles. The authors also discuss product characteristics, which are commonly examined success factors. But researchers who focus specifically on the NPD process are more likely to regard favorable product characteristics as a result of good NPD. Similarly, marketplace characteristics as described in Henard and Szymanski (2001) are more likely to be considered environmental situations, which the NPD process, must assess and to which strategy must adapt.

Most NPD research has been done in industries other than food processing. Research that has focused specifically on food NPD shows, however, that these same general principles apply (Karakaya and Kobu, 1994; Surak, 1996; Hollingsworth, 1996, 1998; Hoban, 1998; Ilori *et al.*, 2000; Benner, 2005; Francis, 2006; van Kleef, 2006; Winger and Wall, 2006). This also holds true for studies done in Thailand (Suwannaporn and Speece, 1998, 2000, 2003). Some results from Thailand suggest that focusing on doing NPD capably, but on fewer new products, achieves better results than a scattershot approach of simply trying out many new products (Dhamvithee *et al.*, 2005). Hence, it seems evident that a careful, disciplined approach to NPD is particularly important in developing countries where resource constraints are typically even more prevalent than in developed countries.

The four areas briefly summarized here follow the conceptual structure, which emerged in our survey from factor analysis of items about practices in the NPD process. Since they are quite consistent with the literature, we will discuss them from the standpoint of the literature, rather than attempting to justify them as grounded theory. The four factors are: new product strategy and planning; internal knowledge sharing and communication; external linkages and collaboration; and use of marketing

research for customer information. They are all included in the several reviews noted above, and have been firmly established by other research on NPD.

New product strategy and planning

A strategic approach to NPD is frequently cited as critical. Brown and Eisenhardt (1995) call this rational planning. They note that planning, frequent milestones, and senior management involvement are some of the critical issues. Poolton and Barclay (1998) see a whole set of elements in strategy and planning, including top management support, integration into strategy, but also flexibility. They assert that strategic factors are even more important than tactical issues. The NPD process must be well planned (though this is a tactical issue in their schema), well implemented, and receive appropriate support. Successful NPD is seen as a balance between the discipline of a heavyweight leader, strong top management, and an outstanding product, vs relatively autonomous problem solving by the project team. Moorman and Miner (1998) point out that it is also critical that planning and strategy be flexible, so that companies can improvise during the NPD process to adapt to changing conditions and new information.

Focus is an important part of strategy. Henard and Szymanski (2001) categorize marketing and technological synergy as well as focused commitment of personnel R&D resources to NPD as strategy characteristics. Cooper and Kleinschmidt (2007) also cite the need for early strategic thinking about a new product, its role in the company, and its positioning. In addition, some of what they call a “high quality process” is about strategic issues, such as initially assessing and working out the proper fit with markets and technologies. Specifically for food NPD, Katz (1998) argues that focusing on core competency is an integral part of best strategy. Francis (2006) distinguishes a “product independent” phase of NPD, which encompasses all the activities, such as concept development and strategic planning, before actual R&D begins on the physical product.

Most of this work has been done in the West, but the modest amount of research performed elsewhere shows little difference in the basic concepts. Based on in-depth interviews and a study of food processing companies in Nigeria, Ilori *et al.* (2000) cite both sufficient resource allocation to R&D and synergy between technical and product capabilities, i.e. core competencies, as two of three key success factors in NPD. Survey data by Jeong *et al.* (2006) show that market orientation and technology orientation have a significant impact on NPD outcomes among Chinese companies. Ngamkroekjoti *et al.* (2005) show that environmental scanning among Thai food SMEs (small and medium enterprises) contributes to keeping NPD in alignment with market and technology trends. Top management involvement also guarantees more of a strategic orientation; and managers in larger Thai food companies report that NPD receives good attention and support, so that strategic consideration of NPD contributes to new product success (Suwannaporn and Speece, 1998, 2003).

Internal knowledge sharing and communication

Strong internal communication is also a key issue in the success or failure of NPD. Indeed, Madhavan and Grover (1998) view NPD as a knowledge management process, in which information use and flow are critical. Moenaert *et al.* (2000) discuss the critical importance of managing communication flows in innovation teams. Cross-functional

involvement in the teams has usually been considered an important aspect of this information flow for successful outcomes of the NPD process (Brown and Eisenhardt, 1995). Henard and Szymanski (2001) dispute this, based on weak results in the little quantitative research on NPD success factors. However, quantitative studies often simply measure the mere presence of cross-functional teams. It seems likely that what really counts is their quality (Cooper and Kleinschmidt, 2007).

For example, as noted above, Gresham *et al.* (2006) argue that differences in customer orientation across business functions makes cross-functional communication less effective. Fredericks (2005) shows that real involvement by team members depends on their understanding of the NPD process and their own roles in it. At any rate, few observers follow Henard and Szymanski (2001) in downgrading the role of cross-functional involvement in NPD. Thus, van der Valk and Winstra (2005) place cross-functional orientation as a key element at both the strategy and operational levels, although many observers are more likely to regard interaction, communication, and information flow as mainly tactical and/or operational (Poolton and Barclay, 1998; Cooper and Kleinschmidt, 2007).

Most researchers include at least R&D, marketing, and manufacturing as the critical functions. For example, Moenaert *et al.* (1995) concluded that success rates in NPD were related to the inter-functional transfer of information between R&D and marketing. Song *et al.* (2000) showed that cross-functional integration, mainly measured by communication and information flow among marketing, R&D, and manufacturing, increases NPD success in Japan, Hong Kong, the USA and the UK. Gresham *et al.* (2006) show the need for a shared commitment to market orientation, especially between marketing and R&D, under such conditions. Rochford and Rudelius (1997) show that inter-department cooperation is important. Different departments are involved in different stages of the NPD process, and success rates decline if any stage is not performed well.

Research specifically on the food processing industry shows that poor communication can lead to costly mistakes and loss of time. For example, teamwork across the three key functions of R&D, marketing, and production, as well as several others, is a key success factor in Nigeria (Ilori *et al.*, 2000). Viaene and Januszewska (1999) show that communication and information flow between marketing and R&D is necessary for NPD to function efficiently. In Thailand's food industry, Suwannaporn and Speece (2000) maintain that information flow and knowledge development are key issues in successful NPD, and that this flow should have several levels, within and across teams and across functions.

External linkages and collaboration

Much general research on NPD combines the internal and external dimensions of communication and information flow together (Brown and Eisenhardt, 1995; Poolton and Barclay, 1998). However, researchers who specifically address communication and information flow in any detail usually recognize external linkages as a distinct issue. For example, although Moenaert *et al.* (2000) focus on internal communication, they also cite strong communication with suppliers as being very important. Ragatz *et al.* (1997) stress the need for effective integration of suppliers into NPD, but point out that benefits depend on managing the integration well. Langerak *et al.* (1997) show that

firms can be distinguished by how they organize internal vs external communication and information flow in NPD.

van der Valk and Winstra (2005) show that supplier involvement works better when it is considered strategically. Sometimes suppliers have expertise in certain technologies, and the ability to implement a particular technology well may require supplier involvement (Mark-Herbert, 2002). More innovative projects, as well as conditions of high technological turbulence, make supplier involvement in NPD more critical (Ragatz *et al.*, 2002; Petersen *et al.*, 2003). Optimal coordination of such involvement depends on market and competitive conditions. For maximum effect, suppliers should be brought in early, and their involvement should be throughout all stages of NPD. However, there are different forms and degrees of supplier integration, depending on strategic and tactical considerations. The deepest involvement of suppliers in NPD projects usually requires stronger relationships (Comer and Zirger, 1997; Handfield *et al.*, 1999; Petersen *et al.*, 2003; van Echtelt *et al.*, 2006).

Clearly, strong external linkages can be critical in much food processing R&D. Discussions of food NPD which look at suppliers in any detail demonstrate that food ingredient suppliers may participate in any stage of their customers' NPD (Galizzi and Venturini, 1996; Hollingsworth, 1995; Hood *et al.*, 1995; Benner, 2005). From the food processor's viewpoint, moving more of the research activities to suppliers can save both money and time when the element to be developed is outside their own core competency. Access to R&D expertise outside the single food company provides a much larger knowledge base, so that specialists who have expertise, product knowledge, ideas, and commitment participate in the R&D. Collaboration also allows intermediate R&D involvement between simply buying technology embodied in products, and developing new products completely with their own R&D. Finally, limited resources and shortened product cycles put great pressure on R&D, and many food companies meet these challenges through shared NPD responsibilities with their suppliers.

Thus, the advantages of supplier involvement include improved quality of the products resulting from NPD, cost effectiveness and, increasingly, project speed. In Thailand, most MNCs and some large Thai companies have good supplier linkages, and a few SMEs collaborate effectively, gaining all of the advantages noted here (Suwannaporn and Speece, 1998, 2000; Ngamkroekjoti *et al.*, 2005). However, the strong tradition of business secrecy sometimes inhibits widespread adoption of collaborative R&D with suppliers (Suwannaporn and Speece, 2000, 2003).

Use of marketing research for customer information

Ogawa and Piller (2006) discuss external linkages in terms of heavy customer involvement in the NPD process. This is a common theme in the broader NPD literature, but prior research in the Thai food processing industry does not indicate much of the very intimate customer involvement, which they call "collective customer commitment". In general, industries such as food processing rarely have concentrated buying, where close collaboration with a few customers is likely to cover a major part of the volume. Even when food processors work closely with big-volume retailers, the information used in NPD usually comes ultimately from the end consumer. The "efficient consumer response" systems Stewart and Martinez (2002) discuss are

essentially about using information technology to capture consumer purchase patterns for analysis and decision-making.

Stewart and Martinez (2002) say that such use of customer information helps improve success rates in new product introductions. In fact, any systematic use of customer information throughout the NPD process can improve NPD performance. A whole range of marketing research methodologies addresses the different kind of information that is useful in making decisions at different stages of the NPD process. Many of the success factors mentioned in Cooper and Kleinschmidt (2007) require accurate market knowledge. To them, a “quality” NPD process has mechanisms for bringing in extensive information about customer needs, wants and preferences. In industries with concentrated buying, where a sales representative’s relationship with customers gives him/her extensive customer knowledge, this might be the responsibility of the sales force (Rajatanavin and Speece, 2004; Judson *et al.*, 2006). Where demand is dispersed and normal customer interaction gives little depth of knowledge, it is more likely to be a marketing research function.

Use of market research can contribute to higher new-product success rates in a wide range of industries, e.g. among computer and medical equipment manufacturers (Ottum and Moore, 1997). It is particularly important in food NPD. Juhl *et al.* (1998), for example, specifically cite use of market research (MR) as a distinguishing success factor. van Kleef (2006) shows the wide range of methods used in consumer research for the early stages of food NPD, and argues that research helps tie marketing and R&D together more strongly, so that the technical people keep new products on track for better meeting specific customer needs and preferences. Viaene and Januszewska (1999) describe the use of marketing research throughout various stages of NPD, and also argue that this is necessary in order to integrate marketing and R&D more closely. Focusing on a specific application – cheese-making – Bogue *et al.* (1999) show how marketing research can be used to guide R&D. Quantitative research in Thailand (Suwannaporn and Speece, 2003) shows that the use of marketing research has one of the strongest impacts on success rates among the four broad factors considered here (strategic, communication and information flow, external linkages, and marketing research).

Company practices vs importance perceptions of managers

Jensen and Harmsen (2001) have pointed out that companies often do not seem to implement many of these success factors. Often “managers are still relying on gut-feel with respect to ‘best practice’ in development . . .” (Poolton and Barclay, 1998, p. 210). Some managers may be unaware of most of the success factors; possibly, as Jensen and Harmsen (2001) say, because many of these factors are rather vague descriptors, which offer limited guidance for actual implementation. But as noted in the introduction, there is much less empirical demonstration that the success factors actually deliver higher new product success rates than there is advice about what is important. Many managers may have their own ideas about what works, but know that it is safer to confirm impressions with empirical data. While such data exists, it does not yet seem overwhelmingly conclusive. Kleinschmidt and Cooper (1995) show that perceptions do not necessarily match reality in NPD, and careful meta-analysis also shows somewhat inconsistent results (Henard and Szymanski, 2001).

One explanation may well be how NPD success factors are measured, often by the perceptions of managers involved in NPD about the importance of various factors. If

everyone perceived things similarly, this might not be a problem. Rochford and Rudelius (1997), for example, show that actual performance of stages in the NPD process is strongly related to perceived importance. However, different departments may perceive the importance of various elements differently, because their jobs are concerned with different things. This can make it difficult to see exactly what really influences NPD success, because there is no agreement on what the key success factors are. Henard and Szymanski (2001) show that estimated relationships to new product success differ across different job functions.

And, if some managers do not feel that some factors in other job functions are very important, the factors may not be performed very well if those functions do not have a strong role in NPD. Rochford and Rudelius (1997), for example, show that many non-marketing managers perceive marketing contributions to NPD as less important, and therefore some of marketing's role is less likely to be performed. As noted in the introduction, Gresham *et al.* (2006) propose that such divergence of opinion on NPD teams diminishes a firm's overall market orientation in NPD. This inhibits real internal communication about customers, and thus makes NPD less effective. Thus:

H1 What managers perceive as important success factors will differ by the function in which the manager works.

H2 Perceived importance of success factors will not be able to predict success rates in NPD.

We assume that most managers involved in NPD will be aware of what actually takes place, even if they disagree on what is important. This is apparent in prior qualitative work on NPD in the Thai food processing industry (Suwannaporn and Speece, 1998, 2000), as well as in work on food packaging development in the Thai packaging industry (Silayoi, 2004), and in new service development in the Thai insurance industry (Rajatanavin, 2004). Managers who participate in NPD or NSD (new service development) projects know what happens on their projects, even if they may disagree about exactly what is most important. Thus:

H3 Managers in different functions will not report actual company practices differently; managers in any function will identify specific practices similarly.

H4 Actual practice of various company activities will be able to predict success rates in NPD.

Hypothesis *H4* can be broken down into sub-dimensions of practices, corresponding to the following four success factors:

H4a Better planning of NPD and integration of NPD into strategy will lead to higher success rates of NPD.

H4b More use of marketing research will lead to higher success rates in NPD.

H4c Stronger internal communication and information flow will lead to higher success rates in NPD.

H4d Better external communication with suppliers will lead to higher success rates in NPD.

Methodology

The quantitative research was designed based upon previous extensive qualitative analysis of NPD practices in Thailand's food processing industry (Suwannaporn and Speece, 1998, 2000). In the qualitative interviewing process, the dimensions from the literature were kept in the background so that appropriate probing could be done, but at no time was the literature's conceptualization imposed. If none of the managers mentioned a specific detail that appears in the literature, we did not use it on the questionnaire. In theory, if they had mentioned a point that was not in the literature, we would have used it. However, this did not come up in practice; there is an extensive range of points covered in the literature, if sometimes only in qualitative form.

We separated the items about actual practices in the NPD process from new product success factors as perceived by managers. While there is considerable overlap, managers themselves did not always talk about the same things when discussing implementation vs their ideas of key success factors. (The fact that what managers say is important does not necessarily correspond to what they report is done in itself provides some indirect support for *H2*.) Thus, we asked respondents to indicate how extensively their companies used various practices in the NPD process, based on their own past experience on NPD projects. (Cooper and Kleinschmidt, 2007) argue that focusing on one specific project in research cannot provide a broad view of how well the company's NPD works in general.) These questions were followed by other questions on how important the respondents thought the various causes of success were.

The Thailand Development Research Institute (TDRI, 1996) categorizes food companies, based on assets (excluding land value), into: small (assets less than 10 million baht); medium (10 to 50 million baht); and large (more than 50 million baht). Previous research indicated that few small food companies do much NPD in Thailand (Suwannaporn and Speece, 1998, 2000), so small companies by the TDRI measure were excluded from the mailing in this study. Accordingly, the questionnaires distributed were directed to three NPD-related functions (marketing, R&D and manufacturing), as well as to top managers, in 650 medium to large Thai and MNC food companies in Thailand, using lists maintained by TDRI.

In total, 114 questionnaires were returned (17.5 percent of companies). Few of the companies were willing to report their assets to outsiders, so company size was categorized using number of employees and/or company revenue as reported on the questionnaire. We categorized companies with either revenues of under 1,000 million baht, or less than 500 employees (or both) as "medium"; and those with revenues over 1,000 million baht and more than 500 employees as "large". By this classification, approximately 60 percent of respondents worked in medium-sized companies (Table I).

Just over 60 percent of respondents indicated that new products contributed to a major part of their companies' sales. However, the success rate of new product introductions was not outstanding: 43 percent of them said that one-fifth or fewer new product introductions were successful in their companies. Still, this suggests a success rate in our study, which is somewhat high compared with rates frequently cited in the literature (as noted in the introduction). Our sample consists of medium to large companies in Thailand, which are probably more sophisticated at NPD than most small companies, as is the case in many other countries. Benner (2005), for example,

Characteristic	Classification	Frequency	%
Size of company	Small/medium	69	60.5
	Large	42	36.8
Annual sales (million baht)	1-200	24	21.2
	201-999	25	22.1
	Over 1,000	21	18.6
Number of employees	1-100	20	17.7
	101-500	49	43.4
	501-up	41	36.3
	100% local owner	77	67.5
Ownership (degree of foreign influence)	Thai major shareholders	14	12.3
	Thai minor shareholders	15	13.2
	100% foreign investment	4	3.5
Position of respondent	R&D	34	29.8
		27	23.7
	Marketing	15	13.2
Parent company	Top manager	14	12.3
	Thailand	77	67.5
	USA	4	3.5
	Europe	7	6.1
New product success rate (%)	Asia	17	14.9
	0-20	49	43.0
	21-40	22	19.3
	41-60	26	22.8
	61-80	10	8.8
Role of new products	81-100	4	3.5
	NP are major part of sales	70	61.4
	NP are minor part of sales	39	34.2
	Very few NP	3	2.6

Table I.
Summary of company
characteristics

Note: Frequencies do not always sum to 114 or 100 percent because of missing data

cites much higher success rates in big companies than in smaller companies. Thus, the Thai sample seems fairly consistent with the situation found elsewhere.

Given that overall success rates are quite low according to the literature, we considered companies reporting success rates over 20 percent to be doing relatively well, and created a dichotomous variable to categorize anything over a 20 percent success rate as "high" for the purposes of further analysis. (We also confirmed that there were no statistical differences in NPD practices between medium and higher success rates, so that a different dichotomous split, or retaining three categories, would not be very useful.)

Results

Even with differences in the questions between perceived success factors and reported practice, there is enough overlap to see that perceptions do not always match practice very well. In their perceptions of what caused success in the NPD process, respondents considered support from top management to be most critical. This was followed by a number of variables with roughly similar levels of perceived importance, many of which are related to strategy and planning. The respondents rated communications

issues relatively low in importance compared to other issues, as well as marketing activities (Table II). Looking ahead, this indicates substantial divergence between what managers consider important, and factors which actually seem to distinguish higher NPD success rates.

Poolton and Barclay (1998) suggest that much research focuses too heavily on variable-by-variable analysis of success factors, rather than on broader conceptual issues. While this is useful for managers in specific situations, they note that success factors and their importance depend heavily on the characteristics of the industry, or even of an individual firm, so that it has less value for understanding general issues. Thus, we used factor scores to represent dimensions of thinking, rather than many individual items, which would be problematic statistically in any case, because of degrees of freedom limitations.

Factor analysis of these perceptions about causes of success in NPD yielded three factors accounting for about 64 percent of variance (Cronbach's alpha 0.839). At 0.970, the third eigenvalue was just under 1.0, but this third factor was included because the two-factor solution was difficult to interpret, several of the communalities were quite low, and two factors accounted for only 50 percent of variance. These conditions all suggest that the third factor should be included (Hair *et al.*, 1995). The first dimension relates to the role of marketing in the NPD process. The second, with equal variance, is about strategic and communications issues, while the third dimension relates to company experience and competencies (Table III). Note also that while individual items can all be found in the literature, the managers' conceptualizations do not seem to clearly distinguish between strategic and implementation issues. In their underlying conceptualization, the managers mix items about communication and project teams together with some strategic issues, and separate core competence items from the strategic component.

Results which demonstrate support for *H1* ("What managers perceive as important success factors will differ by the function in which the manager works") can be seen in Table IV. Using job function (marketing, R&D, manufacturing, and top management) as the categorical independent variable, MANOVA shows that job function does have an impact on the perceived importance of success factors. Perceptions of importance

Reported success factor	Mean	SD	Factor in Table III
Support from top management	1.25	0.58	2
Experience in NPD	1.78**	0.71	3
Company competency incorporated in new product	1.79	0.85	3
New product planning	1.86	0.90	2
Quality/capability of project team members	1.93	0.94	2
Information about competitors and market	1.98	1.06	2
Use of market research, sensory evaluation in NPD	2.15	0.93	1
Pricing	2.15	0.97	1
Internal and external interface/communication	2.32*	0.86	2
Advertising, promotion, and marketing activity	2.36	1.27	1

Notes: *Significantly different from the mean immediately above at $p = 0.10$; **significantly different from the mean immediately above at $p = 0.05$ (In general, differences of approximately 0.26 are significant, $\pm$ a little depending on specific standard deviation.). Scale: 1 = Very important; 5 = Not important at all

Table II.
Means of reported factors
thought to cause NPD
success

Table III.

Factor loadings of reported NPD factors thought to cause NPD success

Reported success factor	1	Factor 2	3	Communality
<i>Marketing-related issues</i>				
Pricing	0.838			0.741
Advertising, promotion, and marketing activity	0.800			0.745
Use of market research, sensory evaluation in NPD	0.471	0.455		0.430
<i>Strategic and communication issues</i>				
Support from top management		0.764		0.596
Internal and external interface/communication		0.746		0.636
New product planning	0.539	0.610		0.700
Quality/capability of project team members	0.504	0.593		0.640
Information about competitors and market	0.489	0.581		0.589
<i>Company experience and competencies</i>				
Experience in NPD			0.931	0.881
Company competency incorporated in new product	0.417		0.426	0.408
Variance in rotated solution	25.74	25.70	12.21	
Cumulative variance	25.74	51.45	63.66	

Notes: Factor 3 had an eigenvalue of 0.970; Factor loadings < 0.40 are not reported

Table IV.

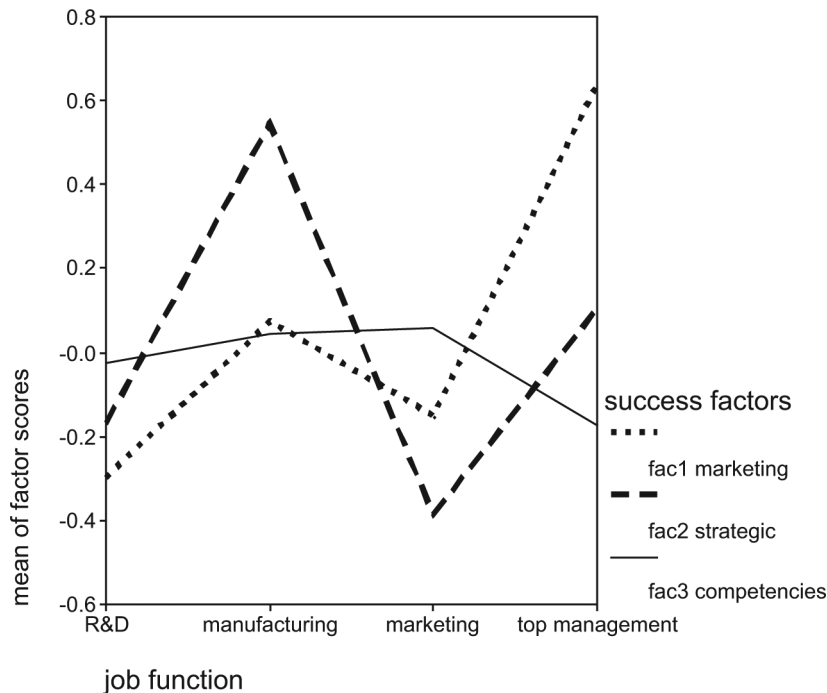
Significance of impact of job function on reported success factor

Reported success factor	Significance
MANOVA significance (Pillai's trace)	0.038
Significance on individual dimensions (<i>F</i>)	
1 Marketing-related issues	0.052
2 Strategic and communication issues	0.022
3 Company experience and competencies	0.920

differ on both marketing-related issues and on strategic and communications issues. Note that MANOVA on the ten individual items also showed a significant impact of job function ($p = 0.007$). Seven individual reported success factor items differed significantly across job function, at $p = 0.1$; and five were different at $p = 0.05$.

Figure 1 shows that top management views the competencies as most important, as does (barely) manufacturing; but both marketing and R&D view this as least important of the three. Marketing views the set of strategic and communications issues as most important, manufacturing ranks them a poor third, and this factor is in the middle of the three in the thinking of top management and R&D. R&D places marketing issues first, manufacturing and marketing people themselves place it second, but top management considers this the least important factor by a wide margin.

Recalling the second hypothesis (*H2*) – “Perceived importance of success factors will not be able to predict success rates in NPD” – the results indicate that perceptions about success factors do not seem to relate to NPD success rates. The discriminant function using factor scores on these three dimensions as independent variables, and the low/high success rate (with the cutoff point at 20 percent dividing the categories) as dependent, was not significant ($p = 0.265$). Nor did any of the group means differ significantly, across both low and high success rates. This supports *H2*, and indicates that respondents overall do not fully understand the causes of success. Perceptions



Note: On the original scale, 1 = very important, 5 = not important at all. (The more negative the factor score, the greater the perceived importance)

Figure 1.
Mean factor scores by job
function for reported
success factors

about success factors are tied to one's own job function, which they may know well. But success in NPD very much depends on coherence among all parts of the company, not only performance of specific job functions. Managers' perceptions about success factors cannot always predict higher vs lower success rates, and diverge substantially in our data (as will be seen) from the actual impact of practices on success rates. One thing which stands out about companies in the Thai food processing industry is the strong role of top managers in the NPD process. Companies also apparently stay close to their core competencies; and communication is fairly strong, both internally and with food ingredient suppliers. The companies are somewhat weaker on strategy and planning for NPD, and in systematic tracking of new product information; though the respondents still report mild agreement that their companies do these things. Use of marketing research is not very extensive overall; and the respondents feel that knowledge-sharing across teams is relatively poor (Table V). These results are consistent with previous qualitative work (Suwannaporn and Speece, 1998, 2000).

Principal components factor analysis of the 15 items about actual practices in the NPD process (Cronbach's alpha 0.897) yielded four factors, which together account for almost 65 percent of variance. (The fourth eigenvalue was 0.980, but four factors were used for the same reasons noted above.) The first dimension concerns the use of marketing research at various stages of the NPD process. The second dimension is about information flow and communication on an NPD project. The third concerns

Reported practice	Mean	SD	Factor in Table VI
Top managers involved and support NP projects	1.64	0.90	3
New product ideas focus on company competency	2.12**	1.04	2
Communication with food ingredient suppliers	2.27	1.11	4
Informal communication among functions	2.28	1.03	2
Knowledge sharing within team	2.47*	1.13	2
New product is announced as company strategy	2.51	1.26	3
Ability to track new product information	2.54	1.06	2
Has a new product plan	2.55	1.17	3
Communication with food equipment suppliers	2.64	1.06	4
Use MR to evaluate prototype	2.81	1.35	1
Use MR to guide formulation/recipe in R&D	2.83	1.29	1
Milestones for new product are set in the company	2.83	1.31	3
Use MR before starting R&D	3.00**	1.36	1
Use MR to determine positioning/price	3.04	1.26	1
Knowledge sharing across teams	3.35	1.29	2

Table V.
Means of practices in
NPD in the Thai food
processing industry

Notes: *Significantly different from the mean immediately above at $p=0.10$; **significantly different from the mean immediately above at $p = 0.05$ (In general, differences of approximately 0.26 are significant, $\pm$ a little depending on specific standard deviation). Scale: 1 = Strongly agree, 5 = Strongly disagree with the statement: "Your company regularly uses the following practices"

strategy and planning of new products, while the fourth dimension is about linkages with suppliers (Table VI).

Most questionnaire items in all four factors load unambiguously, except for "Milestones for new product are set in company". This has a loading on the marketing research dimension which is actually slightly greater than its' loading on the new product and strategy dimension. Managers apparently perceive that the milestones would be measured through marketing research, but we leave it as a strategy and planning item for discussion, following the literature. Of course, given that we use factor scores to represent dimensions in further analysis (rather than means of items in the categories), whichever way we choose to talk about it will have no impact on the actual results.

Most items also have communalities above 0.5, indicating that the majority of variance of each variable is captured by the three factors. However, communality for "New product ideas focus on company competency" is slightly under 0.5; and the variable "Top managers involved and support NP projects" is even a little lower, indicating that the four dimensions do not entirely capture the information in these two variables. Nonetheless, items on the four dimensions are generally consistent with the literature in regard to success factors.

As stated in *H3* – "Managers in different functions will not report actual company practices differently; managers in any function will identify specific practices similarly". MANOVA results indicate that job function does not influence how managers report company practices. Neither the joint effect nor the effect on any individual dimension was significant (Table VII). MANOVA on the 15 individual items of reported practice (rather than on the four practice factor scores) also showed no significance from job function ($p = 0.203$). Thus, reported practice in NPD seems to be consistent across job function, and may be able to better predict new product success rates.

Reported practice	1	Factor		4	Communality
		2	3		
Marketing research					
Use MR to evaluate prototype	0.852				0.755
Use MR to guide formulation/recipe in R&D	0.850				0.765
Use MR before starting R&D	0.836				0.762
Use MR to determine positioning/price	0.828				0.702
Information and communication					
Knowledge-sharing within team		0.822			0.733
Knowledge-sharing across teams		0.658			0.529
Ability to track new product information		0.610	0.444		0.597
Informal communication among functions		0.581		0.425	0.548
New product ideas focus on company competency		0.553			0.471
New product strategy and planning					
New product is announced as company strategy			0.785		0.656
Top managers involved and support NP projects			0.634		0.456
Has a new product plan			0.579		0.606
Milestones for new product are set in company	0.583		0.523		0.679
Supplier linkages					
Communication with food ingredient suppliers				0.827	0.721
Communication with food equipment suppliers				0.807	0.735
Variance in rotated solution	22.74	16.71	13.69	11.63	
Cumulative variance	22.74	39.45	53.14	64.77	

Notes: Factor 4 had an eigenvalue of 0.980; factor loadings < 0.40 are not reported

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Table VI.
Factor loadings of
practices in NPD in the
Thai food processing
industry

Reported practice	Significance
MANOVA significance (Pillai's trace)	0.147
Significance on individual dimensions (<i>F</i>)	
1 Marketing research factor score	0.157
2 Information and communication factor score	0.289
3 New product strategy and planning factor score	0.511
4 Supplier linkages factor score	0.249

Table VII.
Significance of impact of
job function on reported
practice

As stated in *H4*, "Actual practice of various company activities will be able to predict success rates in NPD". Discriminant analysis using factor scores for the four dimensions as independent discriminating variables, and the low/high success rate (with a cutoff point at 20 percent dividing the categories) as dependent, yielded a significant discriminant function ($p = 0.030$). This is able to correctly predict low vs high success rates in 62 percent of cases (Table VIII). None of the four dimensions had discriminant function coefficients or correlation with a function below the minimum 0.30 which Hair *et al.* (1995) consider to be practically significant; i.e. it appears that all four of them make at least some small contribution to better NPD outcomes. Examination of means on each dimension by low vs high success rates showed that in each case, companies with higher success rates were more likely to be doing these things regularly.

However, the four dimensions differ somewhat in the strength of their contributions. The marketing research dimension was the key distinguishing factor, having both a large function coefficient (0.748) and a very high correlation with the discriminant function (0.703). The information and communication dimension and the supplier linkages dimensions were both intermediate, with the former possibly showing a slightly stronger impact. The dimension of new product planning and strategy was somewhat less important, as indicated by smaller function coefficient and lower correlation with the function. It does barely meet the criteria in Hair *et al.* (1995) for being “practically significant,” but would not qualify as an “important discriminator,” the threshold for which they set at correlation scores above 0.4. Overall, then, *H4* has received strong support, and the individual sub-hypotheses of *H4* noted above were all confirmed (although only weakly in the case of *H4a*, about the role of strategy and planning).

Conclusions and implications

In the Thai food processing industry, the use of marketing research during the NPD process seems to be the most important factor leading to higher success rates. However, internal information flow and communication is also an important determinant. Likewise, supplier linkages show an impact, though perhaps slightly less than that of information flow and communications. New product strategy and planning play a role too, although it seems to be a somewhat weaker contributor to success rates, according to our data. These findings come from examining actual reported practices. Manager perceptions about what is important do not follow these patterns.

Overall, managers tend to view strategy and planning elements to be the most important success factors. They rank marketing issues – including marketing research, and communications and information flow issues – as relatively less important. However, manager perceptions of importance of these success factors are not able to distinguish low from high success rates, while reported practice can distinguish them. One important reason for this is probably that managers in different functions each have their own view of NPD, and cannot agree on what is important. Thus, aggregate measures of importance have little predictive ability.

There are several important implications for future NPD research in these results. One important implication is simply that NPD researchers should be careful in focusing too much on manager perceptions of success factors. What managers think is

Discriminating variables	Discriminant function coefficients	Pooled within groups correlations
Marketing research	0.748	0.703
Information and communication	0.479	0.427
New product strategy and planning	0.336	0.300
Supplier linkages	0.426	0.399

Table VIII.
Discriminant analysis
results on low vs. high NP
success rates by NPD
practice dimensions

Note: Significance of the discriminant function (from Wilks’ lambda) = 0.025. (This function correctly predicts 62.0 percent of cases overall, including 62.5 percent of low-success and 61.7 percent of high-success cases)

important depends on their job function, and may not correspond well to actual practice elements. Thus, it is difficult to relate perceived success factors to NPD success rates. Managers do apparently report actual company practices similarly, whatever function they work in. Reported practice is better able to predict high vs low NPD success rates than perceived success factors. This issue has occasionally been pointed out, but has received little empirical attention in most NPD research. In terms of advising managers, it would seem better to focus on what companies actually do and what gets results, rather than on what managers say is important.

Another important implication has been in the background of the discussion throughout: simply that success factors in NPD are context-specific. In the Thai food processing industry, market and consumer information via marketing research and consumer studies play a strong role in fostering higher success rates, although most managers do not seem to recognize this when talking about success factors. Cross-functional communication and information flow within the firm and the NPD team are also important, as are supplier linkages; but strategy and planning are somewhat less critical. Managers' perceptions of what is most important seem to be almost completely opposite; they ranked internal strategy and planning elements highest, and marketing and communications issues, both internal and external, lower.

Past research, of course, has also shown empirically that all four issues are important; although results are sometimes inconsistent, with specific studies showing that one or the other of them are not significant predictors. Some observers, in particular, have questioned whether cross-functional involvement is really a critical success factor, because it shows up weakly in many studies. The real answer is that it seems clear that models of successful NPD must be adapted for context.

In the highly competitive food processing industry, which is strongly market-driven, it makes sense that rapid adaptation to customers, based on knowing their preferences well, is very critical. It may well be that the role of strategy and planning in the NPD process is less important than the ability to remain flexible and move quickly in perceiving and adapting to trends in rapidly changing consumer tastes. Furthermore, in Thailand, and in many other cultural contexts, companies have a long tradition of strong business secrecy. Heavy competition and fear that competitors will gain access to information, especially about new product development, is likely to inhibit widespread adoption of collaborative R&D with suppliers in the near term. We found here that supplier linkages do contribute to distinguishing higher from lower success rates, but it seems slightly less important in our data than internal communication and information flow.

The context-specific nature of NPD elements has been mentioned occasionally before. For example, Jacobs and Herbig (1998) suggest that some elements of NPD are much stronger in Japanese firms than in the West, while some aspects may be weaker. Parts of their discussion focus on cultural differences, especially those related to communications flows, emphasis on collaboration, and teamwork between marketing, R&D, and other functions. Looking across industries, Karakaya and Kobu (1994) noted that success factors in the food industry were not necessarily the same as in higher technology industries. Processed food products, like many other fast-moving consumer goods, are largely marketing-led. Lack of marketing research and consumer studies may well doom new food products emerging from the NPD process. In some industries the sales force is close to customers, and marketing research may be unnecessary (Rajatanavin and Speece, 2004; Judson *et al.*, 2006).

The research does confirm the importance of cross-functional communication and information flow within a firm. Although this element rarely seems to be topmost in importance, it appears to play some role in almost any context, and companies that do not perform this well are likely to have some difficulty in achieving high NPD success rates. Future research should look more carefully at communications and information flow, including marketing information, in various cultural and industry contexts. As noted above, a few observers have already suggested that it is the quality of such interaction that matters, not simply the interaction itself. It is likely that the way an organization can achieve good cross-functional information flow will differ across different cultural and industry contexts.

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การศึกษาทัศนคติและความเชื่อเกี่ยวกับข้าวเปรียบเทียบกับมันฝรั่งและพาสต้าใน ผู้บริโภคชาวอังกฤษ ฝรั่งเศส เบลเยียม และเนเธอร์แลนด์

Belief and attitude towards rice, potato and pasta consumption in the UK, France,
Belgium and the Netherlands

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บทคัดย่อ

ชาวยุโรปบริโภคข้าวเพิ่มมากขึ้น การบริโภคข้าวในยุโรปมีแนวโน้มขยายตัวอย่างต่อเนื่อง แสดงให้เห็นถึงโอกาสทางการตลาดข้าวไทยในยุโรป งานวิจัยนี้จะศึกษาผู้บริโภคชาวยุโรป 4 ประเทศ คือ อังกฤษ ฝรั่งเศส เบลเยียม และเนเธอร์แลนด์ ซึ่งนำเข้าข้าวจากไทยมีมูลค่ารวมถึง 2.3 พันล้านบาท ในปี 2548 การศึกษานี้มีวัตถุประสงค์เพื่อศึกษาความเชื่อและทัศนคติที่มีต่อข้าว เปรียบเทียบกับอาหารประเภทแป้งในประเทศดังกล่าว โดยใช้แบบสอบถามเชิงปริมาณเพื่อประเมินทัศนคติของผู้บริโภคในด้านรสชาติ สุขภาพ ราคา พลังงานที่ได้รับ สิ่งปนเปื้อนที่อันตราย ความน่าเชื่อถือ ความพิเศษของอาหาร ความยากง่ายในการย่อย และการแพ้อาหาร โดยทัศนคติด้านรสชาติ สุขภาพ และราคา อยู่ในด้านบวกสูงสุด แต่ความพิเศษของอาหารมีค่าต่ำสุด ผู้บริโภคมีทัศนคติด้านบวก และมีค่าที่สูงกว่ามันฝรั่งและพาสต้าในเกือบทุกด้านยกเว้นด้านรสชาติ จากผลการวิจัยนี้แสดงถึงศักยภาพของข้าวที่สามารถเติมช่องว่างอุปสงค์ของชาวยุโรปได้ เนื่องจากปริมาณการบริโภคข้าวต่อประชากรชาวยุโรปในปัจจุบันยังน้อยมาก

ABSTRACT

European citizen is consuming more rice nowadays and expected to continue to increase in Europe. This indicates an opportunity for rice market expansion in the EU. Four European countries including UK, France, Belgium and the Netherlands were the focus of our study since they imported rice from Thailand more than 2.3 billion baht in 2005. This study aimed to investigate belief and attitude towards rice compared to their main starchy foods in four target European countries in order to seek substitution possibility by rice. A quantitative questionnaire was designed to assess consumer attitudes in rice, potato and pasta with respect to taste, healthiness, price, calorie, harmful substance, trustworthy, food specialty, digestibility, and allergy. Rice's attitudes about taste, healthiness and price were among the highest whereas food specialty was the lowest rating. Rice gained positive and superior attitudes than potato and pasta in almost every aspect except taste. As rice consumption per capita in Europe is still comparatively low. There is a large potential for Thai rice to fill in this demand gap.

keyword: rice, starchy food, attitude, European

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1. Introduction

Rice exported to the European Union (EU) was expected to increase from 1 million tonnes in 2006 to 1.2 million tonnes in 2007. In conversely, rice production in EU decreased by 0.6 percent in 2006 to 2,594 thousand tonnes in 2007 (FAO, 2007a). These indicated the chance of rice market in the EU. European consumed only 20.5 grams of rice per capita per day in 2005 comparing to 85 grams in America, 78 grams in Africa and 334 grams in Asia (FAO, 2007b). Rice consumption increased higher in Northern European countries such as the UK, Belgium, Germany and the Netherlands. The highest rice consumption per capita was Portugal, Spain, Italy, and the Netherlands (FAO, 2007b). The top ten EU countries imported Thai rice was France, the Netherlands, Spain, Belgium, Italy, United Kingdom (UK), Germany, Sweden, Poland and Czech Republic. Four countries which were UK, France, Belgium and the Netherlands were the focus of our study. These four countries imported rice from Thailand more than 2.3 billion baht (about 65 million US dollar) in 2005. Starchy foods were in general seen as “filling” for the UK consumers (Monteleone *et al.* 1997). Starchy foods were perceived as nutritious and good for health, but high in energy and not help in weight control (Moreira *et al.* 2005). Low income persons in France appeared to consume more starchy food than fruit and vegetables because it was comparatively low price (Roux *et al.*, 2000). French fries consumption in French children remained high but decreased with age and girls consumed lower than boys (Nicklaus *et al.*, 2004). In the UK, both 19 to 24 years old men and women consumed larger quantities of pasta, rice and other cereals than 50 to 64 years old (Hoare *et al.* 2004).

This study aimed to investigate belief and attitude towards rice compared to those of potato and pasta consumptions in the target European countries in order to seek substitution possibility for rice and find proper means for market promotion.

2. Research methodology

The quantitative analysis was designed to prove 2 research hypotheses which were:

Hypothesis 1 rice can partly substitute for potato and pasta.

Hypothesis 2 rice has some attributes superior to potato and pasta.

A quantitative questionnaire was designed to assess consumer attitudes towards rice. Non rice consumers were preliminary screened out. Respondents were selected using a quota sampling plan with nationality, age and gender as quota control variables. Target persons were native European in UK, France, Belgium and the Netherlands. Questionnaires were distributed using internet survey and person-to-person contact in the departure lounge, Suvarnabhumi International Airport,

Thailand. According to Moskowitz, *et al.* (2005), the minimal number of sampling size recommended for the 7-point scale, estimated variance to 3 at 95% confident interval should be more than 100 respondents (Churchill, 2001). In this study we aimed at about 150 respondents per country.

Consumers' attitudes used in this study applied from those of Verbeke and Viaene (1999) and Monteleone (1997) who studied the consumer's attitudes of fresh meat in Belgium and the perception of starchy foods in the UK respectively. Attitudes were rating using a 7-point semantic differential scale with end points associated with bipolar labels. The scale had a semantic meaning, such as bad-good quality, bad-good taste etc. Attributes used in our study were presented in table 1.

Table 1 Semantic differential attributes of rice, potato and pasta

Negative pole	Positive pole
Bad Taste	Good Taste
Not healthy	Healthy
Expensive	Cheap
High calorie	Low calorie
With harmful substance	Without harmful substance
Not trustworthy	Trustworthy
Everyday food	Special food
Difficult to digest	Easy to digest
Allergic	Not allergic

Data was analyzed using pairwise t-test and ANOVA to make a comparison of means of rice with potato and pasta in each attribute among consumers in four target countries.

3. Result and Discussion

Respondents' demographic was shown in table 2. The respondents were almost equally spread over nationality, age and gender due to quota sampling plan.

Significant associations between starchy attitude and socio-demographic variables (gender and age) were discovered by one-way ANOVA. Male consumers had more positive attitude in "Difficult-Easy to digest" (male = 1.30, female = 1.08, p-value = 0.04) but less in "Expensive-Cheap" (male = 1.51, female = 1.76, p-value = 0.02) than female in potatoes. For rice attitude, the European consumers older than 30 years old, were more positive towards "healthiness" (over 30 = 2.10, under

30 = 1.89, p-value = 0.02) and "Difficult-Easy to digest" (over 30 = 1.72, under 30 = 1.25, p-value = 0.00) than the younger one and the Pearson correlation coefficients between two attitudes toward rice ranged in value from -0.12 and +0.59.

Table 2 Characteristics of the respondents.

		NATIONALITY				Total
		British	French	Dutch	Belgian	
Gender	male	99 (54.7%)	66 (48.9%)	84 (51.2%)	85 (58.6%)	334 (53.4%)
	female	82 (45.3%)	69 (51.1%)	80 (48.8%)	60 (41.4%)	291 (46.6%)
Age	under 30	108 (59.0%)	79 (58.1%)	66 (39.5%)	77 (52.0%)	330 (52.1%)
		75 (41.0%)	57 (41.9%)	101 (60.5%)	71 (48.0%)	304 (47.9%)
	over 30	183 (or 28.9%)	136 (or 21.5%)	167 (or 26.3%)	148 (or 23.3%)	634 (or 100.0%)

Table 3 Consumer perception of rice attributes of each countries.

Rice Bipolar semantic	the United Kingdom	France	Netherland	Belgium	Grand means
Bad -Good Taste	1.97±1.19 ^a	2.14±1.10 ^{ab}	2.13±1.06 ^{ab}	2.24±0.89 ^b	2.11±1.07
Not healthy -Healthy	1.87±1.33 ^a	1.95±1.16 ^{ab}	1.97±0.96 ^{ab}	2.19±0.95 ^b	1.99±1.12
Expensive-Cheap	1.87±1.58 ^{ab}	2.16±1.33 ^{ab}	1.82±1.29 ^a	1.95±1.17 ^b	1.94±1.36
High-Low calorie	0.98±1.48 ^{ns}	1.24±1.52 ^{ns}	1.32±1.51 ^{ns}	1.32±1.53 ^{ns}	1.21±1.51
With-Without harmful substance	1.41±1.47 ^{ns}	1.44±1.45 ^{ns}	1.26±1.32 ^{ns}	1.54±1.23 ^{ns}	1.41±1.37
Not trustworthy-Trustworthy	1.54±1.47 ^a	1.58±1.32 ^a	1.13±1.39 ^{ab}	1.29±1.25 ^b	1.38±1.38
Everyday food-Special food	0.03±1.94 ^a	-0.14±1.81 ^a	0.6±1.76 ^b	0.67±1.69 ^b	0.29±1.84
Difficult-Easy to digest	1.33±1.51 ^{ns}	1.51±1.23 ^{ns}	1.56±1.22 ^{ns}	1.52±1.14 ^{ns}	1.47±1.30
Allergic-Not allergic	1.88±1.53 ^{ns}	1.67±1.23 ^{ns}	1.68±1.22 ^{ns}	1.82±1.13 ^{ns}	1.77±1.30

^{a,b} Mean values within the same row followed by a different superscript letters were significantly different at $p < 0.05$.

ns = Not significant at $p < 0.05$.

Consumer attitude towards rice was compared across-countries using Duncan ANOVA. Attitude in calorie, harmful substance, digestibility and allergy were not significant different across nations and was in a positive side (table 3).

Attributes about taste, healthy and cheap price were among the highest positive attitudes. Respondents thought that rice was neither an everyday food nor special food. This actually implied that rice was consumed regularly in these countries even not every day. Comparing across nationalities found that the British tended to rate lower than the others in almost every item but still in positive attitude. British has long experience in Asian food as a result of colonization especially India. As a consequence, attitudes towards rice were not new or special, or they already perceived it as a common commodity. The Dutch was the second lowest positive rating with similar reason in colonization of Indonesia and Surinam. Belgian was the highest positive rating in most aspects.

Consumer attitudes of rice compared to potato and pasta in each country were shown in table 4. Result showed that, in general view, rice was higher positively perceived than pasta in every items and so did potato except taste and allergy. British consumers thought that rice was not as tasty as potato but it was lower in calorie, less harmful substance, a little special than potato and less allergic than pasta. French consumers thought that rice was much lower in calorie than potato and pasta, easy to digest than potato and lower allergic than potato and pasta. Dutch and Belgian's perception were quite similar. Both had positively perception in rice in almost every attitude except taste which was rated equally. Dutch and Belgium perceived that rice was healthier, cheaper, lower calorie, less harmful substance, easy to digest and a little special than potato and pasta. For Dutch, rice was also perceived as healthier, less allergic than pasta. For Belgian, rice was perceived healthier than potato and less allergic than pasta.

4. Conclusion

Rice certainly gained positive attitudes in four target European consumers. Perception in rice among health, price, calorie, chemical, trustworthy, digestibility and allergy gained superior quality than potato and pasta. As rice consumption per capita in Europe was still comparatively lower than potato and pasta, Thai rice has large demand to fill in. Proper marketing means that could differentiate superior quality of rice will help increase consumer demand and preferences in rice. Thai rice manufacturers should educate European customers via product information and application of rice in various cuisine. These can help promote rice consumption in target European countries.

Table 4 Consumer attitude mean score of rice compared to those of potatoes and pasta in each countries.

Bipolar semantic	the United Kingdom			France			Netherland			Belgium			Total		
	Rice	Potatoes	Pasta	Rice	Potatoes	Pasta	Rice	Potatoes	Pasta	Rice	Potatoes	Pasta	Rice	Potatoes	Pasta
Bad-Good Taste	1.98	2.21*	2.16	2.14	2.20	2.38*	2.13	2.02	2.13	2.24	2.30	2.27	2.11	2.18	2.23*
Not healthy-Healthy	1.87	1.65	1.70	1.94	1.79	1.82	1.96	1.84	1.61*	2.18	1.95*	2.01	1.98	1.80*	1.78*
Expensive-Cheap	1.88	1.76	1.75	2.16	2.09	1.87*	1.81	1.57*	1.38*	1.95	1.66*	1.54*	1.94	1.76*	1.63*
High-Low calorie	0.96	0.49*	0.57*	1.24	0.87*	0.83*	1.32	0.96*	0.52*	1.32	0.88*	0.51*	1.20	0.79*	0.60*
With-Without harmful substance	1.41	1.05*	1.26	1.44	1.50	1.39	1.25	0.79*	0.98*	1.54	1.20*	1.03*	1.41	1.11*	1.16*
Not trustworthy-Trustworthy	1.56	1.45	1.53	1.58	1.50	1.50	1.12	0.96	1.06	1.29	1.12	1.03*	1.38	1.25*	1.28*
Everyday-Special food	0.03	-0.41*	-0.13	-0.14	-0.32	-0.42*	0.60	-0.15*	0.12*	0.68	-0.06*	0.07*	0.29	-0.24*	-0.08*
Difficult-Easy to digest	1.31	1.36	1.17	1.51	1.15*	1.42	1.56	1.06*	0.85*	1.52	1.24*	1.23*	1.47	1.21*	1.16*
Allergic-Not allergic	1.90	1.96	1.67*	1.67	1.46*	1.38*	1.68	1.59	1.48*	1.82	1.78	1.53*	1.78	1.71	1.52*

*Significant by different from rice at $p < 0.05$

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