The role of market research during product development

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Abstract: Market oriented product development, essential for enterprises which want to a differentiated performance, requires the continued improvement of the processes associated to the understanding of the market and to product line planning. In this context, the access to market research technology appropriate to the enterprises' needs is as vital as product and process technology. This paper integrates market research technology to the product development process, from the enterprise' portfolio management, during the development of a new product line, to monitoring a product life cycle.
Keywords: *R&D, Marketing, Product Development, Market Research, Statistics techniques*

1. Introduction

The activity of developing products, most often seen as a sequence of technological-scientific efforts needs to be managed more confidently in order to attain the optimization of factors such as speed, quality and cost (CLARK, K. B. & WHEELWRIGHT, 1992; CHENG et al, 1995).

To achieve optimal development, it is necessary, besides the scientific technology inherent to the product under development, to use two others, complimentary to each other: Process Management Technology and Market Information Management Technology.

The term Process Management Technology refers to the knowledge on Product Development Technology, about which there are works by renowned authors (CLARK, K. B. & WHEELWRIGHT, 1992; CLARK, K. B. & FUJIMOTO, 1991) who have looked for a development model, with variations due to the structural organization of the enterprise, relative to the process, the existing resources, etc.

Market Information Management Technology complements, and sometime is a part of Development Process Management. The correct use of Market Research Techniques can greatly help in the task of developing products, working as a mechanism for understanding client's needs, monitoring its habits and attitudes and evaluating concepts, prototypes and products. Works such as those of URBAN & HAUSER, 1993; DOLAN, 1993 and LEHMANN, 1989, to name a few, elucidated the importance of applying some market research techniques to product development.

The objective of this work is to stress the role of market research, highlighting its importance, the data necessary to obtain information, the techniques most indicated for each purpose and the results expected at each step of the development process.

For such, this paper will first deal with each step, breaking them into minor development steps. Next, each step and their minor steps will be analyzed in terms of probable benefits resulting from the use of some statistics tools of market research.

2. Steps in the process of product development

Product Development Process, here considered as being the application of Market Research, is presented in Figure 1.

Product Portfolio Management aims at the equalization of projects carried out by enterprises, in terms of project value maximization, strategic alignment, and the kinds of projects carried out. The analysis of the set of products in terms of market, financial, and technological dimensions along with internal resources is essential (COOPER et al., 1998).

One of the steps necessary for Product Portfolio Management is the Identification of Opportunities in which ideas are generated, investigated, compared and selected.

According to KOTLER (1994), ideas for new products can originate from many sources – consumers, scientists, competitors, top management, etc. – however, creativity techniques, such as brainstorming, market information, and techniques for the selection of ideas can be useful to optimize the results achieved.

The best ideas must be transformed in product concepts. This happens in the Definition and Concept Test phase. According to LEHMANN (1989), the objectives of concept test are: choosing the most promising concept, having an idea of its commercial impact, pointing out who is most interested in the concept and drawing plans for the development work.

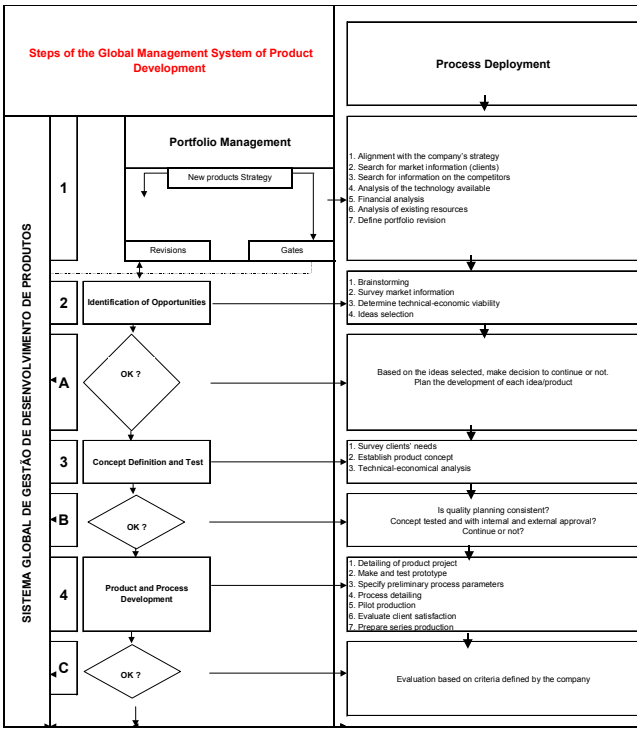


Figure 1 - Steps of product development process

Having defined our working concept of product, it must be translated from the market language to the project technological environment (MIZUNO & AKAO, 1994), which is the reason why product and process deployments are made. Process and Product Development encompasses detailing the product project, production, prototype testing, process specification, pilot prototyping and preparation for large-scale production.

3. Portfolio Management

3.1. Market research for demand prevision and competitor characterization

The main contributions of market research to this step are presented in Table 1

3.2. Case 1: the juice market in Brazil

Case Description

A company already in the phase of implementation of a new business unit - natural products derived from fruits – is faced with a basic market question, but of large impact on its strategic planning: which product families to develop in the short term?

The information obtained by the enterprise staff revealed that there were three main product lines under consideration: F1, F2, and F3. In order to assist making the decision about the product families to be developed in the short term, the company decided to resort to market information, since the technology was fairly spread, the financial study of implementation of each family had already been carried out and the three families met the company's strategies.

Table 1 – Market research in the product portfolio management

Steps	Necessary Data	Technical Analyses	Results Obtained
Obtain market information	Product demand history	Regression Time series	Future demand estimates
Obtain information on competitors	Number of competitors Products Turnover Consumption of each existing brand	Descriptive analyses: measures-summary, tables and graphs	Market growth rate Synthesis and information visualization

Study Objective

1. Research existing information (primary and secondary data) and estimate market demand for each product family.

2. Mapping the market of each family in terms of competition, considering competitors' product portfolio based on packages and taste variables.

3. Indication of product families to be developed in the short term

Methodology Adopted

Basically, two steps were carried out to meet the objectives delineated:

1. Obtaining existing information about the juice market, directed mainly to the Brazilian consumption of concentrated juice, prepared juice and hydroelectrolytic beverages (thirst quenchers). The information obtained was compared, questioned and summarized. From this point on, product demand prevision was made using mathematical fitting models.

2. Analysis of competitors' characteristics, summarized by means of graphs and tables.

Analysis

Initially, a general characterization of the Brazilian beverages market was made based on existing information. Figure 2 shows this characterization, which took into account as total juice, the sum of concentrated juice consumption, prepared juice, soft drinks, hydroelectrolytic beverages (isotonic thirsty quenchers) and nectar.

Comparing the per capita consumption performance of some beverages in Brazil between the years of 1990 and 1998, one can notice the evolution of tea, mineral water, coffee, total juice and softdrinks with values of 0, 133, 31, 56 and 66%, respectively.

The product families, prepared juice, hydroelectrolytic beverages (isotonic thirsty quenchers) and concentrated juice were investigated in relation to the total volume consumed in the last years. The several existing data were compared, and after the choice of the most reliable information, demand was estimated using statistical modeling based on historical data.

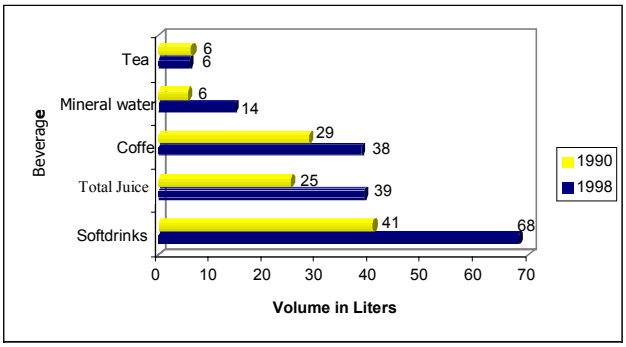


Figure 2 – Per capita consumption of beverages in Brazil (Beverages: tea, mineral water, coffee, Total juice, softdrinks - Volume in liters)

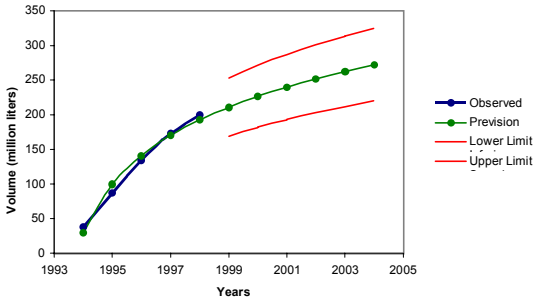


Figure 3: Prevision of family F1 consumption in Brazil (volume in million liters, observed, prevision, lower limit, upper limit)

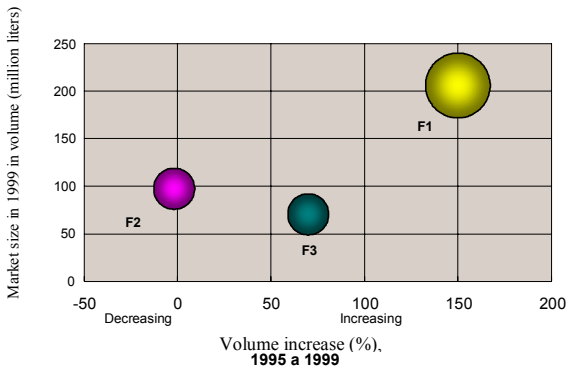


Figure 4 – Family Mapping as a function of market size, growth rate, and number of competitors (sphere area)

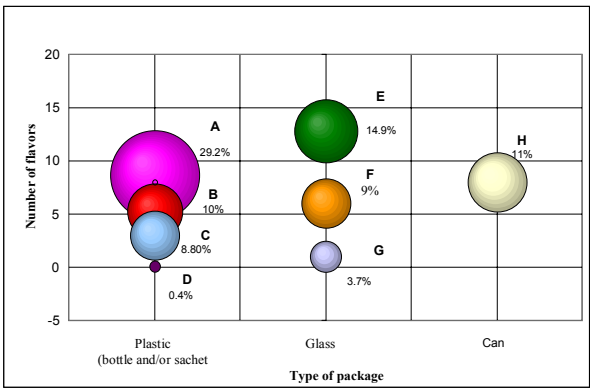


Figure 5 – Mapping of family F2 as a function of flavor size (Y), package (X) and market share (sphere area)

The results found for each family are shown in Figure 3.

Some conclusions could be drawn based on this study:

♦ the market of F1 presents logarithmic growth, and should reach a production volume near 272 million of liters in 2004, with a growth rate of 36% in comparison to 1998.

♦ the market of F2 also presents a logarithmic growth, however, with a growth rate inferior to that of F1. In 2004, sales in the order of 141 million are expected, growth rate a little inferior to 30% in comparison to 1998,

♦ the market of F3 presents a linear growth, with a volume of 189 million expected for 2004. The estimated growth rate from 1998 to 2004 is very attractive, nearing 150%.

The values of market size, growth rate, and number of competitors of each family are shown in Figure 4. Each family was also characterized in terms of competing market, as exemplified in Figure 5 for family F2.

The previous figures reveal that families F1 and F3 are more attractive than F2 because:

♦ despite the number of competitors, family F1 presents high values of market size and growth rate;

♦ despite its small market size, family F3 presents a good growth rate, it is a new growing market and has few competitors.

♦ Family F2 has few competitors, however, it is an old market, well delineated in terms of market share. Besides, it has a lower growth rate leveling .

Conclusion

Follow up development of Families F1 and F3.

4. Identification of opportunities

4.1. Market research in the analysis of market opportunities

The use of market research in the identification of opportunities is summarized in table 3.

Table 3 – Market research for the identification of opportunities

Phase	Necessary data	Analysis techniques	Results obtained
Generation and Selection of Ideas	Qualitative research of consumers (individual and focus group interview), *brainstorming,*, client service data	Descriptive analysis	Consumer needs, habits, attitudes, values and perceptions
	Quantitative research of consumers to evaluate product attributes, preference or similarity of products	Factor Analysis Multidimensional Scaling (MDS) Correspondence analysis	Perceptual map Preference vector Market segmentation Market gaps
	Competitors' data (price, market, promotion, and product)	Descriptive Analysis	Visualization of competitors' strategies

4.2. Case 2: The Brazilian juice market – opportunities and support in the definition of product portfolio

Case description

Considering the former case, it was decided to continue the development of the products of families F1 and F3. The present question is: is there any opportunity in terms of package and flavor to be taken in these markets?

The description of opportunity mapping for family F3, from the competitors, follows.

Objectives of the study

The main objective of this step was to help company X to delineate its strategies in relation to quality, flavors, package types, distribution and promotion of products of family F3.

Some specific objectives were set with this purpose for the work phases:

1. Describe existing products in terms of package and flavor.

2. The research of the large retail in Belo Horizonte sought to investigate its main supermarket chains, aiming to identify which brands are present, which ones have greater penetration, and the average product commercialization price.

3. The research of the small retail sought to detect the presence and penetration of products and brands of family F3 in the small retail of Belo Horizonte.

Methodology used

The work was divided in three steps:

1. Description of the existing products: description of the products was made based on the information available, primary and secondary data about the competitors' market of family F3.

2. The large retail research investigated the following chains: Carrefour, Champion, Bon Marché, Extra, Via Brasil, Epa/ Mart Plus and Wal Mart. Product price and penetration data were gathered through visits to the facilities.

3. A poll dealing with questions such as best-sold products, brands, flavors and packages was made for the small retail research. Eighty companies in Belo Horizonte were interviewed, including bakeries, bars, snackbars, convenience stores and delicatessens, grocers, small supermarkets, green grocers.

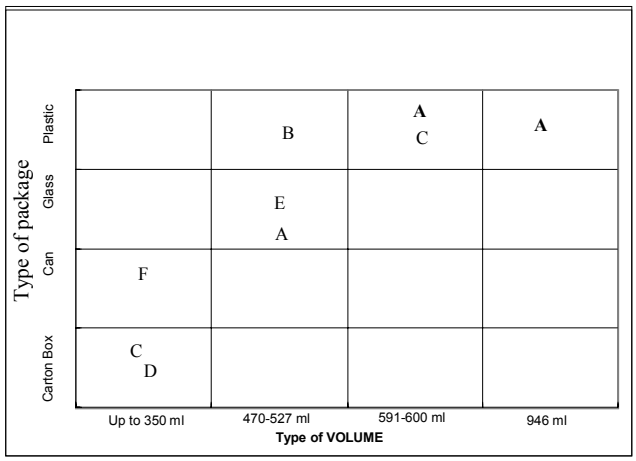
Analysis

Initially the products were characterized by crossing package and flavor (Table 4) and type of package and volume (Table 5).

Table 4 – Product Mapping (Package vs. Flavor)

Package	Flavors						
	Tangerine	Grape	Passion Fruit	Lemon	Citric	Light	Other
Carton box	D	D	D	D			C
		C					
Glass	A	A	A	A	A	E	A
	E			E			E
Can	F			F	F		
Plastic	B	A	B	B	A		B
	A		C	A			A
			A				C

Table 5 – Product Mapping (Package vs. Volume)



From Table 4, it can be noticed the opportunity to develop products with new flavors, mainly with lower calorific level, since the only representative of this segment is brand E. In terms of package, it is observed the opportunity for products of family F3 in cans. This line of product family stands out as a gap in the market.

Product mapping also was carried out in relation to prices and penetration for each type of package, given the suspicion of its effect on the two others. The visualization of this crossing is given in Figure 6.

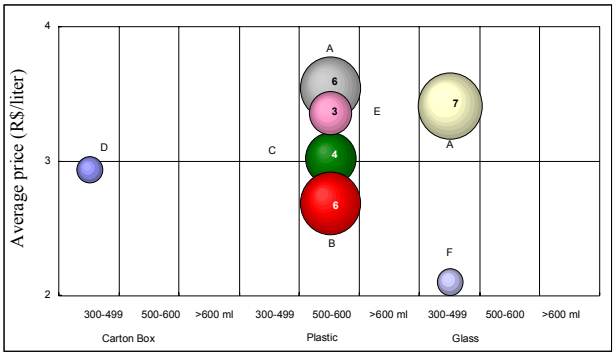


Figure 6 – Family F3 mapping as a function of price size, package and penetration (sphere area) in the large retail in Belo Horizonte

It is noted that there is a large price dispersion, varying from R$2.20 (F) to R$3.5 (A). As to the distribution, products A and B stand out, being present in almost all stores. Product E, the one with larger aggregated value, competes with the others seen as non-natural (with those considered artificial). Nothing was observed about the relation package/price.

Based on the information gathered, some questions can be made:

♦ Concerning the competitors, the carton box lines, with only one competitor, and the metallic ones, without competitors, would they not be very attractive?

♦ Which other positive points should the products of family F3 have to outdo competitors E, B, and A, strong in product quality/flavor innovation, price/flavor diversification/penetration and package options/flavor diversification/penetration?

♦ As the average price seems not to depend on the type of package adopted, the technological process would be decisive factors in the choice of package line and the adequateness to the consumer use. Which type of package do the consumers prefer?

♦ It is know that the consumption of natural products is increasingly frequent. Would the production of traditional products based on flavorings, colorings, acidifiers not go against the consume trend? Would company E not be in the correct direction launching products based on fruits? Would it not be interesting to reevaluate the calorific question of foods, given the consumption option of little calorific products by the population as a whole and especially by the 'health generation"?

♦ Would the quality strategy (beverages based on fruits), package (adequate to the target public), price (affordable to the target public, with average price between B and F) and good penetration be possible?

Conclusion

Many of the previous questions were answered by company X according to the strategic position assigned to family 3. However, other questions will be solved only with product concept testing, which has not been conducted yet.

5. Concept definition and test

5.1. Market research to test product concept

The use of market research to define and test product concept is summarized in Table 6.

Table 6 - Market research in the definition and test of product concept

Phases	Necessary Data	Analysis Techniques	Results obtained
Concept Definition	Research of preference or purchase intention in relation to several concepts	Conjoint analysis	Identification of attributes which most affect preference. Prevision market share Selection of the best concept
Concept testing	Evaluation of concept perception	Descriptive analysis Factor analysis	Perceptual map Strong and weak points of the concept

5.2. Case 3: Testing the concept of a yogurt brand in the market

Case description

A dairy company interested in entering the yogurt market starts its development work by designing its first prototype, prototype A. Worried about its product performance against the competition and expecting to change the concept to reach a larger number of consumers, Dairy company LB chooses to test its prototype against those of the main competitors.

Objective Study

Check out if the prototype concept corresponds to the consumers' expectations.

Methodology used

Consumer polling was used to test the concept of product A employing the Perception Mapping technique.

Perception Maps, according to Dolan (1993), are a graphic representation of the position of products in relation to a smaller number of dimensions considered essential by consumers, to judge and perceive a type of product.

The construction of the Perception Map is preceded by qualitative and quantitative research.

Qualitative research was used to find out the clients' needs, even if those clients do not know them explicitly. Forty male and female youngsters aged over 18 and who consume the product at least once a week were interviewed.

Next, a quantitative research was made with the use of a questionnaire with 80 youngsters, which yielded the following information: 1) importance of each attribute; 2) evaluation/perception of each attribute per brand; and 3) general preference of yogurt (order). These data allowed drawing the perception map by factorial analysis (DILLON. & GOLDSTEIN, 1984).

Analysis

The following attributes were found relevant in the qualitative research for yogurt analysis: sweetness?, acidity, flavor, consistency, aroma, color, residual taste and appearance.

Next, eight brands, identified by A (prototype), B, C, D, E, F, G, and H were selected for analysis. These products were submitted to quantitative analysis.

From the data gathered, a Pearson correlation matrix was made for the attributes. The existence of strong correlations among some attributes allowed to summarize the information reasonably in only two dimensions by means of factorial analysis. The results of the factorial analysis for these two dimensions indicated that the first dimension encompasses the variables flavor, acidity, sweetness, residual taste and consistency, which can be summed up as *Taste*. The second dimension encompasses the variables color, appearance and aroma, which could be named *Aspect*.

The analysis of the data revealed that a considerable amount of the variation was explained for the 2 dimensions (68.7%).

The Perception Map for the eight yogurt brands is presented in Figure 7. The map shows that from the consumers' point of view, brand C is the leader in both dimensions (Taste/Aspect). The analysis of prototype A demonstrates that for its better positioning in the market, the company should give more attention to the factor *Taste*.

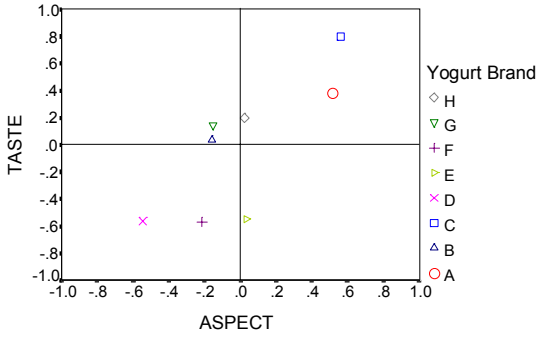


Figure 7 – Perception Map for the eight yogurt brands

Conclusion

Dairy company LB should review its concept in relation to the attributes related to the dimension *Taste*.

6. Product and Process Development

6.1. Market research as a prototyping guide

The use of market research as support in product and process development is summarized in Table 7.

Table 7 - Market research as support in product and process development

Phases	Necessary data	Analysis techniques	Result obtained
Product and process project	Evaluation of the perception or acceptance of the prototypes and final product (market test)	Descriptive analysis Factor analysis Preference Map	Strong and weak points of the product from the point of view of the clients Prioritization of corrective measures

6.2. Case 4: Optimization of the development of chicken pastry

Case description

A food company in the bakery field, DIASA Alimentos, had two products in the market in the semi-prepared segment, Chicken Pastry Traditional and Chicken Pastry Crispy. Some competing products were gaining market, FRANGÃO, with its two products, Chicken Pastry Single and Chicken Pastry Plus, and De Carne Pastry, with the product Common Chicken Pastry.

Interested in better understanding the positioning of its products in the market, with back project in mind, DIASA decided to use the products mentioned with different preparation procedures for sensorial analysis using the acceptance tests with consumers and descriptive analysis with trained tasters. The products chosen were:

♦ DIASA: Traditional fried (Tradicional) , Crisp fried (Crocante f) and baked (Crocante a);

♦ FRANGÃO: Single fried (Single) and Plus fried (Plus); and

♦ De CARNE: Common fried (De carne f) and baked (De Carne a).

With the data gathered with the two tests in hand, the company decided to use the new data crossing technique , MDPREF, to help in reformulating the products.

Work objective

To map the products existing in the market in order to help reformulating the products of the company.

Methodology adopted

1. Selection of the consumers: 100 male and female consumers were interviewed (48 males and 52 females) aged between 20 and 50 (there was only one consumer under 20 and another over 50), from classes A, B and C and who consumed the product with some regularity.

2. Execution of the acceptance test: the samples were taken from the refrigerator and prepared on the spot, according to the specific preparation and the suggestion given in the package of the product. The whole test was carried out in the sensorial analysis laboratory of the company, in 10 individual booths with testing computer workstations, recommendations of SIDEL & STONE (1993). The scale used in the consumer acceptance research was the

hedonic scale of nine scores with expressions ranging from "strongly disliked" to "strongly liked".

3. Descriptive evaluation of the products: to determine which were the sensorial differences between the products, Quantitative Descriptive Analysis (QDA) tests were made for the products in question. The necessary procedures for planning, execution and result analysis of the sensorial test were carried out by the company being researched, in accordance with SIDEL & STONE (1993).

4. Preference map: based on the studies carried out by the company, it was chosen to cross the data obtained with the tool Internal Preference Map (MDPREF). MDPREF seeks to map products based only on its evaluation as to the preference/acceptance. Thus, it deals with market information from the Market Research activity (GREENHOFF, K. and MACFIE, 1994).

5. Correlation Analysis: the correlation analysis was made to find out and explain the preference dimensions obtained by MDPREF. The averages calculated from the sensorial evaluations were used in the correlation analysis of each sensorial attribute with the preference dimensions from MDPREF.

Analysis

Initially, the averages and standard deviations of the data gathered were calculated. The products which had higher average scores, products Traditional and Crocante Fried are the same which had the lowest standard deviation. At first, it can be said that the products of the DIASA company had in average a better performance than the other products.

To determine which were the sensorial differences between the products, Quantitative Descriptive Analysis (QDA) tests were made. The performance of the products in relation to the competitors' can be seen in Figure 8.

In relation to DIASA's products, it can be noticed that the product Traditional Fried had high relative scores for the attributes chicken meat odor, chicken meat taste, salt taste, crust/dough adherence, hardness and chewability. The attribute inner color had relatively low scores. The other attributes of the product had intermediate scores.

In contrast, the Crocante fried product had high relative scores for the attributes granulometry, chicken meat odor and taste, salt taste, crust/dough adherence, dough crispiness and succulence. The attribute inner color had low relative scores, similarly to the other products of DIASA.

In relation to the Crocante baked product, the attributes external color, crispiness and succulence had scores significantly lower than its corresponding fried in the average evaluation of the tasters.

The MDPREF for the set of data is shown in Figure 9.

It shows that the majority of the consumers fall into the right quadrants and has a preference for the Crocante fried and Traditional products. A few consumers are present in the top left quadrant, where the FRANGÃO Plus fried products lies.

To understand the meaning of the dimensions, the correlation between the preference dimensions and the sensorial attributes was made. Figure 10 shows the correlations between attributes and dimensions.

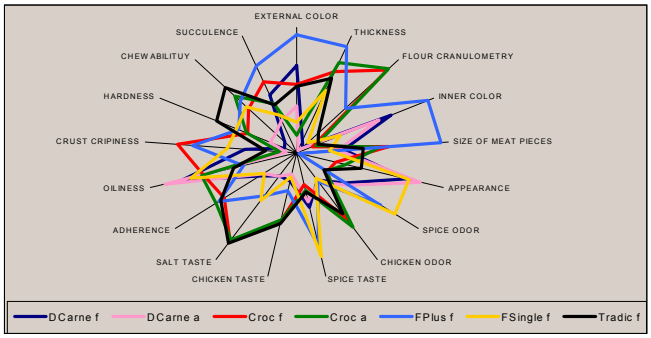


Figure 8 – Spider graph of QDA of chicken pastry

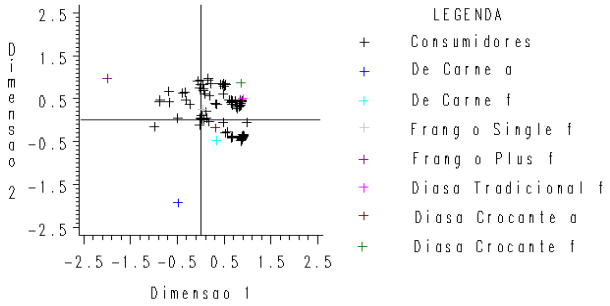


Figure 9 – Consumer and products positioning in dimensions 1 and 2

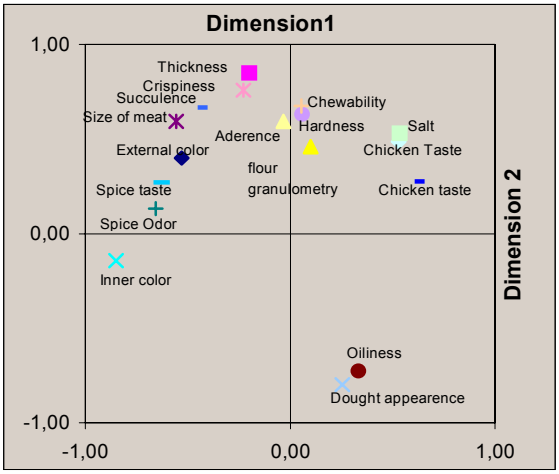


Figure 10 – Correlation of sensorial attributes with dimensions 1 and 2

The following correlations can be observed in the previous graphs:

♦ Dimension 1 is correlated positively with the attributes chicken odor, chicken and salt taste, and negatively correlated with inner color, spice odor, spice taste, size of meat piece and external color.

♦ Dimension 2 correlates positively with thickness, crispiness, size of meat piece, crust/dough adherence, chewability, hardness, succulence and salty, and is negatively correlated for the attributes dough appearance and oiliness.

The analysis of the last two graphs enables us to understand the type of product best accepted. The following observations can be made:

♦ The products of the company fully satisfy most of its consumers. An ideal product would have scores similar to the Traditional and Crocante fried for attributes related to dimension 1.

♦ An improvement to gain this segment for once and for all which can be made is related to Crocante. This product has a differentiated performance when submitted to different processes of preparation, mainly in relation to attributes related to dimension 2 (crispiness and succulence).

♦ As to the consumers lying in the top left quadrant of Figure 9, it is noticed their preference for spicier products, with a darker aspect, with larger pieces of meat (related to dimension 1), with higher crispiness, hardness, succulence and chewability (related to dimension 2). This is a segment dominated by Plus Fried and which does not have a direct competitor. This would be a good opportunity for the company to develop a product targeted on this segment.

Conclusion

The Acceptance Tests can be used to guide product development along several prototypings. The Preference Map contributed for a better understanding of the attributes considered important by the consumers with prototype optimization in view.

7. Conclusions

Market research technologies have been presented, identifying types of data as well as expected results and their utility in each phase of the product development process. Through this reflection, it was evidenced the importance of data gathering, its processing, and the use of the results in decision making for the success of the product under development. The product development process encompasses actions inside and between the several sectors of the company, and is highly desirable for the efficient communication, facilitated by the market research techniques reported.

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