

Food products development process and management in a cereal company: a case study

Luiziane Albino Gonçalves Moreira

Federal University of São Carlos
lualbino@terra.com.br

José Carlos de Toledo

Federal University of São Carlos
toledo@dep.ufscar.br

Abstract: The food industry is known for its frequent launch of large numbers of new products on the market. Another characteristic is its difficulty in defining and systemizing the product development process (PDP), thus contributing to high rates of product defects and market nonacceptance. This situation creates a challenge in terms of the need to streamline and upgrade the know-how of professionals involved in the development of food products. In the cereal industry, cereal bar products for children have gained increasing importance in this market segment. This fact is illustrated by the amazing growth of cereal bar sales, which, according to the Brazilian Food Industry Association (ABIA), rocketed from 77.8 million units in 1998 to 464 million in 2004. This article characterizes the PDP of a company operating in the cereal bar segment and analyzes the involvement of its suppliers in the process. This paper also characterizes the types of products the company develops, and identifies the tools it employs as well as problems in its PDP. This work was based on a case study, whereby the tools and systematized activities in the PDP were identified, as was the need for improving the suitability and choice of performance indicators employed by the company.

Keywords: product development, PDP management, food products

1. Introduction

According to DIMANCESCU & DWENGER (1997), development of new products has become more relevant to companies, it has even influenced their future perspectives. This pronouncement is by PENSO & FORCELLINI (2003), who state that the Product Development Process (PDP) in the food industry holds an important strategic role, becoming a key aspect in order to obtain competitive advantage.

SCHILLING & HILL (1998) emphasize that companies trying to survive in the market should promote new products more adequately and faster than their competitors, they should always be ready to obtain faster technological advantages and implement adequate strategies of product development. The food industry is characterized for launching a great quantity of new products yearly. However, another feature of this industry is the difficulty to define and systematize the product development process (PDP), which contributes, to a large extent, to a high rate of defects when launching the product that leads to product unacceptance by the market.

According to TOLEDO et al. (2003), in the Brazilian food industry the PDP occupies a role that becomes more important and more relevant for success, yet there is still much to be done. For the authors of this work, launching new products must be part of the strategic view, in the case of the market as well as the company. According to them, the first step to be taken must be systematization of their PDP, always considering client satisfaction, development costs, production flexibility, partnerships with suppliers, among others.

To PENSO & FORCELLINI (2003), the models that appear in the literature concerning the food industry's PDP define stages that partially consider the planning stage as well as the product development project. In our view, such models present gaps, especially in the stages that correspond to product development, due to lack of detail, support tools and their systematization.

Reinforcing this statement, SOUZA FILHO & NANTES (2004) suggest that the food area, above all the new products development

sector, presents some specific technical characteristics in their professional's formation, incorporating specific scientific food knowledge. Such information is connected to food safety (microbiology and toxicology), aspects of its sensorial quality, its nutritional quality and chemical properties.

This situation verifies a demand generating condition for studies related to obtaining information, broaching the process, the use of tools and PDP management in the food industry.

Considering the relevancy of the above cited aspects and directing them to the cereal industry, one can verify by its market growth relating to products such as "cereal and flour bars for children", how important generating and diffusing information and knowledge related to PDP in this sector is. Such importance can be seen by the sales growth of cereal bars, that according to ABIA - *Brazilian Association of Food Industry*, jumped from 77.8 million units in 1998 to 464 million units in 2004.

Within this context, the present work has the objective of raising information and characterizing the process of product development (PDP) of a company within the cereal segment, as well as analyzing the involvement of its suppliers in this process. It also aims at characterizing the types of products developed by the company and also identifying the tools used as well as the main problems encountered in its PDP.

2. Bibliographic revision

2.1. The process of product development in the food industry

According to CLARK & FUJIMOTO (1991), the process of product development has as basis the organization of market opportunity information, transforming it into technical information alternatives in order to produce a commercial product. For these authors that process surpasses the activities of the product and process

project, comprising various sectors of the company, as marketing, finances, logistics, among others, and even establishing relationships with various agents from outside the company's environment.

According to GONÇALVES (2003), the development process of new products is fundamentally based on the ability for better identifying ways of meeting market needs and in the capacity of interpreting such information into products, which in fact offers a better solution for such needs in relation to its competition.

To CLARK & FUJIMOTO (1991), the PDP systematizes activities and tasks in the company, promoting organization and integration of their many mechanisms, such as: definition of function arrangement, use and type of tools and forms of external relationships. According to SANTOS & FORCELLINI (2004), the activity of developing new products needs planning, research, control and use of systematic methods capable of integrating and optimizing the different aspects involved. For such, the use of systematic models, supported by methods and tools, helps the project teams to resolve problems during the development, supplying the development team conceptual tools in order to organize PDP more effectively and efficiently.

According to ROZENFELD et al. (2000), the reference models are formal representations of business processes describing their phases, activities, staff held accountable, available resources and necessary or generated information. For the authors, the models serve as common references for communication among the parts in development, whether they are internal (various development teams or people) or outside the company (supplier partners and specialists who render services).

In relation to searching for consumer needs, according to POLIGNANO & DRUMOND (2001), in companies that look for differentiated performance, it is indispensable that product development be guided by the market, demanding continuous improvement of the associated processes with market understanding and product line planning. An important aspect in product development, according to EARLE (1977), is that it should be considered as the beginning of a continuous improvement process associated to the launching of a new product, and this should be part of the company's competitive strategy. For this author, the process of product development in the food industry needs to be more focused, quantitative, quick and knowledge-based. To EARLE (1997), there were many factors that stimulated development of food products in the last 100 years, among which:

- 1) Advancements in new production processes and food conservation methods and changes that occurred in distribution channels;
- 2) Growing participation of marketing and increase in emergence of new formulations;
- 3) Recognition and increase of market research and recognition of consumer needs; and
- 4) Greater integration of marketing activities, consumer research and emergence of new technologies.

SANTOS & FORCELLINI (2004), relate on the use of models employed on product development, developed by many authors as, FULLER (1994), RUDOLPH (1995), POLIGNANO & DRUMOND (2001) and PENSO (2003). According to SANTOS & FORCELLINI (2004), use of these models is relatively new in the food product's PDP.

According to GONÇALVES (2003), in relation to use of PDP models in the food industry, those that are adopted by most of them follow a standard management model that is divided into stages, including from ideas and research alongside the consumer up to each new launched product introduced into the market.

STEWART-KNOX & MITCHELL (2003), in research carried out in the food sector in England, verified as determinant factors of success in the development of new products: development of unique high quality products, knowledge about the consumer market, client involvement, consumers and suppliers in PDP, as well as participation of specialists in food technology.

In his works, FULLER (1994) established a PDP model for the food industry. Fuller's model (1994) begins recognizing the company's objectives and consumer needs. Afterwards, it promotes generating and selecting ideas based on studies of technical feasibility, market research and financial analysis, thus involving all sections of the company. The technical part of Fuller's model is carried out in sequence with the construction of a prototype that generally occurs at indicial stages of development. At the development stage a business plan analysis is performed for subsequent definition of the production process, it is followed by a consumer test and lastly a market test aiming at evaluating the possibility of the product's success.

FULLER (1994) presents a classification for new food products as follows:

- Line extension: Consists of variation of already existing line of products. These demand little time and effort to develop;
- Product repositioning: Consists of an already existing product introduced in a new market. It usually only needs few changes, as label substitution, or new packing;
- New form of existing products: Consists of changing product form, it may require a long development period, added to the need for new processing and packing equipment;
- Reformulation of existing products: Consists of improving some attribute as color, flavor, increase of fiber content, reduction of fact content, etc;
- New packing for existing product: application of new technologies as modified or controlled atmosphere can enable creating a variety of new products;
- Innovating product: Obtained by changes of existing product. Generally, the newer the innovation is, the longer development time and research investment will be; and
- Completely new products: Demand extensive development time, high costs, large investment in marketing and equipment, elevated risk, and strong possibilities of being copied by the competitors if the product is successful.

A PDP structure in the food industry that is often regarded in the area was proposed by RUDOLPH (1995), who outlines a product development model composed of three stages: product definition, product implementation and product introduction. Each phase is then divided into activities with their respective focuses, as seen in Table 1.

In this work FULLER'S proposed PDP model for the food industry will be used as analysis support for collected information.

3. Research methodology

The work was developed by means of a qualitative, investigative and descriptive type research, which according to GIL (1999) has the purpose to elucidate and change concepts, looking for more adequate approaches for future works. It is descriptive as the researcher tries to explore experienced reality as it is, without any modifications. As a research strategy, a single company study case was chosen. This company is considered representative in the segment of cereal products. According to YIN (1994), a study case tries to examine a current phenomenon within its context, not separating from it, as is the case of experimental programs, and also differentiates from the historical method as it refers to the present and not the past.

Table 1. PDP model for food products according to RUDOLPH (1995).

Phase 1: Product Definition	
1.1. - Strategic Planning	Considering: The company's outlook, the market aim, market positioning, legal barriers, essential competencies and financial return
1.2. - Evaluation of market opportunities	Consumer research to characterize market opportunities
1.3. - Business plan for the product	Document preparation describing market opportunity and programming requirement to substantiate opportunity
1.4. - Product definition	Integration of consumer perception, business objectives, definition of product and legal requirements
Phase 2: Product Implementation	
2.1. - Prototype development	Develop a product prototype that will meet business objectives
2.2. - Market strategy and test	Sales prognosis based on market analysis Forecast of repetition intention of product purchase
2.3. - Scale-up and production test	Production of new product and development of total quality program
Phase 3: Product Insertion	
3.1. - Insertion/Production	Sales implementation supported by product marketing and distribution (At this point the consumer is identified in final form)
3.2. - Product improvement and support	Building up a successful product and business renovation by feedback to other functional areas

Source: Adapted to RUDOLPH (1995).

According to GIL (1999, pg. 43) "Explanatory research is developed with the purpose of providing a general view on a certain fact, approximately, [...] usually involve study cases". As a collection instrument of research data, a semi structured questionnaire was applied that contained semi-opened questions that were used as a way to obtain information. It was conducted from the point of view of those interviewed and not the interviewers. As a questionnaire model an adaptation of a model presented in the research project report was used, Management of a Product Development Process in the Food Industry: analysis, proposals for improvement of capacitation and reference model, according to TOLEDO (2003), developed by the Quality Study and Research Group (GEPEQ), Department of Industrial Engineering of the Federal University of São Carlos (UFSCar). To obtain necessary information for work development, the individual in charge and members of the company's product development team were interviewed.

4. Results and discussion

The company in this study case is in the south of Brazil and was established in 1968. It operates in the entire national market as well as abroad. It has six business units and approximately 700 employees. In its line of cereal processing, it produces cereal bars, cereal grains and cereal flour intended for children's food.

The company has established as product innovation dynamics, the launching of pioneer and new products, considered as new in the market, as well as releasing products considered as new for the company, but that already prevail in the market. It has a specific and exclusive department for the development of new products, its R&D center in which a product development team and a process development team operate. The R&D Department has a 12-member team with 9 mid-level technical and non-technical employees and a team of 3 university graduate and post graduate engineers. They are hierarchically connected to the technology directory. There is a product development laboratory and a pilot plant with dryers, *spray-dryers*, mixers and mills that support the PDP.

The company does not use any PDP model. In the past they used elaborated flux diagrams with all the stages a product should go through until being launched in the market. Currently, for each project, the activities to be accomplished are determined by elaborating a chronogram for each specific project. Considerable stages are defined, however, no pre-established flux is followed.

But it was found that the company's PDP is conducted following pre-development, development and post-development stages. In the first stage, activities as marketing studies, financial analysis, market analysis, and market and product strategy are accomplished. These activities are carried out by the company's business unit and involve many sectors. Activities of creation and selection of ideas at this stage are transmitted by the company's business unit and by the center of research and development. At the development phase, the company conducts a product and process project, *shelf-life* study, sensorial evaluation studies, formulation definition, laboratorial tests and Hazard Analysis and Critical Control Points (HACCP) implantation studies. Such activities are done by company's research and development center.

The last stage, post-development, is entirely accomplished by the business unit and incorporates activities as, consumer behavior studies, launching product in market, etc. It can be seen that even though the company informed that it did not follow any model, its PDP activities show a relatively high rate of systematization, strongly based on Fuller's model (1994), already established in the literature.

With relation to ideas for new products, the company uses suggestions made by their employees, market research and R&D information to develop products and processes.

The conversion rate of ideas into new products that the company launches in reality is approximately 5%. It shows a 30% success rate of developed projects. The success rate of developed projects is measured by the number of successful projects (in the market) in relation to the totality of PDP projects developed by the company. The value found for the rate of success in the company's PDP is

higher than what was found in works of RUDDER et al. (2001), which is of 12%.

Communication process of the company's PDP is accomplished by periodic meetings, written reports and communication via e-mail. In regards to this, it is worth mentioning that FULLER (1994) considers essential for a company's successful PDP an adequate and well administrated information flux.

Using as basis FULLER'S (1994) classification for different types of projects, the innovative products are the most developed ones in the company (50% of projects), line extension (10%).

The company attaches motivation for the development of PDP projects to its leadership search strategy, regarding innovation in its main markets. As significant innovation, obtained in recent years by means of its PDP, the company mentions the process of bar extrusion, filled bars and high density pre-cooked multi-cereal bars. The company considers the introduction of new products as the main benefits that result from new improved product processes.

The managing of development process is directed by a team made up of members from many departments (financing, marketing, production, provisions), which is under the coordination of a permanent supervisor who answers to a market coordinator or commercial director. During the administration of a project each team conducts only one project, where a member of any team can participate in more than one project.

As tools and methods of support to the company's PDP the product Benchmarking, Simultaneous Engineering, Sensorial Analysis with data statistics and Experimental users are already implanted. The Portfolio Management and Hazard Analysis and Critical Points of Control (HACCP) are in initial implantation during product development. With relation to Quality Function Deployment (QFD), the company does not have any plans to implant it.

In the supplier-company relationship the first ones participate in the PDP developing specific raw material for the project or providing technological information for its development. Regarding the clients, they participate in specific meetings or in consumer tests. For RAGATZ et al. (1997), the relationship with the suppliers promote a marked differentiation in the PDP. Many evaluations are accomplished with the technical and economic aspects during different stages of PDP, as seen in Table 2.

Performance indicators for the evaluation of product development process are used based on the number of projects developed by the market and by yearly earnings coming from new products, but there was no information about indicators related to client satisfaction evaluation.

Among the main problems found throughout PDP are the project modifications that frequently occur, leading to vulnerability regarding meeting project deadlines. Seen as a positive factor in PDP they mention that there are no problems regarding tests and laboratorial analysis, overseeing legal aspects, supplier relationships and market adequation. The company expects to widen activities in the department of product development, to increase the number of new product releases, to invest on new technologies and to look for external markets.

5. Final considerations

This work enabled to identify the tools and methods employed in the company's PDP, as well as phases and activities included in this process. Although the company informed that it does not make use of any formal PDP model, it was verified that procedures used in its product development process are relatively systematized and that there is room for advancement in the organization by using a

Table 2. Technical economic evaluation during Process of product development.

Evaluation	Project phase
• Product technique in relation to specifications	All phases
• Product Production Yield	At end of development
• Client/consumer Satisfaction	At test phase
• Economy in relation to cost target	Throughout Project
• Sales perspective and market participation	Before beginning Development

Source: Research.

PDP model that could contribute towards obtaining better results in its development process.

It was also seen that the physical structure of laboratory and pilot plant and adequate human resources exist for the technical development of products. The company has tried to prioritize innovative product development as a way to face up to competitors. However, its success rate is still relatively low and this is a characteristic of the food industry. The products developed in the company that are considered innovative, have demanded a 2-3 year development period, and this is considered a relatively long period when compared to other products in the company, as an example of those that are in the extension line, which demand, in average, 6 months to develop. The search for innovative products and frequent PDP changes, previously mentioned, allow deducing that the need for process development technology is a very relevant aspect in the launching of new products in the company. Such a situation is recognized by MONTEIRO (2003), who considers development of many products in the food industry dependent of process technology. The company employs the number of projects developed per market as one of its PDP performance indicators, with the need for improvement in this aspect, as this parameter does not clearly identify PDP efficiency /effectiveness with relation to placing successful products in the market coupled to client satisfaction.

6. References

- CLARK, K. B. & FUJIMOTO, T. (1991) - **Product development performance: strategy, organization, and management in the word auto industry.** Boston-Mass: HBS Press.
- DIMANCESCU, D & DWENGER, K. (1997) - O segredo do lançamento de produtos. **HSM Management.** n. 4, setembro.
- EARLE, M. D. (1997) - Changes in the food product development process. **Trends in Food Science & Technology,** v. 8, p. 19-24.
- FULLER, G. W. (1994) - **New Food Product Development – From Concept to Marketplace.** CRC Press: Boca Raton, FL.
- GIL, A. C. (1999) - **Métodos e técnicas de pesquisa social.** 5.ed. São Paulo: Atlas.
- GONÇALVES, A. M. (2003) - Inovação e desenvolvimento de novos produtos. In: 1º Workshop Brasileiro em aproveitamento de sub produtos do pescado. **Anais...**, Itajai, SC.(Não paginado).
- MONTEIRO, A. R. G. (2003) – **Processo de desenvolvimento de produtos na indústria de biscoitos: estudos de caso em fabricantes de médio e grande porte, fornecedores e prestadores de serviços.** São Carlos. Departamento de Engenharia de Produção (Mestrado), Universidade Federal de São Carlos.

- PENSO, C. C. & FORCELLINI, F. A. (2003) - Aplicação de metodologias de projeto de produtos industriais no processo de desenvolvimento de produtos na indústria de alimentos. In: 5º Congresso Brasileiro de Gestão de Desenvolvimento de Produto, **Anais...**, Gramado, RS, p.1-10.
- PENSO, C. C. (2003) - **Modelo de referencia para o processo de desenvolvimento de produtos na indústria de alimentos**. Florianópolis, 180p. Dissertação de Mestrado em Engenharia Mecânica, Universidade Federal de Santa Catarina (UFSC).
- POLIGNANO, L. A. C. & DRUMOND, F. B. (2001) - O papel da pesquisa de Mercado durante o desenvolvimento de produtos. In: 3º Congresso Brasileiro de Gestão de Desenvolvimento de Produto, **Anais...**, Florianópolis, SC, p. 25-27.
- RAGATZ, G. L.; HANDFIELD, R. B.; SCANNEL, T. V. (1997) - **Success Factors for Integrating Suppliers into New Product Development**. Nova York,, v. 14, p. 190-202.
- ROZENFELD, H; AMARAL, D. A.; TOLEDO, J. C; CARVALHO, J. (2000) - O processo de desenvolvimento de produtos. **Livro Fábrica do Futuro**. Cap. 6, p. 55-64.
- RUDOLPH, M. J. (1995) - The food product development process: progress must be monitored against a planned set of goals. **British Food Journal**, v. 97, n. 3, p. 3-11.
- RUDERR, A.; AINSWORT, P.; HOLGATTE, D. (2001) – New food product development – Strategies for success. **British Food Journal**. V. 103, n, 9, p. 657-670.
- SANTOS, A. C. & FORCELLINI, F. A. (2004) - O processo de desenvolvimento de produtos na indústria de alimentos. In: XXIV Encontro Nacional de Engenharia de Produção, Florianópolis, SC, **Anais...**, CD-ROM: il. p. 2711-2718.
- SCHILLING, M. A.; HILL, C. W. L. (1998) - **Managing the new product development process: strategic imperatives**. Academy of Management Review, Jun.
- STEWART-KNOX, B., MITCHELL, P. (2003) – What separates the winner from true losers in new food development. **Trends in Food Science and Technology**. V. 14, p. 58-64.
- TOLEDO, J. C. et al (2003) - **Gestão do Processo de Desenvolvimento de Produto na Indústria de Alimentos: análise, propostas para melhoria da capacitação e modelo de referência**. Rede de Cooperação de Pesquisas: Produtos e Processos Agroindustriais - RECOPE / FINEP. Grupo de Estudo e Pesquisa em Qualidade (GEPEQ), Departamento de Engenharia de Produção, Universidade Federal de São Carlos. 71p.(Relatório de pesquisa).
- TOLEDO, J. C; ALLIPRANDINI, D. H; ZUIM, L. F. S.; BOSI, M. G.; OLIVEIRA, T. S. C.; FERRATA, M. R. (2004) - Gestão do processo de desenvolvimento de produto na indústria de alimentos: Análise preliminar. In: XXIV Encontro Nacional de Engenharia de Produção, Florianópolis, SC, **Anais...**, CD-ROM: il. p. 283 -2838.
- SOUZA FILHO, M. M. S & NANTES, J. F. D (2004) - O QFD e a análise sensorial no desenvolvimento do produto na indústria de alimentos: Perspectivas para futuras pesquisas. In: **XI SIMPEP** - Simpósio de Engenharia de Produção, Bauru, SP. p.38.
- YIN, R. K. (1994) - **Case study reseavech-design and methods**. Sage publications. Applied social Research Methods Series – vol 5.

