

## PRODUCT DEVELOPMENT PROCESS IN FOOD INDUSTRIES: TOOLS MANAGEMENT ANALYSIS IN POST-DEVELOPMENT STAGE

Melisa De Greef<sup>1</sup>, Leticia Arcusin<sup>2</sup> & Germán Rossetti<sup>3</sup>

<sup>1</sup> melisadegreef@gmail.com, <sup>2</sup> larcusin@fiq.unl.edu.ar, <sup>3</sup> groseti@fiq.unl.edu.ar

Department of Industrial Engineering, Faculty of Chemical Engineering, Universidad Nacional del Litoral  
Tel.: +54 342 4571164, int. 2581, Santiago del Estero 2829, 3000, Santa Fe, Argentina

### ABSTRACT

Product Development Process (PDP) is considered increasingly important to the competitiveness of business procedure, especially at food producing industries.

Some authors propose a model that outlines the process in macrophases. It underscores Post-Development macrophase, which involves following the products on the market, from launch to its recall.

This paper proposes procedures and tools to be used at Post-development macrophase of PDP in food industries. The study is based on a literature review, in relation to the PDP in food producing industries and also to PDP and management tools.

Among the main conclusions, it stresses that in food industries a large number of procedures and tools are related to the activities of Development stage. Regarding Post-development macrophase, the methodologies used are mainly focused on customer satisfaction activities, due to its importance for companies, but is still incipient the use of models that standardize the management of the PDP at this stage.

**Keywords:** *Product Development Process, Food, Post-Development, Management Tools.*

### 1. INTRODUCTION

Product development process (hereinafter, PDP) is the systematic task to generate new products, either by introducing changes to an existing product or creating a completely new and original [1].

Conceptions, models and methodologies to manage the PDP are closely related to the discipline of Project Management, as the new product development involves carrying out start, planning, execution, control and closure activities, which are also present in the processes of efficient management of every project [2].

Manage the development of a product, as managing a project, involves applying knowledge, skills, tools, procedures and techniques to the activities that are necessary to achieve the objectives [1] in an orderly and effective way [3]. Implies acting effectively on key issues such as ensuring customer satisfaction, managing complexity, controlling delegation of responsibilities, driving staff and controlling risk [4].

The construction of a management model that allows systematically develop new products (or new projects) involves providing methodical schemes to organizations that are being improved from the management of each new product (or project) [5].

At food-producing, industries PDP is crucial, because the scenario where companies develop is characterized by high levels of competitiveness and rapid evolution in many perspectives: food security, sustainability, nanotechnology, packaging, among others [6]. Due to the increasing globalization, organizations must survive in a dynamic and often unpredictable market, with shorter life cycles products, intense international competition and segmented markets with sophisticated consumers [2]. For companies, competitive advantages are based on the optimization of costs, time and quality, especially in the product development process [7].

Product quality at food sector is one of the priority criteria to analyze its performance in the market, and is a variable that directly affects on its design and production process [8]. Development time is another important aspect, because it must consider changes in customer requirements, incorporation of new technologies and the introduction of innovative products in increasingly shorter periods. Finally, the productivity of the development process is a decisive factor, because it involves searching for the best performance of resources (material, human and financial) available to the company [9]. One of the biggest challenges of the PDP is to manage the best combination of these three factors for an efficient process [10]. Accordingly, determine appropriate models and tools will contribute to the consolidation of PDP management.

In the literature there are several proposals to systematize activities of product development in PDP models, according on the area of knowledge of authors. However, differences between these proposals are more

terminological than conceptual [11]. Methodological models help new products development using a formal support [12]. The formalization of a PDP management model allows a comprehensive vision for all participants in the process, the expected results for the PDP, the definition of the activities and how they should be carried out, among others [13].

Rozenfeld [14] present the most recent PDP contribution outlining the process into three macrophases: (i) pre-development, (ii) development and (iii) post-development. The model is structured and works as a reference to guide its application into companies.

A stage that attract increasing attention in recent years in the literature of the PDP, is the macrophase called Post-Development by Rozenfeld [14] and Penso [15], which includes monitoring product performance on the market, and, at the right time, to recall it, reaching the end of all tasks related to PDP for the product.

One of the greatest contributions of Rozenfeld [14] is to consider the entire life cycle of the product, which includes post-development macrophase [16]. Unlike other authors, who complete the study of PDP management in the development phase and product launch, they observed that many of the problems related to the PDP arise once the product is consumed or used by customers. Their model incorporates tracking the performance of the product on the market [11] in order to identify areas for improvement [12].

## 2. METHODOLOGY

To achieve the objective of the present work, a qualitative methodology is applied.

From a literature review we proceeded to locate, identify and access documents [17] in order to analyze and synthesize the literature on the PDP in industries producing food. The main instrument used is the analysis of documents, papers, books and publications.

A literature search related to Tools for Managing Product Development was held. Part of the bibliography was analyzed by the authors in previous studies [9]. Articles and publications related to Management of Product Development and Management Tools were selected. This selection was made, first, by reading the title and keywords, and then from reading the summaries; considering the academic origin of the authors and the relevance of the references.

We proceeded to the complete reading of selected articles, detecting tools proposed by different authors. They were classified according to the phases of Ronzenfeld model (predevelopment, development, and post-development). Finally, we proceeded to the description of relevant tools for the post-development macrophase related to its application in food companies.

This documentary study allows a theoretical survey of the tools applied to existing PDP in the literature.

## 3. REFERENCE MODELS

This paper bases its analysis on the model proposed by Rozenfeld [14]. It is a management model that separates PDP product development process in three macrofases: (i) pre-development, (ii) development and (iii) post-development. Each of these macrophases is divided into phases, activities and tasks. The model shows the stages sequentially in the sublevels of activities and tasks, but is normal that exist simultaneity.

The model was originated from the binding of methodologies, case studies, models, experiences and best practices identified by the author and the research team. His contribution is to conceive a management program in a global way, involving all activities since development, release and until removal of a new product. It is therefore known as the Unified Model PDP, because it brings together academic and professional perspectives into a unique theoretical model [18]. Figure 1 shows PDP model.

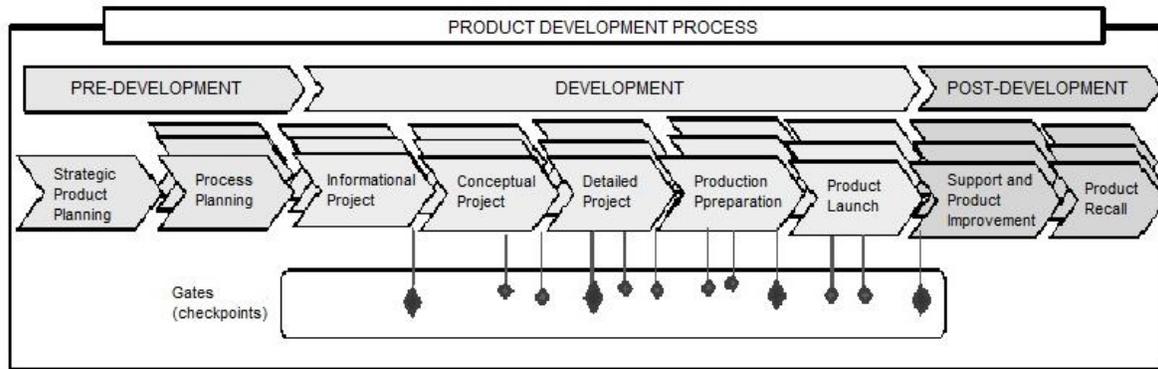


Figure (1): Rozenfeld et al Model (2006).

The model is structured and systematized in a practical way, and is used as an orientation to guide its application to several industries or situations. Each application of the Unified Model to a new industrial sector results in a Reference Model for the sector, that companies operating in it can use to improve their management systems of PDP.

Penso [15] focuses its research to make improvements in relation to previously published models, in order to adapt them to the food sector. She addresses the most known and cited models in the literature for PDP in food producing industries, including Rozenfeld [14], Polignano and Drumond [19], Earle [20], Rudolph [21] and Fuller [22] models. Other mention authors are Hoban [23], Kristensen and colleagues [24] and Stewart-Knox et al [25]. A study of these models was approached by the authors in previous work [9].

Finally, Penso [15] based her study on the model of Rozenfeld [14], for its didactic character, its broad scope and its capacity to include many activities that previously were not considered part of PDP management, a criteria shared by this work.

It should be noted that, when preparing the reference model for the sector (2003), the Unified Model of PDP was in a publication process (2006). The author made a systematization of the PDP focused on the peculiarities of the development of food products. The proposed model (Penso, 2003) is structured in macrophases and phases similar to Rozenfeld [14], differing by adding some specific activities in the area of food in the Development macrophase. Penso [15] and Rozenfeld [14] studies are taken as reference frameworks for this work.

#### 4. POST-DEVELOPMENT MACROPHASE. ITS IMPORTANCE IN FOOD PRODUCING INDUSTRIES

Post-Development macrophase seeks to monitor the performance of the product on the market and consider its subsequent recall. This macrophase includes two phases:

- **Support and product improvement** phase, which aims to guarantee product tracking, identifying needs and opportunities for improvement [9]. In this phase, a post-project audit is performed, satisfying customers (intermediaries and/or final customers) is evaluated and product performance is monitored, both in technical and economic terms.

Activities on this phase are based on the treatment of information that comes to the company after product release, and that can emerge from different sources: customer service offices, technical support or maintenance department, agent or responsible of distribution, production area, etc.

- **Product recall** phase involves the discontinuation of product supply and its associated services, ensuring that withdrawal causes the least possible impact on consumers, on the community and on the environment, as well as evaluating the lifecycle of the product [14].

Production is discontinued when the product does not present any more advantages from the economic point of view (sales, profit contribution, growth of the company, etc.) or from a strategic point of view (competitive advantages, market share, brand image, etc.). The end of this stage is signed by the end of customer support provided, that is, when company stops providing technical assistance and replacement units are not made [9].

It is good to clarify that not necessarily the second phase starts when the earlier is completed: activities of Support and product improvement phase can be in process when the second stage begins; and it is especially valid for products that must be received by the company for reuse, remake or recycling [26]. The organization must be prepared to receive the product back, and must anticipate to the first return to start running the end-life plan. This plan defines critical stages, areas of the company involved, responsibilities and timetables for the recall from the market. Allows viewing and sharing, by all areas of the company, the way of receiving the product (if applicable), finish the production, sale, production of spare parts and offer customer support [15]. A well-formulated and implemented plan to end the life of product helps customers opting for new generations of company products, enabling relocation of resources to more profitable new opportunities.

After these operations, PDP must be evaluated in terms of project performance to record successes and failures and transfer the experience to future projects [5].

Although there are particularities among industries, food sector is generally characterized by saturated markets, full of very similar products, where there are leaders who constantly offer innovations, leading the reduced life cycles of products. It is a sector influenced by trends, lifestyles and there is a large global investment in research and development of new products, in order to find opportunities from innovation in a traditional market [7].

Understanding the importance of Post-development in food sector is essential to create competitive advantages in a crowded marketplace. In this macrophase product tracking is done in the market, primarily to know if the client is satisfied with the product or service provided a decisive factor for company survival.

During the product support, it is also possible to detect needs and opportunities for improvement that could imply profits for the company, as customer loyalty, anticipating competition, grab larger market shares, among others [27].

Finally, this stage determines the efficiency of the entire PDP, to assess whether the decisions taken at the first macrophases were adequate (definition of customers, identification of their requirements, new product concepts with potential success, product development, marketing strategies, etc.) [12]. Good management of these latter stages can become a differentiating factor for organizations.

## 5. TOOLS PROPOSALS FOR POST-DEVELOPMENT MACROPHASE

Tools used in product development processes are a set of recommendations to stimulate ideas, analyze problems and structure the activities of the process [15].

In this stage, tools are important to carry out tasks proposed by the model and to arrive at useful results, optimizing company resources.

Penso [15] systematizes a number of tools that can be used in PDP for food industries, taking some generic from PDP (Brainstorming, Parametric analysis, SWOT analysis, etc.) and others specific of food sector (Sensory analysis, Attribute matrix, Map lifecycle, among others). The author presents these techniques in a common section, without linking them to the macrophases that the model presents (Pre-development, Development and Post-development).

This paper proposes the description of different tools according to the two phases that integrate the Post-Development macrophase. After a literature review, were selected those that are considered most appropriate to carry out the phases mentioned.

Following Rozenfeld model, is detailed below the activities and tasks included in each phase of Post-Development (Support and product improvement and Product recall), and the procedures and tools that can be used to facilitate the achievement thereof. Note that these techniques can be used together, and even some of them support others.

### 5.1 Support and Product Improvement Phase:

- **Assessing customer satisfaction:** this activity includes the tasks plan, perform, analyze and consolidate the assessment of customer satisfaction degree with the product. Procedures, tools and support systems of this activity have several levels of sophistication, depending on the size and condition of the company: from simple files to complex systems, such as Customer Relationship Management (CRM). This allows collecting relevant information about changes needs or opportunities for improvement.

• **Monitoring product performance:** this is one of the most widespread activities in time, as product tracking is done throughout its life in the market. Tasks of this activity are closely related to "critical issues" (a list of aspects defined in the previous two model macrophases: Pre-Development and Development) and should be monitored at this stage. Involves the tasks of monitoring product performance in many variables: technical performance of the product, both in the production process (compliance, reliability, capacity, time) and the market (including associated products or services); economic performance (sales, costs, margins); environmental aspects (in terms of environmental adaptations or modification opportunities/needs in relation to components, packaging, distribution, manufacturing, applications, etc.); among others.

• **Conducting a post-project audit and registering learned lessons:** this activity, which takes place once the new product project is completed, is dedicated to the improvement of development process, as an activity that facilitates organizational learning. It involves the tasks planning audit focuses, conducting the audit and reporting the results of the information obtained (both product and PDP). It is important to determine the significant focuses to review, because PDP is a complex process, and basically they depend on the expected benefits of the audit. During development, much information is generated, registered or modified, and the audit helps to verify the completeness and consistency of this information. This activity concludes with the task of reports (technical, economic, environmental, production and/or services), reflecting a synthesis of learned lessons.

## 5.2 Product recall Phase:

• **Reviewing and approve product discontinuation:** in the early stages of planning, an estimated goal of product life and the benefits it could generate is often made. These goals can be modify according to the results of product performance and strategies of the company (retirement can be approved or it can be recommended to extend the life of the product). This activity requires an analysis of product discontinuity in terms of economic, corporate image, impact on the environment, etc.

• **Planning product discontinuation:** involves planning tasks to ensure that the product is discontinued allowing the formal close of the project.

• **Preparing product reception:** this activity involves, if applicable, the receipt of the products by the company. This means, depending on the product, responsible for its disposal, dismantling, recycling, reuse or re-manufacturing.

• **To discontinue production:** involves the closure of manufacturing –maintaining only manufacturing spare parts (which can even be performed externally to the company)– and includes to consider critical aspects such as contracts with specific suppliers, production systems or human resources.

• **To finish product support:** in this activity product is definitely discontinued, which involves closing the manufacture of spare parts and ceasing technical assistance.

• **Overall assessment and closing of the project:** after the final activities of PDP, a general assessment is made with responsible, for a critical analysis of the whole process, which is recorded in a document that formally closes the project.

To carry out the activities mentioned there has been found in the literature a number of tools listed below:

**Consumer Panel:** is a type of market research panel. It is a tool that regularly collects information on the purchases made by a constant and representative sample of the population ("panelists") in a certain market [7]. Allows collecting and tracking key information, such as purchases evolution of each product, number of buyers, expense levels, size and type of packaging sold, choosing of special offers (discounts, coupons, sweepstakes), providing a demographic profile of customers and their buying habits (how often, what volume each time, in which shops, etc.) as well as the profile of the market share, brands and trends.

This information has many utilities, such as conducting analyzes for further market segmentation, or adapt products, communication or any marketing mix element to the tastes, needs and trends of customer consumption [27].

Sometimes this type of study allows to work with samples of large populations and to get regular reports of them. Due to its complexity, panels are often carried out by specialized institutes, that ensure permanent surveillance of the panel components (a percentage of panelists tend to leave the panel each year), a key factor in this type of research.

**Joint analysis:** this technique reveals how product, price, availability and associated services features affect customer preference. These variables are analyzed together, and can detect the attributes that most affect the preference or purchase intent of a product, and the value that customers attach to each attribute. Responses obtained can generate changes or product improvements to achieve greater success in the market [28].

**Customer Value Chain Analysis:** is the study of customers and product users (distribution, logistics, sales points), analyzing which aspects of the product adds value to each of them. Strategies to enhance these aspects are sought, and thus create advantages over competitors [29].

**Lead user (or supplier) cooperation:** is to involve in product tracing those called lead users (users who have an advanced knowledge of the product and its use) and suppliers with a fluid contact with similar products, channels distribution, technologies, etc. [29], in order to generate ideas to improve product acceptance, and be aware of the moment when product begins its maturity and subsequent decline.

**Storehouse of ideas:** this tool consists on a system to collect ideas that could be useful to improve products, primarily from experience arising from its production, delivery, marketing or departments, technical support and after-sales service. The contribution of ideas by the employees is important to make improvements on processes [29]. Note that development activities do not follow predictable ways, and sometimes are hints or suggestions the ones that determine changes in products to achieve greater success in the market. Improvements often occur by successive approximations [30].

**Product life cycle analysis:** intent to diagnose product performance on the market and take appropriate actions depending on its stage: introduction, growth, maturity or decline [31]. At Post-development phase, this tool is important to detect the stage of maturity, especially in market leading products –to its redesign, in order to restart their growth curve and stay longer in the market–, or decline products, where the need to discontinue the production of the good or service is imminent [32].

**Determination of the useful life:** useful life refers to the period of time between manufacture and consumption of a food product, during which has satisfactory quality in terms of its nutritional value, taste, smell, texture and safety. This technique is essential in any maintenance and improvement of quality, being specific for each type of food product. It involves taking a sample of units (at sales points) and stores them under certain conditions. During the period, the sample is subjected to physical, chemical, microbiological and sensory analysis to compare the results with parameters set at PDP, considering tolerance levels [2].

**Customer information collection systems:** includes different methods and tools to receive important information: suggestions, complaints, failures, inadequacies to certain uses, packaging issues, operational/manufacturing /installation/use issues, sale difficulties, restrictions in technical assistance, outdated data, etc. It includes websites of companies, interviews or questionnaires after receiving technical assistance, "0-800", etc. [33].

**Observation:** it involves monitoring clients using the product in appropriate environments, knowing or not he's being analyzed, to detect tastes, preferences, habits, ways of using, etc. The aim of this technique is to analyze information from people, events, actions and situations, in order to obtain certain information regarding human behavior [2].

**Continuous improvement process:** this concept postulates a continued readiness to improve products, services and processes. The identification of all processes and measurable analysis of each step taken in order to achieve improvement processes is required [9]. There are several methodologies that use this philosophy: Lean Manufacturing, Six Sigma, Theory of Constraints, Kaizen, among others.

**Customer Relationship Management (CRM):** CRM can refer to a system of managing an organization based on customer satisfaction, considered a set of practices designed to achieve a closer contact with them, in order to offer what they need in the right time [14]. It can also refer to software for managing the relationship with customers, that is, computer systems supporting the management of customer relationships. These systems manage data warehouses (data warehousing) with information on sales management and company's customers. The interesting thing is that CRM allows different combinations of information, enabling interesting correlations between variables, for example: use situations, joint purchasing, frequency, etc [27].

**Enterprise Resource Planning (ERP):** these systems collect and group information on product performance, stratifying it into different modules (purchases, sales, management accounting, management control, production, logistics) [14]. ERPs are used for "inward" activities companies (distribution process management and supply chain, improve the accuracy of financial data, standardize critical procedures, reduce redundant tasks, manage human resources, etc. ); while CRM systems are used for "outward" tasks (organize marketing efforts, streamline sales processes, automate customer service, tracking customer interactions with the company, customer participation profiles, etc.) [27].

**Balanced Scorecard:** consist on a indicators system to manage a company, considering especially those aspects that are the main source of competitive advantage, by providing managers a global view of business performance [14]. Each company makes its own scorecard, based on their vision and strategy. The definition of indicators is from the early stages of strategic planning. The information may be organized in different ways, but generally involves areas such as: financial aspects (sales growth, market share, development cost, etc); operational (development time, productivity, use of installed capacity, employees); quality (quality guidelines, failure or returns reported, suitability and durability of use, reliability); customer (consumer acceptability, response times, etc.). In addition, scorecard can detect deviations of strategic plan [27].

**Traceability:** this tool is a set of pre-established procedures that allow knowing history, location and/or path of a product (or batch of products) along the supply chain at any time. To study and establish traceability of a product is essential to identify three basic aspects: origin of its components, assembly processes applied, and location of the product after its distribution. It can be distinguished two types of traceability when trying to know the status of a product which circulates within a logistics chain: internal traceability, acting on the internal procedures of a company and takes into account the composition of the product, its manipulation, machines used and other factors; and external traceability, it adds other elements to outsource information arising from the internal traceability. Systems and tools used are: bar codes, labels that physically travel next to the product, radio frequency electronic devices, automated systems in the process of capture, recording and transmission of information, wireless access, GPS, etc. [1].

**Review reports:** this procedure aims to reflect the performance results of a PDP project, both product and process review. Involves the registration of learned lessons, and compare planned and budgeted with what effectively was done or happened. It can be presented in several ways, and generally contains information referred to: return on investment, costs (real versus budgeted), market share, sales (real and projected), markets attended, level of development (tools, equipment, services, human resources), quality, time of development, customer satisfaction, etc. [34].

## 6. CONCLUSIONS

According to the objective of this study, one of the first conclusions to mention is that was not found specific literature product development tools in the food industry, focused on Post-Development Phase. Analyzed descriptions are related to tools in activities included in Post- Development Phase of many industries, or to Food Industries in general.

Furthermore, in the case of Food Industries tools, techniques are related mostly to facilitate activities in Development macrophase. Among them, there are sensory techniques, product development lifecycle map, Matrix attributes, morphological matrix, Sinetica, Mescrai, Audit Risk Products, Statistical optimization of processes, Taguchi Method, Triz, hazard Analysis critical points [34; 2].

On the other hand, is observed in the analyzed literature related to PDP tools, the way they are known, systematized and classified depending on each author. It is also detected the existence of many tools to carry forward the activity Customer satisfaction, due to the importance this represents for companies, and certain emptiness in other activities, especially for the latest activities of the macrophase.

They have been proposed in this paper a number of tools that are considered suitable to be applied to Post-Development, according to the importance and purpose of this macrophase. Subsequent research could focus on other tools to structure activities to be performed along each macrophase of product development process.

## 7. REFERENCES

- [1] Lerma Kirchner, A, “Desarrollo de nuevos productos, una visión integral”, Cuarta edición, Cengage Learning, Querétaro, México, 2010.
- [2] Cardoso Machado, M., Nunes Toledo, N., “Gestão do processo de desenvolvimento de produtos”, São Paulo, Ed. Atlas, 2008.
- [3] Arboleda Vélez, G. “Proyectos. Identificación, formulación, evaluación y gerencia”, Alfaomega, 2ª edic. México, 2014.
- [4] Davidson Frame, J. “La Nueva Dirección de Proyectos”, Granica, Buenos Aires, 2011.
- [5] Project Management Institute (2008). *Guía de los Fundamentos para la Dirección de Proyectos*. (4ta edición). Atlanta: Global Standard.
- [6] Fuller, G. W. “New food product development: from concept to marketplace.” Florida, CRC Press, 1994.
- [7] Cóccharo, G.C. “Desarrollo de Nuevos Productos: Alimentos Funcionales y Novel Food. Alternativas para el diseño de alimentos y su marco legal”. PROCAL (Programa de Gestión de Calidad y Diferenciación de los Alimentos), Ministerio de Agricultura, Ganadería y Pesca de la Nación, Argentina, 2010. Disponible en: [www.alimentosargentinos.gov.ar/contenido/procal/estudios/02/DesarrolloNuevosProductos](http://www.alimentosargentinos.gov.ar/contenido/procal/estudios/02/DesarrolloNuevosProductos)
- [8] Graf, E. and Saguy, I. “Food Product Development: from Concept to the Marketplace”, Avi, New York, 1991.
- [9] Rossetti G., Arcusin L., Giraud F., Murer P, “Estudio Comparativo de Modelos de Gestión del Proceso de Desarrollo de Productos Alimenticios”, Iberoamerican Journal of Project Management, vol.5, N°.1, 2014, pp.11-22.
- [10] Davidson Frame, J. (2011). *La Nueva Dirección de Proyectos*. Buenos Aires: Granica.
- [11] Alebrant Mendes, A., Siqueira Souza, F, da Luz Seben, L, Flores Magnano, P. “Análise crítica do Processo de Desenvolvimento de Produtos de uma empresa do segmento de Confeitos”. XXIX Encontro Nacional de Engenharia de Produção (ENEGEP): A Engenharia de Produção e o Desenvolvimento Sustentável: Integrando Tecnologia e Gestão, Salvador, 2009.
- [12] Jung, C.; Ten Caten, C; Ribeiro, J.L. “Uma discussão sobre a concepção e estrutura de modelos de desenvolvimento de productos”, Revista Espacios, vol. 34, pág. 7, 2013.
- [13] Cunha, G. D. “Uma Análise da Evolução dos Procedimentos de Execução do Desenvolvimento de Produtos”, Produto & Produção, vol. 7, nº 1, 2004.
- [14] Rozenfeld, H., Forcellini, F.A., Amaral, D.C., Toledo, J.C., Silva, S.L., Alliprandini, D.H., Scalice, R.K., “Gestão de desenvolvimento de produtos: uma referência para a melhoria de processo”, São Paulo, Ed. Saraiva, 2006.
- [15] Penso C.C., “Modelo de Referência para o Processo de Desenvolvimento de Produtos na Indústria de Alimentos” (Dissertação de Mestrado), Florianópolis, Ed. UFSC, 2003.
- [16] Roozemburg N. and Eekels J., “Product Design. Fundamentals and Methods”, New York, Ed. John Wily & Sons, 1995.
- [17] Hernández Sampieri, R; Fernández Collado, C y Baptista Lucio, P. “Metodología de la Investigación”. McGraw Hill, 3º Ed., México, 2003.
- [18] Lledó, P., Rivarola, G; “Gestión de proyectos. Cómo dirigir proyectos exitosos, coordinar los recursos humanos y administrar los riesgos”. Buenos Aires, Ed. Prentice Hall-Pearson Education, 2007.
- [19] Polignano L. A. C., Drumond F. B., “O papel da pesquisa de mercado durante o Desenvolvimento de Novos Produtos”, Anais do 3º Congresso Brasileiro de Gestão de Desenvolvimento de Produto, Florianópolis, 2001, pp. 121-130.
- [20] Earle, M. D. “Changes in the food product development process”. Trends in Food Science & Tecnology. Cambridge, vol. 8, 1997, Pp. 19-24.
- [21] Rudolph, J.M. “The food product development process”. British Food Journal, vol. 97, N° 3, 1995, pp. 3-11.
- [22] Fuller, G. W. (1994). *New food product development: from concept to marketplace*. Florida: CRC Press.
- [23] Hoban, T.J. (1998). Improving the success of new product development. *Food Technology*, vol. 52, pp. 46-49.
- [24] Kristensen, K.; Ostergaard, P.; Juhl, H.J. “Success And Failure Of Product Development in the Danish food sector”. Food Quality and Preference, vol 9, 1998, pp.
- [25] Stewart-Knox, B.; Mitchell, P. (2003). What separates the winner from the losers in new food productdevelopment? *Trends in Food Science and Technology*, vol. 14, pp. 58-64.
- [26] Pereira Gouvinhas, R., Costa, G., “Estratégias de Ecodesign no Processo de Desenvolvimento de Produtos”, Gestão do ciclo de vida dos produtos”, 1 ed, Coleção fábrica do milenio, vol III, Ministério da Ciencia e Tecnologia, 2005, pp. 246-258.
- [27] Santesmases Mestre, M; Sánchez de Dusso, F; Kosiak de Gesualdo, G. “Marketing: conceptos y estrategias”. 2ª edición. Pirámide. Madrid, 2004.

- [28] de Toledo, J., Martins, M., Martins, R., da Silva, S., “O Processo de Desenvolvimento de Produtos Alimentícios no Brasil”, *Gestão do ciclo de vida dos produtos*”, 1 ed, Coleção fábrica do milênio, vol III, Ministério da Ciencia e Tecnologia, 2005, pp. 35-53.
- [29] Val Jáuregui E., Justel Lozano D, “Uso de herramientas durante la primera fase de desarrollo de productos”, *DYNA*, vol. 83, Nº 6, 2008, pp. 363-373.
- [30] Baxter, M. “Projeto do Produto: Guia Prático para o Design de Novos Produtos”, 2º Ed., Edgard Blücher, São Paulo, 2000.
- [31] Hu, G. and Bidanda, B. “Modeling Sustainable Product Lifecycle Decision Support Systems”, *International Journal of Production Economics*, vol. 122, issue 1, 2009.
- [32] Gmelin, H. and Seuring, S. “Achieving Sustainable New Product Development by Integrating Product life-cycle Management Capabilities”, *International Journal of Production Economics*, vol. 154, 2013.
- [33] Holman, R. “El Futuro del Desarrollo de Productos”, *Gestión*, vol. 9, nº 2, 2004.
- [34] Echeveste, M. E. S. (2003). *Uma Abordagem para Estruturação e Controle do Processo de Desenvolvimento de Produtos*. (Tese Doutorado em Engenharia de Produção). Escola de Engenharia. Universidade Federal do Rio Grande do Sul.

#### ACKNOWLEDGEMENT



The authors acknowledge the financial contribution provided by Secretariat of University Policies (SPU), the National Agency for Scientific and Technological Promotion, through Fund for Scientific and Technological Research (FONCYT) for the project "Design of a Management Model for Product Development in Small and Medium Food Production Enterprises" (PICT 2012 - No. 1692) and also the Universidad Nacional del Litoral.

#### BIOGRAPHIES

Dr. Germán Rossetti is a chemical engineer, from UNL, Santa Fe, Argentina, and Ph.D from the same University. He is the director in the Dept of Industrial Engineering, and his research area includes product development management and project management.

M. Sc. Leticia Arcusin is pursuing Ph.D Degree in Administration from UNR University, Rosario, Argentina. She has completed her master degree in Strategic Business Management from UNaM, Misiones, Argentina. Her research area includes product development management.

BBA Melisa De Greef is pursuing Ph.D Degree in Administration from UNR University, Rosario, Argentina. She has completed his studies in Business Administration at UNL, Santa Fe, Argentina. Her research area includes product development management.